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ABSTRACT

Details are given of the CSIRO surface carbon dioxide monitoring programs at the Australian BAPMoN station at Cape Grim in Tasmania, the sub-Antarctic station at Macquarie Island, Mawson on the Antarctic mainland, Wilbinga in Western Australia, and from ships in the Southern Ocean. Data to the end of 1982 are presented in the WMO 1981 CO_2 Calibration Scale with pressure-broadening carrier-gas corrections applied where necessary.

CONTENTS

1. Introduction

The CSIRO Division of Atmospheric Research (formally Meteorological Physics and then Atmospheric Physics) commenced a research program on large-scale atmospheric carbon dioxide (CO_2) in the early 1970's. The program involved the making of routine high precision observations of CO_2 in the Southern Hemisphere atmosphere (previously routine observations were available only for the South Pole), the interpretation of the temporal and spatial variations of CO_2 concentration in terms of meteorological and biogeochemical phenomena and the modelling of the global carbon cycle.

With regards to the observational program, the collection of air samples from aircraft with subsequent laboratory analysis was commenced in 1972. This work is described in Beardsmore et al. (1978), Pearman et al. (1983) and Pearman and Beardsmore (1984). Continuous in situ observations at the earth's surface were commenced in 1976 in temporary facilities at the site of the Australian Baseline Atmospheric Monitoring Station, Cape Grim, Tasmania (Figure 1.1). This project is part of a wider and on-going study of the background composition of the atmosphere (Pearman, 1982) and is the Australian contribution to the World Meteorological Organization's network of background air pollution monitoring stations

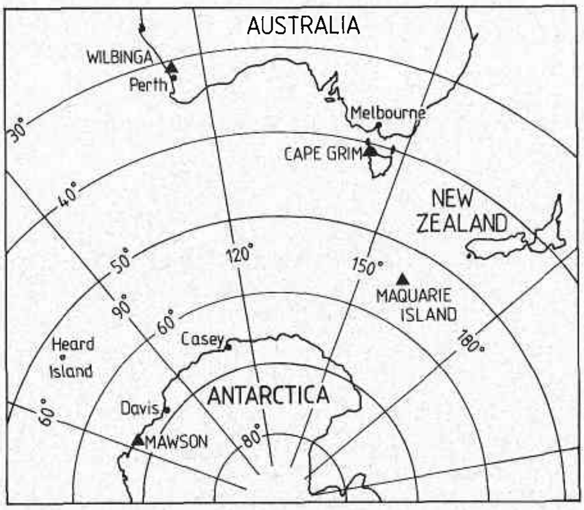

Figure 1.1

Location of surface stations ▲ in the CSIRO CO_2 monitoring program.

(BAPMoN). In addition, supplementary observational projects were established in subsequent years at several other surface locations and from Antarctic supply ships. These include measurements at two of the four permanent Antarctic and sub-Antarctic stations run by the Antarctic Division of the Department of Science and Technology (Mawson in late 1977 and Macquarie Island in 1979). A minor program of sample collection was carried out between 1979 and 1981 at Wilbinga, on the Australian west coast north of Perth in co-operation with the Western Australian Department of Conservation and the Environment.

It is the objective of this technical paper to describe the techniques and data handling procedures associated with these surface observational programs and to present summary data and descriptions of the complete archived data sets.

A key difference between observations of CO_2 concentration made at the earth's surface and those made from aircraft at altitude is that almost inevitably the former, from time to time, will be influenced by local surface exchanges. This will be especially so when the air sampled has resided over active terrestrial vegetation and/or under conditions of strong atmospheric stability (Fraser et al., 1983). Such conditions yield data which are not widely representative in space or time and of little relevance to studies of the large-scale features of the carbon cycle.

It would be, therefore, of limited value for us to present a complete CO_2 data set without establishing a method, peculiar for each sampling site, whereby the reader can select data relevant in the global context. In the present report we have attempted to define criteria which allow such data selection and, in the case of the major in situ project at Cape Grim, we provide data both with and without selection.

Throughout this report, we use the term "baseline" to refer to conditions when measured concentrations are believed to be representative in the vertical of at least the lowest few km of the troposphere and in the horizontal for distances of $\geqslant$ 1000 km. As such, "baseline" conditions are expected to be associated with the observations of relatively constant CO_2 concentrations as the air mass passes by the observatory. Further, because of the relatively small surface exchanges over the oceans, such large-scale constancy is generally characteristic of maritime airmasses.

The criteria we have used to select "baseline" data reflect this qualitative concept of a large, well-mixed, generally maritime, airmass. While a more formal definition might be desirable in the future, we are of the opinion that the present concept is a satisfactory basis on which to provide data for use in the global carbon cycle context.

2. The Programs

2.1 Cape Grim (40°41'S, 144°41'E)

2.1.1 Site: The Cape Grim monitoring station (Figure 2.1) is located near the top of a 95m promontory on the western side of the north-western tip of Tasmania (Baseline, 1978). In this situation it is well sited to sample baseline maritime air from the south-westerly quadrant which has suffered no recent modifications due to terrestrial biospheric or anthropogenic activities. The original, temporary location of the CO_2 monitoring equipment was in a large trailer van situated near the cliff top. With the completion of the permanent station building in 1981, a new set of equipment was built, installed and, after a period of comparison, used for routine CO_2 monitoring. At this point the original equipment was decommissioned, and the CO_2 analyser used as a backup instrument in the new laboratory.

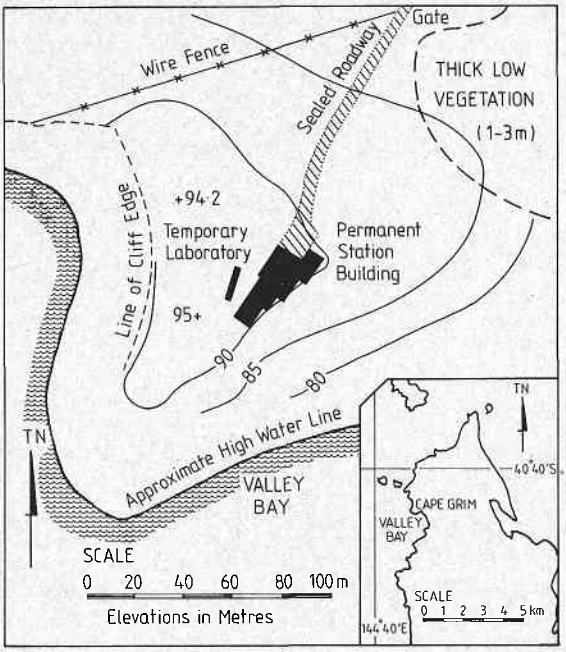

Figure 2.1

Site details of the Cape Grim Atmospheric Baseline Pollution Station and its position relative to the northwestern tip of Tasmania (inset).

2.1.2 Measurement technique: Mark I instrumentation: As with most CO_2 monitoring programs the measuring instrumentation at Cape Grim is based on non-dispersive, infrared (NDIR) gas analysers. Figure 2.2 is a schematic diagram of the equipment in use in the temporary laboratory between April 1976 and November 1981.

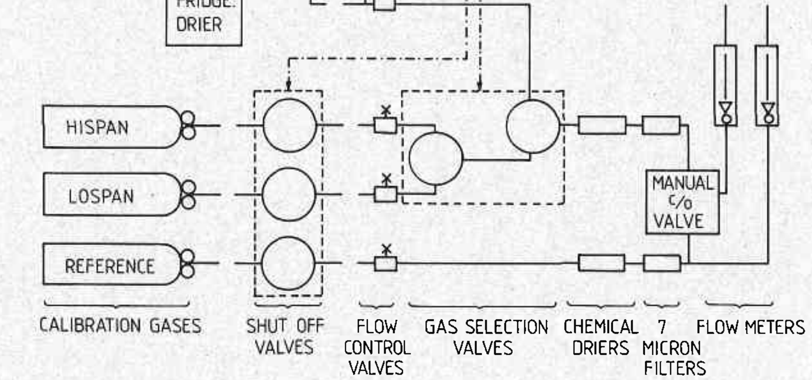

Figure 2.2 General schematic diagram of the CO_2 monitoring equipment used in the Cape Grim temporary laboratory between 1976 and 1981 (Mark I).

Air intake: The sample air was drawn through a 0.64 cm o.d. copper tube from a point 1 metre above the van roof. To avoid direct rain penetration the inlet was pointed down and in February 1979 was fitted with a flared entry as a further precaution against rain drops entering the airstream. A Capex, Mk.II diaphragm pump (Charles Austen Pumps Ltd., Surrey, England) was initially used to pump air through the intake. However, recurring problems caused by perishing and rupturing of the rubber diaphragms, necessitated a change to a metal bellows type (type MB21; Metal Bellows Corp., Mass., U.S.A.). The air was transmitted through a surge damping bottle to a bleed valve where most was vented off, only the volume required for monitoring purposes being passed to the drying system.

Drying: In the original system, installed in March 1976, drying was effected by granular magnesium perchlorate (Dehydrite; Arthur H. Thomas Co., Philadelphia, Pennsylvania, USA) in two glass drying towers. To conserve chemical drying agent, the system was changed in April 1976 so that the air was first passed through a condenser situated in a pre-cooling refrigerator. Here its dew point was lowered to about 1°C, the remaining moisture being removed in the chemical towers. Further refinement saw a commercial freezer unit operating at approx. -20°C taking the place of the refrigerator in July 1977. The tendency for the inlets to the condenser elements to rapidly become clogged with ice led to a special glass trap being installed in December 1978. This trap was designed so that its diameter was increased substantially before entry into the freezer but, unfortunately, it proved to be too fragile and was replaced by a similarly-shaped stainless steel trap in April 1979 (Figure 2.3a).

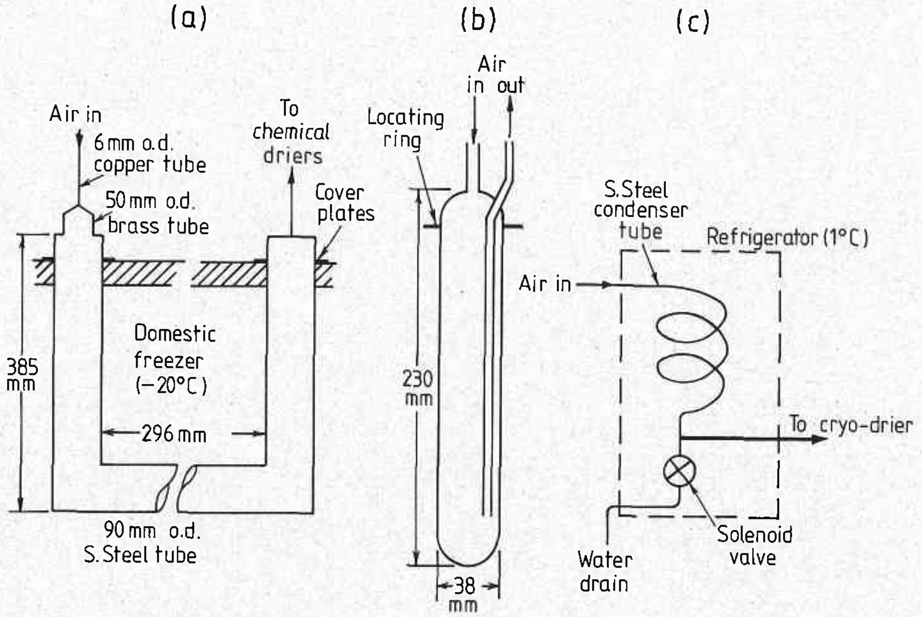

Figure 2.3 Diagrams of elements used in the refrigeration drying sections of the Cape Grim CO_2 monitoring equipment. (a) Details of the stainless steel trap used in a domestic deep freeze unit operated at about -20°C; (b) Glass cryogenic water vapour trap used with Mark II instrumentation at -60° to -80°C; (c) Schematic of pre-drying condenser unit operated at approximately 1°C with the Mark II equipment.

Although the operating temperatures of the freezer should have been low enough to remove sufficient of the water vapour from the air stream, this did not seem to be the case in practice (possibly due to the poor conduction of the stainless steel and inadequate mixing in the air stream). Chemical driers therefore had to be used in addition to ensure adequate drying. After drying, the air passed through a tube containing cotton wool as a medium to filter out any unwanted particles of drying agent. Glass wool was later substituted when suspicions were aroused regarding the capacity of cotton wool to hold moisture.

Analysis: CO_2 analyses at Cape Grim are performed by the method which is basically the same as that for flask analysis described in Beardsmore et al. (1978) where the analyser output for the sample air is compared with those for two different calibration (or span) gases whose concentrations are lower (Lospan) and higher (Hispan) than that of the sample. In the automatic, continuous system used at Cape Grim the gas flows are controlled by solenoid gas-selection valves. These valves are activated by an operation timer in such a way that there is a sequence of sample air followed by one span gas and then the other. Flow rates, as measured by flowmeters (Fischer & Porter Ltd., Cumberland, England) on both the sample and reference inlets to the analyser are adjusted to be the same for each of the gases by flow-controlling needle valves (Sample 0.3-0.4 ℓ min^{-1}; Reference 0.1-0.2 ℓ min^{-1}). In order to avoid stagnation of the air stream in the drying section while the calibration sequence is in operation, a second, very slow, air bleed is installed just before the flow control valve. In April 1980, it was decided that any small amounts

Table 2.1 Summary of the usage of NDIR gas analysers in the CO_2 monitoring program at Cape Grim. The concentration-dependent, carrier-gas concentration factors given for each analyser were derived by the method described in Pearman et al. (1983).

Make and Model	Serial Number	Detector Type	Period of Use	Carrier Gas Correction Factor (= $A + BC_A$)
UNOR 5B	5-0599	Parallel	1.4.76 - 24.6.76	$0.9808(\pm0.0017) + 0.37(\pm0.50) \times 10^{-5}C_A$
UNOR 2	631478	Parallel	13.9.76 - 26.9.77	$0.9854(\pm0.0024) + 0.28(\pm0.71) \times 10^{-5}C_A$
			7.12.79 - 14.4.80	
			23.4.80 - 2.5.80	
URAS 2T	30107275	Series	27.9.77 - 7.12.79	$1.0130(\pm0.0028) + 1.16(\pm0.87) \times 10^{-5}C_A$
			14.4.80 - 23.4.80	
			2.5.80 - 30.11.81	
URAS 2T	30827270	Series	4.6.81 -	$1.0125(\pm0.0039) - 0.23(\pm1.21) \times 10^{-5}C_A$

of moisture (< 25 ppmv) present in the span gases were capable of inducing errors in the results given by the URAS 2T analyser then in use. To overcome this, small chemical drying tubes and 7 micron Swagelok filters were fitted in both sample and reference lines immediately prior to the gas streams entering the analyser. Provision of a manually operated valve enabled the reference gas to be passed through both cells of the analyser to obtain a zero reading.

Four different gas analysers have been used at Cape Grim to date. They include instruments with both series and parallel detector types (Pearman, 1980). Table 2.1 summarizes their periods of usage and characteristics.

A UNOR 5B (H. Maihak AG, Hamburg, W.Germany) was used in the early investigations. Its original free-standing position on a bench proved unsatisfactory due to the sensitivity of the microphonic detector to vibrations of the trailer induced by the movement of personnel or the wind. The instrument was therefore mounted on an aluminium post set in the ground and protruding into the trailer through a hole in the floor. This system was continued when the UNOR 5B was replaced by a UNOR 2 in September 1976. In September 1977 a URAS 2T (Hartmann and Braun, AG, Frankfurt/Main, W.Germany) took over as the monitoring instrument. This was mounted in a large standard rack which in turn was bolted to a more substantial mounting through the van floor into the ground. All the operation timing, valving and flow metering equipment was also built into this rack and the analyser thermally insulated to improve its stability.

Operation timing: In the original equipment the timing was provided by electro-mechanical cam-timers. A sequence of 50 minutes of sample air followed by 5 minutes of each of the span gases proved to be adequate after an initial testing period using a 20 min, 5 min, 5 min sequence. During the initial period (April-June 1976) there were no permanent staff operating the station and the equipment was designed for remote, automatic operation with only intermittent attention to change gas cylinders, etc. In order to conserve gas mixtures and recorder charts, a second timer was incorporated which energized the system for six out of each twelve hours centered on midday and midnight. The air pump, gas selection timer and recorder chart drive were controlled in this way. As the gas cylinder regulators had to be left open during unattended operation, an on/off solenoid valve, operated from the same timer, was installed in each gas line to ensure that no gas was lost in the period when the system was closed down or in the event of power failures. In early 1977 an electronic timing circuit was built to replace the cam-timers. This incorporated a selection facility whereby the permanent personnel now at the station could select whether the monitoring was to be continuous or on a 6 hr on/6 hr off cycle depending on the conditions expected. Manual switching facilities were available on all valves to allow any of the gas flow rates to be adjusted. By mid-1978 supplies of calibration and reference gases had improved and the equipment plumbing had been upgraded to such an extent that the CO_2 was continuously monitored most of the time.

Data acquisition: Prior to the introduction of data logging equipment, the gas analyser outputs were recorded only on potentiometric recorder charts. The hourly CO_2 data were later extracted from the charts manually and placed on computer files along with hourly mean wind speed and direction data from Woeffle recording anemograph charts (W. Lambrecht, KG Gottingen, W. Germany). In steady baseline conditions the CO_2 reading in the final five minutes prior to calibration was considered to give suitable accuracy.

In February 1978 a 9-channel data logger was installed to collect information from the CO_2 and auxilliary meteorological instruments including wind speed and direction, the analogue recorder charts being retained as backup for CO_2 and wind direction.

The sequence of integration of the NDIR signal for each hour is illustrated in Figure 2.4. Basically 5 min were allowed in each hour for the observation of each span gas and 50 min for measuring the atmospheric CO_2 concentration. Because of the slow response of the instrument, however, a 1 or 2 min equilibration time was required after each gas change before signal integration commenced. The span gas signals were then integrated for 2 x 2 min periods and the atmospheric signal for 4 x 12 min periods.

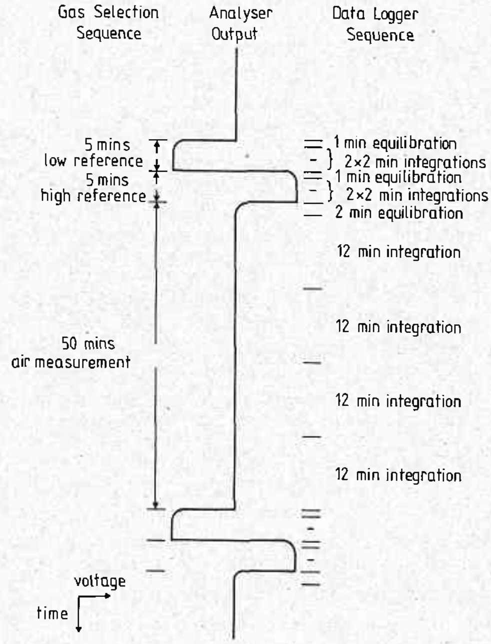

Figure 2.4

The hourly sequence of calibration and measurement by the Cape Grim Mark I CO_2 analyser showing the integration periods.

The cassette recordings made by the data logger, each containing up to about 2 weeks CO_2 and meteorological data, were returned to the Aspendale laboratory and the CO_2 concentration calculated as follows: The output voltage associated with both the Hispan and Lospan gases was estimated for the mid-point of each sampling period by linear interpolation between successive hourly observations. The instrument sensitivity or scale factor (α) was calculated using the relationship,

$$\alpha = (C_{Hi} - C_{Lo})/(V_{Hi} - V_{Lo}) \text{ ppmv mV}^{-1} , \qquad \ldots (1)$$

where C_{Hi} and C_{Lo}, V_{Hi} and V_{Lo} are the concentrations of the high and low span gases and the corresponding output voltages respectively. The concentration of the sample gas (C_A), in ppmv, is then determined from

$$C_A = C_{Hi} - \alpha (V_{Hi} - V_A) , \qquad \ldots (2)$$

where V_A is the output voltage corresponding to the air sample being analysed. The assumption implicit in Equation (2) is that the instrument voltage response is linear with respect to concentration in the range of measurement. The concentration C_A requires correction when the carrier-gas composition of the reference gases (CO_2 in N_2 throughout the period of observation described here) differs from the gas being measured (CO_2 in air). These corrections are described in Section 2.1.3 below.

The four values of the CO_2 concentration obtained in each hour were averaged to give an "hourly" mean while a standard deviation was calculated as an indication of the within-hour consistency and thus quality of the data.

Mark II instrumentation: The permanent laboratory at Cape Grim was built during 1980-81, the new (Mark II) CO_2 instrumentation being installed in June 1981. Whilst the general layout is the same as shown in Figure 2.2, some changes in detail have been made. Air from a high volume general intake 10m above the laboratory roof is passed through the full length of the monitoring room (Baseline 1981) in a 5 cm o.d. stainless-steel duct at a flow rate of 700 ℓ min^{-1}. The 10 m stainless-steel intake only became available in mid-October 1981, a temporary P.V.C. intake approximately 3 m high being used in the interim. Distributed along the laboratory duct are tapping points, fitted with stainless-steel shut-off and non-return valves, from which ambient air can be sampled for the various experiments. Most of the CO_2 monitoring equipment is mounted on panels in a single standard rack, stainless-steel tubing being used for interconnecting plumbing.

The cryogenic drying system was upgraded by the inclusion of a -80°C cooling bath. Small, interchangeable drying tubes in both the calibration and sample gas lines are immersed in a cold ethanol bath. Cooling to -60°C to -80°C is provided by a CryoCool CC-100 cooling probe (Neslab Instruments D.I.S.C., Inc., Portsmouth, NH, U.S.A.). To aid inspection and to avoid the cryodrier tubes in the air line blocking too rapidly, they were built of glass and have a volume much larger than the 0.64 cm o.d. stainless steel tubes in the span gas lines (Figure 2.3b).

However, after initial tests with this system, it was found necessary to return to chemical drying in July 1981 until an efficient condenser trap in the predrying (1°C) refrigerator was developed in June 1982. This consists of a 0.64 cm o.d. stainless steel coil mounted vertically in the refrigerator, at the base of which is a T-piece (Figure 2.3c). The horizontal arm of the T leads the air stream to the cryodrier whilst the vertical arm terminates at a solenoid valve through which any condensate can be drained. For this purpose the solenoid operates for 4 secs every hour when the span gases are being run by the operation timer. This is better than a normal glass condenser in that the dead space available for air stagnation is minimal. During the period of development of this system chemical predrying had to be used intermittently. Small chemical driers are still used in the final stage before the analyser. The analyser in the Mark II system is a URAS 2T instrument (S/No.30827270) which is mounted in a special, removeable cradle in the rack. Although the monitoring room is temperature controlled, the analyser is surrounded by panels of insulation material to ensure that external temperature effects are kept to a minimum. Provision for a 'Calibration' mode as described in Pearman (1980) is built into the system. Extra valves allow for the connection of up to four Secondary Standard gas mixtures. These can be run in a sequence with the routine working mixtures at suitable intervals to keep an ongoing check on the calibrations of the working gases and the analyser characteristics. The new analysis system was accompanied by a new operation timer and data logging unit. Either 'monitoring' or 'calibration' mode can be selected by a panel switch and any of the gas flows can be switched manually to the analyser as required. The same monitoring sample/calibration time sequence as in the original system was retained but the individual integration periods are different.

The new data logger and acquisition system was introduced in July 1981, the equipment being designed and constructed at Aspendale (Bennett, 1984). Minute by minute integrations of sixteen channels of data can be monitored and recorded digitally on magnetic tape cassettes. A dual cassette-drive mechanism automatically changes cassettes after 3 days of information is recorded.

The carbon dioxide calibration sequence on the new system is slightly different to the Mark I equipment in that the Hispan calibration precedes the Lospan calibration each hour. The uncorrected concentration is calculated using the last 2 minutes of the Hi- and Lo-span periods. The same linear interpolation is then used to evaluate any drift in the analyser response between successive calibrations. The equations for the computation of uncorrected and corrected concentrations are identical for both the Mark I and Mark II instrumentation.

2.1.3 Gas calibration and carrier-gas correction: The Tertiary Standard gas mixtures (span or working calibration gases) used at Cape Grim are calibrated by comparison with WMO Secondary Standards held at Aspendale. This means that the concentration values ascribed can be related to those from other stations in the WMO BAPMoN. Detailed descriptions of the calibration techniques used are given elsewhere (Beardsmore et al., 1978; Pearman et al., 1983). After use at Cape Grim the gas mixtures are returned to Aspendale for final calibration. Tables 2.2 and 2.3 summarize the usage of span gas cylinders at Cape Grim since the program's inception. The cylinder designation is an 'in house' numbering system for use in identifying the span gas cylinders in later computation processes. Gases used in the CO_2 monitoring programs at Aspendale are calibrated at intervals during their use in order to identify any concentration drifts which may occur with time (Pearman et al., 1983). The logistics of the Cape Grim gas supply have precluded the use of this method to date although the introduction of regular in situ calibrations as described in Section 2.1.2 will improve our ability to detect concentration changes in the working gases. Full cylinders of span (and reference) gases are calibrated initially at Aspendale and shipped in batches to Cape Grim. When they are depleted in pressure to approximately 2500 kPa. they are returned to Aspendale for a final calibration. Any drifts in concentration between the two calibrations are assumed to be linear with time and a final, mean CO_2 concentration is ascribed to the cylinder. Although periods of actual usage of the mixtures were not prolonged, transport and storage times could increase the period between the initial and final calibrations quite substantially. An inspection of Tables 2.2 and 2.3, however, shows that only 11 of 85 (13%) recalibrated cylinders used to date drifted by more than 0.4 ppmv in periods up to 23 months. Thus, in most cases, a mean concentration value will be in error by < 0.2 ppmv. No gas mixture in the Tables show a drift of more than 0.8 ppmv. On several occasions cylinders were inadvertently completely emptied and no final calibration (NFC) was possible. In these cases the initial CO_2 concentration value had to be used.

The CO_2 concentrations for air samples computed using NDIR gas analysers calibrated with CO_2/N_2 gas standards require a correction factor to be applied (Bischof, 1975; Pearman and Garratt, 1975; Pearman, 1977). The detailed description of the methods used to determine these carrier-gas correction factors for the analysers used in the Cape Grim program is given in Pearman et al. (1983). The correction factor (F) has the form $F = A + B\ C_A$ where A and B are experimentally determined constants and C_A is the apparent CO_2 concentration. The values of these constants for each analyser are included in Table 2.1. Where the tabulated values differ from those given in Pearman et al. (1983), the changes have resulted from subsequent tests using a larger suite of Secondary Standards and, in some cases the omission of data from cylinders where concentration drift was suspected. The true value of CO_2 concentration (C_T) can then be determined by the equation $C_T = F \times C_A$. In accordance with WMO recommendations (WMO, 1981), CO_2/N_2 calibration gases were replaced with CO_2/air mixtures at Cape Grim on 2 November 1982, thus eliminating the necessity for carrier gas correction.

2.1.4 Flask sampling: Air samples have been collected in 0.5 ℓ glass flasks at intervals and returned to Aspendale for analysis. A comparison between the CO_2 values from the flasks and those from the in situ program enable a check to be kept on the equipment and procedures at Cape Grim. The flask sampling equipment used in the temporary laboratory is illustrated in Figure 2.5(a)

Cylinder Designation	Cylinder S/No.	Material of Construction (S=Steel) (A=Aluminium)	Approx. Capacity at Atmospheric Pressure (m^3)	Period of Use From	Period of Use To	Approx. Period Between Cal'ns (months)	Approx. Upward Concentration Drift During Period (ppmv)
T26	TU966	S	6	1.4.76	13.6.76	-	NFC
B/L4	ALSA4629	A	3	19.6.76	26.7.76	-	NFC
BE1	ALSB1401	A	3	13.9.76	10.10.76	-	NFC
BE5	ALSB1410	A	3	11.10.76	7.11.76	-	NFC
BE10	ALSB1394	A	3	7.11.76	22.11.76	3	.1
BE2	ALSB1411	A	3	22.11.76	10.12.76	3	.2
BE7	ALSB1440	A	3	10.12.76	30.12.76	3	-.1
BE11	ALSB1416	A	3	30.12.76	18. 1.77	3	0
BE8	ALSB1406	A	3	18. 1.77	4. 2.77	2	-.2
BE13	ALSB1409	A	3	4. 2.77	25. 2.77	4	.1
BE18	ALSB1439	A	3	25. 2.77	28. 2.77	See Lospan	
BE15	ALSA4581	A	3	28. 2.77	22. 3.77	4	.3
BE2	ALSB1411	A	3	22. 3.77	12. 4.77	4	.2
BE17	ALSA4629	A	3	12. 4.77	29. 4.77	4	.3
BE21	ALSC8492	A	3	29. 4.77	19. 5.77	2	.1
BE23	ALSC8480	A	3	19. 5.77	7. 6.77	2	.2
BE22	ALSC8529	A	3	7. 6.77	27. 6.77	5	.3
BE19	ALSC8503	A	3	27. 6.77	22. 7.77	5	.1
BE20	ALSC8486	A	3	22. 7.77	23. 9.77	5	.2
BE26	ALSA4579	A	3	23. 9.77	2.12.77	6	.8
BE45	ALSE4607	A	3	2.12.77	24. 2.78	7	.2
BE35	ALSD3404	A	3	24. 2.78	12. 5.78	8	0
BE24	ALSB1406	A	3	12. 5.78	23. 6.78	11	.5
BE29	ALSB1401	A	3	23. 6.78	18. 8.78	13	.2
BE39	ALSE4886	A	3	18. 8.78	23.10.78	13	-.1
BE30	ALSD3387	A	3	23.10.78	22.12.78	15	0
BE33	ALSD3403	A	3	22.12.78	20. 2.79	10	.2
BE34	ALSD3396	A	3	20. 2.79	9. 4.79	15	.3
BE50	ALSA4667	A	3	9. 4.79	9. 5.79	9	.3
BE47	ALSB1429	A	3	9. 5.79	2. 7.79	-	NFC
BE51	ALSC7087	A	3	2. 7.79	20. 7.79	-	NFC
BE51				23. 7.79	28. 8.79		
BE44	ALSE4616	A	3	20. 7.79	23. 7.79	See Lospan	
BE40	ALSE4610	A	3	28. 8.79	24.10.79	16	.1
BE46	ALSE4612	A	3	24.10.79	4.12.79	7	.2
BE54	ALSD3444	A	3	4.12.79	24.12.79	6	-.2
BE54				28. 3.80	15. 4.80		
BE55	ALSD3456	A	3	24.12.79	12. 2.80	4	-.4
BE58	ALSD3441	A	3	12. 2.80	28. 3.80	6	-.3
BE60	ALSE4605	A	3	15. 4.80	13. 6.80	5	-.2
BE64	ALSB1438	A	3	13. 6.80	4. 9.80	8	.3
BE61	ALSD0430	A	3	4. 9.80	7.10.80	8	.2
BE68	ALSC8486	A	3	7.10.80	5.12.80	11	.4
BE69	ALSN1201	A	3	5.12.80	9. 2.81	7	-.1
BE70	ALSN1204	A	3	9. 2.81	15. 4.81	10	-.1
BE72	ALSN1195	A	3	15. 4.81	25. 6.81	10	.1
BE75	ALSN1203	A	3	25. 6.81	27. 8.81	14	-.3
BE76	ALSE4886	A	3	27. 8.81	30.10.81	7	-.1
BE77	ALSN6866	A	3	30.10.81	30.11.81	23	.3
MARK II							
BG68	ALVA437	A	6	4. 6.81	12. 1.82	14	.2
BG70	ALVA442	A	6	12. 1.82	26. 5.82	16	.2
BG75	ALVF288	A	6	26. 5.82	2.11.82	12	.5
GA4	ALVA180	A	6	2.11.82	31. 3.83	6	.2

Table 2.2 Summary of Hispan Tertiary standard gases used during the course of the Cape Grim CO_2 monitoring program. All were CO_2 in nitrogen mixtures until 2nd November 1982 when the system changed to CO_2 in air standards. The 'See Lospan' notation indicates that these gases were used mainly as Lospan mixtures and the data for their calibration period and concentration drift are contained in Table 2.3. In some cylinders no final calibration (NFC) was possible after usage at Cape Grim.

Cylinder Design-ation	S/No.	Material of Construction (S=Steel) (A=Aluminium)	Approx. Capacity at Atmospheric Pressure (m^3)	Period of Use From	To	Approx. Period Between Cal'ns (months)	Approx. Upward Concentration Drift During Period (ppmv)
T27	AAF034	S	6	1. 4.76	13. 6.76	7	.8
B/L3	ALSA4667	A	3	19. 6.76	26. 7.76	-	NFC
B/L1	ALSA4654	A	3	13. 9.76	10.10.76	3	.5
BE6	ALSB1398	A	3	11.10.76	7.11.76	3	0
BE8	ALSB1406	A	3	7.11.76	22.11.76	2	.3
BE9	ALSB1412	A	3	22.11.76	24.12.76	3	-.1
BE14	ALSA4596	A	3	24.12.76	7. 1.76	2	-.2
BE12	ALSB1438	A	3	7. 1.77	18. 2.77	4	.1
BE4	ALSB1397	A	3	18. 2.77	7. 4.77	8	.1
BE18	ALSB1439	A	3	7. 4.77	9. 5.77	5	.3
BE16	ALSA4667	A	3	9. 5.77	17. 6.77	2	.2
BE9	ALSB1412	A	3	17. 6.77	12. 7.77	5	.1
ET2	ALSB1417	A	3	12. 7.77	17.10.77	4	.4
BE28	ALSA4654	A	3	17.10.77	21.12.77	6	.5
BE12	ALSB1438	A	3	21.12.77	3. 2.78	-	NFC
BE36	ALSD3400	A	3	3. 2.78	20. 4.78	8	0
BE32	ALSD3397	A	3	20. 4.78	10. 7.78	10	.2
BE43	ALSE4608	A	3	10. 7.78	18. 9.78	9	.3
BE27	ALSB1440	A	3	18. 9.78	7.11.78	16	-.2
BE42	ALSE4619	A	3	7.11.78	12. 1.79	15	-.1
BE49	ALSC4673	A	3	12. 1.79	20. 2.79	6	.5
BE31	ALSD3402	A	3	20. 2.79	18. 4.79	11	0
BE38	ALSE4609	A	3	18. 4.79	11. 6.79	9	-.1
BE44	ALSE4616	A	3	11. 6.79	20. 7.79	-	NFC
BE44				23. 7.79	25. 7.79		
BE51	ALSC7087	A	3	20. 7.79	23. 7.79	See Hispan	
BE52	ALSB1415	A	3	25. 7.79	5. 9.79	11	.2
BE48	ALSB1412	A	3	5. 9.79	26.10.79	11	.2
BE53	ALSD3404	A	3	26.10.79	7.12.79	7	.4
BE56	ALSB1440	A	3	7.12.79	23. 1.80	4	.1
BE41	ALSE4606	A	3	23. 1.80	12. 2.80	-	NFC
BE57	ALSE4608	A	3	12. 2.80	5. 3.80	6	0
BE54	ALSD3444	A	3	5. 3.80	6. 3.80	See Hispan	
BE62	ALSC7084	A	3	6. 3.80	8. 5.80	2	.5
BE59	ALSF0684	A	3	8. 5.80	20. 6.80	5	0
BE59				10. 7.80	22. 7.80		
BE63	ALSD0364	A	3	20. 6.80	10. 7.80	5	.5
BE66	ALSD3397	A	3	22. 7.80	15. 9.80	4	.2
BE65	ALSE4606	A	3	15. 9.80	7.11.80	11	0
BE67	ALSA4629	A	3	7.11.80	29.12.80	11	0
BE71	ALSN1199	A	3	29.12.80	23. 2.81	7	-.3
BE73	ALSN1202	A	3	23. 2.81	1. 5.81	10	-.2
BE74	ALSN1200	A	3	1. 5.81	1. 7.81	10	0
BG69	ALVA447	A	6	1. 7.81	23.10.81	8	-.3
BE78	ALSE4609	A	3	23.10.81	30.11.81	14	.1
MARK II							
BG65	ALVA215	A	6	4. 6.81	8.12.81	8	-.2
ET40	ALSK0046	A	3	8.12.81	12. 2.82	8	.1
BG81	ALVF285	A	6	12. 2.82	14. 7.82	8	.6
BG82	ALVF291	A	6	14. 7.82	2.11.82	16	.6
GA2	ALVD219	A	6	2.11.82	31. 3.83	6	-.1

Table 2.3 As for Table 2.2 but for Lospan standard gases. The 'See Hispan' notation indicates that these gases were used mainly as Hispan mixtures and data for their calibration period and concentration drift are therefore contained in Table 2.2.

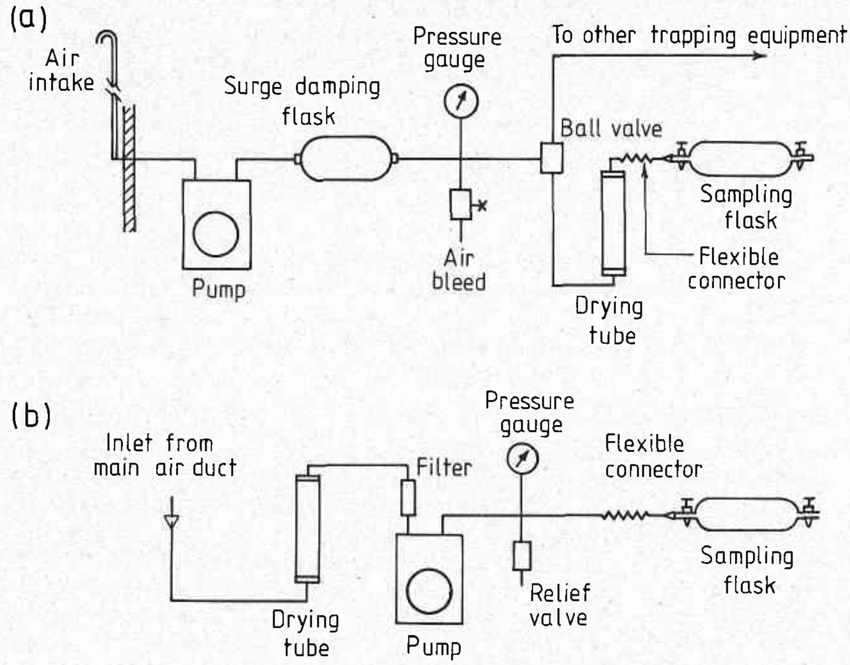

Figure 2.5 Schematic diagrams of the flask sampling equipment used at Cape Grim, (a) in the temporary laboratory, and (b) in the new permanent laboratory building.

A 0.64 cm o.d. copper inlet tube passed through the wall from the sampling point above the upwind side of the caravan. A metal bellows pump drew in air at about 10 ℓ min^{-1} and passed it through a stainless steel surge-damping flask and a drying tube to the glass sampling flask, a gauge indicating overpressure in the flask. Provision of a 3-way ball valve and an air bleed (shut when collecting air samples) enabled the equipment to be used for collection of samples for other purposes as well. CO_2 concentrations of the flask samples were determined on the Aspendale analysis system (Beardsmore et al., 1978). While the equipment always remained basically the same, changes in its position in the caravan necessitated the length and position of the inlet tube to be altered occasionally.

With the shift into the new laboratory, a new pump unit was constructed which was dedicated solely to the collection of flask samples (Figure 2.5b). In this case air is drawn by the pump through a drying tube and filter from one of the tapping points on the main laboratory air duct and passed to the collection flask. A pressure gauge and relief valve on the outlet of the pump respectively monitor the flask filling and protect the pump valves. In both systems the flasks were flushed for 4-5 min before the sample was trapped.

In the first 15 months of the station's activities, collection of flask samples was infrequent and randomly timed. However, since September 1978, two or three flask samples have been collected (on a fairly routine basis) at one to two week intervals, weather and staffing conditions permitting.

2.1.5 Problems: Conditions in the temporary laboratory were rather harsh for the precision monitoring required. The gas analysers, with their microphonic detectors, were particularly susceptable to mechanical vibration caused by the wind on the exposed walls of the caravan. Even mounting them on posts in the ground did not entirely alleviate the situation in very windy conditions.

Failures (mainly short term) in the mains power supply occurred quite frequently, particularly in the first three years of operation. With the commencement of construction of the new laboratory in February, 1980 (Baseline, 1983), the supply line and mains transformer were upgraded and power failures became less frequent. In order to minimize their effects, the operation timers, data logger and gas control solenoids were operated from 24 volt heavy-duty accumulators which were constantly trickle charged. Thus, although power failures affected the analyser, chart recorder and pump, if power returned within approximately 48 hours (the discharge time of the batteries), the system automatically resumed operation with its timing sequences undisturbed. The new building is equipped with facilities for automatic backup power generation and the problem has thus been eliminated.

Between February 1980 and the completion of the new laboratory some baseline data may have been lost as a consequence of the building activities. These losses were caused by extra personnel moving within the caravan causing excess vibration and disturbances to the temperature stability as well as actual contamination of the air. However, as the new building was downwind of the caravan when baseline conditions prevailed, contamination episodes would have been intermittent and minimal.

Checking on the operation of the CO_2 program has been made difficult by the relatively long periods between the acquisition of the data and the final computation of the CO_2 concentrations. Apart from such things as power failures and major contamination episodes which show up readily on the analogue recorder charts, slow drifts in equipment characteristics have been almost impossible to detect at the station to date. Not until the span gases have been recalibrated and calculations completed can a final assessment be made, although tentative decisions can be taken on the basis of comparisons between the analogue charts and flask data. Thus, a lag of several months can occur before a malfunction of the system is corrected, leading to a decrease in the precision of the results or even a loss of data altogether. This problem has recently been remedied to some degree with the installation at the station of standard surveillance cylinders as described in Pearman (1980) and in Section 2.1.3. Further improvement will follow the establishment of on-site data handling by station staff using a dedicated computer system.

2.1.6 Data handling at Aspendale: The original computer system at Aspendale which was used for data processing consisted of a Hewlett Packard M-1000 processor, a 120 megabyte disc drive, plotter, printer and magnetic tape unit. A cassette reading unit designed in the Division was interfaced to a Hewlett Packard 2100 processor to enable the reading of data cassettes from Cape Grim. These functions were expanded over the period of the study to include a Hewlett Packard F-1000 processor.

During 1983, 2 Hewlett Packard A-700 processors and 2 120 megabyte disc drives were purchased for real time acquisition and processing of data in the new laboratory at Cape Grim. Together with a magnetic tape unit, printer and several visual display units this hardware will be used in the future to provide on-site data processing facilities.

However, one processor, disc drive and the magnetic tape unit have been relocated temporarily at Aspendale during 1983/84 to facilitate software development and processing of earlier data.

During the years since the installation of equipment at Cape Grim, there has been constant development of the software and data processing and editing procedure designed to ensure the integrity of the final data sets. To achieve this, processing has been subdivided into the three distinct stages of processing, editing and selection.

Processing (see Appendix 9B, 9C): This involved the reading of raw data from digital cassettes and the subsequent calculation of hourly means of CO_2 concentration and meteorological parameters. Standard deviations of the individual readings contributing to each mean were also calculated. For data collected using the Mark I system, the sequence of events was as follows:

1. Extract raw data (counts) from cassette,
2. Time mark raw data,
3. Compute uncorrected values of CO_2,
4. Apply carrier-gas correction,
5. Compute associated meteorological values,
6. Check that CO_2 and meteorological values are within reasonable limits,
7. Compute hourly means and standard deviations for all parameters,
8. Print out hourly means.

In the period February 1978 through September 1981, 103 Mark I data cassettes were acquired. These produced approximately 250,000 records of raw data which were reduced to about 31,000 hourly mean values with standard deviations. The time marked raw data and unedited hourly means were stored on magnetic tape and as hard copy printouts.

As the Mark II data logger recorded time information and 16 channels of millivolt readings at 1 min intervals, a separate suite of programs was needed to carry out the initial processing of the data collected by that system. A suite of 8 programs was developed. (See Appendix 9H, 9I). Each data cassette produced over 4000 records with 180 Mark II cassettes being accumulated until the end of 1982. The initial transfer of data from cassette to disc file and magnetic tape was essentially the same as that outlined above for Mark I data. The 3 subsequent stages of processing were:

(I) Conversion of sequential raw data files of millivolt readings to direct access files for rapid processing,

(II) Processing of direct access files to produce carrier-gas corrected CO_2 concentrations in hourly means (with standard deviations) together with wind speed and direction for both the 3m and 10m instruments. Up to 6 data cassettes (18 days) of raw data could be processed at one time,

(III) The direct access output file from Stage (II) was reformatted to a sequential access output file, compatible with the Mark I editing, and selection programs.

Editing (see Appendix 9D, 9E): Editing involved the removal of spurious data logged during periods of instrumental adjustments and power failures. Where backup data for CO_2, wind speed and wind direction were available these were extracted from analogue charts and inserted into the data set suitably flagged for future identification. The sequence of editing the hourly mean data was as follows:

a. Concatenate individual result files (CO_2, wind speed, wind direction) into yearly files and save these on magnetic tape,

b. Create files of dates/times to be removed from yearly files, one file for each parameter monitored,

c. Create files of insert backup data for CO_2, wind speed and wind direction,

d. Edit out hourly means using the files created in b,

e. Insert backup data using files created in c,

f. Store edited yearly files of hourly means and standard deviations on magnetic tape and produce print out.

Selection (see Appendix 9F, 9G): Having produced a reliable data set an attempt was made to select data which were representative of baseline or background conditions. The selection procedure was as follows:

(i) The number of hourly means in each month was established and the yearly edited files subdivided into monthly files,

(ii) These were subjected to appropriate selection criteria producing monthly files with baseline data flagged. Hard copy was produced giving monthly means of daily averages.

The selection criteria investigated were:

A. Consistency of CO_2 data within specified limits (e.g. 0.3 ppmv) over a specified period (e.g. 5 hours),

B. Wind direction in a specified sector (e.g. 190-280°),

C. Wind speed greater than a specified value (e.g. 18 km hr^{-1}),

D. Standard deviation of individual values within an hour less than a specific value (e.g. 0.2 ppmv),

E. Various combinations of A through D.

The criteria used in the present presentation are described in Section 3.

(iii) Difficulties encountered due to the use of selection criteria on data at the beginning or ends of each month and the complexities of handling many monthly files have been recently overcome using a program which treats the entire data set in a single run. Data are subdivided into yearly files prior to storage on magnetic tape.

(iv) The selected files were the input files for a further program which produced hard copy of daily, monthly and annual means (either complete or selected data) together with associated standard deviations and numbers of data points (see Appendices 1, 2 and 3).

2.2 Mawson (67°37'S, 62°52'E)

2.2.1 Site: Mawson (Figure 2.6) is one of the three permanent research stations operated by the Antarctic Division of the Australian Department of Science and Technology (DST) on the Antarctic continent. It lies at the southern end of a horseshoe-shaped rocky area enclosing a small, sheltered, deep-water harbour (Antarctic Division, 1982). The level of the area gradually rises until it meets the continental ice-sheet 300-400 meters inland. South-easterly katabatic winds from the ice plateau prevail at a mean annual speed of 40 km hr^{-1} making Mawson one of the windiest places on earth (Betts, 1981).

2.2.2 Monitoring techniques: CO_2 monitoring at Mawson involves the collection of discrete air samples in 0.5 ℓ glass flasks for later analysis at Aspendale. Each summer a number of flasks is sent to the station on the annual supply ships. The air samples are collected throughout the year by personnel of the Australian National Antarctic Research Expeditions (ANARE), stored and returned to Australia on the next year's relief ships. Sampling frequency was originally restricted to a pair of flasks each month, the conditions being selected by the

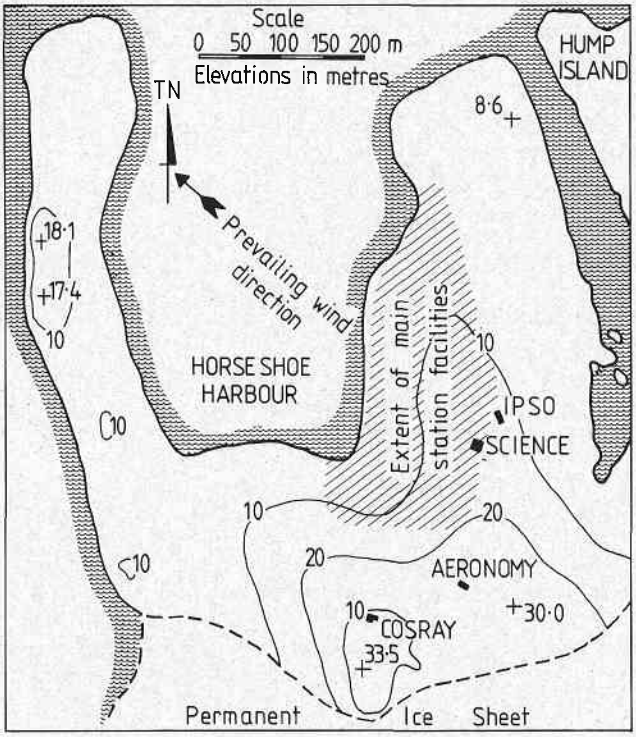

Figure 2.6

Site details of Mawson station showing the position of buildings mentioned in the text.

operator so that there was no possibility of contamination from station activities. When interest was aroused regarding the period of ice-pack break-up in summer, from December 1981 the sampling frequency was increased to two pairs of flasks each month (at approximately 2-weekly intervals) between December and May each year and one pair for each of the other months.

The semi-portable pump unit used at Mawson is basically the same as that used at Cape Grim (Figure 2.4b), the main difference being that cradles are provided for two flasks to be side by side in it's carrying box. For various reasons the pump unit and it's operating position have had to be modified from time to time in the course of the experiment. The original unit in December 1977, had the metal-bellows pump driven by a 12 Vd.c. battery-powered motor. On sampling days it was taken upwind from the Cosray building (see Figure 2.6) where it was stored and a collapsible, 1.5m high intake tube fitted to the pump intake. The two flasks connected to the system were filled concurrently, the observer keeping as far downwind as possible, the equipment then being returned to storage where the accumulator was recharged. In this unit no provision was made for drying the air samples at the time of collection. Drying was done prior to analysis at CSIRO. In January 1978, a fire in the Cosray building caused some damage to the pump unit and resulted in the sampling site being shifted to the vicinity of the Science building where the equipment was now stored.

This unit remained operational until November 1979, although failure of the inbuilt accumulator meant that an extra battery had to be carried out with the unit. In March 1979, the sampling site was moved to the high area upwind of the station near the Aeronomy building. A new pump unit, delivered to the station in December 1979, was driven by a 230V 50Hz motor at the end of a long extension lead and a chemical drying tube was fitted to the pump inlet for the first time. A valve was also fitted to allow the two flasks to be filled consecutively, rather than at the same time, thus giving duplication in the event of contamination during one filling operation. Because of the extreme discomfort to the observers when operating the equipment in exposed positions, the intake was modified so that it projected from the corner of the Science building into the wind flow while the operator was somewhat protected in the lee of the building. This was not entirely satisfactory from the monitoring viewpoint as the operating site had to be at the downwind end of the building. In March 1980, the equipment was therefore moved to a semi-permanent position inside the Science building. A fixed copper inlet tube to the pump unit was passed through the wall at the upwind (SE) corner of the building, the intake being about 3m from the ground and pointing downwards to avoid the entry of any precipitation. Besides adding to the comfort of the operator, the system also avoided the thermal shock previously experienced by the glass flasks when taken indoors after being filled. This arrangement remained until December 1981, when the proximity of building activities on new living quarters threatened possible contamination at the sampling site and the equipment was shifted to the unused ionospheric observatory (IPSO) building. A 2.5m long, permanent intake tube brings air from about 0.5m above the upwind end of the observatory roof to the pump unit inside.

2.2.3 Problems: There appear to be few problems with the monitoring system at Mawson. The fact that the sampling schedule involves only one or two days per month means that the operator is able to choose when there is virtually no possibility of anthropogenic contamination. There has been no evidence to date of any problems induced by the long storage times for some of the samples, particularly since they have been dried during collection. The main loss of data occurs with occasional breakages of the glass flasks during their shipment between Australia and the Antarctic and back.

2.3 Macquarie Island (54°29'S, 158°58'E)

2.3.1 Site: Macquarie Island is located in the sub-Antarctic westerly wind belt. It is a long narrow island some 37 km long by 3 km wide (Antarctic Division, 1982; Betts, 1981) and consists mainly of a plateau about 300m high. Although no trees grow on the island, it is well endowed with grasses and succulent species. The research station operated by the Antarctic Division (DST) is situated on a low narrow isthmus near the northern end of the island (Figure 2.7) from which position an oceanic wind fetch can be experienced from two directions. As the station is in a belt of predominently westerly winds, CO_2 monitoring is carried out mainly when the winds are from the north-westerly quadrant although, on occasions, consistent CO_2 concentrations have been observed when they are from the south-east.

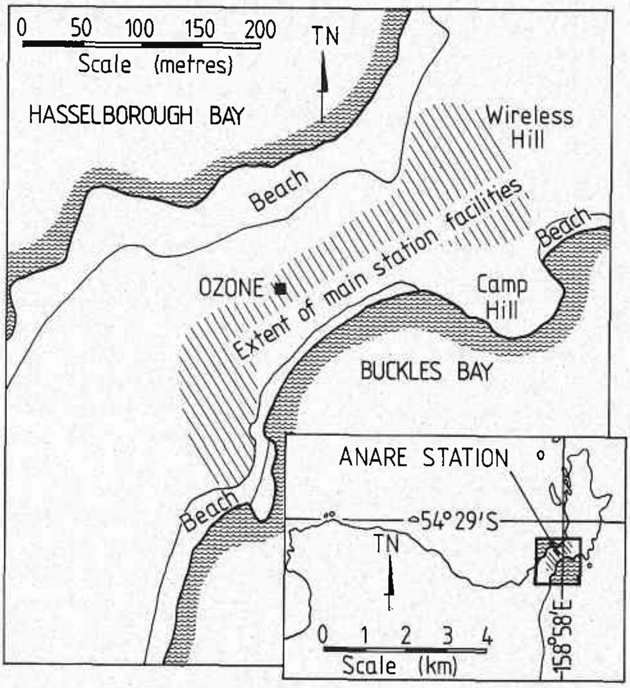

Figure 2.7

Site details of the Macquarie Island station including its position relative to the remainder of the island (inset).

2.3.2 Measurement technique: The CO_2 monitoring program at Macquarie Island is based on an in situ ADC, type 225, NDIR gas analyser (Analytical Development Company Limited, Hoddesdon, Hertfordshire, England). It is a parallel-cell type instrument which is capable of being operated in either an absolute or differential mode with a flowing reference gas. In this program it is used in the 25-0-25 ppmv differential mode. The auxilliary gas control equipment is of basically the same configuration as that at Cape Grim. Air is drawn through a 0.95 cm o.d. Dekabon '1300' tube (Olex Cables Ltd., East Brunswick, Victoria) from a position approximately 1m above the Ozone laboratory (see Figure 2.7). It passes through a flask to extract any liquid water and a dust filter before being delivered by the metal-bellows pump to the gas control solenoid valves via two chemical drying towers (Dehydrite) each fitted with a glass-wool filter. No refrigerated or cryo-drying stage is used. When the experiment commenced in 1979, an electro-mechanical cam-timer automatically controlled the operation of the valves in the same sequence as that at Cape Grim (i.e. 50 min sample, 5 min Lospan, 5 min Hispan). In February 1982, this operation controller was replaced by a solid state electronic unit which served the same functions. To simplify synchronization, this is equipped with a push-button facility to initiate the timing sequence. In both old and new units, override switches allow manual control for the setting of gas flow rates. As with the Cape Grim system, all gas flows to the analyser are via 7 micron Swagelok filters and are monitored by flowmeters. No final chemical drying tubes are fitted in the Macquarie Island equipment. The flow rates of the span gases are adjusted by needle valves whilst that of the sample air stream is controlled by the second air-bleed tap. The ADC analyser differs from the URAS instruments in that it has a built-in provision for flushing the IR-source housing with CO_2-free air and providing a CO_2-free reference gas when operating in the absolute mode. This facility takes the form of a small pump which draws ambient air through a CO_2-stripping tower containing soda lime. In order to avoid changing the chemical in this built-in tower too often, two external glass towers have been provided. These contain soda asbestos and dehydrite to remove the CO_2 from and predry the air respectively, before it enters the analyser housing. The analyser output is recorded on a potentiometric chart recorder.

Although continuous, year-round operation is possible with this equipment, the logistics of supplying large quantities of reference and span gas mixtures and chemicals to the station, make it impractical. Enough supplies are sent to the island each year to enable CO_2 to be measured on three or four days per month. When the weather gives an indication of baseline conditions approaching, the operator activates the equipment and, after a suitable warming-up period, initiates the automatic timing sequence. After monitoring periods of between 8 and 30 hours the experiment is shut down until the next selected time. Thus, the operators choose monitoring periods when they expect baseline conditions to prevail and the gas and chemical supplies are not wasted in non-baseline weather.

2.3.3 Analysis technique: No data-logging facilities are included in the system, the CO_2 concentrations being determined by manual analysis of the analogue chart records. The mean output for the 50 minutes of sample air flow and the mean values for the Hispan and Lospan gases before and after the sampling periods are extracted from the charts and the hourly mean CO_2 concentration calculated by the same formulae used in other programs.

Table 2.4 Summary of Tertiary Standard gases used in the course of the Macquarie Island CO_2 monitoring program. All were mixtures of CO_2 in nitrogen contained in aluminium cylinders.

Cylinder		Approx. Capacity at Atmos Pressure (m^3)	Usage (H-Hispan) (L-Lospan)	Period of Use		Approx. Period Between Calibration (months)	Approx Upward Concentration Drift During Period (ppmv)
Designation	S/No.			From	To		
ET12	ALSC8486	3	H	17.4.79	17.8.79	13	-0.2
ET11	ALSA4654	3	L	17.4.79	17.8.79	12	+0.2
ET18	ALSE4619	3	H	31.10.79	4.5.81	16	-0.7
ET20	ALSB5029	3	L	31.10.79	9.5.80	18	-0.3
ET17	ALSC8492	3	L	10.6.80	22.11.80	19	-0.4
ET37	ALSK0044	3	L	2.12.80	10.10.81	16	-0.3
ET44	ALSK0049	3	H	9.5.81	10.10.81	17	-0.5
ET36	ALSK0043	3	H	16.4.82	6.10.83	29	+0.3
ET41	ALSD0580	3	L	16.4.82	22.7.82	16	0
ET33	ALSB1429	3	L	11.8.82	6.10.83	29	0

As with Cape Grim, the reference and span gases for Macquarie Island are CO_2 in N_2 mixtures and are calibrated at Aspendale before and after use on the island. Table 2.4 is a summary of the mixtures used there to date. The selection of a final concentration value for each mixture is carried out in a similar manner to those for Cape Grim. Perusal of the Table indicates that the drifts in mean concentration are of about the same magnitude as those at Cape Grim, although there is generally a somewhat longer period between calibration sets.

As all span gases used to date have been CO_2 in N_2 mixtures, the computed 'apparent' concentration of CO_2 (C_A) requires a correction factor to be applied to take into account the carrier gas effect on the analyser. The factor (F) deduced for the ADC analyser (S/No. 2020) used on Macquarie Island is given as

$$F = 1.0106(\pm 0.0036) + 0.77(\pm 1.11) \times 10^{-5} C_A \ .$$

CO_2-in-air span gas mixtures will be supplied to the experiment from October 1983 in accordance with the recommendations contained in WMO (1981).

2.3.4 Problems: Apart from the logistic problems mentioned above, the main trouble has been noise and drift in the output signal of the analyser. An attempt was made to lessen the signal drift due to changes in ambient temperature in the laboratory where the instrument is housed, by building an insulated enclosure around it. Noise induced by the mechanical vibration of the building by wind and personnel, were reduced at the end of 1980 by standing the analyser on a foam rubber mat. In July 1981, it was found that some inconsistencies in the output trace were due to the rubber air-bleed tubes perishing and splitting, thus giving variable sample flow rates. Better flow control was obtained by replacing the rubber hoses and screw clips with small brass taps.

About mid-1981 the response of the analyser began to deteriorate. Sensitivity dropped and the signal became noisier and variable, leading to the conclusion that the instrument was in need of maintenance. Although part of the problem was traced to poor regulation of the station power supply, the instrument was returned to Aspendale for maintenance and recalibration between October 1981 and February 1982. In the course of the maintenance it was found that the electronic vacuum tubes in the instrument had degenerated. These were replaced and the analyser returned to Macquarie Island where it, along with the new electronic operation timer and a rebuilt panel for the chemical towers, was installed in a new position in the Ozone laboratory. The adverse effect of the unregulated mains power supply on the timing of the optical chopper in the analyser persisted, however, and eventually the analyser had to be modified to incorporate a stabilized 240V, 50 Hz power supply to the chopper motor. To further smooth the chart recording in times of mechanical vibration due to high wind, an RC filter network with a 6.7s time constant was fitted across the recorded input terminals. Yet another development arose when occasional surges on the mains voltage caused the timing sequence of the new operation timer to be reset. While no data are lost by this occurence, it is inconvenient in the analysis of the charts and will hopefully be overcome by the installation of a mains filter in the power supply to the unit in October 1983.

2.4 Southern Ocean Ships

Sampling technique: During each summer season the Antarctic research stations are remanned and supplied by ships chartered by the Antarctic Division, DST (Betts, 1981). On some of these relief voyages expedition personnel collect air samples at intervals across the Southern Ocean on their way from and to Australia. The equipment used for these sample collections is similar to that used in the CSIRO aircraft CO_2 monitoring system (Beardsmore et al., 1978; Pearman et al., 1983). A butyl-rubber inlet tube from the pump unit is attached to the ship as far upwind as possible from any CO_2 sources. Air is drawn through a chemical drying tower by the pump and passed to one of a set (usually 6) of 0.5 l glass flasks. After flushing for at least 4 mins, the flask taps are closed, trapping an air sample at about 100kPa above ambient air pressure. Power is supplied to the pump from batteries which can be recharged on the ship. The sets of flasks are returned to CSIRO for their CO_2 content to be determined. Where possible, meteorological parameters are also noted by the operators.

2.5 Wilbinga (31°25'S, 115°33'E)

2.5.1 Site: Wilbinga is on the coast of Western Australia approximately 75 km north of Perth. The sampling site is on coastal dunes 100m from the Indian Ocean, the shoreline of which is oriented from about 30° west of north to 30° east of south at this point. For more than 30 km the land elevation rarely exceeds 100m. Vegetation in the vicinity of the site is restricted to a sparse cover of grasses and low shrubs.

2.5.2 Monitoring techniques: A box of six flask samples were collected at Wilbinga approximately once per month when personnel of the W.A. Department of Conservation and Environment were servicing their remote instruments. A semi-permanent copper tube from the inlet point, about 3m up an instrument mast, reached to near ground level where it was connected to the portable battery-operated pump unit used for sampling. The flasks were filled in turn with chemically-dried air in a manner similar to that used in the programs described previously. Basic meteorological information at the time of sampling was included when the flasks were returned to CSIRO for analysis each month. The only data loss in the program was due to an occasional flask breakage during transport.

3. The Data Sets

3.1 Cape Grim

A tabulation of all daily CO_2 concentrations measured by the original (Mark I) equipment in the temporary laboratory between April, 1976 and November, 1981, is given in Appendix 1(a) while Appendix 2(a) contains the similar data set from the Mark II equipment in the permanent laboratory between June, 1981 and December, 1982. All CO_2 concentrations in these and subsequent tabulations are expressed in the WMO 1981 CO_2 Calibration scales and, as previously stated, have had a carrier-gas correction applied to take into account the use of CO_2/N_2 mixtures as calibration gases. Also shown in these tables are the number of hours of data and the standard deviation for each day's mean, the number of days in the month when data are available and the monthly means and the annual means and standard deviations calculated from the monthly means. Total number of hours of data available for each month and for the whole year are also listed. While the equipment is operating efficiently data should be available for 24 hours of each day of every month. Table 3.1 shows the number of hours of CO_2 data acquired for each month since the inception of the monitoring program as a percentage of the total number of hours in each month. The percentages have risen from fairly low values early in the experiment to better than 90% per month with the permanently sited Mark II equipment in 1982. Contributions to the low sampling density have included power failures, equipment failure and maintenance periods and problems relating to the supply of calibration gases which, in the first two years, made it necessary for the equipment to be operated only 50% of the time.

Table 3.1 Total number of hours of CO_2 concentration data collected at Cape Grim each month as a percentage of the number of hours in the month. Annual figures are the means of the percentages for the months when data were available.

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	YEAR
MARK I EQUIPMENT													
1976	-	-	-	15	40	44	-	-	20	12	34	31	28
1977	44	50	41	20	-	21	13	-	-	32	62	56	38
1978	64	71	65	72	68	50	82	63	72	90	51	85	69
1979	70	78	89	96	95	64	92	94	88	96	90	94	87
1980	98	68	89	28	90	49	66	98	86	95	93	93	79
1981	93	94	97	69	92	98	70	91	95	82	22	-	82
MARK II EQUIPMENT													
1981	-	-	-	-	-	24	26	95	91	90	93	98	74
1982	98	97	98	84	94	97	81	99	92	99	90	98	94

The complete data set is of little use in estimating the baseline values, the CO_2 content being modified markedly depending on the trajectory and stability of the airmass being sampled. A set of selection criteria has therefore been devised to filter the hourly mean data leaving, hopefully, only those representing large-scale or background concentrations. Following studies of the monthly mean of baseline CO_2 concentration using different sets of selection criteria (Baseline, 1983), a combination of wind speed, wind direction and CO_2 consistency was developed.

This was (i) Wind speed : $\geq$ 18 km hr^{-1};

(ii) Wind direction : 190-280°;

(iii) Consistency : Hourly mean CO_2 concentration to be part of a block of 5 consecutive hours of data described as baseline by (i) and (ii) in which the CO_2 varies by 0.3 ppmv or less.

Appendices 1(b) and 2(b) contain the selected baseline CO_2 data sets for the Mark I and Mark II installations respectively, the relative parameters in the tables being the same as those described for the total data set.

The sensitivity of the CO_2 at Cape Grim to wind direction can be demonstrated by Figure 3.1 which shows a length of analogue chart recording CO_2 analyser output and wind direction. It can be seen that,

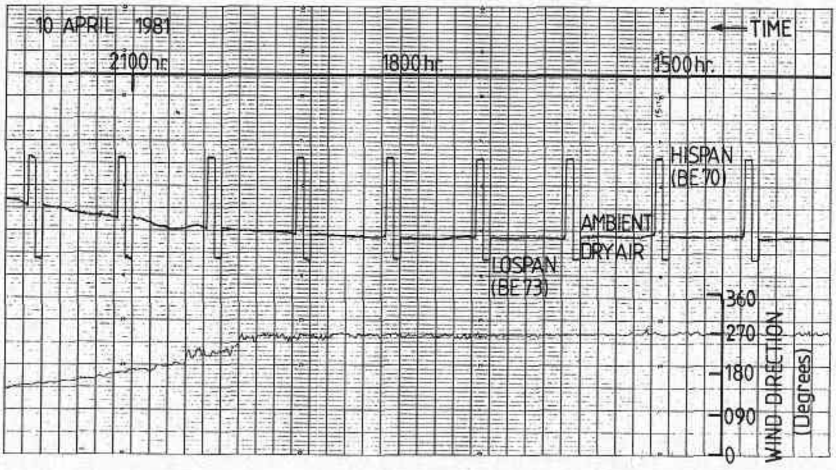

Figure 3.1 Typical section of analogue chart recording the outputs of an NDIR CO_2 gas analyser and a remote wind direction sensor. CO_2 calibrations are automatically performed every hour. CO_2 concentration difference between the Hispan and Lospan mixtures was 12.1 ppmv.

as the wind backs from an oceanic to a land fetch, CO_2 increases significantly as the effects of the land biota respiration are registered. CO_2 values after 2000 hours would be eliminated from the baseline set by the wind direction and/or consistency criteria.

The baseline data set contains a relatively small proportion of the total data available at Cape Grim. Table 3.2 gives the monthly percentage of baseline hours relative to the total monthly data available. It can be seen that most percentages vary between zero and 41% with an average of about 21% per month.

Table 3.2 Number of hours of baseline CO_2 data collected at Cape Grim each month as a percentage of the total number of hours of data available for that month. Annual figures are as for Table 3.1.

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	YEAR
MARK I EQUIPMENT													
1976	-	-	-	74	30	22	-	-	14	0	21	29	27
1977	23	18	3	25	-	22	29	-	-	28	26	36	23
1978	30	12	9	0	0	0	0	21	15	25	1	38	13
1979	34	36	19	25	31	2	4	4	0	0	20	20	16
1980	37	33	40	27	28	29	32	23	43	29	30	22	31
1981	28	18	20	30	7	11	0	33	5	0	0	-	14
MARK II EQUIPMENT													
1981	-	-	-	-	-	0	4	8	12	20	27	35	15
1982	41	32	20	22	28	14	16	33	22	29	19	18	24

In some cases the low figures are because no wind speed and/or wind direction data are available due to breakdown of the monitoring equipment. Normally valid CO_2 data would in this case be eliminated by the wind selection criteria. Also, at Cape Grim, there appeared to be a diurnal variation in CO_2 at times, particularly when measured by the Mark I equipment. In this case data would probably be eliminated by the consistency criteria at times of rapidly changing CO_2 near dawn and dusk.

The air samples in glass flasks which were collected periodically at Cape Grim were analysed for CO_2 at Aspendale on the equipment used for the CSIRO aircraft monitoring program. The results of these analyses for samples collected in Mark I equipment are listed in Appendix 4. All except obviously contaminated samples are listed although not all of them were collected in baseline conditions. Wind speeds and directions at the time of collection of each sample are also tabulated. In order to compare the in situ monitoring system with the flask samples, the in situ CO_2 at the time of flask sampling was computed from point values of analyser output obtained from the analogue chart. Figures 3.2(a) and 3.2(b) show the differences between the two systems for each of the flask samples taken under baseline conditions up to the end of 1982.

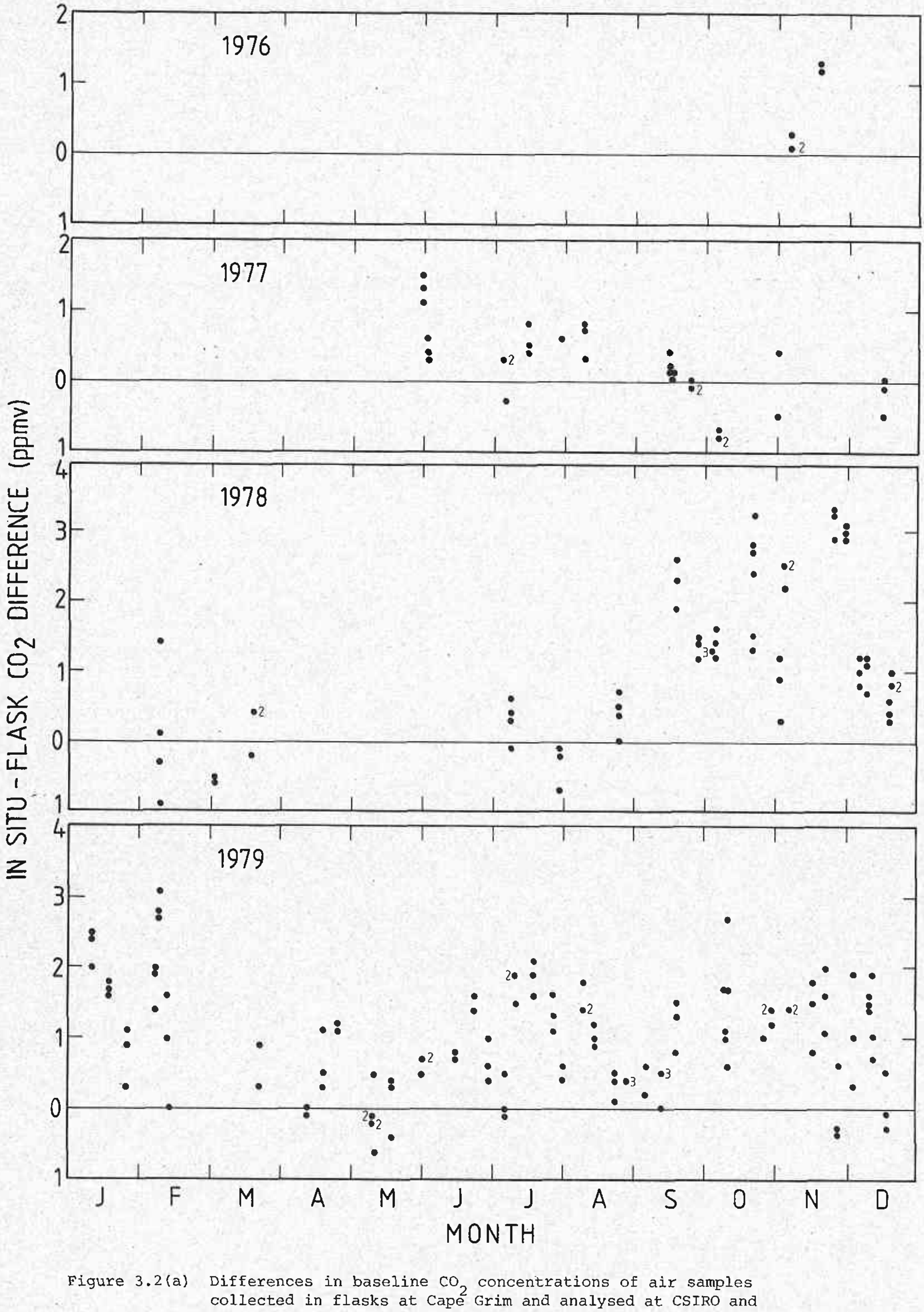

Figure 3.2(a) Differences in baseline CO_2 concentrations of air samples collected in flasks at Cape Grim and analysed at CSIRO and the values measured by the Cape Grim in situ analyser at the same time as each flask was filled during the years 1976 to 1979. Numbers indicate replicate samples which showed identical concentration differences.

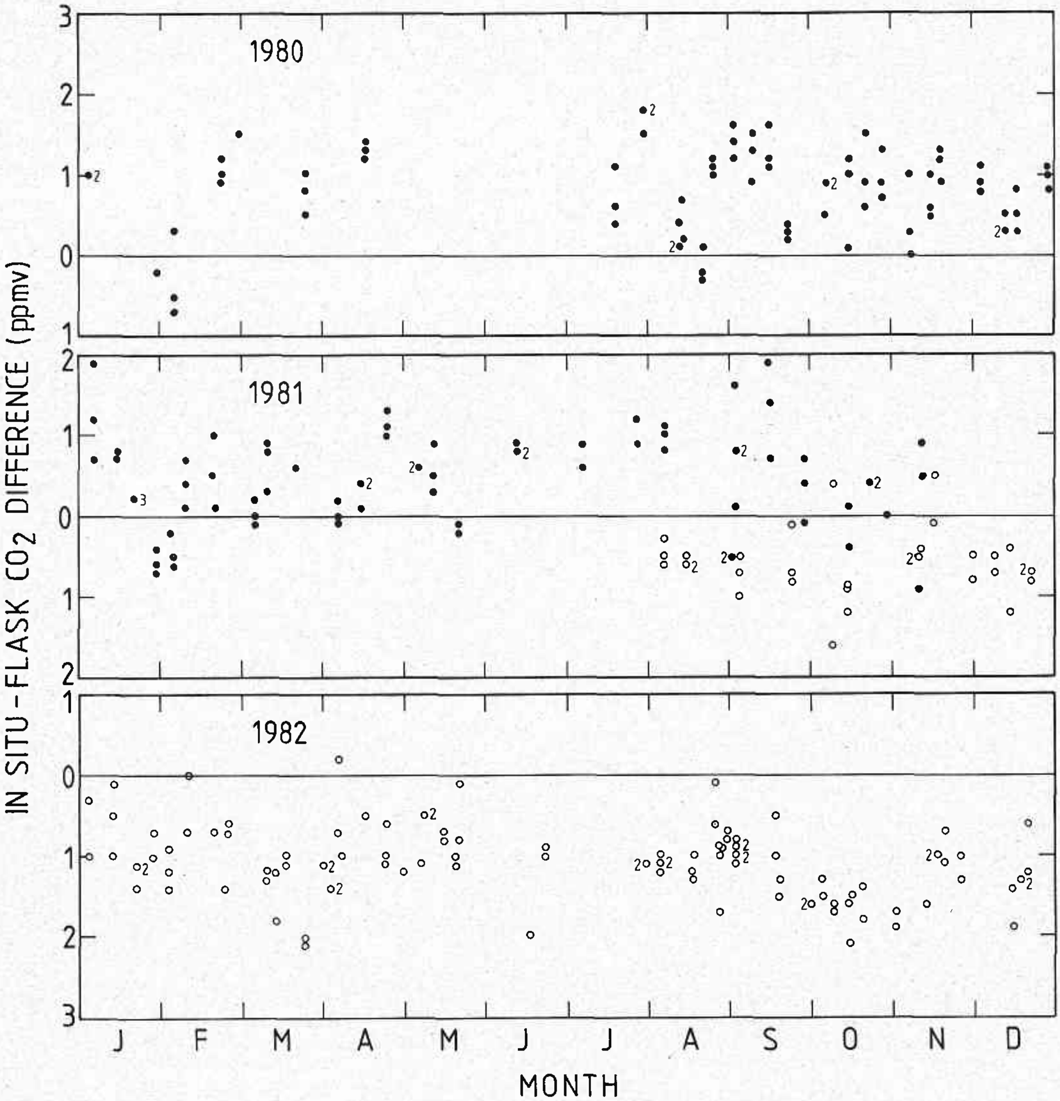

Figure 3.2(b) As for figure 3.2(a) during the years 1980 to 1982. ● - CO_2 differences using Mark I system. 0 - CO_2 differences using Mark II system.

Non-baseline values were not considered due to the relatively high-frequency variability of CO_2 concentration on many of these occasions. It is apparent from the Figures that, for the greater part of the sequence, significant differences existed between the two systems. These, and a derived correction to the in situ values, will be discussed later in this report. Appendices 3(a) and (b) list the finally corrected complete and selected daily CO_2 concentrations measured by the Mark I installation between 1976 and November 1981. The flasks from Mark II system were shown to be consistently contaminated (see Section 4) and are therefore not published.

3.2 Mawson

The CO_2 concentration of all flask samples collected at Mawson are listed, along with other relevant information, in Appendix 5. The samples were analysed at CSIRO and the appropriate 'carrier gas' correction factors applied. All samples were dried either when collected or before analysis except a small batch from March/April 1978. In this case a correction for the volumetric effect of water vapour on the UNOR type analyser, was made using the formula:

$$C_d = C_w (1 + 1.61 r)$$

where C_d and C_w are the CO_2 concentration of the dry and wet sample respectively and r, the mass mixing ratio of water vapour in the samples (see Pearman, 1975). This could lead to small errors, however, as experiments described in Pearman et al. (1983), indicate that a correction in excess of the purely volumetric one may be required. Samples were mainly collected with the wind in the south easterly sector off the Antarctic continental plateau. However, as samples were only collected in non-contaminating conditions, all data are considered to be baseline no matter what wind direction prevailed.

3.3 Macquarie Island

Appendix 6 lists the hourly mean concentration of CO_2, wind speed and wind direction for all periods of monitoring on Macquarie Island up to the end of 1982. All times are given in Australian Eastern Standard Time (AEST) (= G.M.T + 10 hours) although the local solar time precedes this by 36 minutes (i.e. local solar time = G.M.T + 10 hours 36 mins). Listed wind speeds are obtained from Australian Bureau of Meteorology observations at 3 hourly intervals. Intermediate values of wind speed and direction (in brackets) are interpolated between the observed values.

Although Macquarie Island has no large plants, the native flora is prolific enough to have a marked effect on the surface CO_2 at the monitoring point depending on the wind conditions at the time. Figure 3.3 illustrates the type of variation in CO_2 which may be expected as the wind changes between baseline and non-baseline conditions. A set of criteria therefore had to be developed to define what could be considered baseline data. As winds from two sectors approach the station over water, the baseline CO_2 selection criteria were determined to be:

(i) Wind direction : 110-180°, 290-360°;

(ii) Wind speed : ≥ 25 km hr^{-1};

and (iii) Consistency : Hourly mean concentration to be 0.3 ppmv or less from either adjacent valid hour.

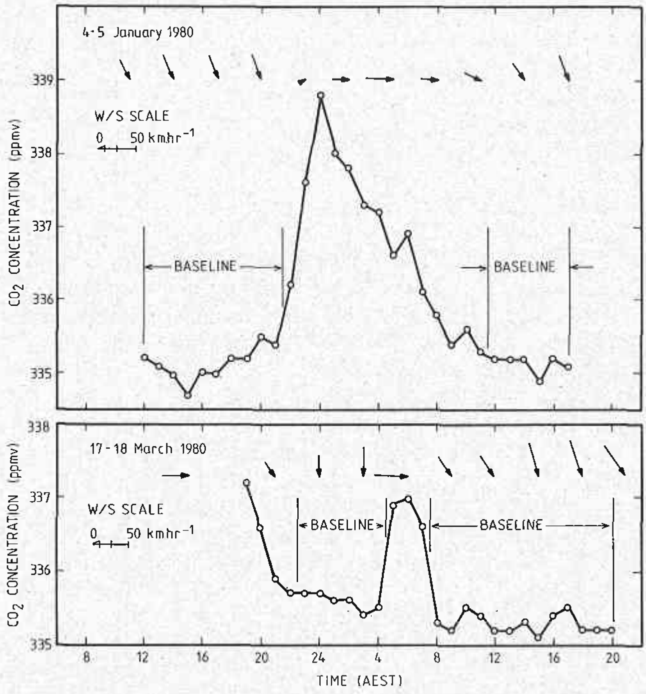

Figure 3.3 Hourly mean CO_2 concentrations measured at Macquarie Island illustrating the magnitude of changes which can occur with changes between baseline and non-baseline conditions. Arrows indicate the wind directions and speed (w/s) at 3-hourly intervals.

3.4 Southern Ocean Ships

CO_2 concentration data for air samples collected aboard supply ships whilst traversing the Southern Ocean are contained in Appendix 7. Information regarding position and weather conditions at the time of sampling are also included. The occasional sample where obvious contamination has occurred has been omitted.

3.5 Wilbinga

Appendix 8 contains the CO_2 and meteorological data obtained during the monitoring experiment at Wilbinga. As each set of flasks were sampled within a short time span, differences in CO_2 concentration are probably not significant, only giving an indication of the sampling variability. Also, there are probably local biological effects on the CO_2 concentration of some of these samples when the wind is from certain directions. Baseline values would be most likely to be encountered from the on-shore sector of 150-330°.

4. Discussion

A comparison of the CO_2 concentration at Cape Grim as determined from flask samples, with that measured in situ at the same time (Figures 3.2(a) and (b)) shows reasonable agreement prior to September 1978. The mean difference between the two data sets up until that time was 0.21 ppmv (standard errors 0.08 ppmv). During September 1978, in situ measurements suddenly appeared to be higher than flask measurements. On average this difference was 0.91 ppmv (standard error = 0.05 ppmv) between September 1978 and November 1981. Inspection of the analogue record suggests that this step change occurred at $\sim$ 1500 hours on 12 September 1978, following some adjustments to the drying equipment and the analyser. Unfortunately, no details of these adjustments were recorded by the station staff. Investigations of the possible cause(s) of the change have failed to yield a satisfactory explanation. Tests commenced in January 1980 indicated that the linearity and carrier gas errors of the analyser were unchanged from those before the incident. This suggested that the changes resulted from slightly ineffective drying or minor leakage in the system. Extensive tests failed to confirm these possibilities.

Figures 3.2(a) and (b) also indicate that the in situ - flask difference appears to decrease with time. Thus, in order to correct the data during this period without knowing the cause of the discrepancy, we have chosen to calculate an additive correction using the least squares linear regression describing the changing difference between the in situ and flask data,

Correction(ppmv) = $-1.45(\pm 0.08) + 0.00100(\pm 0.00012)$(Day no.after 31/8/78)

As a check of the effect of this correction on the integrity of the in situ data, Figure 4.1 shows the linear trends of the monthly mean CO_2 concentrations (selected baseline data) determined from the Cape Grim flasks and the CSIRO aircraft program (Pearman and Beardsmore, 1984) between September 1976 and September 1981. Compared with these trends are those based on the uncorrected monthly mean in situ data (selected baseline) between September 1976 and August 1978 and from September 1978 through September 1981. Also shown is a regression for the entire corrected and selected in situ data set up until September 1981.

The Figure illustrates the agreement obtained, on average, between the in situ and flask data using the linear correction. But in addition, the consistency of the concentration difference between these two data sets and the aircraft data support the contention that we were correct in applying corrections to the in situ rather than the flask data from Cape Grim.

The corrected data sets (without and with selection) from the Mark I monitoring equipment are given in Appendices 3 (a) and (b).

Following these experiences with the Mark I system, checks between the flask samples and in situ data from the Mark II system, were commenced immediately after its commissioning in mid-1981. The differences between the flask concentrations and those measured in situ at the same time are plotted in Figure 3.2(b). The consistently high CO_2 concentration (up to 2 ppmv) in the flask samples was eventually traced to an obscure fracture in a glass drying tower which had allowed them to be contaminated by laboratory air. When the tower was replaced in August 1983, the mean difference between flask and in situ concentrations decreased to 0.2 ppmv (standard error = 0.05).

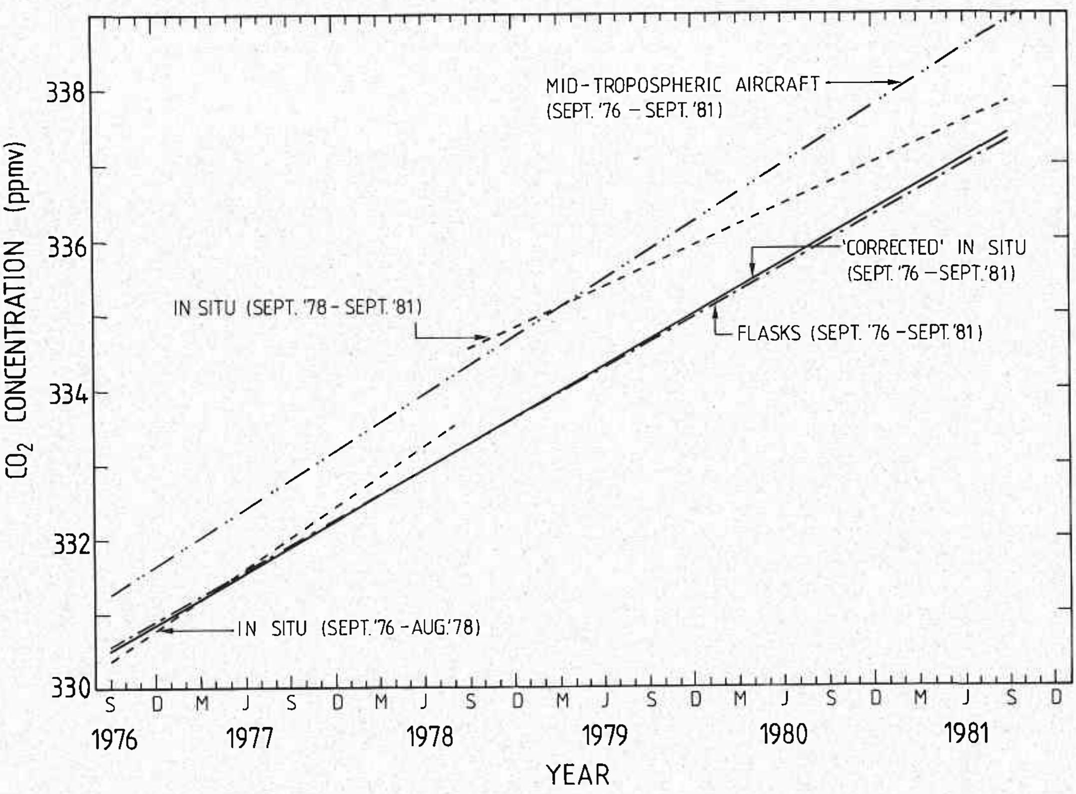

Figure 4.1 Linear trends of mean monthly CSIRO aircraft CO_2 data (from Pearman and Beardsmore, 1984), Cape Grim Mark I monthly mean baseline flask CO_2 data and Mark I in situ monthly mean baseline CO_2 data before and after corrections. All concentrations are in WMO 1981 CO_2 Calibration Scale. Equations for the above trends are as follows: Mid-tropospheric aircraft: C = 331.135 + 0.1275(M); Flasks: C = 330.466 + 0.1122(M); In situ (Sept.'76-Aug.'78): C = 330.248 + 0.1354(M); In situ (Sept.'78-Sept.'81): C = 332.248 + 0.0917(M); 'Corrected' In situ: C = 330.394 + 0.1150(M), where M is the month after August 1976 and C is the CO_2 concentration.

The monthly mean baseline CO_2 concentrations from the Mark I flasks and both uncorrected and corrected in situ equipment, along with the Mark II in situ values are shown in Figure 4.2. These values, excluding those uncorrected, are also tabulated in Table 4.1. The greater scatter in the flask compared with the in situ data results from the limited number of discrete samples collected in flasks each month (a maximum of 13), whereas the monthly means for in situ data represent the means of up to 280 hourly values.

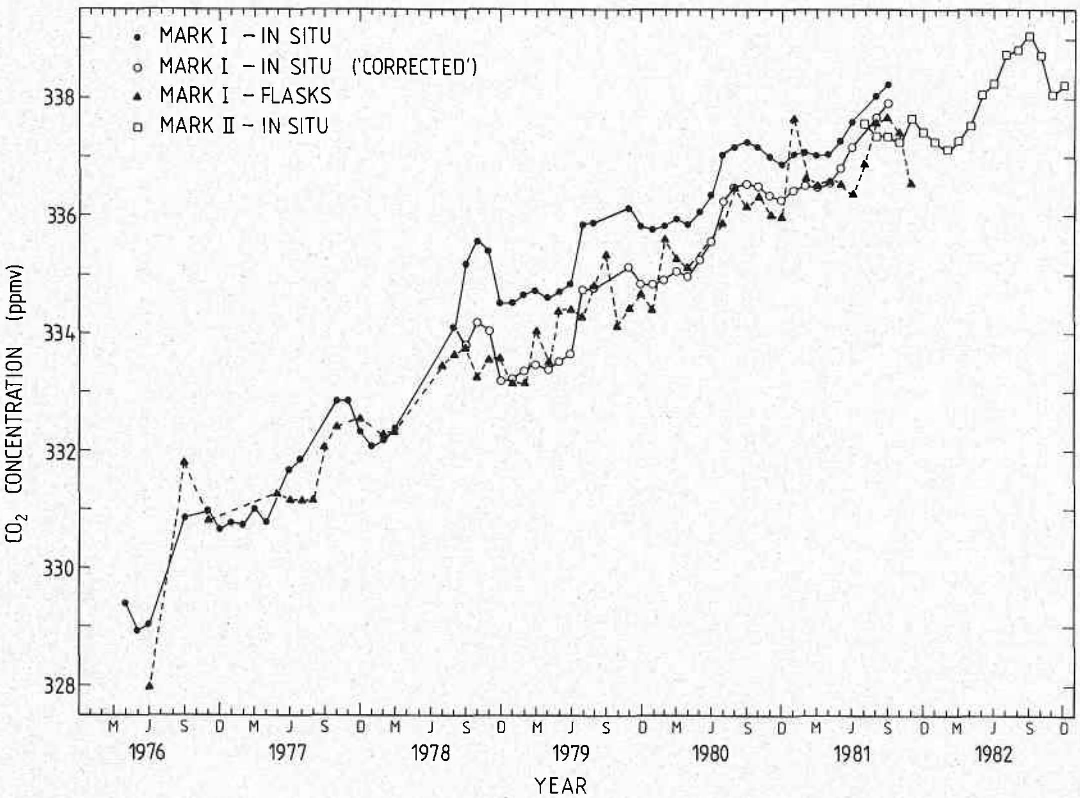

Figure 4.2 Monthly mean baseline CO_2 variation at Cape Grim as measured by flask and in situ sampling techniques in the temporary laboratory and in situ in the new permanent laboratory. CO_2 concentrations are given in WMO 1981 CO_2 Calibration Scale.

Table 4.1 Monthly mean baseline CO_2 concentration at Cape Grim (a) from Mark I in situ equipment in the temporary laboratory corrected as described in the text after September 1978; (b) from Mark II in situ equipment in the new permanent laboratory; and (c) from flasks collected on the Mark I sampling equipment in the temporary laboratory and analysed at CSIRO, Aspendale. Also listed for each month are the standard deviation of mean and the number of days data included in the means in the case of in situ data on the number of flasks in the flask data. All concentrations are on the 1981 WMO CO_2 Calibration Scale and corrected for appropriate carrier-gas errors.

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
(a) CAPE GRIM IN SITU (MARK I) CORRECTED												
1976	-	-	-	329.4 0.1;5	328.9 0.1;7	329.0 0.3;6	-	-	330.9 0.4;4	-	331.0 0.4;12	330.6 0.3;14
1977	330.8 0.2;15	330.7 0.5;11	331.0 0.1;3	330.8 0.2;10	-	331.7 0.1;8	331.9 0.2;6	-	-	332.9 0.3;14	332.9 0.2;19	332.3 0.3;19
1978	332.1 0.4;17	332.2 0.2;7	332.4 0.3;5	-	-	-	-	334.1 0.7;8	333.8 0.6;9	334.2 0.2;17	334.0 1.1;2	333.2 0.3;16
1979	333.2 0.4;16	333.3 0.5;13	333.5 0.4;13	333.4 0.4;12	333.5 0.2;19	333.7 0;2	334.7 0.1;4	334.8 0.1;5	-	-	335.1 0.2;10	334.8 0.3;11
1980	334.8 0.4;20	334.9 0.3;11	335.0 0.2;21	335.0 0.2;6	335.3 0.4;12	335.6 0.5;10	336.2 0.4;15	336.4 0.2;15	336.5 0.3;24	336.5 0.2;19	336.4 0.2;15	336.3 0.4;17
1981	336.4 0.3;16	336.5 0.4;11	336.5 0.1;10	336.6 0.1;10	336.8 0.1;4	337.2 0.2;7	-	337.7 0.3;15	337.9 0.1;5	-	-	-
(b) CAPE GRIM IN SITU (MARK II)												
1981	-	-	-	-	-	-	337.6 0.2;3	337.3 0.4;9	337.3 0.4;11	337.2 0.4;15	337.7 0.3;18	337.4 0.3;23
1982	337.2 0.2;22	337.0 0.3;16	337.2 0.3;12	337.5 0.6;15	338.0 0.2;21	338.2 0.2;9	338.7 0.2;10	338.8 0.2;19	339.1 0.4;15	338.7 0.2;18	338.0 0.9;10	338.2 0.2;16
(c) CAPE GRIM FLASKS (MARK I)												
1976	-	-	-	-	-	328.0 0.4;4	-	-	331.8 0;2	-	330.8 1.1;13	-
1977	-	-	-	-	331.3 0.1;3	331.2 0.1;3	331.1 0.3;7	331.2 0.1;3	332.0 0.4;8	332.4 0.9;5	-	332.5 0.2;3
1978	-	332.3 1.0;4	332.4 0.2;5	-	-	-	333.4 0.7;7	333.6 0.3;8	333.8 0.5;6	333.2 0.6;12	333.5 0.8;12	333.6 0.3;12
1979	333.2 0.6;12	333.1 0.8;9	334.0 0.1;2	333.5 0.6;7	334.4 0.5;12	334.4 0.7;8	334.3 0.6;14	334.8 0.7;12	335.3 0.6;9	334.1 0.6;10	334.4 0.9;11	334.7 0.8;12
1980	334.4 0;2	335.6 1.0;7	335.3 0.2;3	335.1 0.1;3	-	-	335.9 0.3;6	336.5 0.4;11	336.2 0.3;12	336.3 0.9;12	336.0 0.6;9	336.0 0.6;12
1981	337.7 0.8;11	336.6 0.8;9	336.5 0.3;7	336.6 0.2;6	336.5 0.3;7	336.4 0.1;3	336.9 0.2;4	337.6 1.0;6	337.7 0.4;6	337.4 0.5;8	336.5 1.1;6	-

Errors or variability in estimates of CO_2 concentrations obtained at Cape Grim can originate from several sources. These include:

(a) Differences in selection criteria: It has been shown elsewhere (Baseline, 1983) that small differences (up to ∿ 0.2 ppmv) can occur in monthly means produced for Cape Grim data, depending on the particular selection criteria used. The criteria used in the present report appear to be satisfactory but, of course, the definition of what should be regarded as background or baseline data is still somewhat arbitrary. Some further modification of the criteria might occur in the future as a result of greater effort in the interpretative study of the data. For instance, it seems possible that consistency alone may be an adequate baseline selection criterion, thus allowing inclusion of data at present lost when the wind instruments are inoperative. However, we also know that a considerable amount of consistent data is collected at Cape Grim when winds are in a direction other than those selected here. We have yet to evaluate the influence of inclusion of these data in the selected set and the significance of such inclusion on the spatial representativeness of the data. The important point is that, although the valid data set may be increased by such changes, it seems unlikely that the monthly mean data will be influenced by more than about 0.2 ppmv.

(b) Efficiency of drying: Care has to be taken when using magnesium perchlorate as a drying agent. The drying efficiency of this chemical appears to diminish if used for too long, even though it may not show obvious signs (coagulation) of being spent. The NDIR analysers are, in general, extremely sensitive to traces of water vapour and thus small inefficiencies in the capacity of the drying system can result in inaccuracies in the CO_2 concentrations recorded. Given the development which took place through the earlier years of this project and at times the insufficient routine attention given to the equipment on site, it is likely that at times small inaccuracies were introduced due to inadequate sample drying. However, given the general agreement obtained between in situ and flask sampling programs, aside from the period of systematic difference described above, it appears unlikely the persistent errors of more than a few tenths of a ppmv could have been introduced in this way. With the routine inspections, improved cryogenic drying techniques and adequate station staffing, such problems are believed to have been virtually eliminated.

(c) Analyser performance: Close check also has to be kept on the output balance points of the URAS 2T analysers as they have a tendency to drift with time. If this is allowed to continue uncorrected, instrument sensitivity can decrease and the response become non-linear. The introduction of routine linearity checks should avoid this difficulty. As far as we are aware, the data presented in this report have not been influenced by this phenomenon. It is true, however, that we have chosen to infer concentrations by linear interpolation between the instrument output for two calibration gases, even though it is known that the instruments used were not linear in their response to CO_2. In general this is acceptable in a southern hemisphere program because the temporal variability of background concentrations is so small. This means that the calibration gases can contain concentrations only 5-10 ppmv different. Interpolation over such a narrow concentration range will introduce errors of generally < 0.1 ppmv (see Beardsmore et al., 1978). However, for concentrations more than 10 ppmv outside the range of the calibration gases (non-baseline conditions) the errors can become significantly larger.

(d) Sampling time: Some of the discrepancies between the data sets illustrated in Figure 4.2 relate to the fact that, even under conditions where the winds are reasonably strong (≳ 18 km hr^{-1}) and from the south west sector, a diurnal variation of CO_2 concentration can be detected if the air is sampled near the ground. This is shown in Figure 4.3 which depicts the changes in CO_2 concentration measured by both the Mark I and Mark II systems on such days. Figure 4.3(a) shows that, where both instruments were sampling air through low intakes (both ∿ 3m above the highest point of the Cape), the diurnal CO_2 variation is clearly evident in both data sets. In Figure 4.3(b), the Mark II system had been connected to the 10m intake and the diurnal variation is almost eliminated.

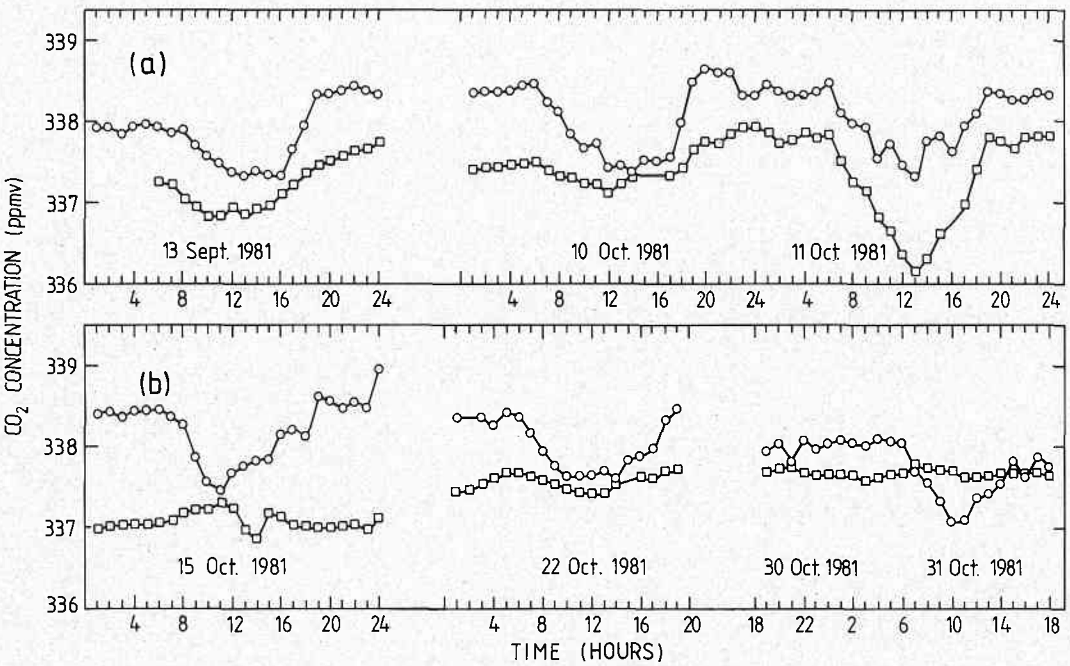

Figure 4.3 Examples of diurnal cycles of CO_2 under baseline conditions for Mark I (○) and Mark II (□) monitoring systems at Cape Grim. (a) Both Mark I and Mark II air intakes about 3m above the highest point of the Cape; (b) Mark I as in (a), Mark II through air intake 10m above laboratory roof (NB: Mark I concentrations have not been corrected as described in text).

As flask samples are almost invariably collected during daylight hours, one might expect that flask and in situ data may show some systematic difference in concentration if the in situ data is not selected to represent exactly only those hours for which flask samples were taken.

The full impact of the low level intakes on the concentrations of CO_2 in these data sets depends on the micrometeorology of the Cape Grim site. Data relevant to this have been collected and a complete analysis will be reported elsewhere. However, results such as those in Figure 4.3(b) would suggest the monthly mean concentrations since the introduction of the 10m intake probably vary by < 0.1 ppmv due to small local exchanges influencing the diurnal variation of concentration.

The monthly mean baseline CO_2 concentration measured at the sub-Antarctic station on Macquarie Island and at Mawson on the Antarctic coast are shown in Figure 4.4 and tabulated in Table 4.2. Differences in phase and amplitude of the annual cycles from the two stations are readily apparent and will be discussed elsewhere. Because of its remote

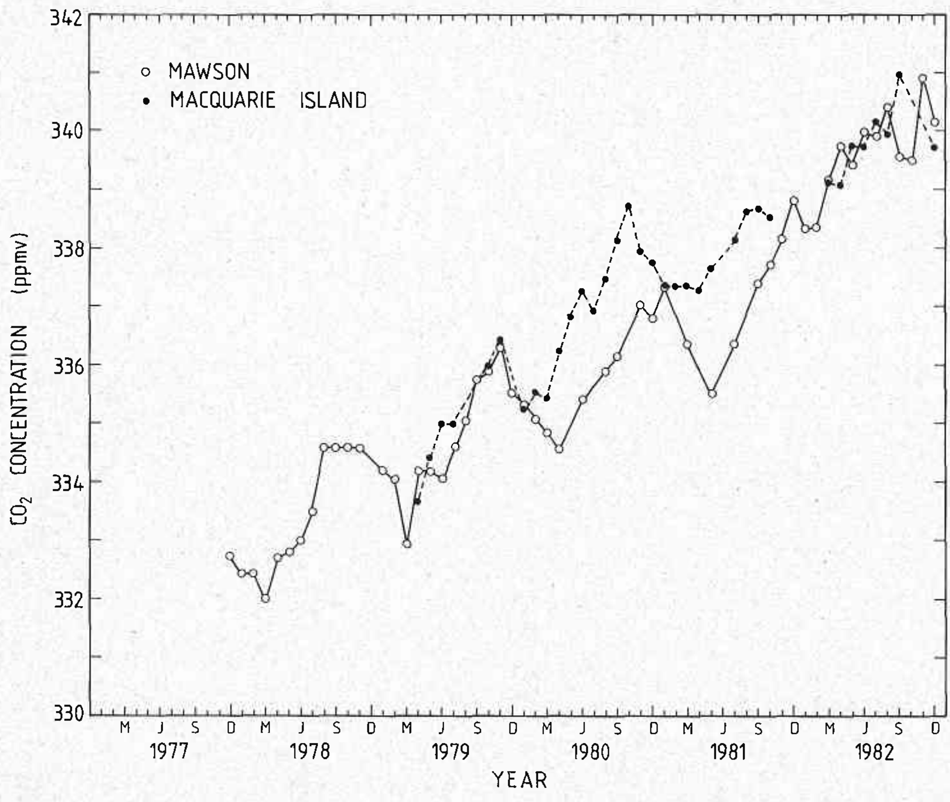

Figure 4.4 Variations of monthly mean baseline CO_2 concentrations at Mawson and Macquarie Island. Concentrations are given in WMO 1981 CO_2 Calibration Scale.

Table 4.2 (a) Monthly mean baseline CO_2 concentration, standard deviation and number of flasks per month from Mawson; (b) Monthly mean baseline CO_2 concentration, standard deviation and number of hours of data per month from Macquarie Island. All concentrations are in 1981 WMO CO_2 Calibration Scale and corrected for appropriate carrier-gas errors.

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
(a) MAWSON FLASKS												
1977	-	-	-	-	-	-	-	-	-	-	-	332.8 0.1;2
1978	332.4 0.1;2	332.4 0.1;2	332.0 0.1;2	332.7 0;1	332.8 0.4;2	333.0 0;1	333.5 0;1	334.6 0;1	334.6 0;1	334.6 0;1	334.6 0;1	-
1979	334.2 0;1	334.0 0.1;2	333.0 0.1;2	334.2 0;1	334.2 0;1	334.0 0.1;2	334.6 0;2	335.0 0.1;2	335.8 0.1;2	335.9 0;2	336.3 0;1	335.5 0.4;3
1980	335.4 0.4;2	335.1 0;1	334.8 0.2;2	334.6 0.4;2	-	335.4 0.1;2	-	335.9 0;1	336.2 0.2;2	-	337.0 0.3;4	336.8 0.3;2
1981	337.4 0.2;2	-	336.4 0.2;2	-	335.5 0;1	-	336.4 0.6;2	-	337.4 0.1;2	337.7 0;2	338.2 0.1;2	338.8 0;2
1982	338.3 0.2;6	338.4 0.2;2	339.2 0.7;3	339.8 0.4;4	339.4 0;1	340.0 0.4;4	339.9 0;1	340.4 0.3;2	339.6 0.2;2	339.5 0;2	340.9 0.3;2	340.1 0.7;2
(b) MACQUARIE ISLAND IN SITU												
1979	-	-	-	333.7 0.2;31	334.4 0;4	335.0 0.4;23	335.0 0;3	-	-	336.0 0.1;3	336.4 0.2;9	-
1980	335.2 0.2;27	335.6 0.2;25	335.4 0.2;19	336.2 0.2;10	336.8 0.2;10	337.2 0.1;2	336.9 0.2;16	337.5 0.6;32	338.1 0.3;13	338.7 0.4;14	337.9 0.2;32	337.7 0.5;61
1981	337.4 0.3;18	337.4 0.9;39	337.4 0.5;26	337.3 0.2;22	337.6 0.4;31	-	338.2 0.3;27	338.6 0.4;32	338.7 0.3;8	338.5 0.8;21	-	-
1982	-	-	339.1 0.1;6	339.1 0.4;17	339.7 0.4;8	339.7 0.2;10	340.2 0.4;24	339.9 0.5;24	341.0 0.2;11	-	-	339.7 0.2;8

location and few local biospheric effects, variability in the Mawson data, other than that due to the normal sampling and analysis techniques, will be mainly associated with large scale transport processes. On the other hand, the variation in the Macquarie Island data set are influenced by several factors. Although it is an in situ analysis system, the sampling density is restricted by the need to only operate on three or four occasions each month. Thus, although a maximum of 61 hours of baseline data has been used to compute one of the monthly means in Figure 4.4, the average number of hours per month is only 19. Unlike Mawson, Macquarie Island has a flourishing flora and fauna and, whilst the selection criteria applied should eliminate biospheric influences, there is a possibility that diurnal effects (up to ∿ 1 ppmv in summer), similar to those at Cape Grim, may have been recorded through the low level (∿ 3m above ground level) air intake. Variations in the station power supply and deterioration in the analyser response characteristics before maintenance in late 1981 are other factors effecting the quality of the Macquarie Island data. These factors all combine to, on occasions, elevate the standard deviations on the monthly baseline CO_2 means to values as high as ± 0.9 ppmv.

Despite the sampling point being kept as far upwind as possible, the flasks from ships in the Southern Ocean are filled in close proximity to sources of CO_2. This leads to a higher-than-normal risk of minor contamination, although no concrete evidence of its occurrence has been noted to date. The small number of flasks available on these voyages often precludes the collection of replicate pairs of samples as a precaution against contamination.

The data set from Wilbinga is too limited to provide valid baseline CO_2 information, comprising a single sampling set per month at the most.

Throughout this report, emphasis has been given to those factors which may have influenced the accuracy and precision of the measurements. The reader may find it difficult to assess the over-all impact of these factors on the accuracy and precision of the data presented. We hope the following concluding remarks will be of assistance.

(i) The accuracy required of baseline data for these to be of use in global carbon studies is 0.1-0.2 ppmv with respect to the international standards (Fraser et al., 1983).

(ii) For the period 1976 through August 1978 (Mark I equipment) and then since 1983 using the Mark II equipment, we have shown that two markedly different measurement systems (in situ and flask sampling) can agree on average to within 0.2 ppmv. Given that prior to the application of carrier-gas corrections to data collected with the Mark I system, the apparent concentrations would have differed by 4-10 ppmv, such agreement is testomony of the accuracy of the carrier-gas correction which are believed to be for each analyser ± 0.1-0.2 ppmv.

(iii) For the period September 1978 through November 1981, a correction was necessary to compensate for a systematic error in the Mark I data. The cause of the error is unknown and thus uncertainty exists as to the best way to correct the data. As a result Cape Grim data have an accuracy during this period of ± 0.5 ppmv.

(iv) The only other correction that was made to the data was for 3 flask samples collected at Mawson. The correction was to allow for the fact that the samples were not dried before analysis.

(v) While agreement between in situ and flask sampling has generally confirmed our ability to obtain accurate mean baseline concentrations to within ± 0.2 ppmv, it is true that the precision of the individual flask or instantaneous in situ measurements has on occasions deteriorated to ± 0.5-1.0 ppmv. This is a disturbing aspect of the data and one which is presently receiving further attention.

(vi) Aside from the corrections mentioned in (ii), (iii) and (iv) above all other data manipulations relate to selection for the so-called "baseline" conditions. The effect of this can be seen by comparison of the complete and selected data sets for Cape Grim. The monthly and annual mean concentrations are generally lower for selected data by ∿ 1 ppmv. We do not wish to suggest that these selection criteria are inviolable. They are the subject of on-going research and some modification of the criteria can be expected in the future. But from our studies thus far it appears unlikely that these changes will modify monthly or annual means by more than ± 0.3 ppmv.

5. Acknowledgements

The setting up and operation of the CO_2 monitoring programs at the widespread, and often remote, locations described in this paper would have been impossible without the assistance of many people from a number of organizations. We therefore gratefully acknowledge the efforts, on our behalf, of the staff of the Australian Baseline Station at Cape Grim, members of the Antarctic Division of the Australian Department of Science and Technology and the Australian National Antarctic Research Expeditions responsible for the observations, maintenance and logistics associated with the programs at Mawson, Macquarie Island and on Southern Ocean ships, and the officers of the Western Australian Department of Conservation and Environment who collected air samples at Wilbinga. Mr. Lewis Wainwright of the Australian Department of Science was largely responsible for the logistics associated with the setting up of the temporary station at Cape Grim whilst our colleague, Mr. G. Rutter and ex-colleague Mr. J. O'Toole, were most helpful in the early development of the computing facilities.

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APPENDIX 1(a)

Complete Mark I CO_2 data set from the Australian BAPMoN station at Cape Grim, Tasmania.

Tabulation of all CO_2 concentration data obtained using the Mark I in situ monitoring systems in the temporary laboratory for the period 1976 through 1981.

Numbers in the body of the Table are the mean concentrations, standard deviations and number of hours of data for each day. Monthly means are averages of daily means and are listed with the number of days represented, standard deviations and total number of hours. Annual means are the averages of the monthly means available for that year.

Concentrations are expressed in parts per million by volume (ppmv) with respect to the WMO 1981 CO_2 calibration scale. A carrier-gas correction has been applied to all values based on comparisons of instrument response to WMO Central CO_2 Laboratory CO_2/N_2 and CO_2/Air Secondary Standards as described in Pearman et al. (1983).

Values are as computed, no correction having been applied for the step change in concentration discussed in Section 4 of the text.

CAPE GRIM CO2 CONCENTRATIONS (MARK I)

1976 COMPLETE DATA SET

MONTH	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
DAY 1				337.06 4.05(14)	329.26 .18(24)							330.54 .45(9)
DAY 2				329.46 .82(12)	331.07 2.49(24)							330.81 .42(10)
DAY 3					332.01 1.93(12)	329.39 .08(2)					330.70 1.34(2)	330.66 .19(7)
DAY 4					329.10 .07(5)	329.29 .50(24)					330.89 .27(8)	330.70 .11(5)
DAY 5					329.05 .16(24)	329.67 2.03(24)					330.68 .39(9)	330.46 .24(5)
DAY 6					328.91 .17(24)	329.14 .44(24)					330.91 .42(4)	
DAY 7					329.69 2.82(24)	329.04 .29(24)					331.70 .96(4)	330.98 .07(3)
DAY 8					328.97 .13(24)	328.75 .12(24)					332.12 3.29(10)	330.54 1.49(10)
DAY 9					329.00 .27(24)						331.79 2.73(10)	331.47 1.97(8)
DAY 10					329.00 .71(24)	328.62 .18(24)					330.52 1.70(16)	332.47 1.09(5)
DAY 11					329.08 .85(24)	328.57 .30(23)				331.93 .21(2)	331.31 1.82(24)	330.33 .63(10)
DAY 12					333.16 3.21(24)	328.67 .58(23)				331.99 1.36(9)	332.52 3.90(16)	330.26 .03(2)
DAY 13					336.20 6.82(24)	328.43 .59(6)			330.80 .86(2)	336.45 2.64(5)	336.66 4.66(10)	330.26 .14(7)
DAY 14					336.29 6.67(20)				331.21 .96(9)	335.95 3.29(10)	329.93 2.24(10)	329.73 1.40(10)
DAY 15									331.31 .68(10)	332.73 5.13(10)	330.29 1.32(11)	339.25 7.80(7)
DAY 16									331.34 .51(10)	332.65 3.37(10)	331.50 .32(7)	333.42 .28(4)
DAY 17									331.32 .52(10)	334.74 3.27(10)	331.31 .49(9)	333.60 .33(8)
DAY 18									330.60 1.27(10)	332.61 3.77(10)	331.36 .16(10)	332.99 .32(10)
DAY 19						331.21 1.21(9)			332.10 1.21(10)	330.42 2.29(10)	331.20 .15(6)	332.53 .13(2)
DAY 20						333.29 3.80(22)			333.88 4.57(10)	330.30 1.19(10)	330.62 .73(10)	326.35 .09(2)
DAY 21						331.39 2.46(24)			335.40 3.25(10)	330.61 1.00(2)	331.23 .90(10)	326.33 4.81(10)
DAY 22						331.18 1.82(23)			330.19 .66(10)		330.79 .39(10)	334.81 1.77(10)
DAY 23						329.43 .89(24)			330.97 .81(10)		330.89 .68(10)	330.70 .55(10)
DAY 24						329.18 1.06(15)			331.72 1.73(10)		333.94 1.54(9)	330.32 .68(10)
DAY 25									332.43 3.08(10)		329.55 3.74(6)	330.51 .17(10)
DAY 26									333.59 5.86(10)		334.04 3.89(8)	330.32 .24(10)
DAY 27				329.47 .11(8)					331.06 2.23(10)		335.83 (1)	330.21 .30(10)
DAY 28				329.48 .41(24)					332.60 3.05(4)			330.27 .28(10)
DAY 29				329.45 .07(24)							328.80 1.93(8)	330.32 .30(10)
DAY 30				329.27 .14(24)							330.54 .42(10)	331.57 1.65(10)
DAY 31												332.14 1.43(9)
MONTHLY MEAN				330.70 3.12 6	330.77 2.66 14	329.70 1.35 16			331.91 1.38 16	332.76 2.13 11	331.54 1.76 27	331.16 2.31 30
HOURS PER MONTH				106	301	315			145	88	248	233

ANNUAL MEAN = 331.22
STANDARD DEVIATION = .98
HOURS PER YEAR = 1436

CAPE GRIM CO2 CONCENTRATIONS (MARK I)

1977 COMPLETE DATA SET

MONTH	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
DAY 1	331.58	330.70	334.91	330.77			333.63				335.18	332.28
	2.05(10)	.17(12)	5.97(10)	.42(10)			.32(3)				2.39(12)	2.34(9)
DAY 2	330.67	330.98	334.98	330.86							332.94	333.07
	.22(10)	1.02(12)	9.03(10)	.16(10)							.28(10)	1.01(13)
DAY 3	331.00	332.34	336.16	330.75						333.29	333.61	332.51
	.78(10)	1.37(12)	7.97(10)	.12(10)						.03(2)	2.15(11)	.16(12)
DAY 4	331.96	332.75	330.73	331.37						331.99	336.12	332.39
	2.43(10)	1.43(11)	1.34(9)	1.34(9)						2.53(11)	2.50(12)	.25(12)
DAY 5	334.75	333.65	333.78	332.50						332.67	332.91	332.26
	3.61(10)	3.50(12)	2.55(10)	1.30(10)						.30(12)	.54(12)	.21(20)
DAY 6	336.69	332.05	330.64	331.81						332.94	334.84	332.15
	1.21(10)	3.09(12)	.27(10)	2.32(10)						.31(12)	1.73(6)	.31(23)
DAY 7	331.94	333.06	330.64	331.21						332.37	333.75	332.20
	1.97(10)	5.43(11)	.22(10)	1.39(11)						.91(12)	2.54(12)	.59(24)
DAY 8	330.10	332.26	331.21	331.23						331.77	332.28	332.63
	2.11(10)	3.45(12)	1.47(10)	.57(11)						2.30(12)	.74(8)	.58(24)
DAY 9	331.15	331.10	334.30	330.50						336.37	333.24	335.86
	2.59(10)	.87(12)	3.11(10)	1.06(8)						2.33(12)	2.29(9)	6.08(18)
DAY 10	330.71	330.75	338.55							335.76	332.68	332.43
	.32(10)	.85(12)	3.46(10)							.35(3)	.53(13)	.33(12)
DAY 11	331.37	334.98	334.85							334.91	333.78	332.24
	1.56(7)	2.40(12)	3.32(10)							2.03(11)	1.06(10)	.43(12)
DAY 12	331.45	334.57	330.49							338.45	333.47	332.45
	2.28(8)	1.51(12)	.30(10)							8.22(12)	1.53(12)	.76(12)
DAY 13	331.52	331.33	330.69							338.58	336.20	332.23
	2.05(7)	1.46(12)	.48(10)							3.65(12)	1.45(12)	2.80(12)
DAY 14	336.69	331.19	332.54	330.98						332.55	333.66	333.00
	4.19(8)	2.07(12)	1.29(9)	.23(3)						.21(12)	1.87(20)	2.19(10)
DAY 15	336.69	330.82	330.67	330.56						332.63	333.24	332.33
	4.89(9)	.70(12)	.21(10)	.50(12)						.37(12)	1.35(24)	.19(9)
DAY 16	334.34	332.92	330.54	330.60						332.41	332.39	332.47
	3.72(10)	2.37(12)	.14(10)	.33(12)						.45(12)	.53(24)	.18(13)
DAY 17	334.20	332.23	330.54	330.47		334.62				332.28	332.38	332.55
	3.73(10)	1.41(12)	.13(8)	.38(12)		1.24(7)				.32(9)	.75(15)	.11(12)
DAY 18	333.29	331.81	330.58	330.41		333.00				332.51	334.29	332.45
	5.51(11)	2.29(12)	.14(10)	.31(12)		1.72(10)				.07(3)	2.72(15)	.17(12)
DAY 19	330.62	332.46	331.47	330.66		332.22					332.74	332.47
	2.24(11)	2.93(12)	2.80(10)	.10(3)		1.21(10)					.31(24)	.22(13)
DAY 20	331.04	333.56	332.37			332.16	330.59				332.57	332.65
	1.20(12)	2.35(12)	2.10(10)			.53(10)	2.75(8)				.37(24)	1.00(12)
DAY 21	331.58	331.01	332.41			331.97	330.54				333.29	333.85
	1.76(12)	.62(12)	1.00(8)			.78(9)	1.54(12)				.97(24)	5.89(12)
DAY 22	331.39	330.87	331.85			333.82	332.07				333.26	332.20
	1.69(12)	1.49(12)	3.10(6)			2.67(12)	.87(12)				1.56(24)	2.17(10)
DAY 23	330.93	333.22	333.05			333.69	331.83				332.74	332.14
	.79(12)	3.64(12)	2.80(12)			3.02(12)	.16(12)				.32(24)	2.25(12)
DAY 24	330.63	331.87	339.06			331.56	331.78				333.04	332.33
	.38(12)	2.80(12)	10.98(10)			.18(11)	.16(12)				2.09(18)	2.23(12)
DAY 25	330.59	334.23	341.24			331.77	331.82			332.99	333.53	331.54
	.35(12)	1.62(13)	7.43(10)			.35(12)	.22(12)			1.17(6)	1.34(12)	3.13(12)
DAY 26	330.75	330.71	334.01			332.00	331.96			333.29	332.89	332.37
	.25(12)	.74(12)	5.29(12)			1.18(8)	.03(3)			7.21(12)	1.77(12)	.49(12)
DAY 27	331.25	331.89	332.58			331.99	331.59			337.59	336.03	332.41
	.68(12)	1.84(12)	1.71(11)			.79(14)	.06(3)			4.15(12)	1.80(12)	.10(12)
DAY 28	330.86	332.15	331.21			331.37	331.61			334.12	339.34	332.20
	1.18(12)	2.76(11)	1.01(8)			.65(12)	.12(6)			2.23(10)	4.87(12)	.22(12)
DAY 29	332.78		332.28			331.56	332.40			332.76	335.77	332.23
	5.05(12)		1.55(11)			.15(11)	.08(3)			.31(12)	3.48(12)	.20(12)
DAY 30	330.65		331.00			331.89	332.19			332.60	332.83	334.01
	.29(12)		.75(10)			1.10(10)	.19(8)			.36(12)	.22(9)	2.99(12)
DAY 31	330.53		332.11							334.68		333.82
	.43(12)		2.01(10)							4.85(12)		1.69(12)
MONTHLY	332.05	332.20	332.95	330.98		332.40	331.83			333.89	333.83	332.64
MEAN	1.93	1.23	2.75	.57		.99	.80			2.08	1.56	.80
	31	28	31	15		14	12			23	30	31
HOURS PER MONTH	325	334	304	143		148	94			235	444	414

ANNUAL MEAN = 332.53
STANDARD DEVIATION = .93
HOURS PER YEAR = 2441

CAPE GRIM CO2 CONCENTRATIONS (MARK I)

1978 COMPLETE DATA SET

MONTH	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
DAY 1	334.96	334.31	332.17	334.26	335.45	336.80	336.10	331.74		330.76	335.28	338.49
	1.80(13)	6.60(24)	.27(23)	1.06(12)	4.36(18)	3.79(24)	2.80(24)	2.51(17)		3.58(24)	1.49(23)	3.94(9)
DAY 2	332.71	346.81	332.21	333.68	339.23	336.43	334.10	333.51		333.13	338.09	335.49
	1.08(13)	.15(3)	.50(17)	1.33(12)	3.07(12)	4.26(18)	3.73(20)	.36(23)		2.58(14)	3.14(24)	2.74(24)
DAY 3	333.84	332.00	333.25	333.75	335.53	334.16	334.57	333.31		335.70	337.49	337.05
	3.80(13)	.83(11)	1.56(23)	3.14(12)	3.02(12)	2.86(12)	1.91(24)	.34(23)		.31(9)	2.13(24)	2.50(10)
DAY 4	333.96	333.22	332.14	332.78	336.91	334.61	333.29	333.69		335.62	338.01	335.14
	4.13(13)	.83(9)	.23(24)	.96(12)	3.51(12)	2.99(12)	.28(20)	.96(21)		.17(24)	3.90(24)	.19(13)
DAY 5	332.32		332.30	336.46	339.20	342.17	333.11	331.84	333.13	335.92	338.40	334.62
	1.52(12)		.21(24)	4.00(12)	7.90(11)	10.55(11)	.20(24)	.99(24)	.46(3)	.66(16)	1.26(10)	.51(6)
DAY 6	334.65	333.04	333.39	333.39	342.63	341.45	333.18	333.98	335.32	335.72	338.34	334.45
	3.07(12)	.69(8)	1.13(24)	2.31(12)	7.70(12)	7.58(12)	.24(24)	.88(16)	.88(19)	.45(24)	2.73(24)	.11(14)
DAY 7	332.35	333.27	333.03	332.59	334.29	341.43	333.16	335.94	334.49	336.07	344.36	334.20
	.20(12)	1.50(14)	1.53(24)	.43(12)	1.44(12)	3.20(12)	.23(23)	.98(5)	.51(24)	1.53(24)	1.99(14)	.21(24)
DAY 8	332.38	332.01	336.27	335.68	334.39	344.94	333.04	340.32	334.41	335.75	336.65	334.23
	.22(12)	.29(8)	2.52(24)	5.84(12)	2.20(12)	8.62(11)	.40(24)	8.02(14)	.41(24)	1.07(24)	1.03(6)	.28(24)
DAY 9	332.36	332.41	339.49	338.79	334.51	338.08	333.17		334.36	335.76	335.71	334.80
	.21(11)	.18(7)	3.80(23)	5.23(12)	2.02(9)	1.15(12)	.39(24)		.57(24)	5.17(23)	.98(11)	1.61(24)
DAY 10	333.44	333.80	334.70	339.21	331.26	339.52	333.26		332.95	335.03	336.89	334.21
	.92(8)	1.81(16)	3.24(18)	4.07(12)	3.13(7)	1.05(12)	.28(21)		3.27(24)	2.35(19)	2.72(12)	2.72(24)
DAY 11	332.47	332.52	334.83	335.71	333.13	341.86	333.59		326.30	336.73	336.75	334.69
	.17(19)	1.73(24)	1.95(18)	3.57(12)	.68(12)	1.52(12)	.25(24)		3.46(21)	3.64(23)	2.31(12)	1.37(21)
DAY 12	332.23	331.83	338.91	332.65	332.64	341.46	333.44		338.06	335.72	335.61	337.59
	.19(24)	.10(24)	5.43(12)	1.26(18)	.52(16)	1.57(11)	.24(23)		4.92(23)	2.27(24)	1.36(12)	3.27(23)
DAY 13	332.44	332.37	332.52	332.46	332.72	340.56	333.72		338.02	335.64	335.07	341.15
	1.45(18)	.80(22)	.67(18)	.73(23)	.13(24)	2.98(10)	.58(23)		2.96(24)	.32(23)	.15(11)	6.36(24)
DAY 14	335.49	332.01	336.90	332.85	333.15	339.02	333.31		336.18	335.33	335.36	337.55
	2.61(4)	.57(22)	5.15(15)	1.68(22)	.94(24)	4.56(12)	.84(24)		.45(24)	.22(24)	.19(12)	3.06(22)
DAY 15	332.77	335.75	337.45	333.07	333.74	334.84	333.47		335.84	334.99	335.09	346.24
	.84(9)	4.45(21)	3.11(13)	1.31(24)	1.80(22)	4.69(12)	.61(12)		.27(23)	1.22(24)	.56(12)	14.34(22)
DAY 16	332.39	334.05	338.13	332.48	338.35	334.98		334.97	335.90	335.36	336.55	339.74
	1.45(19)	1.52(24)	3.15(12)	.41(24)	7.33(24)	1.87(9)		.41(9)	1.80(24)	.85(23)	2.51(10)	10.91(24)
DAY 17	335.30	332.47	332.98	333.91	333.18	332.71	333.74	335.71	332.26	335.91	339.66	338.30
	5.49(23)	.55(23)	1.35(15)	1.57(22)	1.73(16)	3.29(12)	.34(13)	2.04(24)	.37(3)	.71(23)	5.80(11)	6.84(24)
DAY 18	332.12	333.10	336.89	332.74	334.39	335.05	333.64	338.71	335.75	335.63	337.66	334.42
	.21(24)	1.00(24)	4.44(24)	.63(24)	1.03(6)	1.54(12)	1.02(24)	4.84(21)	1.45(13)	.44(23)	3.18(11)	.41(24)
DAY 19	331.99	336.16	336.24	333.61	334.70	337.03	335.77	337.51	336.17	335.35		334.48
	.34(24)	3.86(24)	4.25(24)	1.48(19)	2.67(11)	4.36(11)	2.65(18)	4.51(24)	4.17(18)	.20(24)		.19(22)
DAY 20	334.45	334.14	338.20	333.62	333.96	336.08	334.17	333.70	336.73	335.34	335.31	334.28
	1.54(24)	2.56(20)	7.20(18)	1.49(13)	3.36(12)	3.17(12)	1.05(12)	1.19(24)	1.44(12)	.30(23)	.13(5)	.30(24)
DAY 21	333.31	332.39	333.56	335.24	333.05	337.94	332.69	334.08	335.92	336.92	335.13	334.33
	1.11(24)	.52(24)	.80(11)	4.67(18)	1.22(12)	3.75(10)	1.23(17)	.29(24)	1.06(18)	2.65(24)	.21(10)	.24(24)
DAY 22	332.82	332.14	332.41	335.11	332.79	336.72	334.03	334.22	335.70	335.60	335.04	336.04
	1.27(24)	.14(24)	.33(13)	2.57(12)	1.67(11)	4.44(12)	1.20(24)	.42(24)	1.13(24)	2.91(24)	.18(12)	3.40(21)
DAY 23	339.72	332.39	332.90	332.58	334.00	333.96	333.52	334.14	336.27	339.73	335.36	334.17
	3.08(12)	.65(24)	1.23(16)	.21(12)	2.14(18)	2.18(12)	.25(24)	.23(21)	.46(24)	4.36(20)	.46(9)	1.84(24)
DAY 24	331.93	332.69	339.52	332.66	332.73	333.71	333.77	334.16	338.03	339.94	335.21	335.32
	.24(15)	1.34(19)	1.90(2)	.13(16)	.86(20)	1.01(12)	.24(22)	.70(12)	3.54(24)	4.04(24)	.58(12)	1.06(24)
DAY 25	331.92	333.23		332.64	332.77	333.58	334.52	332.44	336.63	339.99	335.98	336.44
	.22(14)	2.44(14)		.16(24)	.47(23)	1.43(12)	1.38(14)	1.03(22)	2.41(24)	1.54(18)	4.11(12)	1.89(24)
DAY 26	332.16	334.10		332.52	334.43	334.74	332.94	334.64	336.96	345.70	340.51	335.33
	1.03(14)	5.14(14)		.17(23)	1.44(24)	2.20(11)	1.51(24)	.19(24)	2.14(19)	4.75(17)	2.10(10)	1.17(24)
DAY 27	331.40	333.01		332.54	334.68	333.37	332.47	334.41	335.64	336.16	336.31	334.63
	.76(14)	.71(11)		.60(24)	2.37(24)	1.33(12)	1.78(24)	.24(24)	.20(11)	.74(13)	.96(6)	.11(4)
DAY 28	332.22	332.05		333.83	334.37	333.67	333.72	334.46	335.34	335.36	338.28	334.77
	1.77(14)	.42(16)		1.15(24)	1.29(24)	1.62(12)	.18(24)	.38(21)	.27(24)	.33(24)	3.06(10)	.20(16)
DAY 29	333.25		334.37	332.84	335.78	335.69	333.37	332.74	335.20	335.33	339.02	334.79
	4.68(10)		1.52(11)	.70(24)	1.41(19)	1.24(5)	.80(21)	1.77(24)	.55(23)	.34(24)	3.19(12)	.45(21)
DAY 30	332.21		332.50	333.89	333.09	334.92	333.05	332.30	335.51	335.95	335.30	335.00
	1.14(9)		.60(22)	.75(24)	.77(24)	2.40(14)	.50(8)	2.90(24)	.77(24)	.52(23)	.40(5)	.28(24)
DAY 31	330.98		332.53		333.12		330.36	336.18		335.36		334.89
	.35(19)		.42(17)		2.07(24)		2.75(6)	1.10(5)		.61(24)		.46(24)
MONTHLY	333.11	333.60	334.81	333.92	334.65	337.05	333.54	334.53	335.27	336.18	336.98	336.03
MEAN	1.66	2.86	2.54	1.77	2.40	3.27	.99	2.07	2.33	2.46	2.10	2.60
	31	27	27	30	31	30	30	24	26	31	29	31
HOURS PER MONTH	476	474	485	522	507	361	609	470	518	670	366	632

ANNUAL MEAN = 334.97
STANDARD DEVIATION = 1.34
HOURS PER YEAR = 6090

CAPE GRIM CO2 CONCENTRATIONS (MARK I)

1979 COMPLETE DATA SET

MONTH	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
DAY 1	335.84		334.32	335.69	335.92	336.24	334.97	335.79	336.03	336.09	336.20	336.37
	1.47(24)		4.58(24)	2.54(24)	2.69(24)	1.90(24)	.14(22)	.16(24)	.38(24)	1.23(24)	.94(22)	1.30(24)
DAY 2	334.82		337.81	338.70	338.79	339.40	334.84	335.72	335.79	334.79	337.90	336.00
	.35(24)		3.23(23)	6.82(24)	1.37(22)	4.52(24)	.89(11)	.15(21)	1.10(9)	3.31(24)	3.04(23)	.32(24)
DAY 3	334.66		335.04	336.65	335.45	338.63	336.28	335.89		337.18	337.16	336.20
	1.47(24)		1.59(24)	1.63(24)	1.69(20)	2.40(24)	1.33(24)	.37(24)		2.88(22)	1.79(24)	.95(24)
DAY 4	335.30		340.05	335.39	334.59	339.73	336.29	335.68	338.49	337.37	337.25	337.06
	2.10(24)		6.88(24)	.69(22)	.79(21)	3.78(18)	1.42(22)	.40(24)	1.08(8)	1.64(20)	2.79(24)	2.00(19)
DAY 5	337.81		336.35	336.54	337.50	336.36	337.57	335.07	337.23	338.51	335.91	336.33
	5.57(24)		3.15(24)	1.30(17)	3.27(24)	2.22(21)	4.30(24)	.73(24)	1.62(17)	1.13(24)	.45(24)	.27(14)
DAY 6	334.70	334.91	334.54	335.16	338.58	337.66	335.52	335.22	336.20	336.21	336.12	336.26
	.83(24)	.87(11)	.13(8)	1.87(24)	3.70(24)	2.44(24)	.38(24)	.98(23)	.21(24)	.58(24)	.49(21)	1.59(16)
DAY 7	335.93	337.29	337.35	334.55	338.08	337.50	334.23	336.13	336.29	336.26	336.16	336.65
	2.01(24)	3.30(24)	2.11(13)	.36(24)	4.64(24)	2.10(19)	1.66(24)	.62(24)	.13(22)	.50(24)	.73(24)	1.79(20)
DAY 8	335.12	339.17	336.42	334.74	336.58	337.11	334.86	336.23	336.06	337.53	335.76	335.72
	2.59(22)	4.49(24)	1.07(12)	.57(24)	2.29(24)	3.48(24)	.81(22)	.58(24)	.45(24)	2.81(24)	3.66(13)	.45(24)
DAY 9	340.53	335.85	334.96	334.54	334.30	339.26	335.35	335.98	337.32	337.31	335.85	335.72
	8.59(24)	3.24(24)	.58(23)	.46(24)	1.30(15)	5.85(24)	.21(22)	.14(23)	3.54(24)	2.80(24)	1.63(20)	.25(24)
DAY 10	334.54	335.80	335.54	334.37	336.41	335.80	335.43	335.88	338.37	336.58	338.28	335.55
	.27(21)	1.40(24)	2.03(24)	.23(24)	8.18(24)	2.35(24)	.17(24)	.11(24)	1.95(24)	.71(24)	2.96(24)	.26(22)
DAY 11	334.59	334.59	336.71	334.77	335.33	335.07	334.62	335.77	339.51	334.97	339.34	336.45
	.26(24)	.18(24)	4.07(24)	.80(24)	.32(20)	.38(17)	1.79(18)	.14(24)	5.14(24)	1.39(24)	2.72(23)	1.40(24)
DAY 12	334.43	334.74	340.37	335.86	334.95	338.96	335.22	336.08	335.79	336.04	335.56	335.77
	.43(18)	.37(24)	3.38(24)	1.89(22)	.21(24)	2.97(24)	.35(19)	.50(24)	.19(24)	.43(24)	.30(12)	1.81(24)
DAY 13	334.21	335.10	339.70	338.64	334.72		335.35	335.70	336.11	336.14	336.77	335.48
	1.62(24)	.50(24)	4.60(16)	5.23(24)	.13(24)		.16(24)	.25(24)	.14(24)	.71(24)	2.07(12)	.30(24)
DAY 14	340.61	334.51	339.74	343.89	334.86		338.25	335.83	335.52	336.09	336.75	335.99
	10.42(24)	.11(22)	2.08(24)	7.41(24)	.12(24)		3.05(24)	.11(11)	1.52(18)	1.26(24)	2.41(18)	1.33(20)
DAY 15	334.95	334.66	339.03	335.02	334.87		334.87	333.45	331.18	336.26	337.91	337.69
	2.27(24)	.15(24)	6.70(24)	1.01(24)	.57(21)		2.18(24)	2.77(14)	2.22(24)	.47(24)	1.44(23)	2.25(22)
DAY 16	337.09	334.13	336.81	340.49	336.30		331.36	336.39	332.94	337.13	336.22	335.56
	3.92(24)	.20(23)	3.34(24)	7.11(22)	2.03(24)		1.52(24)	.86(24)	4.20(19)	2.45(24)	.73(24)	.39(24)
DAY 17	335.68	333.96	336.47	338.51	334.87		334.94	340.11	336.12	338.03	336.64	335.88
	2.92(24)	.22(24)	1.46(24)	3.96(24)	.62(24)		1.55(22)	4.05(22)	.17(24)	2.03(24)	2.28(24)	.32(22)
DAY 18	334.99	334.30	334.68	334.72	337.40		335.66	338.06	336.20	337.84	336.94	335.76
	2.10(22)	.69(24)	1.30(24)	.85(24)	3.54(24)		.43(24)	4.19(24)	.16(24)	3.40(14)	.64(15)	.31(24)
DAY 19	337.40	336.67	338.46	335.87	334.30		336.08	337.62	336.29	338.16	335.58	335.70
	4.30(22)	5.66(24)	4.89(24)	1.90(24)	.90(24)		1.01(24)	1.63(24)	.18(24)	3.61(21)	5.09(23)	.36(24)
DAY 20	338.55	335.19	336.80	338.35	336.41		336.52	335.90	336.96	335.96	336.42	337.22
	2.20(24)	1.33(17)	4.66(24)	5.04(24)	3.71(20)		1.89(17)	.49(24)	.37(24)	.66(24)	1.64(24)	3.48(24)
DAY 21	334.70	336.64	338.48	336.87	335.06		335.50	335.76	336.87	335.72	336.27	336.88
	.69(24)	1.63(24)	5.62(10)	2.50(24)	1.01(24)		.56(24)	.18(22)	.16(22)	2.37(23)	.54(23)	3.39(23)
DAY 22	336.12	337.80	334.78	334.47	334.96	335.38	335.57	335.88	336.73	337.49	336.45	335.39
	2.30(24)	1.82(23)	1.53(15)	.24(24)	.78(22)	1.26(11)	.46(23)	.10(24)	1.35(24)	1.66(21)	1.62(20)	.32(23)
DAY 23	339.20	339.15	335.55	334.61	336.35	334.96	335.82	335.78	337.75	339.33	336.93	335.88
	4.27(7)	3.14(24)	1.37(23)	.15(13)	1.03(24)	2.40(24)	.14(23)	.47(24)	1.65(24)	3.09(22)	8.62(23)	.29(24)
DAY 24		338.30	334.74	334.41	337.40	334.24	335.32	335.91	336.41	336.07	342.41	335.84
		4.22(24)	.26(24)	.27(24)	1.22(24)	1.07(24)	1.41(24)	1.14(24)	1.40(24)	.37(24)	5.63(24)	.32(20)
DAY 25		338.85	335.21	340.13	334.75	334.41	339.46	337.51	338.24	335.81	335.74	335.78
		1.35(24)	.32(24)	5.50(24)	.35(23)	2.57(23)	3.80(20)	2.68(24)	1.40(24)	.47(24)	.44(24)	.38(24)
DAY 26		337.53	340.01	336.30	342.42	335.54	335.81	336.31	337.18	336.41	335.88	336.23
		5.13(24)	3.12(22)	2.08(19)	7.87(24)	.80(21)	.77(21)	1.58(24)	2.48(21)	1.19(20)	.43(24)	1.35(24)
DAY 27		335.62	343.30	334.32	334.63	335.09	336.34	336.14	342.62	335.98	336.12	336.81
		.70(17)	11.45(24)	.15(24)	.13(24)	.94(24)	1.20(24)	.31(24)	3.31(21)	.33(24)	.24(22)	1.62(24)
DAY 28		339.33	336.83	334.20	335.50	335.61	335.84	336.98	340.70	336.01	335.93	339.74
		4.88(24)	2.43(24)	.18(24)	1.58(24)	.75(23)	.36(24)	1.11(16)	5.00(24)	.23(24)	.32(24)	4.12(24)
DAY 29			335.22	334.20	336.99	335.43	335.98	338.06	337.67	335.72	335.95	342.01
			1.12(19)	.23(24)	3.54(24)	.46(21)	.62(17)	3.37(24)	1.36(24)	.46(24)	.22(24)	5.34(23)
DAY 30			336.73	336.56	334.66	334.92	334.40	336.73	336.05	335.99	335.96	340.50
			2.13(20)	1.62(24)	.14(19)	.74(23)	1.02(24)	2.15(24)	.33(24)	.60(24)	.28(22)	3.10(24)
DAY 31			338.16		334.83		335.84	336.17		335.96		336.47
			2.72(24)		.36(24)		.14(24)	.30(20)		2.45(24)		1.74(24)
MONTHLY MEAN	336.16	336.26	337.10	336.28	336.06	336.54	335.62	336.25	336.85	336.61	336.75	336.61
	1.96	1.81	2.18	2.31	1.75	1.77	1.34	1.14	2.07	1.04	1.38	1.51
	23	23	31	30	31	21	31	31	29	31	30	31
HOURS PER MONTH	520	521	660	691	707	461	687	700	637	715	647	700

ANNUAL MEAN = 336.42
STANDARD DEVIATION = .40
HOURS PER YEAR = 7646

CAPE GRIM CO2 CONCENTRATIONS (MARK I)

1980 COMPLETE DATA SET

MONTH	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
DAY 1	336.91	339.00	339.50	336.40	336.88	335.98		337.76	337.61	337.11	336.98	337.22
	2.27(24)	1.67(24)	4.56(24)	1.20(24)	1.37(24)	.17(24)		4.78(24)	.30(24)	.73(24)	.23(24)	1.50(16)
DAY 2	335.92	336.36	336.28	338.11	336.30	336.50	337.59	336.45	337.75	337.65	337.15	340.32
	1.99(21)	1.06(24)	.65(24)	2.53(23)	1.98(17)	1.08(22)	.23(8)	1.14(24)	.14(24)	1.55(21)	.36(24)	3.26(20)
DAY 3	335.76	335.71	335.94	335.79	340.24	339.15	337.55	336.93	337.57	336.99	337.09	338.56
	3.90(24)	.12(24)	1.03(24)	.09(9)	7.91(24)	3.82(16)	.27(24)	.33(24)	.42(20)	.43(24)	1.00(24)	3.10(24)
DAY 4	335.74	335.70	336.44		337.81	338.45	337.46	336.89	337.64	338.91	337.23	336.84
	.40(24)	.21(24)	1.23(24)		1.34(24)	2.77(24)	.26(24)	1.09(23)	1.57(22)	3.75(24)	1.34(24)	.43(24)
DAY 5	338.47	335.63	335.90		337.99	337.85	336.90	336.47	337.05	338.01	337.71	337.27
	3.53(24)	.18(24)	.15(13)		.88(22)	1.29(16)	1.14(24)	1.90(23)	.44(23)	.93(24)	2.18(24)	1.23(20)
DAY 6	336.92	335.38	337.64		339.16	337.80	336.85	336.16	335.73	338.41	336.80	337.49
	2.00(24)	.28(21)	2.43(8)		2.12(21)	1.35(20)	.34(24)	1.96(24)	2.78(24)	1.82(24)	1.17(20)	1.48(24)
DAY 7	338.45	335.91	340.10		340.52	339.60	336.96	336.88	335.74	337.35	339.31	338.60
	3.30(24)	.60(20)	3.17(23)		1.55(24)	4.92(24)	.29(24)	.92(22)	2.60(24)	.94(20)	3.18(21)	2.21(24)
DAY 8	338.70	336.01	336.38		340.84	335.50	337.10	337.07	337.49	336.93	337.24	336.33
	3.95(23)	1.28(24)	.61(24)		3.10(19)	2.03(16)	.31(24)	.19(20)	1.35(24)	.37(19)	.94(24)	1.56(24)
DAY 9	339.36	336.77	337.26		341.34	335.57	337.19	335.60	337.37	336.65	339.83	338.01
	6.86(24)	1.08(24)	1.80(24)		3.73(17)	1.49(22)	.59(24)	2.77(24)	.25(24)	.77(24)	3.22(24)	2.79(24)
DAY 10	336.16	337.97	337.81		336.96	336.50	337.40	335.54	337.24	338.30	337.59	345.31
	2.03(24)	4.07(24)	2.45(24)		.99(23)	.88(22)	.70(19)	1.88(23)	.29(24)	2.95(24)	.27(7)	6.26(24)
DAY 11	336.77	339.68	341.92		340.22	337.23	338.89	337.32	337.09	337.67	345.28	338.02
	2.23(24)	1.99(9)	5.05(24)		3.58(24)	1.60(24)	1.65(12)	1.16(24)	.35(24)	1.17(24)	8.09(15)	2.67(24)
DAY 12	337.29	342.12	338.41		336.61	336.24		336.98	337.30	338.09	339.33	336.60
	3.30(24)	2.25(8)	4.66(23)		.57(24)	.31(24)		.20(24)	.51(24)	3.47(24)	5.24(24)	1.18(24)
DAY 13	335.33		337.19		336.79	336.59		336.99	337.71	337.49	341.35	338.04
	1.14(24)		2.02(24)		.77(16)	.11(9)		.55(24)	1.19(24)	2.27(24)	3.78(24)	2.39(24)
DAY 14	334.91		335.92	339.58	341.19			337.55	336.31	336.97	337.07	337.06
	3.96(21)		.20(24)	.25(3)	2.41(24)			.65(24)	1.33(24)	.46(24)	.49(23)	.44(24)
DAY 15	335.74	335.50		340.38	341.89		335.94	337.12	337.33	337.07	338.22	337.02
	.20(24)	.19(13)		2.40(13)	4.04(24)		.65(8)	.23(22)	.16(21)	.36(24)	1.68(24)	.55(23)
DAY 16	335.84	335.55	335.97	337.18	339.13		336.81	336.86	336.85	337.05	337.04	336.60
	.65(24)	.21(10)	.21(12)	2.80(24)	2.96(23)		1.39(22)	.36(24)	.70(24)	.49(22)	1.20(24)	1.41(15)
DAY 17	338.29		337.05	338.34	335.82		336.69	337.14	337.54	338.22	342.22	336.99
	2.53(24)		1.00(24)	2.46(24)	.14(24)		.98(9)	.54(24)	1.15(24)	2.08(24)	5.26(21)	.56(24)
DAY 18	335.64		338.01	340.38	335.86	337.49	336.38	335.45	337.44	338.53	339.81	336.81
	.21(22)		1.78(24)	1.44(15)	.14(24)	1.25(10)	.73(12)	1.56(24)	.43(24)	4.74(24)	3.98(20)	.68(24)
DAY 19	335.64	335.49	335.81		335.89	337.46	336.69	339.50	337.21	336.94	336.89	337.64
	.17(24)	(1)	.17(17)		.13(24)	1.50(22)	.28(24)	3.11(24)	.11(21)	1.39(24)	.86(22)	1.73(24)
DAY 20	335.52	339.45	336.44		335.94	336.25	337.39	340.43	336.95	338.31	336.92	339.50
	.17(24)	1.03(16)	.85(21)		.14(24)	.26(13)	3.29(17)	2.77(24)	.24(24)	1.71(24)	.14(21)	3.01(24)
DAY 21	335.46	337.86	336.80		335.87	336.93	339.56	337.99	336.86	338.61	336.94	337.74
	.22(23)	3.49(15)	1.27(24)		.07(24)	.21(6)	1.22(9)	2.11(24)	.11(24)	2.17(24)	.25(24)	2.31(24)
DAY 22	335.70	335.94	335.81		335.59	336.77	337.76	336.26	336.98	339.13	336.84	339.11
	.48(24)	.41(24)	.28(24)		.66(20)	.96(24)	.50(8)	2.09(24)	.33(24)	3.99(24)	.33(24)	1.67(22)
DAY 23	335.48	337.48	336.06		334.34	336.32	337.73	337.39	336.38	339.75	336.74	336.34
	.18(22)	1.59(15)	.17(24)		1.78(16)	1.93(14)	1.66(24)	1.06(24)	2.91(24)	2.50(16)	.38(24)	.75(24)
DAY 24	335.32	335.77	335.98		335.79	336.54	339.16	337.11	339.38	337.36	336.92	337.25
	.45(24)	.20(24)	.22(24)		.32(24)	(1)	3.73(18)	.24(24)	7.86(20)	1.08(21)	.74(24)	1.05(19)
DAY 25	335.62	335.91	336.09		336.89		340.48	337.33	337.44	338.15	339.35	341.84
	.20(20)	.17(22)	.22(24)		2.76(24)		6.35(21)	.32(24)	.36(21)	2.57(23)	3.83(24)	4.54(24)
DAY 26	335.84	337.37	336.36		337.66		337.58	337.13	337.35	338.41	342.04	339.54
	.14(24)	1.31(14)	.97(24)		1.99(24)		1.66(24)	.44(24)	.18(14)	2.82(24)	7.16(24)	5.78(24)
DAY 27	336.11	341.89	337.04		339.39		339.06	335.12		339.44	338.99	336.78
	.64(24)	2.75(19)	1.46(24)		2.52(12)		1.40(24)	1.61(24)		4.01(24)	2.71(22)	.73(24)
DAY 28	336.81	338.28	336.04	335.95	342.15		337.45	337.43		337.17	339.52	337.18
	1.87(24)	1.60(24)	.13(22)	.34(15)	3.39(15)		.56(16)	1.06(24)		.37(18)	2.78(21)	1.46(24)
DAY 29	335.94	336.51	335.85	335.71	339.86		337.32	337.71	332.52	337.04	337.29	337.50
	.37(24)	.57(23)	.12(24)	.23(24)	2.99(24)		.34(13)	.54(20)	1.95(6)	.53(23)	.79(24)	.43(18)
DAY 30	335.93		335.85	336.64	340.14		337.33	337.57	337.67	336.78	338.15	338.96
	.19(22)		.20(24)	1.18(24)	2.63(16)		.31(14)	1.43(24)	1.52(20)	.51(24)	2.97(24)	2.20(13)
DAY 31	338.12		335.01		336.14		337.42	337.68		336.89		337.26
	2.37(24)		4.04(20)		.46(24)		.95(22)	.24(24)		.56(21)		1.32(22)
MONTHLY	336.44	337.17	336.90	337.68	338.10	337.04	337.58	337.09	337.05	337.79	338.46	338.06
MEAN	1.19	1.95	1.48	1.79	2.24	1.10	1.02	1.06	1.12	.85	2.06	1.84
	31	25	30	11	31	20	27	31	28	31	30	31
HOURS PER MONTH	726	470	663	198	669	353	492	729	620	708	669	692

ANNUAL MEAN = 337.45
STANDARD DEVIATION = .59
HOURS PER YEAR = 6989

CAPE GRIM CO2 CONCENTRATIONS (MARK I)

1981 COMPLETE DATA SET

MONTH	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
DAY 1	339.18	338.81	337.37	350.26	339.70	343.48	337.75	336.50	338.04		337.20	
	2.70(19)	3.37(22)	.65(24)	6.30(24)	2.02(10)	4.21(24)	.15(16)	1.75(24)	.26(14)		2.43(18)	
DAY 2	337.15	336.78	340.08	341.53	339.09	346.79	337.69	337.18	337.95	338.17		
	.70(11)	.58(24)	1.75(24)	2.82(22)	1.42(24)	7.76(24)	.23(11)	1.33(24)	.72(23)	.44(15)		
DAY 3	337.68	339.69	338.03	338.96	337.68	345.31	338.00	345.52	338.10	338.29		
	.94(24)	1.92(24)	.93(24)	1.70(24)	1.37(24)	5.29(24)	.34(18)	3.44(8)	.25(18)	.24(24)		
DAY 4	336.85	338.47	336.92	337.67	340.13	343.30	338.26	341.64	338.09	337.91		
	.18(24)	1.28(17)	.16(22)	1.20(24)	5.63(24)	4.74(24)	1.70(24)	4.25(17)	.38(24)	.29(24)		
DAY 5	338.38	340.35	337.08	339.79	338.27	340.22	337.74	337.74	337.94	337.86		
	3.56(24)	4.32(24)	.49(23)	3.05(24)	1.83(24)	4.44(22)	.31(15)	1.31(24)	.53(24)	.39(24)		
DAY 6	341.29	337.72	339.53	337.34	340.33	341.27	337.92	338.04	336.07	336.50		
	5.66(24)	1.56(24)	1.03(22)	.76(24)	2.91(24)	3.34(24)	.06(10)	.25(23)	3.12(24)	2.42(24)		
DAY 7	338.84	337.61	337.52	340.72	337.34	340.43	337.74	338.80	336.09	338.09		
	3.28(24)	1.28(24)	.66(24)	4.56(23)	.51(24)	2.51(24)	.20(24)	2.07(24)	3.00(24)	.44(18)		
DAY 8	337.31	340.86	337.26	346.96	337.22	337.89	337.90	337.81	337.53	340.85		
	.86(24)	3.26(24)	.56(24)	9.38(24)	.11(24)	1.32(24)	.55(24)	1.20(24)	1.32(24)	6.61(14)		
DAY 9	341.11	338.69	337.05	340.42	337.18	337.88	338.17	338.31	337.98	338.19		
	2.03(22)	2.73(19)	.07(24)	4.99(21)	.12(24)	1.17(23)	.83(24)	.60(24)	.45(23)	.43(14)		
DAY 10	337.71	336.98	337.09	337.55	337.23	338.76	340.81	339.52	340.49	338.07		
	1.79(24)	.08(23)	.11(24)	1.76(24)	.05(6)	1.31(24)	3.84(24)	2.45(24)	2.40(24)	.44(24)		
DAY 11	337.83	338.11	337.01	337.50	337.16	337.70	338.83	339.25	338.23	338.06		
	2.37(24)	.90(24)	.16(24)	2.05(24)	.22(14)	1.00(24)	1.48(24)	2.25(24)	.26(24)	.35(24)		
DAY 12	337.74	336.96	337.51	337.97	338.21	337.40	338.33	338.34	338.02	339.09		
	2.46(24)	.45(24)	.86(24)	.83(24)	2.12(22)	.36(22)	1.56(24)	1.64(24)	.23(24)	2.95(24)		
DAY 13	337.30	337.07	337.10	337.01	339.32	338.36	337.94	338.17	337.85	338.68		
	.85(18)	.76(20)	.39(21)	.13(24)	1.03(23)	.86(24)	.50(22)	1.93(24)	.37(24)	2.50(16)		
DAY 14	338.97	337.61	337.19	336.98	345.25	338.44	338.40	337.74	338.59	339.19		
	1.26(20)	.93(24)	.44(23)	.17(24)	6.74(24)	1.82(24)	.84(12)	.58(24)	1.23(24)	2.00(19)		
DAY 15	339.11	340.24	336.91	337.13	344.00	337.55		337.34	340.62	338.22		
	1.25(24)	1.80(24)	.07(24)	.24(19)	4.51(20)	.42(24)		.78(24)	2.26(24)	.38(24)		
DAY 16	34	337.83	336.93	337.15	338.37	337.58		337.82	338.32	338.57		
	4.20(21)	2.06(21)	.13(24)	.15(24)	.98(24)	.80(24)		.38(24)	2.49(24)	1.85(18)		
DAY 17	338.02	337.21	337.46	336.91	337.23	341.13		338.05	339.02	343.06	337.88	
	.73(24)	.69(22)	1.33(19)	.14(21)	.21(23)	4.15(24)		.13(24)	1.75(20)	5.69(10)	.39(9)	
DAY 18	339.77	336.73	341.51	337.16	337.23	337.77		338.01	338.14	338.33	337.92	
	1.14(24)	.12(24)	3.28(24)	.07(8)	.81(23)	.41(24)		.23(24)	.97(23)	1.70(16)	.52(21)	
DAY 19	337.30	336.87	339.21		338.33	337.42		338.52	337.99	338.35	338.86	
	.62(24)	.52(24)	2.16(24)		1.57(24)	.29(24)		.21(24)	.50(24)	1.61(23)	3.62(24)	
DAY 20	338.24	337.79	337.04		339.32	340.45		338.73	339.00	338.23	339.76	
	1.14(24)	1.20(24)	.15(22)		1.84(20)	2.78(24)		1.15(24)	1.47(24)	1.99(24)	2.86(24)	
DAY 21	337.87	340.38	336.98		341.36	337.54	340.57	338.21	337.99	340.80	338.31	
	1.43(24)	3.12(24)	.10(24)		6.50(23)	1.58(24)	2.52(15)	.71(24)	.35(24)	3.39(24)	1.74(24)	
DAY 22	337.00	338.23	336.99		337.85	338.10	337.96	338.11	338.29	338.57	337.97	
	.18(24)	1.29(23)	.09(24)		1.85(22)	1.46(24)	1.45(24)	.19(24)	.53(24)	1.07(24)	1.23(24)	
DAY 23	336.72	341.03	338.58	337.11	337.61	339.23	337.27	338.07	338.00	338.52	338.07	
	.18(24)	5.58(13)	2.02(24)	.23(24)	.93(24)	2.39(24)	1.00(24)	.17(24)	.67(24)	1.21(20)	1.26(14)	
DAY 24	337.46	337.65	338.19	337.26	337.71	338.24	338.05	339.05	338.20	337.92		
	1.12(24)	.45(24)	1.35(24)	.12(17)	.77(24)	2.52(24)	.37(24)	1.69(18)	.19(24)	.29(24)		
DAY 25	341.83	337.85	336.87		343.07	339.80	337.55	338.81	338.16	338.04		
	6.23(24)	1.80(24)	.13(23)		2.42(24)	2.62(18)	.88(24)	2.11(24)	.23(23)	.10(18)		
DAY 26	338.73	338.51	338.88		343.24	337.83	337.91	337.01	337.48	338.81		
	3.04(24)	1.87(24)	1.66(24)		2.80(22)	.70(22)	.24(24)	3.06(22)	2.25(24)	3.74(24)		
DAY 27	337.38	337.56	338.50	336.65	342.04	337.34	338.06	338.24	337.68	341.15		
	1.01(21)	.50(21)	3.05(20)	.09(10)	3.93(24)	.17(24)	.18(24)	.19(21)	2.58(24)	2.15(23)		
DAY 28	341.59	337.58	339.77	336.66	340.56	337.47	338.69	338.15	338.22	338.13		
	5.04(20)	.67(24)	2.72(24)	.06(12)	1.89(24)	.80(24)	2.42(21)	.73(24)	.30(24)	.26(13)		
DAY 29	338.00		338.71	337.59	341.13	337.81	339.47	339.93	338.48	337.79		
	2.06(24)		2.12(24)	.40(7)	1.32(24)	.69(24)	1.67(24)	1.95(24)	1.24(24)	.74(14)		
DAY 30	337.63		344.33	339.06	338.72	337.55	338.93	347.81	339.05	337.42		
	2.02(23)		8.48(24)	2.58(24)	1.25(24)	1.82(22)	1.50(24)	7.64(13)	1.73(11)	.40(22)		
DAY 31	339.87		341.32		341.94		338.28			338.43		
	4.16(16)		3.53(24)		1.70(24)		2.04(21)			1.85(24)		
MONTHLY	338.51	338.26	338.22	338.89	339.48	339.33	338.33	338.88	338.19	338.64	338.25	
MEAN	1.45	1.29	1.73	3.32	2.28	2.50	.85	2.34	.91	1.27	.77	
	31	28	31	24	31	30	25	30	30	30	8	
HOURS PER MONTH	695	633	723	496	684	705	521	674	683	609	158	

ANNUAL MEAN = 338.63
STANDARD DEVIATION = .46
HOURS PER YEAR = 6581

APPENDIX 1(b)

Selected baseline Mark I data set from the Australian BAPMoN station at Cape Grim, Tasmania.

Tabulation of baseline CO_2 concentration data obtained using the Mark I in situ monitoring system in the temporary laboratory for the period 1976 through 1981.

Numbers in the body of the Table are the mean concentrations, standard deviations and number of hours of data for each day. Monthly means are averages of daily means and are listed with the number of days represented, standard deviations and total number of hours. Annual means are the averages of the monthly means available for that year.

Data selection has been made for conditions when local winds were in the sector 190° to 280° and of an average speed $\geq$ 18 km hr, and where the hourly mean concentration is part of a period of at least 5 such hours during which hourly mean concentrations varied by no more than ± 0.3 ppmv.

Concentrations are expressed in parts per million by volume (ppmv) with respect to the WMO 1981 CO_2 Calibration Scale. A carrier-gas correction has been applied to all values based on comparisons of instrument response to WMO Central CO_2 Laboratory CO_2/N_2 and CO_2/Air Secondary Standards as described in Pearman et al. (1983).

Values are as computed, no corrections having been applied for the step change in concentration discussed in Section 4 of the text.

CAPE GRIM CO2 CONCENTRATIONS (MARK I)

1976 SELECTED BASELINE VALUES

MONTH	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
DAY 1												331.02 .08(3)
DAY 2				329.26 .15(10)								331.05 .11(2)
DAY 3						329.33 (1)						
DAY 4					329.10 .07(5)	329.29 .11(11)					331.11 .12(4)	330.70 .11(5)
DAY 5					329.02 .12(21)						330.81 .24(4)	
DAY 6					328.88 .19(17)	328.93 .08(6)						
DAY 7					328.81 .09(20)	329.19 .14(12)						330.98 .07(3)
DAY 8					329.02 .10(15)	328.71 .11(18)						331.11 .04(2)
DAY 9												330.14 .07(5)
DAY 10					328.79 .06(2)	328.59 .15(21)						
DAY 11					328.79 .12(9)							
DAY 12												
DAY 13												
DAY 14												
DAY 15											331.50 .06(3)	
DAY 16											331.43 .01(2)	
DAY 17									331.08 .07(8)		330.98 .02(3)	
DAY 18									331.30 .03(2)		331.31 .13(8)	
DAY 19											331.20 .15(6)	
DAY 20											330.39 .63(5)	
DAY 21											331.34 .08(3)	
DAY 22									330.62 .06(3)		330.67 .41(7)	
DAY 23									330.51 .22(7)		330.32 .07(5)	330.84 .02(3)
DAY 24												330.85 .02(2)
DAY 25												330.39 .11(6)
DAY 26												330.32 .25(9)
DAY 27				329.52 .09(6)								330.21 .30(10)
DAY 28				329.48 .23(19)								330.40 .22(6)
DAY 29				329.45 .07(24)								330.32 .30(10)
DAY 30				329.27 .15(19)							330.68 .45(3)	330.68 .06(2)
DAY 31												
MONTHLY MEAN				329.40 .12 5	328.92 .13 7	329.01 .31 6			330.88 .37 4		330.98 .40 12	330.64 .34 14
HOURS PER MONTH				78	89	69			20		53	68

ANNUAL MEAN = 329.97
STANDARD DEVIATION = .97
HOURS PER YEAR = 377

CAPE GRIM CO2 CONCENTRATIONS (MARK I)

1977 SELECTED BASELINE VALUES

MONTH	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
DAY 1	330.67 .37(2)	330.70 .17(12)		331.00 .11(2)							332.86 .02(3)	
DAY 2	330.67 .22(10)	330.56 .28(5)									332.79 .13(4)	332.54 (1)
DAY 3	330.54 .17(7)			330.72 .12(8)						333.29 .03(2)		332.52 .09(5)
DAY 4				330.82 .05(2)						333.08 .08(3)	332.90 .06(3)	332.31 .12(7)
DAY 5		330.72 .04(3)		331.05 .13(3)						332.83 .27(4)	333.05 .03(3)	332.25 .18(12)
DAY 6		330.52 .21(9)		331.04 .09(2)						333.00 .05(4)		332.16 .31(19)
DAY 7										333.11 (1)	332.49 .35(9)	332.40 .52(9)
DAY 8				330.76 .11(5)							333.09 .04(3)	332.42 .52(8)
DAY 9		330.81 .07(3)										
DAY 10		330.79 .03(3)									332.62 .18(5)	
DAY 11											333.03 .29(4)	
DAY 12	330.40 .08(5)										333.46 .01(2)	331.84 (1)
DAY 13		330.49 .14(5)										
DAY 14										332.47 .21(8)	332.87 .17(15)	331.62 (1)
DAY 15		330.63 .70(6)								332.71 .37(9)	333.10 .03(2)	332.33 .19(9)
DAY 16		332.05 .13(2)		330.62 .29(5)						332.67 .26(5)	332.74 .15(3)	332.43 .11(9)
DAY 17				330.83 .04(5)						332.46 .14(6)	332.74 .10(5)	332.60 .09(8)
DAY 18		330.59 .06(5)		330.32 .27(2)		331.65 .02(3)				332.51 .07(3)	333.02 .12(10)	332.45 .17(12)
DAY 19				330.60 (2)		331.59 .17(4)						332.53 .19(9)
DAY 20											332.52 .09(11)	332.66 .08(3)
DAY 21	330.86 .21(2)										332.53 .10(6)	
DAY 22	330.85 .04(2)										332.66 .21(11)	
DAY 23	330.86 .02(2)						332.00 .03(3)				332.90 .07(15)	
DAY 24	330.60 .39(11)					331.61 .12(5)	331.71 .13(9)				332.93 (1)	
DAY 25	330.78 .31(6)					331.77 .04(3)	331.82 .23(6)					
DAY 26	330.64 .16(9)	330.24 .04(6)					331.96 .03(3)					332.18 .17(5)
DAY 27	331.17 .03(3)					331.72 .04(3)						332.41 .10(12)
DAY 28	331.13 .03(3)		330.99 .05(3)			331.67 .07(6)	331.61 .03(3)			333.36 .03(3)		332.26 .19(9)
DAY 29	331.00 .04(3)		331.11 .06(3)			331.57 .18(6)				332.89 .25(7)		332.14 .14(9)
DAY 30	330.54 .27(8)					331.77 .05(3)	332.07 .05(3)			332.74 .33(8)		
DAY 31	330.87 .03(3)		330.94 .11(3)							332.95 .10(3)		
MONTHLY MEAN	330.77 .22 15	330.74 .46 11	331.01 .09 3	330.78 .23 10		331.67 .08 8	331.86 .18 6			332.86 .29 14	332.86 .24 19	332.32 .26 19
HOURS PER MONTH	76	59	9	36		33	27			66	115	148

ANNUAL MEAN = 331.65
STANDARD DEVIATION = .88
HOURS PER YEAR = 569

CAPE GRIM CO2 CONCENTRATIONS (MARK I)

1978 SELECTED BASELINE VALUES

MONTH	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
DAY 1			332.44 .08(4)								334.61 .53(3)	
DAY 2												
DAY 3			332.28 .07(7)							335.82 .12(7)	336.19 (1)	
DAY 4			332.09 .07(12)							335.60 .09(13)		
DAY 5			332.21 .16(17)							335.86 .43(9)		
DAY 6	332.24 .03(3)								334.99 .13(5)	335.70 .26(20)		334.45 .11(14)
DAY 7	332.35 .20(12)	332.27 .14(2)							334.79 .11(11)	335.50 .05(7)		334.20 .21(24)
DAY 8	332.54 .05(5)	332.29 (1)							334.46 .29(17)	335.57 (1)		334.26 .27(22)
DAY 9	332.29 .15(9)	332.45 .12(5)							334.72 .11(8)			334.25 .28(17)
DAY 10	332.96 .08(2)		332.77 .05(3)									
DAY 11	332.47 .17(19)	332.11 .20(14)										
DAY 12	332.22 .19(21)	331.83 .10(24)								335.91 .33(2)		
DAY 13	331.95 .18(12)	332.06 .21(3)								335.58 .30(11)		
DAY 14										335.33 .23(23)		
DAY 15	332.23 .08(2)									335.46 .13(7)		
DAY 16	331.96 .14(11)									335.80 .32(10)		
DAY 17										335.45 .06(6)		334.39 .17(14)
DAY 18	332.19 .19(12)									335.71 .11(5)		334.25 .17(18)
DAY 19	332.05 .15(10)									335.35 .15(16)		334.39 .10(15)
DAY 20								334.24 .18(13)		335.50 .21(14)		334.18 .26(18)
DAY 21								333.96 .28(12)		335.57 .25(7)		334.36 .25(19)
DAY 22	331.83 .07(7)							334.31 .08(15)				334.57 .27(7)
DAY 23								334.10 .19(11)	336.14 (1)			
DAY 24	331.81 .01(3)											
DAY 25	331.64 .01(2)							332.50 .04(3)				
DAY 26	331.34 .13(4)							334.66 .20(20)				334.76 .12(11)
DAY 27	330.95 .18(8)							334.51 .15(18)	335.60 .17(10)			334.63 .11(4)
DAY 28		332.23 .20(6)						334.56 .30(8)	335.51 .14(14)			334.85 .15(10)
DAY 29									335.37 .50(11)			335.06 .12(14)
DAY 30												335.00 .25(21)
DAY 31										335.02 .10(7)		334.59 .38(12)
MONTHLY MEAN	332.06 .47 17	332.18 .20 7	332.36 .26 5					334.10 .69 8	335.20 .56 8	335.57 .22 17	335.40 1.12 2	334.51 .28 16
HOURS PER MONTH	142	55	43					100	77	165	4	240

ANNUAL MEAN = 333.92
STANDARD DEVIATION = 1.51
HOURS PER YEAR = 826

CAPE GRIM CO2 CONCENTRATIONS (MARK I)

1979 SELECTED BASELINE VALUES

MONTH	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
DAY 1	335.19 .13(7)			334.21 .29(11)				335.93 .08(7)				335.83 .27(12)
DAY 2	334.58 .36(10)							335.77 .05(3)				336.04 .31(21)
DAY 3			334.37 .53(16)	335.09 .07(9)	334.33 .09(12)							335.89 .48(14)
DAY 4				335.00 .06(9)	334.47 .05(7)			335.89 .08(5)				
DAY 5			334.33 .21(14)	334.99 .14(4)								336.24 .24(6)
DAY 6	334.51 .29(21)	334.35 .09(7)	334.54 .13(8)									335.31 .06(3)
DAY 7	334.99 .14(11)	335.09 .11(8)										
DAY 8	335.04 (1)											
DAY 9	334.52 .11(10)		335.05 .68(13)					335.92 .03(3)				
DAY 10	334.70 .12(10)	334.82 .25(14)	334.34 (1)		334.61 .06(12)	334.83 .08(2)		335.95 .07(9)				
DAY 11	334.61 .21(20)	334.60 .15(21)			335.16 .06(6)	334.84 .03(5)						
DAY 12	334.49 .46(12)	334.67 .15(17)			334.94 .22(21)							
DAY 13	333.41 .35(13)	334.58 .31(5)			334.72 .13(24)							
DAY 14	334.13 .26(10)	334.52 .10(21)			334.86 .12(24)							
DAY 15	334.08 .26(12)	334.66 .15(24)			334.73 .10(14)							
DAY 16		334.16 .19(19)										
DAY 17	334.41 .09(15)	333.96 .22(24)	334.53 (1)		334.69 .16(13)							
DAY 18	334.37 .31(8)	334.07 .17(19)	334.40 .09(5)		334.68 .03(3)							
DAY 19					334.67 .10(7)							
DAY 20	334.71 (2)										336.46 .07(5)	
DAY 21	334.45 .26(18)			334.93 .09(7)							336.30 .52(18)	335.61 .28(8)
DAY 22			334.77 .07(6)	334.45 .22(23)							336.27 .11(8)	335.48 .24(19)
DAY 23			334.88 .17(10)	334.61 .15(13)			335.80 .11(9)					336.04 .10(14)
DAY 24			334.74 .27(23)	334.35 .26(18)	334.89 .14(3)		335.88 .17(2)				336.16 (1)	335.98 .25(13)
DAY 25			335.14 .29(20)		334.80 .09(5)						335.85 .42(19)	335.85 .33(16)
DAY 26		335.86 .10(5)	335.70 (1)	334.76 .20(10)	334.61 (1)						336.06 .31(12)	335.75 .41(16)
DAY 27		334.91 .03(2)		334.32 .15(24)	334.63 .13(24)						336.14 .14(14)	
DAY 28				334.20 .18(24)	334.65 .07(6)		335.95 .09(10)				335.97 .31(17)	
DAY 29				334.15 .24(18)	334.63 .07(2)		335.79 .11(9)				335.97 .21(23)	
DAY 30					334.63 .09(16)						336.02 .19(12)	
DAY 31			334.76 .08(5)		334.71 .08(20)							
MONTHLY MEAN	334.51 .42 16	334.63 .49 13	334.74 .39 13	334.59 .35 12	334.71 .18 19	334.83 .02 2	335.85 .07 4	335.89 .07 5			336.12 .19 10	335.82 .27 11
HOURS PER MONTH	179	186	123	170	220	7	30	27			129	142

ANNUAL MEAN = 335.17
STANDARD DEVIATION = .66
HOURS PER YEAR = 1213

CAPE GRIM CO2 CONCENTRATIONS (MARK I)

1980 SELECTED BASELINE VALUES

MONTH	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
DAY 1				335.89 .09(13)		335.98 .17(24)			337.68 .11(15)	336.83 .11(6)	336.98 .23(24)	
DAY 2		335.68 .30(14)	335.82 .09(12)	336.05 .02(3)		336.11 .08(8)	337.69 .13(6)	337.22 .25(7)	337.74 .12(21)	337.18 .11(7)	337.16 .38(20)	
DAY 3		335.71 .12(24)	335.78 .24(20)	335.78 .08(8)			337.47 .11(12)	336.95 .32(23)	337.81 .18(6)	336.97 .40(13)	336.98 .61(7)	336.99 .14(10)
DAY 4	335.66 .25(14)	335.70 .14(14)	335.65 .17(9)				337.36 .13(14)	336.84 .11(9)	337.40 .09(8)			337.18 .24(12)
DAY 5	336.04 .09(5)	335.67 .14(20)	335.90 .15(13)				337.21 .12(11)		337.16 .29(20)			336.87 .26(6)
DAY 6	336.12 (1)	335.36 .22(17)					336.88 .27(19)		337.42 .07(7)	337.45 .07(6)		336.44 .05(6)
DAY 7		335.98 .57(15)					336.99 .16(15)	337.20 .10(7)	336.99 .32(16)	337.29 .08(14)	337.46 .04(5)	
DAY 8		336.31 .34(9)	336.16 .18(15)				337.08 .09(14)	337.12 .13(16)	337.25 .07(12)	337.15 .11(13)	337.01 .66(12)	
DAY 9		336.35 .11(20)	335.62 .04(2)			335.34 .12(6)	336.93 .15(10)		337.24 .12(12)	337.14 .07(6)		
DAY 10								337.06 .10(6)	337.36 .14(7)			
DAY 11						336.20 .10(11)		337.04 .07(9)	337.16 .10(8)			336.56 .33(12)
DAY 12	335.53 .12(4)				336.94 .06(3)	336.32 .25(20)		337.00 .16(20)				336.97 .08(6)
DAY 13	337.03 .03(2)		336.08 .06(2)			336.60 .06(7)		337.23 .04(8)	337.08 .29(2)	337.21 .13(8)	337.17 .11(3)	336.83 .52(8)
DAY 14	335.68 .14(3)		335.94 .11(19)					337.15 .06(9)	336.90 .07(4)	337.27 .12(14)	336.91 .24(13)	336.95 .37(17)
DAY 15	335.76 .18(23)	335.52 .18(9)					336.29 .06(3)	337.12 .13(6)	337.29 .09(14)	337.09 .23(15)		336.87 .31(15)
DAY 16	335.65 .24(20)	335.59 .15(4)		335.95 .09(7)	335.79 .07(7)		336.34 .09(8)		337.07 .08(10)	337.38 .20(13)		
DAY 17					335.82 .14(24)				337.52 (1)	337.67 .12(4)		337.36 .07(3)
DAY 18	335.62 .15(14)		335.89 .09(6)		335.86 .14(24)		336.74 .03(4)		337.32 .09(11)			336.74 .32(14)
DAY 19	335.63 .15(23)		335.74 .10(8)		335.87 .11(23)	336.57 .11(4)	336.73 .22(20)		337.20 .12(16)		337.00 .05(5)	336.94 .05(4)
DAY 20	335.52 .17(24)				335.95 .11(23)	336.37 .14(10)			336.95 .24(24)	336.92 .11(9)	336.94 .12(20)	336.42 .04(2)
DAY 21	335.51 .12(21)		336.10 .12(8)		335.87 .07(24)	336.96 .13(4)			336.86 .11(24)	336.92 .26(14)	336.94 .25(24)	
DAY 22	335.58 .09(11)		335.90 .24(16)		335.87 .10(11)	337.01 .06(7)			336.97 .18(17)		336.85 .34(23)	337.22 .13(5)
DAY 23	335.45 .15(19)		336.04 .11(21)						337.45 .04(2)		336.75 .39(23)	336.12 .48(16)
DAY 24	335.44 .13(15)		335.94 .10(10)		335.75 .18(20)						337.04 .32(7)	
DAY 25	335.75 .16(10)		336.05 .17(18)		336.00 .08(9)							337.10 (1)
DAY 26	335.83 .13(23)		336.29 .06(5)						337.34 .11(9)			
DAY 27	335.93 .08(7)		335.92 .24(13)							337.24 .30(11)		
DAY 28			336.06 .11(18)	335.66 .05(5)				336.98 .07(7)		337.22 .21(10)		
DAY 29	335.82 .17(19)	336.17 .08(7)	335.87 .08(23)	335.64 .10(17)			337.12 .06(7)	337.45 .29(10)		337.09 .07(12)	336.88 .41(15)	337.55 .37(14)
DAY 30	335.96 .09(7)		335.89 .12(18)		337.10 .01(2)		337.22 .17(2)	337.53 .18(8)	336.61 .03(2)	337.05 .33(14)	336.84 .99(2)	
DAY 31			335.96 .13(8)		336.16 .50(17)		337.05 .12(10)	337.72 .17(21)		337.22 .14(13)		
MONTHLY MEAN	335.78 .35 20	335.82 .33 11	335.93 .16 21	335.83 .16 6	336.08 .45 12	336.35 .49 10	337.01 .38 15	337.17 .24 15	337.24 .29 24	337.17 .20 19	336.99 .17 15	336.89 .36 17
HOURS PER MONTH	265	153	264	53	187	101	155	166	268	202	203	151

ANNUAL MEAN = 336.52
STANDARD DEVIATION = .61
HOURS PER YEAR = 2168

CAPE GRIM CO2 CONCENTRATIONS (MARK I)

1981 SELECTED BASELINE VALUES

MONTH	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
DAY 1	337.36 .31(8)											
DAY 2												
DAY 3	336.86 .11(12)		337.16 .12(4)									
DAY 4	336.85 .18(24)	337.61 .11(3)	336.89 .14(20)						338.44 .09(5)			
DAY 5	336.85 .13(16)	336.91 .13(8)	336.92 .17(20)					338.13 .05(7)				
DAY 6	337.12 .07(7)	336.74 .25(3)		336.88 .08(9)				338.06 .27(17)				
DAY 7												
DAY 8			337.05 .05(8)						338.21 .08(8)			
DAY 9		336.89 .08(11)	337.05 .07(24)						338.23 .13(3)			
DAY 10	336.93 .16(17)	336.97 .07(22)	337.09 .11(24)	336.86 .24(18)								
DAY 11	336.95 .19(20)		337.01 .16(24)		337.17 .23(13)	337.55 .09(8)						
DAY 12			336.98 .13(9)			337.65 .15(13)						
DAY 13			337.11 .05(5)	337.01 .12(8)		337.98 .07(8)						
DAY 14				336.99 .16(23)		337.46 .13(10)		337.47 .23(8)				
DAY 15				337.09 .21(17)		337.48 .22(20)		337.60 .22(16)				
DAY 16		337.23 .48(6)		337.15 .15(24)	337.29 .09(9)			337.88 .04(3)				
DAY 17		336.67 .11(10)		336.91 .14(21)	337.23 .21(22)			338.05 .14(19)				
DAY 18		336.73 .12(24)		337.16 .07(8)	337.42 .11(6)	337.58 .07(7)		338.07 .14(22)	338.07 .31(13)			
DAY 19	336.97 .10(13)	336.68 .12(19)				337.50 .06(9)		338.49 .19(21)	338.32 .10(8)			
DAY 20	337.09 .04(3)											
DAY 21	336.99 .09(11)							338.09 .20(17)				
DAY 22	336.98 .16(23)							338.11 .19(23)				
DAY 23	336.72 .18(24)			337.17 .18(12)				338.07 .17(24)				
DAY 24	336.70 .14(14)	337.78 .08(2)		337.25 .08(8)				338.31 .05(5)				
DAY 25		337.77 .11(6)	336.85 .12(5)									
DAY 26	337.61 (1)							338.10 .04(2)				
DAY 27	337.47 (1)							338.24 .19(21)				
DAY 28								337.89 .63(15)				
DAY 29												
DAY 30												
DAY 31	336.95 (1)											
MONTHLY MEAN	337.03 .26 16	337.09 .44 11	337.01 .11 10	337.05 .14 10	337.28 .10 4	337.60 .18 7		338.04 .25 15	338.25 .14 5			
HOURS PER MONTH	195	114	143	148	50	75		220	37			

ANNUAL MEAN = 337.42
STANDARD DEVIATION = .49
HOURS PER YEAR = 982

APPENDIX 2(a)

Complete Mark II CO_2 data set from the Australian BAPMoN station at Cape Grim, Tasmania.

Tabulation of all CO_2 concentration data obtained using the Mark II in situ monitoring system in the permanent laboratory during the years 1981-1982.

Numbers in the body of the Table are the mean concentrations, standard deviations and number of hours of data for each day. Monthly means are averages of daily means and are listed with the number of days represented, standard deviation and total number of hours. Annual means are the averages of the monthly means available for that year.

Concentrations are expressed in parts per million by volume (ppmv) with respect to the WMO 1981 CO_2 Calibration Scale. Until 2nd November 1982 a carrier-gas correction has been applied, based on comparisons of instrument response to WMO Central CO_2 Laboratory CO_2/N_2 and CO_2/Air Secondary Standards as described in Pearman et al. (1983). After 2nd November 1982, CO_2/Air standard calibration gas mixtures were used at the station.

CAPE GRIM CO2 CONCENTRATIONS (MARK II)

1981 COMPLETE DATA SET

MONTH	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
DAY 1								335.76 1.82(24)	337.24 .31(23)	336.25 .98(24)	337.22 1.57(24)	338.50 1.11(24)
DAY 2								336.41 1.22(24)	337.34 .18(24)	336.63 .41(24)	337.22 .85(24)	341.32 5.51(20)
DAY 3								343.06 3.30(17)	337.35 .33(21)	337.04 .27(24)	338.52 1.39(24)	340.96 6.25(24)
DAY 4								341.10 4.02(18)	337.47 .35(24)	336.56 .45(24)	337.46 1.30(24)	338.28 3.33(24)
DAY 5						342.38 3.30(15)		337.28 1.34(20)	337.14 .56(23)	336.40 .46(24)	337.18 .12(24)	337.68 .84(24)
DAY 6						343.99 1.81(12)		337.87 .15(23)	335.81 2.30(24)	335.94 1.60(22)	337.69 .82(24)	337.35 .52(24)
DAY 7								338.57 1.99(24)	335.77 2.21(24)	337.52 .30(20)	338.74 1.58(24)	337.37 .39(24)
DAY 8						338.61 1.84(11)		337.41 1.19(24)	336.86 1.05(24)	339.28 4.38(24)	340.21 3.48(24)	337.63 .10(24)
DAY 9						338.40 1.16(24)		337.85 .40(24)	337.11 .36(24)	337.24 .75(24)	338.71 2.40(24)	337.71 .09(24)
DAY 10						339.05 1.70(21)		339.48 2.48(21)	339.83 2.80(24)	337.48 .22(24)	338.05 1.79(24)	338.07 1.32(24)
DAY 11						337.88 1.21(13)		338.73 2.19(24)	337.40 .41(22)	337.30 .59(24)	337.67 .06(24)	340.60 3.88(24)
DAY 12						337.37 .47(18)		337.70 1.65(24)	337.32 .32(24)	337.39 .39(10)	337.84 .05(24)	337.41 .18(24)
DAY 13						338.50 1.22(22)		337.42 1.84(24)	337.21 .27(24)	338.15 .53(5)	338.18 .69(24)	337.81 .64(24)
DAY 14						338.51 1.61(17)		337.07 .63(24)	337.62 1.18(21)	337.69 1.42(24)	338.27 .92(24)	338.50 1.19(24)
DAY 15								336.58 .73(24)	339.20 2.02(17)	337.07 .11(22)	337.88 .23(24)	340.41 2.79(24)
DAY 16								337.07 .34(24)	337.50 1.89(24)	338.04 1.01(24)	338.48 1.01(24)	338.65 1.28(20)
DAY 17						338.36 1.05(7)		337.50 .13(17)	337.81 2.04(24)	340.58 3.09(24)	337.71 .06(22)	337.83 1.05(21)
DAY 18						338.03 .53(16)		337.25 .19(24)	337.37 .86(24)	336.77 1.09(22)	337.77 .10(23)	337.42 .11(24)
DAY 19								337.77 .29(21)	337.36 .42(24)	336.86 1.14(24)	338.76 2.70(24)	337.36 .06(24)
DAY 20								337.97 1.25(24)	337.99 .95(24)	337.43 1.50(22)	339.02 2.09(24)	337.43 .15(24)
DAY 21								337.31 .28(23)	337.02 .49(24)	340.21 3.19(24)	338.19 .87(24)	337.79 .70(23)
DAY 22								337.37 .30(24)	337.49 .55(24)	337.94 .78(23)	337.68 .84(24)	337.98 .68(24)
DAY 23							335.87 .99(7)	337.27 .21(24)	337.19 .79(22)	337.98 .73(24)	338.06 1.09(24)	337.49 .96(24)
DAY 24							337.97 1.31(23)	337.93 1.59(24)	337.70 .23(24)	337.28 .19(24)	337.86 .70(24)	337.67 .39(24)
DAY 25							337.07 .96(24)	337.79 1.96(24)	337.58 .31(24)	337.26 .04(11)	340.36 2.89(12)	338.11 1.18(24)
DAY 26							337.42 .24(24)	336.99 2.31(21)	336.99 1.73(24)	337.03 1.35(14)		342.70 6.20(24)
DAY 27							337.53 .22(24)	337.73 .06(24)	336.75 1.30(24)	339.95 2.44(23)	337.51 .51(15)	338.26 2.54(24)
DAY 28							337.73 3.14(23)	337.55 .38(24)	337.11 .30(15)	336.93 .11(24)	337.56 .95(24)	337.12 .97(24)
DAY 29							339.37 1.68(20)	338.90 1.28(24)		336.84 .30(24)	338.21 1.22(24)	337.17 .13(24)
DAY 30							338.63 1.37(24)	343.85 8.07(23)	337.26 .91(12)	337.20 .48(22)	337.67 .12(22)	339.02 1.68(22)
DAY 31							337.70 1.89(24)	340.04 3.02(24)		338.27 1.51(24)		339.80 3.38(23)
MONTHLY MEAN						339.19 2.05 11	337.70 .98 9	338.15 1.76 31	337.37 .77 29	337.56 1.11 31	338.13 .77 29	338.43 1.40 31
HOURS PER MONTH						176	193	708	656	672	670	729

ANNUAL MEAN = 338.08
STANDARD DEVIATION = .62
HOURS PER YEAR = 3804

CAPE GRIM CO2 CONCENTRATIONS (MARK II)

1982 COMPLETE DATA SET

MONTH	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
DAY 1	337.52	337.02	337.49	339.56	339.06	337.92	348.16	338.64	339.08	338.36	338.65	338.77
	.51(24)	.13(24)	.07(24)	3.97(24)	1.71(24)	.12(24)	4.79(19)	.23(24)	2.06(24)	.08(23)	.14(24)	.11(22)
DAY 2	337.34	337.07	337.58	337.91	340.75	338.29	340.89	338.55	338.59	338.54	338.46	338.98
	.10(24)	.08(24)	.23(24)	1.67(23)	1.27(24)	.72(24)	3.40(24)	.86(24)	.24(24)	.83(24)	.08(12)	.92(22)
DAY 3	337.26	337.19	339.54	337.18	339.40	338.68	341.19	338.93	339.23	338.40		338.67
	.04(24)	.15(24)	1.46(24)	.08(24)	.76(24)	.76(24)	2.76(24)	.16(24)	.17(24)	.35(24)		.58(19)
DAY 4	337.30	337.30	338.84	337.19	338.37	341.61	340.20	338.84	339.12	339.23	346.90	338.52
	.03(24)	.41(22)	.92(24)	.04(24)	.97(24)	2.78(23)	2.94(24)	.13(24)	.15(24)	.69(24)	6.99(24)	.18(24)
DAY 5	337.86	338.61	343.97	337.40	338.68	341.64	342.24	338.18	339.52	340.04	342.84	338.30
	1.18(24)	1.30(24)	3.94(22)	.41(20)	.64(24)	5.12(24)	3.88(22)	1.51(24)	.71(24)	2.16(24)	4.29(23)	.10(24)
DAY 6	338.07	337.72	345.57	337.59	338.25	339.07	340.63	338.54	339.41	338.44	351.57	338.78
	1.77(24)	1.40(24)	4.39(22)	.14(19)	.07(24)	.99(24)	3.09(24)	.15(24)	.03(24)	2.16(24)	10.50(24)	.88(23)
DAY 7	337.46	344.03	340.50	337.70	338.28	338.90	339.00	338.36	338.85	338.20	336.11	338.81
	.47(22)	4.94(24)	3.31(24)	.79(24)	.05(23)	1.16(24)	1.01(24)	.13(24)	.19(24)	.78(24)	.40(24)	.86(24)
DAY 8	337.39	342.44	338.50	340.08	338.15	338.99	342.08	340.23	339.45	338.67	336.53	340.77
	.12(24)	7.57(24)	3.25(24)	4.40(24)	.09(24)	1.24(11)	2.68(24)	3.14(24)	.54(24)	.14(23)	.78(24)	4.56(24)
DAY 9	337.40	337.29	337.08	338.69	337.91	338.40	342.14	337.61	339.33	338.88	336.13	339.80
	.09(24)	.63(23)	.09(24)	2.17(24)	.62(24)	1.38(23)	5.07(24)	2.38(24)	.06(24)	.11(24)	.24(22)	2.45(24)
DAY 10	339.73	339.37	337.13	344.38	338.22	337.92	339.31	342.40	339.18	338.50	336.78	343.08
	4.58(24)	3.10(24)	.39(22)	6.07(24)	.79(24)	.79(24)	1.78(24)	6.84(23)	.21(23)	.13(24)	.41(24)	7.16(24)
DAY 11	343.68	338.74	337.00	340.23	338.14	338.67	339.21	341.83	339.52	338.85	336.12	343.96
	3.18(24)	2.62(24)	.10(24)	2.09(24)	.06(23)	.80(24)	1.21(24)	1.19(24)	.04(24)	1.37(24)	.52(23)	6.32(24)
DAY 12	338.79	338.47	337.67	340.11	337.91	339.00	339.17	340.57	339.51	341.66	337.60	339.42
	1.71(17)	1.08(18)	1.97(22)	5.53(24)	.18(24)	3.40(24)	1.14(23)	2.61(24)	1.11(13)	4.68(21)	2.21(22)	1.38(24)
DAY 13	337.69	337.76	337.94	339.00	338.14	342.26	338.50	339.18	339.52	338.50	338.88	340.61
	.51(22)	.24(24)	.86(24)	2.46(22)	.14(21)	3.46(24)	.99(24)	1.13(24)	.94(13)	.18(24)	2.04(24)	1.10(23)
DAY 14	337.94	337.58	337.80	352.36	337.97	341.22	340.18	338.71	346.57	338.98	344.87	338.82
	.83(24)	.73(24)	.72(24)	2.33(13)	.09(24)	3.66(24)	1.07(14)	.39(24)	6.79(12)	.08(24)	6.50(24)	.78(24)
DAY 15	341.07	338.80	339.47	336.58	338.11	339.35		338.88	339.31	338.91	342.99	338.93
	6.35(24)	1.47(22)	1.39(24)	.25(8)	.30(24)	2.12(22)		.09(24)	.10(5)	.23(23)	6.73(24)	2.12(24)
DAY 16	338.03	337.49	340.09	337.38	338.31	338.09		338.83	340.17	338.86	338.85	338.19
	.36(24)	.46(20)	3.80(24)	.84(17)	.56(24)	.11(24)		.07(24)	1.38(23)	.26(24)	.10(24)	.08(24)
DAY 17	340.14	338.39	337.29	338.88	338.83	339.17		339.81	339.68	338.72	338.66	338.23
	4.12(24)	1.69(22)	.33(22)	2.80(24)	.96(24)	.73(24)		2.00(19)	1.59(20)	.07(24)	.18(24)	.15(24)
DAY 18	337.44	337.14	338.40	337.65	338.74	338.11		340.01	338.85	338.63	339.02	338.07
	.56(24)	.18(24)	1.08(24)	.30(24)	1.99(24)	.20(24)		1.95(24)	.07(24)	1.17(24)	.12(24)	.08(24)
DAY 19	337.78	337.39	339.50	339.68	337.95	338.39		338.64	338.68	339.39	338.51	338.19
	.44(24)	.56(24)	2.74(24)	5.92(24)	.12(23)	.48(24)		1.70(23)	.14(24)	1.56(24)	.19(24)	.05(24)
DAY 20	337.78	338.29	340.27	337.26	337.91	338.23	339.18	340.28	339.86	338.73	338.52	338.34
	1.08(24)	1.05(24)	2.66(24)	.25(24)	.20(22)	.08(24)	.54(24)	1.55(24)	2.05(24)	.12(24)	.10(24)	.18(24)
DAY 21	336.91	336.92	342.56	338.18	338.15	338.72	339.46	338.83	348.04	338.74	338.67	338.33
	.05(24)	.14(24)	3.28(24)	1.17(17)	.07(24)	.60(24)	.85(22)	.17(24)	9.76(24)	.08(24)	.61(24)	.16(24)
DAY 22	337.39	337.35	340.81	342.97	338.01	338.29	339.22	338.77	338.64	338.36	338.57	338.43
	.51(22)	.80(24)	2.40(24)	2.86(22)	.14(24)	.06(22)	.94(22)	.12(24)	1.04(24)	.09(24)	1.63(24)	.94(24)
DAY 23	339.44	336.79	337.08	338.55	337.85	338.60	339.56	337.00	338.88	338.76	337.89	342.50
	5.01(24)	.20(24)	.31(22)	.96(24)	.21(21)	.92(24)	1.41(24)	1.73(24)	1.14(24)	.55(24)	.20(13)	5.57(24)
DAY 24	339.14	337.52	342.40	338.71	337.92	338.99	338.72	339.04	344.02	340.01	342.18	338.35
	1.46(24)	.70(24)	4.51(21)	.95(24)	.11(24)	1.60(23)	.22(24)	1.55(24)	3.51(23)	4.64(24)	2.16(12)	.48(23)
DAY 25	337.26	336.78	339.29	338.26	338.99	34	339.24	338.98	346.47	338.16	338.66	339.69
	.11(23)	.20(24)	1.36(24)	.40(24)	1.86(20)	2.13(20)	.70(24)	.08(24)	9.28(24)	.75(24)	.12(24)	2.18(24)
DAY 26	337.35	336.93	342.07	338.97	339.84	340.39	338.87	338.93	339.00	339.02	338.40	340.95
	.07(24)	.58(24)	1.41(24)	1.50(18)	1.26(15)	3.01(24)	.62(24)	.17(24)	.82(24)	1.25(23)	.14(24)	5.16(24)
DAY 27	337.31	337.66	340.98	341.67	339.25	338.41	340.62	338.96	339.16	338.84	338.87	338.38
	.05(23)	1.04(24)	3.59(24)	4.75(11)	2.39(9)	.12(24)	1.74(24)	.10(24)	1.81(24)	.49(22)	.70(24)	.40(24)
DAY 28	337.55	337.35	346.81		340.06	338.27	339.29	339.33	338.65	338.68	340.35	338.41
	.38(24)	.50(22)	5.57(24)		4.44(19)	.13(23)	.75(24)	1.57(24)	.29(24)	.28(24)	2.78(24)	1.76(24)
DAY 29	340.14		346.77	337.82	338.48	340.73	339.00	341.96	339.19	339.29	339.18	338.11
	3.48(24)		7.96(22)	.28(9)	.67(24)	3.18(24)	.04(24)	2.87(24)	.77(24)	.57(23)	1.33(17)	.92(24)
DAY 30	337.07		343.71	338.14	338.28	342.28	338.92	339.12	338.93	338.47	339.91	339.59
	.05(24)		7.78(23)	.17(19)	.47(24)	4.53(24)	.04(23)	.29(24)	.66(24)	.15(24)	2.05(24)	2.70(24)
DAY 31	337.06		339.71		338.27		338.70	340.88		338.64		339.90
	.11(24)		3.80(24)		.13(24)		.10(24)	2.12(23)		.42(24)		1.11(22)
MONTHLY	338.20	338.05	340.12	339.31	338.52	339.29	340.14	339.32	340.15	338.88	339.68	339.35
MEAN	1.47	1.63	2.87	3.07	.71	1.33	1.98	1.21	2.53	.68	3.41	1.51
	31	28	31	29	31	30	26	31	30	31	29	31
HOURS PER MONTH	729	653	726	602	700	695	601	736	660	734	648	730

ANNUAL MEAN = 339.25
STANDARD DEVIATION = .72
HOURS PER YEAR = 8214

APPENDIX 2(b)

Selected baseline Mark II data set from the Australian BAPMoN station at Cape Grim, Tasmania.

Tabulation of baseline CO_2 concentration data obtained using the Mark II in situ monitoring system in the permanent laboratory during the years 1981-1982.

Numbers in the body of the Table are the mean concentrations, standard deviations and number of hours of data for each day. Monthly means are averages of daily means and are listed with the number of days represented, standard deviations and total number of hours. Annual means are the averages of the monthly means available for that year.

Data selection has been made for conditions when local winds were in the sector 190° to 280° and of an average speed ≥ 18 km hr^{-1}, and where the hourly mean concentration is part of a period of at least 5 such hours during which hourly mean concentrations varied by no more than ± 0.3 ppmv.

Concentrations are expressed in parts per million by volume (ppmv) with respect to the WMO 1981 CO_2 Calibration Scale. Until 2nd November 1982 a carrier-gas correction has been applied based on comparisons of instrument response to WMO Central CO_2 Laboratory CO_2/N_2 and CO_2/Air Secondary Standards as described in Pearman et al. 1983. After 2nd November 1982 CO_2/Air standard calibration gas mixtures were used at the station.

CAPE GRIM CO2 CONCENTRATIONS (MARK II)

1981 SELECTED BASELINE VALUES

MONTH	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
DAY 1										337.07 .03(5)		337.78 .03(7)
DAY 2										336.47 .31(10)		
DAY 3									337.59 .02(3)	336.86 .07(8)		337.63 .09(15)
DAY 4									337.42 .13(16)	337.09 .26(8)	337.08 .01(5)	
DAY 5										336.66 .05(5)	337.26 .11(9)	337.04 .10(6)
DAY 6								337.96 .02(5)			337.46 .39(17)	
DAY 7								337.96 (2)		337.79 .06(5)		
DAY 8									337.25 .08(7)			337.67 .07(15)
DAY 9									337.08 .15(7)			337.71 .09(24)
DAY 10										337.36 .12(13)	337.20 .62(2)	337.58 .05(5)
DAY 11										337.77 .06(5)	337.65 .04(10)	
DAY 12											337.84 .04(13)	337.39 .15(7)
DAY 13									337.08 .24(13)		337.89 .04(15)	337.53 .06(16)
DAY 14								336.94 (1)		337.02 .10(5)	337.86 .06(16)	337.51 .11(9)
DAY 15								336.66 (1)		337.08 .10(18)	337.81 .10(20)	337.78 .10(8)
DAY 16											337.83 .05(11)	337.83 .06(5)
DAY 17											337.73 .06(15)	
DAY 18									336.66 .11(6)		337.72 .01(11)	337.44 .11(21)
DAY 19									337.23 .30(9)		337.72 .01(5)	337.39 .04(11)
DAY 20											338.08 .06(7)	337.36 .04(13)
DAY 21								337.54 .09(6)		337.35 .05(4)	337.90 .11(2)	
DAY 22								337.30 .33(16)		337.54 .10(14)		337.41 .03(11)
DAY 23								337.38 .15(12)	337.94 (1)			337.27 .22(14)
DAY 24							337.60 .07(4)	337.32 .02(7)	337.92 .02(5)		337.37 .08(8)	337.43 .04(15)
DAY 25							337.78 (1)			337.27 .04(5)		337.16 .06(7)
DAY 26												337.30 .10(5)
DAY 27							337.37 (2)					336.89 .13(7)
DAY 28								337.05 .11(7)	337.38 .11(7)			336.76 .10(11)
DAY 29											337.67 .08(5)	337.17 .13(24)
DAY 30									337.10 .02(3)	337.26 .44(12)	337.81 .04(8)	337.40 .08(2)
DAY 31										337.66 .04(18)		
MONTHLY MEAN							337.58 .21 3	337.34 .44 9	337.33 .38 11	337.22 .38 15	337.66 .27 18	337.41 .28 23
HOURS PER MONTH							7	57	77	135	179	258

ANNUAL MEAN = 337.42
STANDARD DEVIATION = .17
HOURS PER YEAR = 713

CAPE GRIM CO2 CONCENTRATIONS (MARK II)

1982 SELECTED BASELINE VALUES

MONTH	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
DAY 1	337.40 .17(10)	337.02 .13(24)	337.47 .05(20)			338.02 .08(12)		338.57 .09(13)	338.41 (1)		338.64 .02(11)	338.84 .04(5)
DAY 2	337.39 .13(12)	337.08 .08(16)	337.50 .03(15)	337.13 .08(8)		338.12 .09(6)			338.44 .03(8)		338.53 .01(5)	
DAY 3	337.24 .02(12)	337.19 .14(22)		337.18 .08(24)				338.91 .06(8)	339.34 .04(7)	338.68 .12(12)		
DAY 4	337.31 .03(23)	337.03 .14(13)		337.20 .04(5)	338.23 .04(6)			338.93 .06(10)	339.30 .05(7)	338.77 .09(15)		
DAY 5	337.32 .06(13)				338.16 .05(6)			338.63 .19(2)	339.33 (1)	338.52 .11(6)		338.34 .04(9)
DAY 6					338.29 .01(2)		338.44 .06(4)	338.55 .14(23)	339.41 .03(20)			338.45 .03(7)
DAY 7	337.44 .06(7)			337.35 .08(15)	338.30 .05(16)		338.42 (1)	338.39 .14(16)				
DAY 8	337.39 .11(18)	337.06 .10(11)	337.00 .09(9)		338.06 .08(5)					338.77 .17(9)		
DAY 9	337.39 .11(16)	337.05 .13(18)	337.09 .10(19)		337.87 .08(15)				339.33 .07(18)	338.88 .11(23)		
DAY 10			336.92 .05(7)	338.92 (1)	337.96 .10(8)				339.43 .11(6)	338.51 .13(17)	337.00 .09(17)	338.10 .01(2)
DAY 11		337.12 .07(8)	336.99 .10(22)		338.12 .04(9)		338.49 .07(8)		339.52 .04(24)		336.27 .33(12)	
DAY 12	337.36 .07(7)		336.73 .10(8)		337.75 .11(11)			338.88 .07(11)	339.43 .03(4)		336.92 1.36(17)	
DAY 13	337.45 .11(15)				338.15 .14(18)			338.93 .04(8)	338.92 .07(8)	338.69 .10(4)		
DAY 14	337.41 .03(11)				337.99 .11(10)					338.99 .08(23)		338.31 .15(13)
DAY 15				336.68 .01(5)				338.86 .08(20)		339.01 .08(11)		
DAY 16			337.00 .15(6)	336.72 .02(10)		338.04 .08(16)		338.83 .07(24)		338.83 .08(6)		
DAY 17	337.12 .10(7)		337.26 .31(20)	337.78 .06(3)				339.00 .14(13)		338.71 .08(21)		338.20 .05(6)
DAY 18		337.12 .04(4)	337.49 .09(7)	337.57 .08(16)		338.21 .05(5)				338.68 .02(3)		338.19 .03(3)
DAY 19		337.18 .03(7)		337.63 .07(6)	337.86 .03(6)					338.76 .03(3)		338.18 .04(12)
DAY 20	336.80 .06(11)			337.40 .15(15)		338.21 .06(16)	338.81 .04(5)			338.75 .11(11)	338.51 .04(10)	338.20 .13(12)
DAY 21	336.91 .05(20)	336.89 .13(20)		337.26 .01(4)	338.18 .05(8)	338.44 .11(11)		338.80 .10(12)		338.77 .05(17)	338.50 .11(19)	338.13 .03(6)
DAY 22	337.17 .22(16)				338.01 .14(22)	338.30 .06(19)		338.76 .12(22)		338.38 .08(8)		338.10 .04(13)
DAY 23		336.64 .11(14)	336.93 .08(8)		337.70 .09(10)			338.87 (1)		338.48 .05(17)		337.91 .06(5)
DAY 24	337.18 .21(2)	337.48 .13(5)			337.87 .10(13)		338.76 .08(21)					338.17 .09(15)
DAY 25	337.25 .10(22)	336.71 .11(20)		337.94 .02(5)	337.96 .16(3)		338.90 .02(2)	339.01 .07(14)	338.66 .13(10)		338.79 .11(7)	338.04 .04(5)
DAY 26	337.35 .07(24)	336.67 .08(17)					338.92 .03(8)	338.94 .17(18)	338.67 .14(12)		338.53 .06(8)	
DAY 27	337.32 .04(17)	336.47 .11(4)				338.40 .02(7)					338.67 .10(19)	
DAY 28		337.52 .55(6)			338.12 .04(5)	338.39 .02(8)		338.77 .06(5)	338.95 .15(9)			337.81 .17(14)
DAY 29	337.13 .04(8)			337.95 .10(7)	338.12 .02(5)		339.01 .06(7)	338.81 .08(2)	338.69 .41(7)			
DAY 30	337.08 .05(14)			338.08 .07(10)	338.11 .06(8)		338.93 .04(22)	339.03 .10(20)				338.50 .25(6)
DAY 31	337.07 .08(15)		337.79 .06(5)		338.32 .16(13)		338.75 .06(16)			338.81 .04(8)		
MONTHLY MEAN	337.25 .17 22	337.01 .29 16	337.18 .32 12	337.52 .57 15	338.05 .18 21	338.24 .16 9	338.74 .22 10	338.81 .17 19	339.06 .39 15	338.72 .17 18	338.04 .92 10	338.22 .24 16
HOURS PER MONTH	300	209	146	134	199	100	94	242	142	214	125	133

ANNUAL MEAN = 338.07
STANDARD DEVIATION = .70
HOURS PER YEAR = 2038

CAPE GRIM CORRECTED CO2 CONCENTRATIONS (MARKI)

1976 COMPLETE DATA SET

MONTH	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
DAY 1				337.06 4.05(14)	329.26 .18(24)							330.54 .45(9)
DAY 2				329.46 .82(12)	331.07 2.49(24)							330.81 .42(10)
DAY 3					332.01 1.93(12)	329.39 .08(2)					330.70 1.34(2)	330.66 .19(7)
DAY 4					329.10 .07(5)	329.29 .50(24)					330.89 .27(8)	330.70 .11(5)
DAY 5					329.05 .16(24)	329.67 2.03(24)					330.68 .39(9)	330.46 .24(5)
DAY 6					328.91 .17(24)	329.14 .44(24)					330.91 .42(4)	
DAY 7					329.69 2.62(24)	329.04 .29(24)					331.70 .96(4)	330.98 .07(3)
DAY 8					328.97 .13(24)	328.75 .12(24)					332.12 3.29(10)	330.54 1.49(10)
DAY 9					329.00 .27(24)						331.79 2.73(10)	331.47 1.97(8)
DAY 10					329.00 .71(24)	328.62 .18(24)					330.52 1.70(16)	332.47 1.09(5)
DAY 11					329.08 .85(24)	328.57 .30(23)				331.93 .21(2)	331.31 1.82(24)	330.33 .63(10)
DAY 12					333.16 3.21(24)	328.67 .58(23)				331.99 1.36(9)	332.52 3.90(16)	330.26 .03(2)
DAY 13					336.20 6.82(24)	328.43 .59(6)			330.80 .86(2)	336.45 2.64(5)	336.66 4.66(10)	330.26 .14(7)
DAY 14					336.29 6.67(20)				331.21 .96(9)	335.95 3.29(10)	329.93 2.24(10)	329.73 1.40(10)
DAY 15									331.31 .68(10)	332.73 5.13(10)	330.29 1.32(11)	339.25 7.80(7)
DAY 16									331.34 .51(10)	332.65 3.37(10)	331.50 .32(7)	333.42 .28(4)
DAY 17									331.32 .52(10)	334.74 3.27(10)	331.31 .49(9)	333.60 .33(8)
DAY 18									330.60 1.27(10)	332.61 3.77(10)	331.36 .16(10)	332.99 .32(10)
DAY 19						331.21 1.21(9)			332.10 1.21(10)	330.42 2.29(10)	331.20 .15(6)	332.53 .13(2)
DAY 20						333.29 3.80(22)			333.88 4.57(10)	330.30 1.19(10)	330.62 .73(10)	326.35 .09(2)
DAY 21						331.39 2.46(24)			335.40 3.25(10)	330.61 1.00(2)	331.23 .90(10)	326.33 4.81(10)
DAY 22						331.18 1.82(23)			330.19 .66(10)		330.79 .39(10)	334.81 1.77(10)
DAY 23						329.43 .89(24)			330.97 .81(10)		330.89 .68(10)	330.70 .55(10)
DAY 24						329.18 1.06(15)			331.72 1.73(10)		333.94 1.54(9)	330.32 .68(10)
DAY 25									332.43 3.08(10)		329.55 3.74(6)	330.51 .17(10)
DAY 26									333.59 5.86(10)		334.04 3.89(8)	330.32 .24(10)
DAY 27				329.47 .11(8)					331.06 2.23(10)		335.83 (1)	330.21 .30(10)
DAY 28				329.48 .41(24)					332.60 3.05(4)			330.27 .28(10)
DAY 29				329.45 .07(24)							328.80 1.93(8)	330.32 .30(10)
DAY 30				329.27 .14(24)							330.54 .42(10)	331.57 1.65(10)
DAY 31												332.14 1.43(9)
MONTHLY MEAN				339.70 3.12 6	330.77 2.66 14	329.70 1.35 16			331.91 1.38 16	332.76 2.13 11	331.54 1.76 27	331.16 2.31 30
HOURS PER MONTH				106	301	315			145	88	248	233

ANNUAL MEAN = 331.22
STANDARD DEVIATION = .98
HOURS PER YEAR = 1436

CAPE GRIM CORRECTED CO2 CONCENTRATIONS (MARKI)

1977 COMPLETE DATA SET

MONTH	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
DAY 1	331.58	330.70	334.91	330.77			333.63				335.18	332.28
	2.05(10)	.17(12)	5.97(10)	.42(10)			.32(3)				2.39(12)	2.34(9)
DAY 2	330.67	330.98	334.98	330.86							332.94	333.07
	.22(10)	1.02(12)	9.03(10)	.16(10)							.28(10)	1.01(13)
DAY 3	331.00	332.34	336.16	330.75						333.29	333.61	332.51
	.78(10)	1.37(12)	7.97(10)	.12(10)						.03(2)	2.15(11)	.16(12)
DAY 4	331.96	332.75	330.73	331.37						331.99	336.12	332.39
	2.43(10)	1.43(11)	1.34(9)	1.34(9)						2.53(11)	2.50(12)	.25(12)
DAY 5	334.75	333.65	333.78	332.50						332.67	332.91	332.26
	3.61(10)	3.50(12)	2.55(10)	1.30(10)						.30(12)	.54(12)	.21(20)
DAY 6	336.69	332.05	330.64	331.81						332.94	334.84	332.15
	1.21(10)	3.09(12)	.27(10)	2.32(10)						.31(12)	1.73(6)	.31(23)
DAY 7	331.94	333.06	330.64	331.21						332.37	333.75	332.20
	1.97(10)	5.43(11)	.22(10)	1.39(11)						.91(12)	2.54(12)	.59(24)
DAY 8	330.10	332.26	331.21	331.23						331.77	332.28	332.63
	2.11(10)	3.45(12)	1.47(10)	.57(11)						2.30(12)	.74(8)	.58(24)
DAY 9	331.15	331.10	334.30	330.50						336.37	333.24	335.86
	2.59(10)	.87(12)	3.11(10)	1.06(8)						2.33(12)	2.29(9)	6.08(18)
DAY 10	330.71	330.75	338.55							335.76	332.68	332.43
	.32(10)	.85(12)	3.46(10)							.35(3)	.53(13)	.33(12)
DAY 11	331.37	334.98	334.85							334.91	333.78	332.24
	1.56(7)	2.40(12)	3.32(10)							2.03(11)	1.06(10)	.43(12)
DAY 12	331.45	334.57	330.49							338.45	333.47	332.45
	2.28(8)	1.51(12)	.30(10)							8.22(12)	1.53(12)	.76(12)
DAY 13	331.52	331.33	330.69							338.58	336.20	332.23
	2.05(7)	1.46(12)	.48(10)							3.65(12)	1.45(12)	2.80(12)
DAY 14	336.69	331.19	332.54	330.98						332.55	333.66	333.00
	4.19(8)	2.07(12)	1.29(9)	.23(3)						.21(12)	1.87(20)	2.19(10)
DAY 15	336.69	330.82	330.67	330.56						332.63	333.24	332.33
	4.89(9)	.70(12)	.21(10)	.50(12)						.37(12)	1.35(24)	.19(9)
DAY 16	334.34	332.92	330.54	330.60						332.41	332.39	332.47
	3.72(10)	2.37(12)	.14(10)	.33(12)						.45(12)	.53(24)	.18(13)
DAY 17	334.20	332.23	330.54	330.47		334.62				332.28	332.38	332.55
	3.73(10)	1.41(12)	.13(8)	.38(12)		1.24(7)				.32(9)	.75(15)	.11(12)
DAY 18	333.29	331.81	330.58	330.41		333.00				332.51	334.29	332.45
	5.51(11)	2.29(12)	.14(10)	.31(12)		1.72(10)				.07(3)	2.72(15)	.17(12)
DAY 19	330.62	332.46	331.47	330.66		332.22					332.74	332.47
	2.24(11)	2.93(12)	2.80(10)	.10(3)		1.21(10)					.31(24)	.22(13)
DAY 20	331.04	333.56	332.37			332.16	330.59				332.57	332.65
	1.20(12)	2.35(12)	2.10(10)			.53(10)	2.75(8)				.37(24)	1.00(12)
DAY 21	331.58	331.01	332.41			331.97	330.54				333.29	333.85
	1.76(12)	.62(12)	1.00(8)			.78(9)	1.54(12)				.97(24)	5.89(12)
DAY 22	331.39	330.87	331.85			333.82	332.07				333.26	332.20
	1.69(12)	1.49(12)	3.10(6)			2.67(12)	.87(12)				1.56(24)	2.17(10)
DAY 23	330.93	333.22	333.05			333.69	331.83				332.74	332.14
	.79(12)	3.64(12)	2.80(12)			3.02(12)	.16(12)				.32(24)	2.25(12)
DAY 24	330.63	331.87	339.06			331.56	331.78				333.04	332.33
	.38(12)	2.80(12)	10.98(10)			.18(11)	.16(12)				2.09(18)	2.23(12)
DAY 25	330.59	334.23	341.24			331.77	331.82			332.99	333.53	331.54
	.35(12)	1.62(13)	7.43(10)			.35(12)	.22(12)			1.17(6)	1.34(12)	3.13(12)
DAY 26	330.75	330.71	334.01			332.00	331.96			333.29	332.89	332.37
	.25(12)	.74(12)	5.29(12)			1.18(8)	.03(3)			7.21(12)	1.77(12)	.49(12)
DAY 27	331.25	331.89	332.58			331.99	331.59			337.59	336.03	332.41
	.68(12)	1.84(12)	1.71(11)			.79(14)	.06(3)			4.15(12)	1.80(12)	.10(12)
DAY 28	330.86	332.15	331.21			331.37	331.61			334.12	339.34	332.20
	1.18(12)	2.76(11)	1.01(8)			.65(12)	.12(6)			2.23(10)	4.87(12)	.22(12)
DAY 29	332.78		332.28			331.56	332.40			332.76	335.77	332.23
	5.05(12)		1.55(11)			.15(11)	.08(3)			.31(12)	3.48(12)	.20(12)
DAY 30	330.65		331.00			331.89	332.19			332.60	332.83	334.01
	.29(12)		.75(10)			1.10(10)	.19(8)			.36(12)	.22(9)	2.99(12)
DAY 31	330.53		332.11							334.68		333.82
	.43(12)		2.01(10)							4.85(12)		1.69(12)
MONTHLY	332.05	332.20	332.95	330.98		332.40	331.83			333.89	333.83	332.64
MEAN	1.93	1.23	2.75	.57		.99	.80			2.08	1.56	.80
	31	28	31	15		14	12			23	30	31
HOURS PER MONTH	325	334	304	143		148	94			235	444	414

ANNUAL MEAN = 332.53
STANDARD DEVIATION = .93
HOURS PER YEAR = 2441

CAPE GRIM CORRECTED CO2 CONCENTRATIONS (MARKI)

1978 COMPLETE DATA SET

MONTH	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
DAY 1	334.96	334.31	332.17	334.26	335.45	336.80	336.10	331.74		329.34	333.89	337.13
	1.80(13)	6.60(24)	.27(23)	1.06(12)	4.36(18)	3.79(24)	2.80(24)	2.51(17)		3.58(24)	1.49(23)	3.94(9)
DAY 2	332.71	346.81	332.21	333.68	339.23	336.43	334.10	333.51		331.71	336.70	334.13
	1.08(13)	.15(3)	.50(17)	1.33(12)	3.07(12)	4.26(18)	3.73(20)	.36(23)		2.58(14)	3.14(24)	2.74(24)
DAY 3	333.84	332.00	333.25	333.75	335.53	334.16	334.57	333.31		334.28	336.10	335.69
	3.80(13)	.83(11)	1.56(23)	3.14(12)	3.02(12)	2.86(12)	1.91(24)	.34(23)		.31(9)	2.13(24)	2.50(10)
DAY 4	333.96	333.22	332.14	332.78	336.91	334.61	333.29	333.69		334.20	336.62	333.78
	4.13(13)	.83(9)	.23(24)	.96(12)	3.51(12)	2.99(12)	.28(20)	.96(21)		.17(24)	3.90(24)	.19(13)
DAY 5	332.32		332.30	336.46	339.20	342.17	333.11	331.84	331.69	334.50	337.02	333.27
	1.52(12)		.21(24)	4.00(12)	7.90(11)	10.55(11)	.20(24)	.99(24)	.46(3)	.66(16)	1.26(10)	.51(6)
DAY 6	334.65	333.04	333.39	333.39	342.63	341.45	333.18	333.98	333.88	334.31	336.96	333.10
	3.07(12)	.69(8)	1.13(24)	2.31(12)	7.70(12)	7.58(12)	.24(24)	.88(16)	.88(19)	.45(24)	2.73(24)	.11(14)
DAY 7	332.35	333.27	333.03	332.59	334.29	341.43	333.16	335.94	333.05	334.66	342.98	332.85
	.20(12)	1.50(14)	1.53(24)	.43(12)	1.44(12)	3.20(12)	.23(23)	.98(5)	.51(24)	1.53(24)	1.99(14)	.21(24)
DAY 8	332.38	332.01	336.27	335.68	334.39	344.94	333.04	340.32	332.97	334.34	335.27	332.88
	.22(12)	.29(8)	2.52(24)	5.84(12)	2.20(12)	8.62(11)	.40(24)	8.02(14)	.41(24)	1.07(24)	1.03(6)	.28(24)
DAY 9	332.36	332.41	339.49	338.79	334.51	338.08	333.17		332.92	334.35	334.33	333.45
	.21(11)	.18(7)	3.80(23)	5.23(12)	2.02(9)	1.15(12)	.39(24)		.57(24)	5.17(23)	.98(11)	1.61(24)
DAY 10	333.44	333.80	334.70	339.21	331.26	339.52	333.26		331.51	333.62	335.51	332.86
	.92(8)	1.81(16)	3.24(18)	4.07(12)	3.13(7)	1.05(12)	.28(21)		3.27(24)	2.35(19)	2.72(12)	2.72(24)
DAY 11	332.47	332.52	334.83	335.71	333.13	341.86	333.59		324.86	335.32	335.37	333.34
	.17(19)	1.73(24)	1.95(18)	3.57(12)	.68(12)	1.52(12)	.25(24)		3.46(21)	3.64(23)	2.31(12)	1.37(21)
DAY 12	332.23	331.83	338.91	332.65	332.64	341.46	333.44		336.62	334.31	334.23	336.24
	.19(24)	.10(24)	5.43(12)	1.26(18)	.52(16)	1.57(11)	.24(23)		4.92(23)	2.27(24)	1.36(12)	3.27(23)
DAY 13	332.44	332.37	332.52	332.46	332.72	340.56	333.72		336.58	334.23	333.69	339.80
	1.45(18)	.80(22)	.67(18)	.73(23)	.13(24)	2.98(10)	.58(23)		2.96(24)	.32(23)	.15(11)	6.36(24)
DAY 14	335.49	332.01	336.90	332.85	333.15	339.02	333.31		334.74	333.92	333.98	336.20
	2.61(4)	.57(22)	5.15(15)	1.68(22)	.94(24)	4.56(12)	.84(24)		.45(24)	.22(24)	.19(12)	3.06(22)
DAY 15	332.77	335.75	337.45	333.07	333.74	334.84	333.47		334.41	333.58	333.72	344.90
	.84(9)	4.45(21)	3.11(13)	1.31(24)	1.80(22)	4.69(12)	.61(12)		.27(23)	1.21(24)	.56(12)	14.34(22)
DAY 16	332.39	334.05	338.13	332.48	338.35	334.98		334.97	334.47	333.96	335.17	338.40
	1.45(19)	1.52(24)	3.15(12)	.41(24)	7.33(24)	1.87(9)		.41(9)	1.80(24)	.85(23)	2.51(10)	10.91(24)
DAY 17	335.30	332.47	332.98	333.91	333.18	332.71	333.74	335.71	330.83	334.51	338.29	336.96
	5.49(23)	.55(23)	1.35(15)	1.57(22)	1.73(16)	3.29(12)	.34(13)	2.04(24)	.37(3)	.71(23)	5.80(11)	6.84(24)
DAY 18	332.12	333.10	336.89	332.74	334.39	335.05	333.64	338.71	334.32	334.23	336.29	333.08
	.21(24)	1.00(24)	4.44(24)	.63(24)	1.03(6)	1.54(12)	1.02(24)	4.84(21)	1.45(13)	.44(23)	3.18(11)	.41(24)
DAY 19	331.99	336.16	336.24	333.61	334.70	337.03	335.77	337.51	334.74	333.95		333.14
	.34(24)	3.86(24)	4.25(24)	1.48(19)	2.67(11)	4.36(11)	2.65(18)	4.51(24)	4.17(18)	.20(24)		.19(22)
DAY 20	334.45	334.14	338.20	333.62	333.96	336.08	334.17	333.70	335.30	333.94	333.94	332.94
	1.54(24)	2.56(20)	7.20(18)	1.49(13)	3.36(12)	3.17(12)	1.05(12)	1.19(24)	1.44(12)	.30(23)	.13(5)	.30(24)
DAY 21	333.31	332.39	333.56	335.24	333.05	337.94	332.69	334.08	334.49	335.52	333.76	332.99
	1.11(24)	.52(24)	.80(11)	4.67(18)	1.22(12)	3.75(10)	1.23(17)	.29(24)	1.06(18)	2.65(24)	.21(10)	.24(24)
DAY 22	332.82	332.14	332.41	335.11	332.79	336.72	334.03	334.22	334.27	334.20	333.67	334.70
	1.27(24)	.14(24)	.33(13)	2.57(12)	1.67(11)	4.44(12)	1.20(24)	.42(24)	1.13(24)	2.91(24)	.18(12)	3.40(21)
DAY 23	339.72	332.39	332.90	332.58	334.00	333.96	333.52	334.14	334.84	338.33	333.99	332.83
	3.08(12)	.65(24)	1.23(16)	.21(12)	2.14(18)	2.18(12)	.25(24)	.23(21)	.46(24)	4.36(20)	.46(9)	1.84(24)
DAY 24	331.93	332.69	339.52	332.66	332.73	333.71	333.77	334.16	336.60	338.54	333.85	333.98
	.24(15)	1.34(19)	1.90(2)	.13(16)	.86(20)	1.01(12)	.24(22)	.70(12)	3.54(24)	4.04(24)	.58(12)	1.06(24)
DAY 25	331.92	333.23		332.64	332.77	333.58	334.52	332.44	335.21	338.59	334.62	335.11
	.22(14)	2.44(14)		.16(24)	.47(23)	1.43(12)	1.38(14)	1.03(22)	2.41(24)	1.54(18)	4.11(12)	1.89(24)
DAY 26	332.16	334.10		332.52	334.43	334.74	332.94	334.64	335.54	344.31	339.15	334.00
	1.03(14)	5.14(14)		.17(23)	1.44(24)	2.20(11)	1.51(24)	.19(24)	2.14(19)	4.75(17)	2.10(10)	1.17(24)
DAY 27	331.40	333.01		332.54	334.68	333.37	332.47	334.41	334.22	334.77	334.95	333.30
	.76(14)	.71(11)		.60(24)	2.37(24)	1.33(12)	1.78(24)	.24(24)	.20(11)	.74(13)	.96(6)	.11(4)
DAY 28	332.22	332.05		333.83	334.37	333.67	333.72	334.46	333.92	333.97	336.92	333.44
	1.77(14)	.42(16)		1.15(24)	1.29(24)	1.62(12)	.18(24)	.38(21)	.27(24)	.33(24)	3.06(10)	.20(16)
DAY 29	333.25		334.37	332.84	335.78	335.69	333.37	332.74	333.78	333.94	337.66	333.46
	4.68(10)		1.52(11)	.70(24)	1.41(19)	1.24(5)	.80(21)	1.77(24)	.55(23)	.34(24)	3.19(12)	.45(21)
DAY 30	332.21		332.50	333.89	333.09	334.92	333.05	332.30	334.09	334.56	333.94	333.67
	1.14(9)		.60(22)	.75(24)	.77(24)	2.40(14)	.50(8)	2.90(24)	.77(24)	.52(23)	.40(5)	.28(24)
DAY 31	330.98		332.53		333.12		330.36	336.18		333.97		333.56
	.35(19)		.42(17)		2.07(24)		2.75(6)	1.10(5)		.61(24)		.46(24)
MONTHLY MEAN	333.11	333.60	334.81	333.92	334.65	337.05	333.54	334.53	333.84	334.77	335.61	334.68
	1.66	2.86	2.54	1.77	2.40	3.27	.99	2.07	2.33	2.46	2.10	2.60
	31	27	27	30	31	30	30	24	26	31	29	31
HOURS PER MONTH	476	474	485	522	507	361	609	470	518	670	366	632

ANNUAL MEAN = 334.51
STANDARD DEVIATION = 1.06
HOURS PER YEAR = 6090

CAPE GRIM CORRECTED CO2 CONCENTRATIONS (MARKI)

1979 COMPLETE DATA SET

MONTH	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
DAY 1	334.51		333.05	334.45	334.71	335.06	333.82	334.68	334.95	335.04	335.18	335.38
	1.47(24)		4.58(24)	2.54(24)	2.69(24)	1.90(24)	.14(22)	.16(24)	.38(24)	1.23(24)	.94(22)	1.30(24)
DAY 2	333.49		336.54	337.46	337.58	338.23	333.70	334.61	334.71	333.74	336.88	335.01
	.35(24)		3.23(23)	6.82(24)	1.37(22)	4.52(24)	.89(11)	.15(21)	1.10(9)	3.31(24)	3.04(23)	.32(24)
DAY 3	333.33		333.77	335.42	334.25	337.46	335.14	334.78		336.13	336.15	335.21
	1.47(24)		1.59(24)	1.63(24)	1.69(20)	2.40(24)	1.33(24)	.37(24)		2.88(22)	1.79(24)	.95(24)
DAY 4	333.98		338.79	334.16	333.39	338.56	335.15	334.57	337.41	336.32	336.23	336.07
	2.10(24)		6.88(24)	.69(22)	.79(21)	3.78(18)	1.42(22)	.40(24)	1.08(8)	1.64(20)	2.79(24)	2.00(19)
DAY 5	336.49		335.09	335.31	336.30	335.19	336.43	333.97	336.15	337.46	334.89	335.34
	5.57(24)		3.15(24)	1.30(17)	3.27(24)	2.22(21)	4.30(24)	.73(24)	1.62(17)	1.13(24)	.45(24)	.27(14)
DAY 6	333.38	333.62	333.28	333.93	337.38	336.49	334.38	334.11	335.12	335.16	335.10	335.27
	.83(24)	.87(11)	.13(8)	1.87(24)	3.70(24)	2.44(24)	.38(24)	.98(23)	.21(24)	.58(24)	.49(21)	1.59(16)
DAY 7	334.61	336.00	336.09	333.32	336.88	336.33	333.09	335.02	335.21	335.21	335.14	335.67
	2.01(24)	3.30(24)	2.11(13)	.36(24)	4.64(24)	2.10(19)	1.66(24)	.62(24)	.13(22)	.50(24)	.73(24)	1.79(20)
DAY 8	333.80	337.88	335.16	333.51	335.38	335.94	333.72	335.11	334.98	336.48	334.74	334.73
	2.59(22)	4.49(24)	1.07(12)	.57(24)	2.29(24)	3.48(24)	.81(22)	.58(24)	.45(24)	2.81(24)	3.66(13)	.45(24)
DAY 9	339.21	334.56	333.70	333.31	333.10	338.09	334.21	334.87	336.24	336.26	334.83	334.73
	8.59(24)	3.24(24)	.58(23)	.46(24)	1.30(15)	5.85(24)	.21(22)	.14(23)	3.54(24)	2.80(24)	1.62(20)	.25(24)
DAY 10	333.22	334.51	334.29	333.14	335.21	334.63	334.29	334.77	337.29	335.54	337.27	334.57
	.27(21)	1.40(24)	2.03(24)	.23(24)	8.18(24)	2.35(24)	.17(24)	.11(24)	1.95(24)	.71(24)	2.96(24)	.26(22)
DAY 11	333.27	333.30	335.45	333.54	334.13	333.90	333.48	334.66	338.44	333.93	338.33	335.47
	.26(24)	.18(24)	4.07(24)	.80(24)	.32(20)	.38(17)	1.79(18)	.14(24)	5.14(24)	1.39(24)	2.72(23)	1.40(24)
DAY 12	333.11	333.45	339.11	334.63	333.75	337.79	334.08	334.98	334.72	335.00	334.55	334.79
	.43(18)	.37(24)	3.38(24)	1.89(22)	.21(24)	2.97(24)	.35(19)	.50(24)	.19(24)	.43(24)	.30(12)	1.81(24)
DAY 13	332.90	333.82	338.44	337.41	333.52		334.22	334.60	335.04	335.10	335.76	334.50
	1.62(24)	.50(24)	4.60(16)	5.23(24)	.13(24)		.16(24)	.25(24)	.14(24)	.71(24)	2.07(12)	.30(24)
DAY 14	339.30	333.23	338.49	342.67	333.67		337.12	334.73	334.45	335.05	335.74	335.01
	10.42(24)	.11(22)	2.08(24)	7.41(24)	.12(24)		3.05(24)	.11(11)	1.52(18)	1.26(24)	2.41(18)	1.33(20)
DAY 15	333.64	333.38	337.78	333.80	333.68		333.74	332.35	330.11	335.22	336.90	336.71
	2.27(24)	.15(24)	6.70(24)	1.01(24)	.57(21)		2.18(24)	2.77(14)	2.22(24)	.47(24)	1.44(23)	2.25(22)
DAY 16	335.78	332.85	335.56	339.27	335.11		330.23	335.29	331.87	336.09	335.21	334.58
	3.92(24)	.20(23)	3.34(24)	7.11(22)	2.03(24)		1.52(24)	.86(24)	4.20(19)	2.45(24)	.73(24)	.39(24)
DAY 17	334.37	332.68	335.22	337.29	333.68		333.81	339.01	335.05	336.99	335.63	334.90
	2.92(24)	.22(24)	1.46(24)	3.96(24)	.62(24)		1.55(22)	4.05(22)	.17(24)	2.03(24)	2.28(24)	.32(22)
DAY 18	333.68	333.02	333.43	333.50	336.21		334.53	336.96	335.13	336.80	335.93	334.78
	2.10(22)	.69(24)	1.30(24)	.85(24)	3.54(24)		.43(24)	4.19(24)	.16(24)	3.40(14)	.64(15)	.31(24)
DAY 19	336.09	335.39	337.21	334.65	333.11		334.95	336.52	335.22	337.12	334.57	334.72
	4.30(22)	5.66(24)	4.89(24)	1.90(24)	.90(24)		1.01(24)	1.63(24)	.18(24)	3.61(21)	5.09(23)	.36(24)
DAY 20	337.24	333.91	335.55	337.13	335.22		335.39	334.80	335.89	334.92	335.42	336.25
	2.20(24)	1.33(17)	4.66(24)	5.04(24)	3.71(20)		1.89(17)	.49(24)	.37(24)	.66(24)	1.64(24)	3.48(24)
DAY 21	333.39	335.36	337.23	335.65	333.87		334.37	334.66	335.81	334.69	335.27	335.91
	.69(24)	1.63(24)	5.62(10)	2.50(24)	1.01(24)		.56(24)	.18(22)	.16(22)	2.37(23)	.54(23)	3.39(23)
DAY 22	334.81	336.52	333.53	333.25	333.77	334.22	334.45	334.79	335.67	336.46	335.45	334.42
	2.30(24)	1.82(23)	1.53(15)	.24(24)	.78(22)	1.26(11)	.46(23)	.10(24)	1.35(24)	1.66(21)	1.62(20)	.32(23)
DAY 23	337.90	337.88	334.30	333.39	335.16	333.81	334.70	334.69	336.69	338.30	335.93	334.91
	4.27(7)	3.14(24)	1.37(23)	.15(13)	1.03(24)	2.40(24)	.14(23)	.47(24)	1.65(24)	3.09(22)	8.62(23)	.29(24)
DAY 24		337.03	333.50	333.20	336.22	333.09	334.20	334.82	335.35	335.04	341.41	334.87
		4.22(24)	.26(24)	.27(24)	1.22(24)	1.07(24)	1.41(24)	1.14(24)	1.40(24)	.37(24)	5.63(24)	.32(20)
DAY 25		337.58	333.97	338.92	333.57	333.26	338.34	336.42	337.18	334.78	334.74	334.81
		1.35(24)	.32(24)	5.50(24)	.35(23)	2.57(23)	3.80(20)	2.68(24)	1.40(24)	.47(24)	.44(24)	.38(24)
DAY 26		336.26	338.77	335.09	341.24	334.39	334.69	335.22	336.12	335.38	334.88	335.26
		5.13(24)	3.12(22)	2.08(19)	7.87(24)	.80(21)	.77(21)	1.58(24)	2.48(21)	1.19(20)	.43(24)	1.35(24)
DAY 27		334.35	342.06	333.11	333.45	333.94	335.22	335.05	341.56	334.95	335.12	335.84
		.70(17)	11.45(24)	.15(24)	.13(24)	.94(24)	1.20(24)	.31(24)	3.31(21)	.33(24)	.24(22)	1.62(24)
DAY 28		338.06	335.59	332.99	334.32	334.46	334.72	335.89	339.64	334.98	334.93	338.77
		4.88(24)	2.43(24)	.18(24)	1.58(24)	.75(23)	.36(24)	1.11(16)	5.00(24)	.23(24)	.32(24)	4.12(24)
DAY 29			333.98	332.99	335.81	334.28	334.86	336.97	336.61	334.69	334.95	341.04
			1.12(19)	.23(24)	3.54(24)	.46(21)	.62(17)	3.37(24)	1.36(24)	.46(24)	.22(24)	5.34(23)
DAY 30			335.49	335.35	333.48	333.77	333.28	335.64	334.99	334.96	334.97	339.54
			2.13(20)	1.62(24)	.14(19)	.74(23)	1.02(24)	2.15(24)	.33(24)	.60(24)	.28(22)	3.10(24)
DAY 31			336.92		333.65		334.72	335.08		334.94		335.51
			2.72(24)		.36(24)		.14(24)	.30(20)		2.45(24)		1.74(24)
MONTHLY	334.85	334.98	335.85	335.06	334.86	335.38	334.48	335.15	335.78	335.57	335.74	335.63
MEAN	1.96	1.81	2.18	2.31	1.75	1.76	1.34	1.14	2.07	1.04	1.38	1.52
	23	23	31	30	31	21	31	31	29	31	30	31
HOURS PER MONTH	520	521	660	691	707	461	687	700	637	715	647	700

ANNUAL MEAN = 335.28
STANDARD DEVIATION = .44
HOURS PER YEAR = 7646

CAPE GRIM CORRECTED CO2 CONCENTRATIONS (MARKI)

1980 COMPLETE DATA SET

MONTH	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
DAY 1	335.95	338.07	338.60	335.53	336.04	335.17		337.01	336.89	336.42	336.32	336.59
	2.27(24)	1.67(24)	4.56(24)	1.20(24)	1.37(24)	.17(24)		4.78(24)	.30(24)	.73(24)	.23(24)	1.50(16)
DAY 2	334.96	335.43	335.38	337.24	335.46	335.69	336.81	335.70	337.03	336.96	336.49	339.69
	1.99(21)	1.06(24)	.65(24)	2.53(23)	1.98(17)	1.08(22)	.23(8)	1.14(24)	.14(24)	1.55(21)	.36(24)	3.26(20)
DAY 3	334.80	334.78	335.04	334.92	339.40	338.34	336.77	336.18	336.85	336.30	336.43	337.93
	3.90(24)	.12(24)	1.03(24)	.09(9)	7.91(24)	3.82(16)	.27(24)	.33(24)	.42(20)	.43(24)	1.01(24)	3.10(24)
DAY 4	334.78	334.77	335.54		336.97	337.64	336.68	336.14	336.92	338.22	336.58	336.22
	.40(24)	.21(24)	1.23(24)		1.34(24)	2.77(24)	.26(24)	1.09(23)	1.57(22)	3.75(24)	1.34(24)	.43(24)
DAY 5	337.51	334.70	335.00		337.15	337.04	336.12	335.72	336.34	337.33	337.06	336.65
	3.53(24)	.18(24)	.15(13)		.88(22)	1.29(16)	1.14(24)	1.90(23)	.44(23)	.93(24)	2.18(24)	1.23(20)
DAY 6	335.96	334.45	336.74		338.32	337.00	336.07	335.42	335.02	337.73	336.15	336.87
	2.00(24)	.28(21)	2.43(8)		2.12(21)	1.35(20)	.35(24)	1.96(24)	2.78(24)	1.82(24)	1.17(20)	1.48(24)
DAY 7	337.49	334.99	339.20		339.68	338.80	336.19	336.14	335.03	336.67	338.66	337.98
	3.30(24)	.60(20)	3.17(23)		1.55(24)	4.92(24)	.29(24)	.92(22)	2.60(24)	.94(20)	3.18(21)	2.21(24)
DAY 8	337.74	335.09	335.48		340.01	334.70	336.33	336.33	336.78	336.25	336.59	335.71
	3.95(23)	1.28(24)	.62(24)		3.10(19)	2.03(16)	.31(24)	.19(20)	1.35(24)	.37(19)	.94(24)	1.56(24)
DAY 9	338.41	335.85	336.37		340.51	334.77	336.42	334.86	336.66	335.97	339.18	337.39
	6.86(24)	1.08(24)	1.80(24)		3.73(17)	1.49(22)	.59(24)	2.77(24)	.25(24)	.77(24)	3.22(24)	2.79(24)
DAY 10	335.21	337.05	336.92		336.13	335.70	336.63	334.80	336.53	337.62	336.94	344.69
	2.03(24)	4.07(24)	2.45(24)		.99(23)	.88(22)	.70(19)	1.88(23)	.29(24)	2.95(24)	.27(7)	6.26(24)
DAY 11	335.82	338.76	341.03		339.39	336.43	338.12	336.58	336.38	336.99	344.63	337.40
	2.23(24)	1.99(9)	5.05(24)		3.58(24)	1.60(24)	1.65(12)	1.16(24)	.35(24)	1.17(24)	8.09(15)	2.67(24)
DAY 12	336.35	341.20	337.52		335.78	335.44		336.24	336.59	337.41	338.68	335.98
	3.30(24)	2.25(8)	4.66(23)		.57(24)	.31(24)		.20(24)	.51(24)	3.47(24)	5.24(24)	1.18(24)
DAY 13	334.38		336.30		335.96	335.79		336.25	337.00	336.81	340.70	337.42
	1.14(24)		2.02(24)		.77(16)	.11(9)		.55(24)	1.19(24)	2.27(24)	3.78(24)	2.39(24)
DAY 14	333.96		335.03	338.72	340.36			336.81	335.60	336.29	336.43	336.45
	3.96(21)		.20(24)	.25(3)	2.41(24)			.65(24)	1.33(24)	.46(24)	.49(23)	.44(24)
DAY 15	334.79	334.58		339.52	341.06		335.17	336.39	336.63	336.40	337.58	336.41
	.20(24)	.19(13)		2.40(13)	4.04(24)		.65(8)	.23(22)	.16(21)	.36(24)	1.68(24)	.55(23)
DAY 16	334.89	334.63	335.08	336.32	338.30		336.04	336.13	336.15	336.38	336.40	335.99
	.65(24)	.21(10)	.21(12)	2.80(24)	2.96(23)		1.39(22)	.36(24)	.70(24)	.49(22)	1.20(24)	1.41(15)
DAY 17	337.34		336.16	337.48	334.99		335.93	336.41	336.84	337.55	341.58	336.38
	2.53(24)		1.00(24)	2.46(24)	.13(24)		.98(9)	.54(24)	1.15(24)	2.08(24)	5.26(21)	.56(24)
DAY 18	334.69		337.12	339.53	335.04	336.70	335.62	334.72	336.74	337.86	339.17	336.20
	.21(22)		1.78(24)	1.44(15)	.14(24)	1.25(10)	.73(12)	1.56(24)	.43(24)	4.74(24)	3.98(20)	.68(24)
DAY 19	334.70	334.58	334.93		335.07	336.67	335.93	338.77	336.51	336.27	336.25	337.03
	.17(24)	(1)	.17(17)		.13(24)	1.50(22)	.28(24)	3.11(24)	.11(21)	1.39(24)	.86(22)	1.73(24)
DAY 20	334.58	338.54	335.56		335.12	335.46	336.63	339.70	336.25	337.64	336.28	338.89
	.17(24)	1.03(16)	.85(21)		.14(24)	.26(13)	3.29(17)	2.77(24)	.24(24)	1.71(24)	.14(21)	3.01(24)
DAY 21	334.52	336.95	335.92		335.05	336.15	338.80	337.26	336.17	337.94	336.30	337.14
	.22(23)	3.49(15)	1.27(24)		.07(24)	.21(6)	1.22(9)	2.11(24)	.11(24)	2.17(24)	.25(24)	2.31(24)
DAY 22	334.76	335.03	334.93		334.77	335.98	337.00	335.53	336.28	338.46	336.20	338.50
	.48(24)	.41(24)	.28(24)		.66(20)	.96(24)	.50(8)	2.09(24)	.33(24)	3.99(24)	.33(24)	1.67(22)
DAY 23	334.54	336.57	335.18		333.52	335.53	336.97	336.66	335.68	339.08	336.10	335.73
	.18(22)	1.59(15)	.17(24)		1.78(16)	1.93(14)	1.66(24)	1.06(24)	2.91(24)	2.50(16)	.38(24)	.75(24)
DAY 24	334.38	334.86	335.10		334.97	335.75	338.40	336.38	338.69	336.69	336.29	336.65
	.45(24)	.20(24)	.22(24)		.32(24)	(1)	3.73(18)	.24(24)	7.86(20)	1.08(21)	.74(24)	1.05(19)
DAY 25	334.68	335.00	335.21		336.07		339.72	336.60	336.75	337.49	338.72	341.24
	.20(20)	.17(22)	.22(24)		2.76(24)		6.35(21)	.32(24)	.36(21)	2.57(23)	3.83(24)	4.54(24)
DAY 26	334.90	336.46	335.48		336.84		336.82	336.41	336.66	337.75	341.41	338.94
	.14(24)	1.31(14)	.97(24)		1.99(24)		1.66(24)	.44(24)	.18(14)	2.82(24)	7.16(24)	5.78(24)
DAY 27	335.17	340.98	336.16		338.57		338.31	334.40		338.78	338.36	336.18
	.64(24)	2.75(19)	1.46(24)		2.52(12)		1.40(24)	1.61(24)		4.01(24)	2.71(22)	.73(24)
DAY 28	335.87	337.38	335.16	335.11	341.34		336.70	336.71		336.51	338.89	336.58
	1.87(24)	1.60(24)	.12(22)	.34(15)	3.39(15)		.56(16)	1.06(24)		.37(18)	2.78(21)	1.46(24)
DAY 29	335.01	335.61	334.98	334.87	339.05		336.57	336.99	331.83	336.38	336.66	336.90
	.37(24)	.57(23)	.12(24)	.23(24)	2.99(24)		.34(13)	.54(20)	1.95(6)	.53(23)	.79(24)	.43(18)
DAY 30	335.00		334.98	335.80	339.33		336.58	336.85	336.98	336.12	337.52	338.36
	.19(22)		.20(24)	1.18(24)	2.63(16)		.31(14)	1.43(24)	1.52(20)	.51(24)	2.97(24)	2.20(13)
DAY 31	337.19		334.14		335.33		336.67	336.96		336.23		336.66
	2.37(24)		4.04(20)		.46(24)		.95(22)	.24(24)		.56(21)		1.32(22)
MONTHLY	335.49	336.25	336.01	336.82	337.28	336.24	336.82	336.36	336.35	337.11	337.82	337.44
MEAN	1.19	1.95	1.48	1.79	2.24	1.10	1.02	1.06	1.12	.85	2.06	1.84
	31	25	30	11	31	20	27	31	28	31	30	31
HOURS PER MONTH	726	470	663	198	669	353	492	729	620	708	669	692

ANNUAL MEAN = 336.67
STANDARD DEVIATION = .67
HOURS PER YEAR = 6989

CAPE GRIM CORRECTED CO2 CONCENTRATIONS (MARKI)

1981 COMPLETE DATA SET

MONTH	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
DAY 1	338.58	338.25	336.83	349.75	339.22	343.03	337.33	336.12	337.69		336.91	
	2.70(19)	3.37(22)	.65(24)	6.30(24)	2.02(10)	4.21(24)	.15(16)	1.75(24)	.26(14)		2.43(18)	
DAY 2	336.55	336.22	339.54	341.02	338.61	346.35	337.28	336.80	337.60	337.85		
	.70(11)	.58(24)	1.75(24)	2.82(22)	1.42(24)	7.76(24)	.23(11)	1.33(24)	.72(23)	.44(15)		
DAY 3	337.09	339.13	337.49	338.46	337.21	344.87	337.59	345.14	337.75	337.97		
	.94(24)	1.92(24)	.93(24)	1.70(24)	1.37(24)	5.29(24)	.34(18)	3.44(8)	.25(18)	.24(24)		
DAY 4	336.26	337.91	336.39	337.17	339.66	342.86	337.85	341.26	337.74	337.59		
	.18(24)	1.28(17)	.16(22)	1.20(24)	5.63(24)	4.74(24)	1.70(24)	4.25(17)	.38(24)	.29(24)		
DAY 5	337.79	339.79	336.55	339.29	337.80	339.78	337.33	337.36	337.59	337.54		
	3.56(24)	4.32(24)	.49(23)	3.05(24)	1.83(24)	4.44(22)	.31(15)	1.31(24)	.53(24)	.39(24)		
DAY 6	340.70	337.16	339.00	336.84	339.86	340.83	337.51	337.66	335.72	336.18		
	5.66(24)	1.56(24)	1.03(22)	.76(24)	2.91(24)	3.34(24)	.06(10)	.25(23)	3.12(24)	2.42(24)		
DAY 7	338.25	337.05	336.99	340.22	336.87	339.99	337.33	338.42	335.74	337.77		
	3.28(24)	1.28(24)	.66(24)	4.56(23)	.51(24)	2.51(24)	.20(24)	2.07(24)	3.00(24)	.44(18)		
DAY 8	336.72	340.30	336.73	346.46	336.75	337.45	337.49	337.43	337.18	340.54		
	.86(24)	3.26(24)	.56(24)	9.38(24)	.11(24)	1.32(24)	.55(24)	1.20(24)	1.32(24)	6.61(14)		
DAY 9	340.52	338.13	336.52	339.92	336.71	337.44	337.76	337.93	337.63	337.87		
	2.03(22)	2.73(19)	.07(24)	4.99(21)	.12(24)	1.17(23)	.83(24)	.60(24)	.45(23)	.43(14)		
DAY 10	337.12	336.42	336.56	337.05	336.76	338.32	340.40	339.15	340.15	337.76		
	1.79(24)	.08(23)	.11(24)	1.76(24)	.05(6)	1.31(24)	3.84(24)	2.45(24)	2.40(24)	.44(24)		
DAY 11	337.24	337.55	336.48	337.00	336.69	337.26	338.42	338.88	337.89	337.75		
	2.37(24)	.90(24)	.16(24)	2.05(24)	.22(14)	.99(24)	1.48(24)	2.25(24)	.26(24)	.35(24)		
DAY 12	337.15	336.41	336.98	337.48	337.74	336.97	337.93	337.97	337.68	338.78		
	2.46(24)	.45(24)	.86(24)	.83(24)	2.12(22)	.36(22)	1.56(24)	1.64(24)	.23(24)	2.95(24)		
DAY 13	336.72	336.52	336.57	336.52	338.86	337.93	337.54	337.80	337.51	338.37		
	.85(18)	.76(20)	.39(21)	.13(24)	1.03(23)	.86(24)	.50(22)	1.93(24)	.37(24)	2.50(16)		
DAY 14	338.39	337.07	336.67	336.49	344.79	338.01	338.00	337.37	338.25	338.88		
	1.26(20)	.93(24)	.44(23)	.17(24)	6.74(24)	1.82(24)	.84(12)	.58(24)	1.23(24)	2.00(19)		
DAY 15	338.53	339.69	336.39	336.64	343.54	337.12		336.97	340.28	337.91		
	1.25(24)	1.80(24)	.07(24)	.24(19)	4.51(20)	.42(24)		.78(24)	2.26(24)	.38(24)		
DAY 16	339.42	337.28	336.41	336.66	337.91	337.15		337.45	337.98	338.26		
	4.20(21)	2.06(21)	.13(24)	.15(24)	.98(24)	.80(24)		.38(24)	2.49(24)	1.85(18)		
DAY 17	337.44	336.66	336.94	336.42	336.77	340.70		337.68	338.68	342.75	337.60	
	.73(24)	.69(22)	1.33(19)	.14(21)	.21(23)	4.15(24)		.13(24)	1.75(20)	5.69(10)	.39(9)	
DAY 18	339.19	336.18	340.99	336.67	336.77	337.34		337.64	337.80	338.02	337.64	
	1.14(24)	.12(24)	3.28(24)	.07(8)	.81(23)	.41(24)		.23(24)	.97(23)	1.70(16)	.52(21)	
DAY 19	336.72	336.32	338.69		337.87	337.00		338.15	337.65	338.04	338.59	
	.62(24)	.52(24)	2.16(24)		1.57(24)	.29(24)		.21(24)	.50(24)	1.61(23)	3.62(24)	
DAY 20	337.66	337.24	336.52		338.86	340.02		338.37	338.67	337.93	339.49	
	1.14(24)	1.20(24)	.15(22)		1.84(20)	2.78(24)		1.15(24)	1.47(24)	1.99(24)	2.86(24)	
DAY 21	337.29	339.84	336.46		340.90	337.12	340.17	337.85	337.66	340.50	338.04	
	1.43(24)	3.12(24)	.10(24)		6.50(23)	1.58(24)	2.52(15)	.71(24)	.35(24)	3.39(24)	1.74(24)	
DAY 22	336.42	337.69	336.47		337.39	337.68	337.57	337.75	337.96	338.27	337.70	
	.18(24)	1.29(23)	.09(24)		1.85(22)	1.46(24)	1.45(24)	.19(24)	.53(24)	1.07(24)	1.23(24)	
DAY 23	336.15	340.49	338.06	336.63	337.16	338.81	336.88	337.71	337.67	338.22	337.80	
	.18(24)	5.58(13)	2.02(24)	.23(24)	.93(24)	2.39(24)	1.01(24)	.17(24)	.67(24)	1.21(20)	1.26(14)	
DAY 24	336.89	337.11	337.68	336.78	337.26	337.82	337.66	338.69	337.87	337.62		
	1.12(24)	.45(24)	1.35(24)	.12(17)	.77(24)	2.52(24)	.37(24)	1.69(18)	.19(24)	.29(24)		
DAY 25	341.26	337.31	336.36		342.62	339.38	337.16	338.45	337.83	337.74		
	6.23(24)	1.80(24)	.13(23)		2.42(24)	2.62(18)	.88(24)	2.11(24)	.23(23)	.10(18)		
DAY 26	338.16	337.97	338.37		342.79	337.41	337.52	336.65	337.15	338.51		
	3.04(24)	1.87(24)	1.66(24)		2.80(22)	.70(22)	.24(24)	3.06(22)	2.25(24)	3.74(24)		
DAY 27	336.81	337.02	337.99	336.17	341.59	336.92	337.67	337.88	337.35	340.85		
	1.01(21)	.50(21)	3.05(20)	.09(10)	3.93(24)	.17(24)	.18(24)	.19(21)	2.58(24)	2.15(23)		
DAY 28	341.02	337.04	339.26	336.18	340.11	337.05	338.30	337.79	337.89	337.83		
	5.04(20)	.67(24)	2.72(24)	.06(12)	1.89(24)	.80(24)	2.42(21)	.73(24)	.30(24)	.26(13)		
DAY 29	337.43		338.20	337.11	340.68	337.39	339.08	339.57	338.15	337.50		
	2.06(24)		2.12(24)	.40(7)	1.32(24)	.69(24)	1.67(24)	1.95(24)	1.24(24)	.74(14)		
DAY 30	337.06		343.82	338.58	338.27	337.13	338.54	347.45	338.73	337.13		
	2.02(23)		8.48(24)	2.58(24)	1.25(24)	1.82(22)	1.50(24)	7.64(13)	1.73(11)	.40(22)		
DAY 31	339.30		340.81		341.49		337.89			338.15		
	4.16(16)		3.53(24)		1.70(24)		2.03(21)			1.85(24)		
MONTHLY	337.93	337.71	337.70	338.40	339.02	338.90	337.93	338.51	337.85	338.34	337.97	
MEAN	1.45	1.29	1.73	3.32	2.29	2.49	.85	2.34	.91	1.27	.77	
	31	28	31	24	31	30	25	30	30	30	8	
HOURS PER MONTH	695	633	723	496	684	705	521	674	683	609	158	

ANNUAL MEAN = 338.20
STANDARD DEVIATION = .46
HOURS PER YEAR = 6581

APPENDIX 3(b)

Corrected and selected baseline Mark I data set from the Australian BAPMoN station at Cape Grim, Tasmania.

Tabulation of baseline CO_2 concentration data obtained using the Mark I in situ monitoring system in the temporary laboratory for the period 1976 through 1981.

Corrections, as discussed in Section 4 of the text, have been applied to all CO_2 values after 31st August 1978.

All other corrections, definitions and formatting are the same as in Appendix 1(b).

CAPE GRIM CORRECTED CO_2 CONCENTRATIONS (MARKI)

1976 SELECTED BASELINE VALUES

MONTH	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
DAY 1												331.02 .08(3)
DAY 2				329.26 .15(10)								331.05 .11(2)
DAY 3						329.33 (1)						
DAY 4					329.10 .07(5)	329.29 .11(11)					331.11 .12(4)	330.70 .11(5)
DAY 5					329.02 .12(21)						330.81 .24(4)	
DAY 6					328.88 .19(17)	328.93 .08(6)						
DAY 7					328.81 .09(20)	329.19 .14(12)						330.98 .07(3)
DAY 8					329.02 .10(15)	328.71 .11(18)						331.11 .04(2)
DAY 9												330.14 .07(5)
DAY 10					328.79 .06(2)	328.59 .15(21)						
DAY 11					328.79 .12(9)							
DAY 12												
DAY 13												
DAY 14												
DAY 15											331.50 .06(3)	
DAY 16											331.43 .01(2)	
DAY 17									331.08 .07(8)		330.98 .02(3)	
DAY 18									331.30 .03(2)		331.31 .13(8)	
DAY 19											331.20 .15(6)	
DAY 20											330.39 .63(5)	
DAY 21											331.34 .08(3)	
DAY 22									330.62 .06(3)		330.67 .41(7)	
DAY 23									330.51 .22(7)		330.32 .07(5)	330.84 .02(3)
DAY 24												330.85 .02(2)
DAY 25												330.39 .11(6)
DAY 26												330.32 .25(9)
DAY 27				329.52 .09(6)								330.21 .30(10)
DAY 28				329.48 .23(19)								330.40 .22(6)
DAY 29				329.45 .07(24)								330.32 .30(10)
DAY 30				329.27 .15(19)							330.68 .45(3)	330.68 .06(2)
DAY 31												
MONTHLY MEAN				329.40 .12 5	328.92 .13 7	329.01 .31 6			330.88 .37 4		330.98 .40 12	330.64 .34 14
HOURS PER MONTH				78	89	69			20		53	68

ANNUAL MEAN = 329.97
STANDARD DEVIATION = .97
HOURS PER YEAR = 377

CAPE GRIM CORRECTED CO_2 CONCENTRATIONS (MARKI)

1977 SELECTED BASELINE VALUES

MONTH	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
DAY 1	330.67 .37(2)	330.70 .17(12)		331.00 .11(2)							332.86 .02(3)	
DAY 2	330.67 .22(10)	330.56 .28(5)									332.79 .13(4)	332.54 (1)
DAY 3	330.54 .17(7)			330.72 .12(8)						333.29 .03(2)		332.52 .09(5)
DAY 4				330.82 .05(2)						333.08 .08(3)	332.90 .06(3)	332.31 .12(7)
DAY 5		330.72 .04(3)		331.05 .13(3)						332.83 .27(4)	333.05 .03(3)	332.25 .18(12)
DAY 6		330.52 .21(9)		331.04 .09(2)						333.00 .05(4)		332.16 .31(19)
DAY 7										333.11 (1)	332.49 .35(9)	332.40 .52(9)
DAY 8				330.76 .11(5)							333.09 .04(3)	332.42 .52(8)
DAY 9		330.81 .07(3)										
DAY 10		330.79 .03(3)									332.62 .18(5)	
DAY 11											333.03 .29(4)	
DAY 12	330.40 .08(5)										333.46 .01(2)	331.84 (1)
DAY 13		330.49 .14(5)										
DAY 14										332.47 .21(8)	332.87 .17(15)	331.62 (1)
DAY 15		330.63 .70(6)								332.71 .37(9)	333.10 .03(2)	332.33 .19(9)
DAY 16		332.05 .13(2)		330.62 .29(5)						332.67 .26(5)	332.74 .15(3)	332.43 .11(9)
DAY 17				330.83 .04(5)						332.46 .14(6)	332.74 .10(5)	332.60 .09(8)
DAY 18		330.59 .06(5)		330.32 .27(2)		331.65 .02(3)				332.51 .07(3)	333.02 .12(10)	332.45 .17(12)
DAY 19				330.60 (2)		331.59 .17(4)						332.53 .19(9)
DAY 20											332.52 .09(11)	332.66 .08(3)
DAY 21	330.86 .21(2)										332.53 .10(6)	
DAY 22	330.85 .04(2)										332.66 .21(11)	
DAY 23	330.86 .02(2)						332.00 .03(3)				332.90 .07(15)	
DAY 24	330.60 .39(11)					331.61 .12(5)	331.71 .13(9)				332.93 (1)	
DAY 25	330.78 .31(6)					331.77 .04(3)	331.82 .23(6)					
DAY 26	330.64 .16(9)	330.24 .04(6)					331.96 .03(3)					332.18 .17(5)
DAY 27	331.17 .03(3)					331.72 .04(3)						332.41 .10(12)
DAY 28	331.13 .03(3)		330.99 .05(3)			331.67 .07(6)	331.61 .03(3)			333.36 .03(3)		332.26 .19(9)
DAY 29	331.00 .04(3)		331.11 .06(3)			331.57 .18(6)				332.89 .25(7)		332.14 .14(9)
DAY 30	330.54 .27(8)					331.77 .05(3)	332.07 .05(3)			332.74 .33(8)		
DAY 31	330.87 .03(3)		330.94 .11(3)							332.95 .10(3)		
MONTHLY MEAN	330.77 .22 15	330.74 .46 11	331.01 .09 3	330.78 .23 10		331.67 .08 8	331.86 .18 6			332.86 .29 14	332.86 .24 19	332.32 .26 19
HOURS PER MONTH	76	59	9	36		33	27			66	115	148

ANNUAL MEAN = 331.65
STANDARD DEVIATION = .88
HOURS PER YEAR = 569

CAPE GRIM CORRECTED CO2 CONCENTRATIONS (MARKI)

1978 SELECTED BASELINE VALUES

MONTH	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
DAY 1			332.44 .08(4)								333.22 .53(3)	
DAY 2												
DAY 3			332.28 .07(7)							334.40 .12(7)	334.80 (1)	
DAY 4			332.09 .07(12)							334.18 .09(13)		
DAY 5			332.21 .16(17)							334.39 .43(10)		
DAY 6	332.24 .03(3)								333.55 .13(5)	334.29 .26(20)		333.10 .11(14)
DAY 7	332.35 .20(12)	332.27 .14(2)							333.35 .11(11)	334.09 .05(7)		332.85 .21(24)
DAY 8	332.54 .05(5)	332.29 (1)							333.02 .29(17)	334.16 (1)		332.91 .27(22)
DAY 9	332.29 .15(9)	332.45 .12(5)							333.28 .11(8)			332.90 .28(17)
DAY 10	332.96 .08(2)		332.77 .05(3)									
DAY 11	332.47 .17(19)	332.11 .20(14)										
DAY 12	332.22 .19(21)	331.83 .10(24)								334.73 (1)		
DAY 13	331.95 .18(12)	332.06 .21(3)								334.17 .30(11)		
DAY 14										333.92 .23(23)		
DAY 15	332.23 .08(2)									334.05 .13(7)		
DAY 16	331.96 .14(11)									334.40 .32(10)		
DAY 17										334.05 .06(6)		333.05 .17(14)
DAY 18	332.19 .19(12)									334.31 .11(5)		332.91 .17(18)
DAY 19	332.05 .15(10)									333.95 .15(16)		333.05 .10(15)
DAY 20								334.24 .18(13)		334.10 .21(14)		332.83 .26(18)
DAY 21								333.96 .28(12)		334.17 .25(7)		333.02 .25(19)
DAY 22	331.83 .07(7)							334.31 .08(15)				333.23 .27(7)
DAY 23								334.10 .19(11)	334.71 (1)			
DAY 24	331.81 .01(3)											
DAY 25	331.64 .01(2)							332.50 .04(3)				
DAY 26	331.34 .13(4)							334.66 .20(20)				333.41 .09(10)
DAY 27	330.95 .18(8)							334.51 .15(18)	334.18 .17(10)			333.30 .11(4)
DAY 28		332.23 .20(6)						334.56 .30(8)	334.09 .14(14)			333.52 .15(10)
DAY 29									333.95 .50(11)			333.73 .12(14)
DAY 30												333.67 .25(21)
DAY 31										333.63 .10(7)		333.26 .38(12)
MONTHLY MEAN	332.06 .47 17	332.18 .20 7	332.36 .26 5					334.10 .69 8	333.77 .56 8	334.18 .24 17	334.01 1.12 2	333.17 .29 16
HOURS PER MONTH	142	55	43					100	77	165	4	239

ANNUAL MEAN = 333.23
STANDARD DEVIATION = .91
HOURS PER YEAR = 825

CAPE GRIM CORRECTED CO2 CONCENTRATIONS (MARKI)

1979 SELECTED BASELINE VALUES

MONTH	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
DAY 1	333.86 .13(7)			332.97 .29(11)				334.82 .08(7)				334.84 .25(13)
DAY 2	333.25 .36(10)							334.66 .05(3)				335.05 .31(21)
DAY 3			333.01 .49(14)	333.85 .07(9)	333.12 .09(12)							334.90 .48(14)
DAY 4				333.77 .06(9)	333.27 .05(7)			334.78 .08(5)				
DAY 5			333.07 .21(14)	333.76 .14(4)								335.25 .24(6)
DAY 6	333.19 .29(21)	333.06 .09(7)	333.28 .13(8)									334.32 .06(3)
DAY 7	333.67 .14(11)	333.80 .11(8)										
DAY 8	333.72 (1)											
DAY 9	333.20 .11(10)		333.79 .68(13)					334.81 .03(3)				
DAY 10	333.38 .12(10)	333.53 .25(14)	333.08 (1)		333.41 .06(12)	333.66 .08(2)		334.84 .07(9)				
DAY 11	333.29 .21(20)	333.31 .15(21)			333.93 .09(7)	333.67 .03(5)						
DAY 12	333.17 .46(12)	333.38 .15(17)			333.75 .22(22)							
DAY 13	332.09 .35(13)	333.25 .32(4)			333.52 .13(24)							
DAY 14	332.82 .26(10)	333.24 .10(21)			333.67 .12(24)							
DAY 15	332.77 .26(12)	333.38 .15(24)			333.54 .10(14)							
DAY 16		332.86 .20(20)										
DAY 17	333.10 .09(15)	332.68 .22(24)	333.28 (1)		333.50 .16(13)							
DAY 18	333.06 .31(8)	332.79 .17(19)	333.15 .09(5)		333.49 .03(3)							
DAY 19					333.48 .10(7)							
DAY 20	333.40 (2)										335.46 .07(5)	
DAY 21	333.14 .26(18)			333.71 .09(7)							335.30 .52(18)	334.64 .28(8)
DAY 22			333.52 .07(6)	333.23 .22(23)							335.27 .11(8)	334.51 .24(19)
DAY 23			333.63 .17(10)	333.39 .15(13)			334.68 .11(9)					335.07 .10(14)
DAY 24			333.50 .27(23)	333.14 .26(18)	333.71 .14(3)		334.76 .17(2)				335.16 (1)	335.01 .25(13)
DAY 25			333.90 .29(20)		333.62 .09(5)						334.85 .42(19)	334.88 .33(16)
DAY 26		334.59 .10(5)	334.46 (1)	333.51 .20(8)	333.43 (1)						335.06 .31(12)	334.78 .41(16)
DAY 27		333.58 .11(3)		333.11 .15(24)	333.45 .13(24)						335.14 .14(14)	
DAY 28				332.99 .18(24)	333.47 .07(6)		334.83 .09(10)				334.97 .31(17)	
DAY 29				332.94 .24(18)	333.45 .07(2)		334.67 .11(9)				334.97 .21(23)	
DAY 30					333.45 .09(16)						335.03 .19(12)	
DAY 31			333.52 .08(5)		333.53 .08(20)							
MONTHLY MEAN	333.19 .42 16	333.34 .49 13	333.48 .41 13	333.36 .35 12	333.51 .18 19	333.66 .02 2	334.73 .07 4	334.78 .07 5			335.12 .18 10	334.84 .27 11
HOURS PER MONTH	180	187	121	168	222	7	30	27			129	143

ANNUAL MEAN = 334.00
STANDARD DEVIATION = .76
HOURS PER YEAR = 1214

CAPE GRIM CORRECTED CO2 CONCENTRATIONS (MARKI)

1980 SELECTED BASELINE VALUES

MONTH	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
DAY 1				335.02 .09(13)		335.17 .17(24)			336.96 .11(15)	336.14 .11(6)	336.32 .23(24)	
DAY 2		334.75 .30(14)	334.92 .09(12)	335.18 .02(3)		335.30 .08(8)	336.91 .13(6)	336.47 .25(7)	337.02 .12(21)	336.49 .11(7)	336.50 .38(20)	
DAY 3		334.78 .12(24)	334.88 .23(21)	334.91 .08(8)			336.69 .11(12)	336.20 .32(23)	337.09 .18(6)	336.33 .38(12)	336.26 .60(8)	336.36 .14(10)
DAY 4	334.70 .25(14)	334.77 .14(14)	334.75 .17(9)				336.58 .13(14)	336.09 .11(9)	336.68 .09(8)			336.56 .24(12)
DAY 5	335.08 .09(5)	334.74 .14(20)	335.00 .15(13)				336.43 .12(11)		336.45 .29(20)			336.25 .26(6)
DAY 6	335.16 (1)	334.43 .22(17)					336.10 .27(19)		336.71 .07(7)	336.77 .07(6)		335.82 .05(6)
DAY 7		335.12 .54(14)					336.22 .16(15)	336.46 .10(7)	336.28 .32(16)	336.61 .08(14)	336.81 .04(5)	
DAY 8		335.41 .33(10)	335.26 .18(15)				336.31 .09(14)	336.38 .13(16)	336.54 .07(12)	336.47 .11(13)	336.43 .64(11)	
DAY 9		335.43 .11(20)	334.73 .04(2)			334.54 .12(6)	336.16 .15(10)		336.53 .12(12)	336.46 .07(6)		
DAY 10								336.32 .10(6)	336.65 .14(7)			
DAY 11						335.40 .10(11)		336.30 .07(9)	336.45 .10(8)			335.94 .33(12)
DAY 12	334.58 .12(4)				336.11 .06(3)	335.52 .25(20)		336.26 .16(20)				336.35 .08(6)
DAY 13	336.08 .03(2)		335.19 .06(2)			335.80 .06(7)		336.49 .04(8)	336.36 .29(2)	336.53 .13(8)	336.52 .11(3)	336.22 .52(8)
DAY 14	334.73 .14(3)		335.05 .11(19)					336.41 .06(9)	336.19 .08(4)	336.60 .12(14)	336.27 .24(13)	336.30 .33(16)
DAY 15	334.81 .18(23)	334.60 .18(9)					335.52 .06(3)	336.39 .13(6)	336.59 .09(14)	336.42 .23(15)		336.26 .31(15)
DAY 16	334.70 .24(20)	334.67 .15(4)		335.09 .09(7)	334.96 .07(7)		335.57 .09(8)		336.38 .07(9)	336.71 .20(13)		
DAY 17					334.99 .13(24)				336.82 (1)	337.01 .12(4)		336.73 .08(2)
DAY 18	334.67 .15(14)		335.00 .09(6)		335.04 .14(24)		335.98 .03(4)		336.62 .09(11)			336.13 .32(14)
DAY 19	334.69 .15(23)		334.86 .10(8)		335.05 .11(23)	335.78 .11(4)	335.97 .22(20)		336.50 .12(16)		336.36 .05(5)	336.33 .05(4)
DAY 20	334.58 .17(24)				335.13 .11(23)	335.58 .14(10)			336.25 .24(24)	336.25 .11(9)	336.30 .12(20)	335.78 (1)
DAY 21	334.57 .12(21)		335.24 .12(9)		335.05 .07(24)	336.23 .04(3)			336.17 .11(24)	336.25 .26(14)	336.30 .25(24)	
DAY 22	334.63 .09(10)		335.02 .24(16)		335.05 .10(11)	336.22 .06(7)			336.27 .18(17)		336.21 .34(23)	336.61 .13(5)
DAY 23	334.51 .15(19)		335.16 .11(21)						336.74 .04(2)		336.11 .39(23)	335.51 .48(16)
DAY 24	334.50 .13(15)		335.06 .10(10)		334.93 .18(20)						336.41 .32(7)	
DAY 25	334.81 .16(10)		335.17 .17(18)		335.18 .08(9)							336.50 (1)
DAY 26	334.89 .13(23)		335.41 .06(5)						336.65 .11(9)			
DAY 27	334.99 .08(7)		335.04 .24(13)							336.58 .30(11)		
DAY 28			335.18 .10(18)	334.82 .05(5)				336.26 .07(7)		336.57 .21(10)		
DAY 29	334.89 .17(19)	335.27 .08(7)	335.00 .08(23)	334.80 .10(17)			336.37 .06(7)	336.73 .29(10)		336.43 .07(12)	336.25 .41(15)	336.95 .37(14)
DAY 30	335.03 .09(7)		335.02 .12(18)		336.29 .01(2)		336.47 .17(2)	336.81 .18(8)	335.92 .03(2)	336.39 .33(14)	336.21 .99(2)	
DAY 31			335.09 .13(8)		335.35 .50(17)		336.30 .12(10)	337.00 .17(21)		336.56 .14(13)		
MONTHLY MEAN	334.83 .35 20	334.91 .34 11	335.05 .17 21	334.97 .15 6	335.26 .45 12	335.55 .50 10	336.24 .38 15	336.44 .24 15	336.53 .28 24	336.50 .20 19	336.35 .17 15	336.27 .36 17
HOURS PER MONTH	264	153	266	53	187	100	155	166	267	201	203	148

ANNUAL MEAN = 335.74
STANDARD DEVIATION = .70
HOURS PER YEAR = 2163

CAPE GRIM CORRECTED CO2 CONCENTRATIONS (MARKI)

1981 SELECTED BASELINE VALUES

MONTH	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
DAY 1	336.76 .33(7)											
DAY 2												
DAY 3	336.27 .11(12)		336.62 .12(4)									
DAY 4	336.26 .18(24)	337.05 .11(3)	336.36 .14(20)						338.09 .09(5)			
DAY 5	336.26 .13(16)	336.35 .13(8)	336.39 .17(20)					337.75 .05(7)				
DAY 6	336.53 .07(7)	336.18 .25(3)		336.38 .08(9)				337.68 .27(17)				
DAY 7												
DAY 8			336.52 .05(8)						337.86 .08(8)			
DAY 9		336.33 .08(11)	336.52 .07(24)						337.88 .13(3)			
DAY 10	336.34 .16(17)	336.41 .07(22)	336.56 .11(24)	336.36 .24(18)								
DAY 11	336.36 .19(20)		336.48 .16(24)		336.70 .23(13)	337.11 .09(8)						
DAY 12			336.45 .13(9)			337.22 .15(13)						
DAY 13			336.58 .05(5)	336.52 .12(8)		337.55 .07(8)						
DAY 14				336.50 .16(23)		337.03 .13(10)		337.08 .22(10)				
DAY 15				336.60 .21(17)		337.05 .22(20)		337.23 .22(16)				
DAY 16		336.68 .48(6)		336.66 .15(24)	336.83 .09(9)			337.51 .04(3)				
DAY 17		336.12 .11(10)		336.42 .14(21)	336.77 .21(22)			337.68 .14(19)				
DAY 18		336.18 .12(24)		336.67 .07(8)	336.96 .11(6)	337.15 .07(7)		337.70 .14(22)	337.73 .31(13)			
DAY 19	336.39 .10(13)	336.13 .12(19)				337.07 .06(9)		338.12 .19(21)	337.98 .11(8)			
DAY 20	336.51 .04(3)											
DAY 21	336.41 .09(11)							337.73 .20(17)				
DAY 22	336.41 .16(23)							337.75 .19(23)				
DAY 23	336.15 .18(24)			336.69 .18(12)				337.71 .17(24)				
DAY 24	336.13 .14(14)	337.23 .08(2)		336.77 .08(8)				337.95 .05(5)				
DAY 25		337.23 .11(6)	336.34 .12(5)									
DAY 26	337.04 (1)							337.74 .04(2)				
DAY 27	336.90 (1)							337.88 .19(21)				
DAY 28								337.53 .63(15)				
DAY 29												
DAY 30												
DAY 31	336.38 (1)											
MONTHLY MEAN	336.44 .26 16	336.53 .44 11	336.48 .09 10	336.56 .14 10	336.81 .11 4	337.17 .18 7		337.67 .26 15	337.91 .13 5			
HOURS PER MONTH	194	114	143	148	50	75		222	37			

ANNUAL MEAN = 336.95
STANDARD DEVIATION = .57
HOURS PER YEAR = 983

APPENDIX 4

Mark I flask CO_2 data set from the Australian BAPMoN station at Cape Grim, Tasmania.

Tabulation of all wind and CO_2 concentration data obtained using the Mark I flask filling equipment and associated meteorological instruments in the temporary laboratory for the years 1976 through 1981.

Analysis for CO_2 was performed on UNOR 2 type, NDIR gas analysers at CSIRO, and concentrations are expressed in parts per million by volume (ppmv) with respect to the WMO 1981 CO_2 Calibration Scale. A carrier-gas correction has been applied to all values based on comparison of instrument response to WMO Central CO_2 Laboratory CO_2/N_2 and CO_2/Air Secondary Standards as described in Pearman et al. (1983).

All samples are chemically dried at the time of collection using granular magnesium perchlorate (Dehydrite) as the drying agent.

Sampling time is given in Australian Eastern Standard Time (EST). (EST = Greenwich Mean Time + 10 hours).

CAPE GRIM FLASK CO2 AND WIND DATA

DATE	TIME (EST)	CO2 CONCENTRATION (PPMV)	WIND DIRECTION (DEGREES)	WIND SPEED (KM/HR)
19.06.76	1435	328.1	225	20
	1505	327.4	225	20
	1545	328.2	225	20
	1553	328.2	225	20
13.09.76	2231	331.8	200	21
	2240	331.8	200	21
04.11.76	1655	331.0	220	50
	1710	331.2	220	50
	1715	331.1	220	50
05.11.76	1446	330.8	210	43
	1455	330.8	210	43
	1510	330.6	210	43
11.11.76	0900	330.5	060	-
	0905	329.2	060	-
12.11.76	0815	329.9	280	5
	0830	328.5	280	5
17.11.76	0936	329.4	210	49
	0941	329.3	210	49
19.11.76	0853	329.3	210	35
	0900	330.2	210	35
26.11.76	0851	329.9	090	-
	0857	328.1	090	-
	0905	329.2	090	-
	1505	332.3	220	12
	1511	332.3	220	12
	1517	332.3	220	12
31.05.77	1603	331.3	230	64
	1620	331.3	220	64
	1655	331.2	220	64
01.06.77	0849	331.2	220	65
	0937	331.2	220	64
	0954	331.1	220	64
04.07.77	1026	331.3	260	19
	1100	330.7	250	19
	1125	330.9	240	22
14.07.77	1300	331.0	210	50
	1350	331.5	220	33
	1445	331.4	210	32
28.07.77	1343	331.2	220	37
08.08.77	0959	331.2	250	22
	1034	331.2	250	22
	1100	331.1	260	22
14.09.77	1245	331.5	210	31
	1253	331.5	220	31
	1346	332.1	220	35
15.09.77	1434	331.9	220	28
	1449	332.0	230	28
23.09.77	1425	332.5	240	53
	1436	332.5	240	53
	1454	332.4	250	53
05.10.77	1254	333.2	270	53
	1354	333.0	260	49
	1454	332.8	270	50
31.10.77	1054	331.2	270	27
	1154	331.8	270	27
15.12.77	1040	332.8	240	43
	1137	332.4	250	42
	1237	332.4	250	46

CAPE GRIM FLASK CO2 AND WIND DATA

DATE	TIME (EST)	CO2 CONCENTRATION (PPMV)	WIND DIRECTION (DEGREES)	WIND SPEED (KM/HR)
08.02.78	1152	332.0	250	22
	1352	331.2	260	26
09.02.78	1039	333.5	240	60
	1101	332.4	250	70
10.02.78	0904	332.2	330	-
01.03.78	1245	332.3	260	24
	1300	332.7	260	24
17.03.78	1401	332.2	225	48
	1419	332.2	225	48
	1435	332.4	225	48
27.04.78	1400	334.9	290	36
	1411	334.4	290	36
	1413	334.7	290	36
	1421	334.3	290	36
21.06.78	1410	334.1	090	27
	1415	332.3	090	27
	1420	332.4	090	26
	1425	332.5	090	26
	1430	332.4	090	20
07.07.78	1312	333.4	250	44
	1321	332.9	250	44
	1329	332.7	250	44
	1335	332.6	250	44
13.07.78	1044	334.7	310	44
	1052	334.9	315	49
	1429	333.3	290	30
28.07.78	1429	334.5	260	40
	1444	334.0	260	40
	1457	333.9	260	40
10.08.78	1442	333.5	275	35
	1450	334.2	275	35
	1455	333.7	280	40
	1500	333.7	285	40
23.08.78	1341	333.8	215	20
	1350	333.3	220	20
	1358	333.3	215	20
	1406	333.4	215	20
18.09.78	1248	333.6	220	22
	1300	333.6	220	22
	1359	332.9	215	22
27.09.78	1459	334.1	218	57
	1537	334.1	220	57
	1550	334.2	220	57
03.10.78	1350	333.6	260	27
	1400	333.4	265	30
	1452	333.3	260	25
04.10.78	1548	333.7	260	45
	1555	334.0	260	50
	1600	333.7	260	55
20.10.78	1100	333.5	240	35
	1132	333.6	240	35
	1144	332.4	240	35
	1153	333.1	235	35
	1200	332.7	240	35
	1235	332.0	240	35
01.11.78	1400	333.6	210	25
	1430	334.0	210	25
	1447	333.6	210	25

CAPE GRIM FLASK CO2 AND WIND DATA

DATE	TIME (EST)	CO2 CONCENTRATION (PPMV)	WIND DIRECTION (DEGREES)	WIND SPEED (KM/HR)
03.11.78	1054	333.7	205	25
	1100	333.4	210	25
	1359	333.8	205	25
24.11.78	1200	332.5	230	20
	1246	331.8	230	22
	1300	332.9	240	20
29.11.78	1340	334.4	235	45
	1350	334.5	240	45
	1400	334.3	240	45
05.12.78	0900	333.8	205	60
	0947	333.6	200	50
	1042	333.7	208	50
08.12.78	0957	333.4	210	28
	1135	333.0	210	35
	1158	332 9	215	35
18.12.78	0858	333.6	210	40
	0957	333.8	210	40
	1158	333.8	210	40
19.12.78	0758	333.8	220	65
	0838	333.9	200	65
	0859	333.5	210	55
10.01.79	1547	333.0	238	30
	1554	332.6	235	30
	1600	332.6	232	30
15.01.79	1125	333.0	220	18
	1140	333.1	220	18
	1205	333.0	220	18
17.01.79	0859	332.8	210	35
	0928	332.8	210	35
	0944	332.9	210	35
25.01.79	1213	334.7	210	40
	1228	333.9	210	40
	1243	333.6	210	40
07.02.79	1337	333.6	210	28
	1349	333.3	210	28
	1400	333.1	210	28
08.02.79	1447	332.5	210	30
	1459	332.4	210	28
	1550	331.9	210	28
12.02.79	1300	333.9	215	15
	1350	333.6	225	20
	1359	333.0	230	20
13.02.79	0946	334.8	260	60
21.03.79	1102	334.0*	260	60
	1248	334.1*	260	60
29.03.79	0951	333.8*	075	50
30.03.79	0859	332.5*	075	40
11.04.79	1242	334.2*	220	18
	1435	334.1*	210	25
18.04.79	1300	333.7	220	30
	1346	333.7	215	25
	1500	333.0	220	25
24.04.79	1100	332.9	240	50
	1200	332.8	235	50
10.05.79	1259	335.2	220	38
	1354	334.8	215	65
	1442	334.8	220	55
	1259	334.8*	220	38
	1354	334.3*	215	65
	1442	334.8*	220	55

*-SAMPLED THROUGH ANALYSER.

CAPE GRIM FLASK CO2 AND WIND DATA

DATE	TIME (EST)	CO2 CONCENTRATION (PPMV)	WIND DIRECTION (DEGREES)	WIND SPEED (KM/HR)
17.05.79	1400	334.3	215	25
	1447	334.2	220	25
	1450	333.9	215	25
31.05.79	0846	334.0	225	35
	0854	333.8	220	35
	0900	333.8	225	35
14.06.79	1251	333.8	260	50
	1300	333.9	260	50
22.06.79	0900	334.2	235	40
	0948	334.8	235	40
	1451	333.4	235	30
28.06.79	1543	335.3	260	40
	1556	335.0	260	40
	1620	335.0	260	40
05.07.79	0941	334.6	265	30
	0950	334.8	265	30
	1000	334.4	265	30
10.07.79	1340	333.4	260	30
	1400	333.9	260	30
	1454	333.5	260	30
18.07.79	1000	334.0	245	28
	1100	333.6	250	28
	1548	334.0	250	22
26.07.79	1436	334.2	230	30
	1446	334.7	220	25
	1500	334.5	220	25
31.07.79	1253	335.3	260	50
	1300	335.2	270	50
09.08.79	0900	333.9	260	50
	0945	334.2	260	50
	1000	334.3	260	65
13.08.79	1250	334.3	220	35
	1300	334.1	215	30
	1400	334.1	220	25
22.08.79	1150	335.1	230	65
	1200	335.4	230	75
	1400	335.6	220	45
27.08.79	1450	335.7	215	42
	1500	335.6	215	35
	1554	335.6	215	35
05.09.79	0955	336.0	260	82
	1000	336.4	260	82
12.09.79	1050	335.7	240	55
	1100	335.3	240	35
	1155	335.2	250	45
	1352	335.0	258	35
18.09.79	1000	335.3	260	25
	1100	334.6	260	35
	1200	334.6	260	35
28.09.79	1100	339.5	100	20
	1353	338.0	100	20
	1400	339.0	100	20
09.10.79	0945	334.3	260	35
	0958	334.8	260	35
	1600	333.4	235	19
10.10.79	1200	335.4	250	45
	1300	334.4	260	45
	1500	333.7	260	45

CAPE GRIM FLASK CO2 AND WIND DATA

DATE	TIME (EST)	CO2 CONCENTRATION (PPMV)	WIND DIRECTION (DEGREES)	WIND SPEED (KM/HR)
22.10.79	1400	337.3	085	60
	1540	336.8	080	60
	1559	336.3	080	55
25.10.79	1000	334.3	210	30
	1100	334.7	220	15
	1300	333.6	235	15
29.10.79	1049	333.7	215	30
	1100	333.7	218	30
	1300	333.5	215	25
06.11.79	1325	334.0	235	18
	1339	333.8	240	18
16.11.79	0955	334.7	210	40
	1055	334.1	210	40
	1155	333.6	210	40
21.11.79	0850	334.5	240	50
	0900	334.0	240	50
	0950	333.5	250	50
26.11.79	1100	334.5	255	18
	1245	335.8	255	20
	1300	336.2	260	20
03.12.79	1252	334.2	255	20
	1300	335.0	255	20
	1355	333.6	255	25
10.12.79	1253	334.4	270	45
	1300	334.2	270	55
	1345	334.0	270	55
11.12.79	0851	334.7	235	50
	0900	334.8	235	50
	0955	333.7	235	50
17.12.79	0900	336.2	265	45
	1000	335.5	250	45
	1055	335.9	255	45
04.01.80	1040	334.4	213	45
	1058	334.4	210	45
08.01.80	1117	335.4	075	35
	1158	334.3	075	35
30.01.80	1255	335.9	290	25
05.02.80	0900	335.3	260	30
	0955	336.0	260	30
	1000	336.2	260	30
22.02.80	1434	334.8	210	42
	1459	334.8	205	45
	1524	334.8	200	40
28.02.80	1400	337.7	220	10
	1445	337.6	225	15
	1500	337.3	225	18
07.03.80	1451	339.0	230	15
	1456	338.6	235	12
24.03.80	1357	335.5	260	20
	1454	335.2	260	25
	1500	335.1	260	30
16.04.80	0929	335.0@	208	20
	0959	335.2@	208	20
	1029	335.1@	208	20
18.07.80	1450	335.8	205	60
	1455	335.3	205	60
	1500	336.1	205	60
25.07.80	1159	335.5	065	35
	1259	334.7	065	37

@-AIRCRAFT PUMP UNIT USED.

CAPE GRIM FLASK CO2 AND WIND DATA

DATE	TIME (FST)	CO2 CONCENTRATION (PPMV)	WIND DIRECTION (DEGREES)	WIND SPEED (KM/HR)
29.07.80	1046	335.9	250	40
	1050	336.2	250	40
	1056	335.9	250	40
12.08.80	1352	336.9	250	90
	1400	336.9	250	90
	1445	336.7	250	90
13.08.80	0951	336.3	250	40
	1000	336.8	250	40
21.08.80	1400	336.6	245	25
	1550	336.4	250	25
	1559	336.2	250	25
25.08.80	0955	335.8	225	35
	1000	335.9	245	35
	1100	336.7	240	40
02.09.80	1652	335.9	255	85
	1700	336.2	255	85
	1800	336.2	255	75
09.09.80	1053	335.7	255	85
	1100	336.0	255	85
	1200	335.7	258	100
15.09.80	1200	335.8	250	70
	1556	336.2	250	70
	1600	336.3	250	70
22.09.80	0953	336.6	250	65
	1000	336.6	250	65
	1500	336.6	250	65
06.10.80	0948	337.6	220	25
	1000	337.7	220	30
	1638	337.8	235	30
15.10.80	1100	336.2	250	45
	1300	336.4	255	45
	1644	335.9	245	55
21.10.80	1054	335.0	260	25
	1100	335.6	270	25
	1159	335.8	260	30
27.10.80	1300	336.1	278	35
	1449	335.6	255	45
	1500	336.2	255	45
07.11.80	1246	335.9	215	35
	1300	335.1	215	35
	1400	335.7	218	32
14.11.80	0856	335.6	215	40
	0900	335.8	215	40
	1200	335.5	215	40
18.11.80	1455	336.9	255	25
	1500	336.8	270	25
	1556	336.6	260	35
03.12.80	1153	336.8	260	68
	1200	336.8	260	80
	1300	337.0	260	80
12.12.80	0756	335.9	235	40
	0800	336.0	225	40
	0859	335.5	252	32
16.12.80	1200	335.2	210	20
	1255	335.6	215	25
	1300	335.5	215	23
29.12.80	0859	335.7	220	65
	1052	336.0	215	45
	1059	335.8	215	45

CAPE GRIM FLASK CO2 AND WIND DATA

DATE	TIME (EST)	CO2 CONCENTRATION (PPMV)	WIND DIRECTION (DEGREES)	WIND SPEED (KM/HR)
06.01.81	1016	338.6	220	20
	1025	338.7	220	20
	1120	337.8	225	35
15.01.81	1305	338.6	210	12
	1314	338.5	220	32
	1416	338.5	215	30
21.01.81	1227	336.8	255	70
	1240	337.0	260	75
	1245	336.7	265	68
29.01.81	1057	337.4	220	25
	1102	337.4	220	25
	1201	337.0	225	25
04.02.81	1255	338.2	220	47
05.02.81	1451	337.3	220	35
	1500	337.3	220	40
09.02.81	1251	336.3	260	55
	1300	336.2	260	64
	1400	336.7	260	58
19.02.81	1256	336.1	220	25
	1300	335.9	220	25
	1352	335.8	225	25
25.02.81	1527	336.9	220	-
05.03.81	1250	336.8	220	45
	1257	336.8	220	35
	1336	336.6	220	25
10.03.81	0955	336.6	230	60
	1000	336.1	230	60
	1500	336.1	240	55
20.03.81	1350	336.5	230	50
06.04.81	1158	336.9	215	23
	1259	336.7	215	33
	1359	336.5	210	23
14.04.81	1351	336.6	250	24
	1359	336.3	250	25
	1456	336.4	240	23
24.04.81	1000	336.2	255	-
	1052	336.0	255	-
	1100	336.2	255	-
30.04.81	1123	336.8	310	8
	1131	336.8	310	8
	1224	336.3	280	5
	1229	336.7	280	5
	1316	336.7	310	3
	1320	337.1	315	3
06.05.81	1255	336.6	210	25
	1400	336.4	210	25
11.05.81	1450	336.4	250	65
	1453	336.0	250	65
	1457	336.6	250	65
20.05.81	1144	336.9	220	23
	1150	336.8	230	23
04.06.81	1020	344.1	100	30
	1026	343.6	100	28
05.06.81	1438	333.8	095	20
	1515	333.6	105	20
	1524	333.8	105	20
12.06.81	1423	336.4	270	25
	1427	336.3	270	25
	1433	336.4	265	22
18.06.81	1445	337.0	320	40
	1449	337.2	335	38
	1519	337.2	330	25

CAPE GRIM FLASK CO2 AND WIND DATA

DATE	TIME (EST)	CO2 CONCENTRATION (PPMV)	WIND DIRECTION (DEGREES)	WIND SPEED (KM/HR)
26.06.81	1424	337.6	340	35
	1428	337.3	350	35
	1513	338.4	350	33
06.07.81	1450	336.9	255	68
	1454	337.2	260	35
10.07.81	1425	335.7	078	32
	1436	337.2	080	25
	1512	336.6	085	22
20.07.81	0950	339.0	060	23
	0953	338.4	060	23
	1127	338.6	075	23
23.07.81	1342	337.6	342	35
	1345	338.4	340	42
	1456	337.2	345	46
27.07.81	1335	336.8	255	25
	1517	336.6	255	24
06.08.81	1145	336.8	250	40
	1335	336.9	230	25
	1542	336.7	240	35
20.08.81	1052	337.1+	315	35
	1059	336.8+	315	38
	1129	337.4+	320	35
	1148	338.9	320	36
	1154	337.6	325	32
	1159	338.6	325	35
02.09.81	1339	337.0+	243	43
	1344	337.0+	240	45
	1448	336.1+	245	36
	1512	337.5	250	24
	1520	338.1	250	28
	1525	338.1	245	26
15.09.81	1733	342.5	272	33
	1811	341.7	271	25
	1839	340.1	272	25
28.09.81	1346	337.2	260	35
	1356	337.5	265	35
	1459	337.7	260	30
14.10.81	0709	336.4	285	50
	0813	337.6	275	52
	0851	338.2	275	52
	0905	338.1	290	45
	0922	337.6	290	45
	1000	338.2	285	42
	1036	338.0	285	42
22.10.81	1058	337.2	219	45
	1159	337.2	220	45
28.10.81	1754	337.7	250	34
29.10.81	0026	338.6	280	12
	1124	336.5	270	36
	1523	337.2	250	24
	2130	337.6	260	18
10.11.81	1615	337.2	243	65
11.11.81	0855	337.4	246	60
	0900	337.8	267	51
18.11.81	1350	335.8	228	24
	1357	335.2	228	25
	1359	335.7	228	25
19.11.81	0850	335.4	207	10
	0858	335.3	207	10
	1347	336.0	214	15
20.11.81	1239	338.9	257	13
	1259	339.1	258	13

+-DRYING TUBE ON PUMP INLET.

APPENDIX 5

CO_2 data set from CSIRO monitoring program at Mawson.

Tabulation of all CO_2 concentrations and auxilliary data from flask samples collected at Mawson for the years 1977 through 1982.

Analysis for CO_2 was performed on NDIR gas analysers at CSIRO and concentrations are expressed in parts per million by volumes (ppmv) with respect to the WMO 1981 CO_2 Calibration Scale. When necessary, a carrier-gas correction has been applied to all values based on comparisons of instrument response to WMO Central CO_2 Laboratory CO_2/N_2 and CO_2/Air Secondary Standards as described in Pearman et al. (1983).

Except where otherwise stated, samples are chemically dried, either during collection or prior to analysis, using granular magnesium perchlorate (Dehydrite) as the drying agent.

Times of sampling in the tabulation are in Greenwich Mean Time (Z) and the sampling locations can be determined by referring to Figure 2.7.

CO2 MONITORING DATA - MAWSON

SAMPLING DATE	TIME (Z)	SAMPLING LOCATION	CO2 CONCENTRATION (PPMV)	WIND DIRECTION (DEGREES)	SPEED (KM/HR)	COMMENTS
28.12.77	1005	COSRAY	332.8	045	15	FLASK PRESS.
			332.7	045	15	21 KPA
19.01.78	1112	"	332.4	090	48	
			332.5	090	48	
18.02.78	0330	NEAR SCI.	332.5	157	26	
		BLDG.	332.4	157	26	
17.03.78	1330	W.END OF	332.1	080	18	SAMPLES NOT
		SCI.BLDG.	331.9	080	18	DRIED."DRIED"
						VALUES COMPUTED.
24.04.78	1430	"	332.7	130	83	"
24.05.78	0755	"	333.1	130	51	
			332.5	130	51	
28.06.78	0835	"	333.0	110	83	
21.07.78	1651	"	333.5	145	40	
			333.5	145	40	
15.08.78	1143	"	334.6	150	55	ONLY 28 KPA
						PRESS.
19.09.78	0122	"	334.6	150	33	
26.10.78	0325	"	334.6	110	33	
26.11.78	0550	"	334.6	110	73	
09.01.79	1626	E.END OF	335.6	110	66	
		SCI.BLDG.	334.2	110	66	
20.02.79	1000	50M.N.OF	334.0	120	28	
		SCI.BLDG.	334.1	120	28	
21.03.79	0515	50MSE. OF	333.0	110	37	
		AER.BLDG.	332.9	110	37	
23.04.79	0705	"	334.2	120	37	
18.05.79	0745	"	334.2	120	46	
18.06.79	0705	"	334.0	120	33	
			334.1	120	33	
18.07.79	1150	"	334.6	120	18	
			334.6	120	18	
18.08.79	0925	"	335.1	120	37	
			335.0	120	37	
21.09.79	0820	"	335.8	120	55	
			335.7	120	55	
16.10.79	0900	"	335.9	120	37	
			335.9	120	37	
19.11.79	1000	"	336.3	085	55	
18.12.79	0730	"	335.7	090	46	
			335.8	090	46	
17.12.79	-	SW. CNR.OF	335.1	135	18	
		SCI.BLDG.				
04.01.80	-	"	335.6	135	18	
			335.1	135	18	
04.02.80	-	"	335.1	135	33	
22.03.80	-	SE.CNR.OF	334.7	120	28	
		SCI.BLDG.	335.0	120	28	
30.04.80	0332	"	334.3	160	37	
	0350		334.8	160	37	
05.06.80	0557	"	335.5	130	37	
	0607		335.3	130	37	
08.08.80	0455	"	335.9	115	33	
08.09.80	0355	"	336.3	090	28	
	0410		336.0	090	28	
05.11.80	0615	"	337.5	130	55	
	0622		336.7	130	55	
24.11.80	0545	"	337.0	120	73	
	0550		336.9	120	73	
12.12.80	1110	"	336.6	130	59	
	1115		337.0	130	59	

CO2 MONITORING DATA - MAWSON

SAMPLING DATE	TIME (Z)	SAMPLING LOCATION	CO2 CONCENTRATION (PPMV)	WIND DIRECTION (DEGREES)	WIND SPEED (KM/HR)	COMMENTS
13.01.81	1050	SE.CNR.OF	337.5	120	92	
	1100	SCI.BLDG.	337.2	120	92	
04.03.81	0515	"	336.5	120	55	
	0526		336.2	120	55	
18.05.81	0512	"	335.5	120	53	
EARLY.07.81	0511	"	335.9	165	55	
	0517		336.8	165	55	
16.09.81	0545	"	337.3	135	46	
	0551		337.5	135	46	
19.10.81	0448	"	337.7	157	44	
	0455		337.7	157	44	
16.11.81	0411	"	338.2	120	40	
	0417		338.1	120	40	
21.12.81	0115	SE.CNR.OF	338.8	130	48	
	0122	IPSO BLDG.	338.8	130	48	
03.01.82	0335	"	338.5	120	46	
	0442		338.5	120	46	
18.01.82	0532	"	338.1	120	35	
	0538		338.2	120	35	
30.01.82	0540	"	338.4	120	37	
	0545		338.2	120	37	
17.02.82	0828	"	338.2	135	55	
	0834		338.5	135	55	
06.03.82	0307	"	338.4	135	46	
20.03.82	0822	"	339.6	158	33	
	0834		339.5	158	33	
01.04.82	0835	"	339.7	135	37	
	0841		340.3	135	37	
22.04.82	1409	"	339.4	135	73	
	1414		339.6	135	73	
03.05.82	0950	"	339.4	135	55	
02.06.82	1142	"	339.5	125	64	
	1149		340.4	125	64	
29.06.82	1005	"	339.8	140	59	
	1025		340.1	140	59	
22.07.82	1505	"	339.9	135	59	
18.08.82	1632	"	340.2	135	55	
	1637		340.6	135	55	
21.09.82	0818	"	339.4	115	61	
	0823		339.7	115	61	
17.10.82	1223	"	339.5	120	51	
	1228		339.5	120	51	
22.11.82	0530	"	340.7	110	46	
	0535		341.1	110	46	
08.12.82	0420	"	341.0	130	37	
	0425		340.7	130	37	
19.12.82	1150	"	340.2	120	37	
	1155		340.2	120	37	
31.12.82	0509	"	339.3	130	73	
	0514		339.4	130	73	

APPENDIX 6

Complete CO_2 data set from CSIRO monitoring program at Macquarie Island.

Tabulation of all hourly mean CO_2 concentrations obtained using an in situ NDIR CO_2 analysis system at Macquarie Island for the years 1979 through 1982.

Concentrations are expressed in parts per million by volume (ppmv) with respect to the WMO 1981 CO_2 Calibration Scale. A carrier-gas correction has been applied to all values based on comparison of instrument response to WMO Central CO_2 Laboratory CO_2/N_2 and CO_2/Air Secondary Standards as described in Pearman et al. (1983).

Wind speed and direction data are obtained from Australian Bureau of Meteorology surface observation at 3-hourly intervals. Values for intermediate hours (in brackets) are determined by interpolation.

Times of sampling refer to Australian Eastern Standard Time (AEST) (AEST = Z + 10 hours).

MACQUARIE ISLAND CO_2 AND SURFACE WIND DATA

YEAR:- 1979

DATE	17 APRIL			18 APRIL			26 APRIL			15 MAY			16 JUNE		
TIME AEST	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)
01				333.6	(350)	(52)									
02				333.5	350	51									
03				333.4	(350)	(51)									
04				333.4	(340)	(51)									
05				333.4	340	51									
06				333.3	(340)	(51)									
07				333.4	(350)	(50)									
08				333.5	350	50					310	51			
09				333.6	(350)	(50)					(310)	(51)			
10				333.4	(350)	(50)					(310)	(51)			
11		340	40	333.5	(340)	(50)		330	55	334.5	(310)	(51)	335.0	320	46
12	333.9	(330)	(40)		(340)	(51)	334.0	(330)	(55)	334.4	(300)	(51)	334.6	(320)	(46)
13	333.9	(330)	(40)		(340)	(51)	334.1	(330)	(55)	334.8	(300)	(51)	334.6	(320)	(46)
14	333.8	320	40		340	51	333.6	(330)	(55)	334.4	300	51	334.6	(320)	(46)
15	333.9	(330)	(42)				333.7	(330)	(55)	334.4	(290)	(46)	334.5	(320)	(46)
16	333.9	(340)	(44)				333.8	(330)	(55)	334.1	(270)	(42)	334.5	(320)	(45)
17	333.9	350	46				333.7	(330)	(55)	334.2	260	37	334.7	(320)	(45)
18	333.9	(350)	(46)				333.7	(330)	(55)	334.2	(250)	(35)	334.5	(310)	(45)
19	333.8	(350)	(46)					(330)	(55)	334.3	(240)	(33)	334.5	(310)	(44)
20	333.8	350	46					330	55	334.3	(230)	(32)	334.8	(310)	(44)
21	333.7	(350)	(48)								(220)	(30)	335.0	(310)	(44)
22	333.6	(350)	(51)								(210)	(28)	335.0	(310)	(44)
23	333.6	350	53								200	26	335.0	310	44
24	333.6	(350)	(52)										335.1	(310)	(43)

DATE	17 JUNE			20 JULY			21 JULY			17 AUGUST			31 OCTOBER		
TIME AEST	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)
01	335.4	(310)	(42)				335.0	(220)	(38)						
02	335.4	(310)	(40)				335.2	(220)	(38)						
03	335.5	(310)	(39)				335.3	(210)	(38)						
04	335.3	(310)	(38)				334.8	(200)	(37)						
05	335.2	(310)	(37)				334.3	(200)	(37)						
06	335.3	(310)	(35)				334.9	(200)	(36)						
07	335.3	(310)	(34)				335.0	(190)	(36)						
08	335.3	310	33		300	46	335.0	(180)	(36)						
09	335.5	(310)	(35)		(300)	(46)	335.0	(180)	(35)						
10	335.5	(310)	(38)		(290)	(45)	335.0	(180)	(34)						
11	336.2	310	40		(280)	(44)		(170)	(34)					320	55
12				335.4	(280)	(44)		(160)	(34)	336.1				(320)	(52)
13				335.0	(280)	(44)		(160)	(33)	335.4			335.9	(320)	(49)
14				335.1	(270)	(43)		160	33	335.8			336.1	320	46
15				335.2	(260)	(43)				335.4			336.0	(320)	(45)
16				335.2	(260)	(42)				335.9			-	(310)	(45)
17				335.1	(260)	(42)				336.1			336.0	310	44
18				335.2	(250)	(42)				336.4			338.5		
19				335.1	(250)	(41)				336.0			339.8		
20				335.2	(240)	(40)				335.7					
21				335.0	(240)	(40)									
22				335.1	(240)	(40)									
23				335.0	(230)	(39)									
24				334.9	(220)	(39)									

MACQUARIE ISLAND CO_2 AND SURFACE WIND DATA

YEAR: - 1979

DATE	2 NOVEMBER			9 NOVEMBER			4 DECEMBER			5 DECEMBER		
TIME AEST	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)
01										341.2	(350)	(7)
02										341.8	360	7
03										339.4	(030)	(12)
04										337.6	(060)	(17)
05										337.4	090	22
06										337.3	(080)	(30)
07										337.5	(070)	(38)
08					260	31				336.4	070	46
09					(270)	(31)				336.2	(090)	(50)
10				336.0	(280)	(31)				336.1	(110)	(55)
11	336.7	270	40	336.4	290	31	335.3	270	42		130	59
12	336.5	(280)	(38)	336.5	(290)	(30)	335.4	(270)	(41)			
13	336.6	(280)	(35)	336.3	(290)	(29)	335.4	(270)	(41)			
14	337.2	290	33	335.8	290	28	335.3	270	40			
15	338.0	(290)	(33)	336.4	(290)	(32)	335.5	(270)	(36)			
16	-	(290)	(32)	336.3	(290)	(36)	335.8	(270)	(33)			
17	337.0	(280)	(32)	336.7	290	40	336.1	270	29			
18	337.4	(280)	(31)	336.7	(290)	(40)	336.5	(280)	(25)			
19	337.6	(280)	(31)	336.3	(290)	(41)	336.8	(280)	(22)			
20		(280)	(30)	336.2	(300)	(42)	337.1	290	18			
21		(270)	(30)		(300)	(42)	337.7	(310)	(14)			
22		(270)	(29)		(300)	(43)	337.5	(320)	(10)			
23		270	29		300	44	337.3	340	6			
24							339.7	(350)	(6)			

MACQUARIE ISLAND CO_2 AND SURFACE WIND DATA

YEAR:- 1980

DATE	4 JANUARY			5 JANUARY			30 JANUARY			19 FEBRUARY			20 FEBRUARY		
TIME AEST	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)
01				338.0	(260)	(18)							335.7	290	37
02				337.8	270	24							335.6	(290)	(36)
03				337.3	(270)	(29)							335.7	(290)	(34)
04				337.2	(270)	(35)							335.9	290	33
05				336.6	270	40							335.7	(290)	(29)
06				336.9	(270)	(34)							335.9	(280)	(26)
07				336.1	(270)	(28)							336.1	280	22
08				335.8	270	22							335.4	(270)	(18)
09				335.4	(280)	(22)							335.2	(250)	(15)
10				335.6	(280)	(24)					310	37	334.7	240	11
11		340	33	335.3	290	24	335.4	340	39		(320)	(38)	335.2	(220)	(17)
12	335.2	(340)	(34)	335.2	(300)	(26)	335.4	(340)	(39)	335.3	(330)	(38)		(210)	(23)
13	335.1	(340)	(36)	335.2	(310)	(28)	335.4	(340)	(40)	335.4	340	39		190	29
14	335.0	340	37	335.2	320	29	334.9	340	40	335.3	(330)	(41)			
15	334.7	(340)	(39)	334.9	(330)	(30)	335.2	(330)	(40)	335.5	(330)	(42)			
16	335.0	(340)	(42)	335.2	(330)	(32)	335.4	(330)	(39)	335.0	320	44			
17	335.0	340	44	335.1	340	33	335.3	320	39	335.5	(310)	(42)			
18	335.2	(340)	(42)				335.6	(320)	(37)	335.5	(300)	(39)			
19	335.2	(340)	(39)				335.5	(320)	(35)	335.6	290	37			
20	335.5	340	37				335.7	320	33	335.6	(290)	(38)			
21	335.4	(310)	(27)				335.6	(320)	(34)	335.7	(290)	(39)			
22	336.2	(280)	(17)					(320)	(36)	335.7	290	40			
23	337.6	250	7					320	37	335.7	(290)	(39)			
24	338.8	(260)	(13)							335.8	(290)	(38)			

DATE	25 FEBRUARY			17 MARCH			18 MARCH			3 APRIL			20 APRIL		
TIME AEST	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)
01							335.6	(360)	(33)						
02							335.6	(360)	(36)						
03							335.4	360	40						
04							335.5	(330)	(41)						
05							336.9	(300)	(43)						
06							337.0	270	44						
07							336.6	(290)	(40)						
08		160	28				335.3	(300)	(37)						
09		(160)	(30)				335.2	320	33						
10	335.1	(160)	(33)				335.5	(320)	(33)						
11	335.3	160	35				335.4	(320)	(33)						
12	335.5	(160)	(36)				335.2	320	33		270	33			
13	335.2	(160)	(38)				335.2	(330)	(38)		(270)	(30)			
14	335.7	160	39				335.3	(330)	(43)	335.2	(270)	(27)			
15	335.4	(160)	(36)		270	33	335.1	340	48	335.0	270	24	336.0	290	51
16	335.8	(160)	(32)		(280)	(31)	335.4	(340)	(49)	335.4	(270)	(28)	336.5	(280)	(51)
17	335.5	160	29		(290)	(29)	335.5	(340)	(50)	336.1	(270)	(33)	336.6	(280)	(51)
18				338.0	(300)	(28)	335.6	340	51	336.4	270	37	336.7	270	51
19				337.2	(300)	(26)	335.5	(330)	(51)	336.3	(250)	(28)	336.8	(270)	(52)
20				336.6	(310)	(24)	335.6	(330)	(51)	336.3	(220)	(20)	336.7	(270)	(54)
21				335.9	320	22		320	51	336.6	200	11	336.8	270	55
22				335.7	(330)	(24)							336.8	(270)	(53)
23				335.7	(350)	(27)							336.6	(270)	(52)
24				335.7	360	29							336.6	270	50

MACQUARIE ISLAND CO_2 AND SURFACE WIND DATA

YEAR:- 1980

DATE	21 APRIL			9 MAY			10 JUNE			11 JUNE			12 JUNE		
TIME AEST	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)
01	336.6	(270)	(50)							338.7	(280)	(25)	336.8	(260)	(36)
02	336.7	(270)	(50)							337.4	(280)	(36)	337.0	(260)	(44)
03	336.7	270	50								270	46	337.0	270	51
04	336.9	(280)	(44)												
05	337.1	(280)	(37)												
06	337.6	290	31												
07	337.0	(300)	(32)												
08	336.6	(310)	(32)												
09	336.2	320	33												
10	336.2	(320)	(35)												
11	336.2	(320)	(38)												
12	336.1	320	40	337.2	320	28		250	22	336.4	270	44			
13	336.1	(310)	(38)	336.7	(320)	(27)	336.3	(260)	(22)	336.4	(280)	(39)			
14	336.0	(300)	(35)	336.7	(320)	(25)	336.5	(260)	(22)	337.1	(280)	(34)			
15	336.1	290	33	336.5	320	24	337.2	270	22	337.3	290	28			
16	336.3	(290)	(32)	336.8	(330)	(25)	337.4	(270)	(22)	336.8	(280)	(34)			
17	336.7	(290)	(30)	337.1	(330)	(25)	337.4	(270)	(22)	336.9	(280)	(40)			
18	336.5	290	29	-	340	26	337.4	270	22	337.1	270	46			
19				-			337.2	(270)	(22)	337.1	(270)	(45)			
20				-			337.2	(270)	(22)	337.1	(270)	(45)			
21				-	320	51	337.5	270	22	337.1	270	44			
22				336.3	(320)	(47)	337.6	(280)	(20)	337.2	(260)	(39)			
23					(310)	(44)	337.5	(280)	(17)	337.1	(260)	(34)			
24					310	40	338.2	290	15	337.0	250	29			

DATE	25 JUNE			13 JULY			14 JULY			2 AUGUST			18 AUGUST		
TIME AEST	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)
01							337.2	(180)	(52)						
02								(180)	(49)						
03								180	46						
04															
05															
06								180	39						
07															
08															
09							337.1	180	33					310	61
10							336.9	(180)	(37)					(310)	(62)
11							336.8	(180)	(40)				337.1	(320)	(63)
12				337.5	270	50	336.7	180	44				337.0	320	64
13				337.6	(260)	(42)	336.8	(180)	(40)				336.7	(320)	(67)
14				337.4	(260)	(34)	336.7	(180)	(37)	336.7			336.7	(320)	(70)
15	338.0	270	44	337.6	250	26	336.8	180	33	336.7	320	33	336.7	320	73
16	337.7	(270)	(44)	337.7	(250)	(26)	336.8	(180)	(34)	336.8	(330)	(36)	336.6	(300)	(60)
17	337.6	(270)	(44)	337.6	(250)	(26)	336.9	(180)	(36)	336.9	(330)	(39)	336.5	(290)	(46)
18	337.5	270	44	337.3	250	26	336.9	180	37	336.9	340	42	336.7	270	33
19	337.4	(280)	(44)	337.4	(230)	(31)	337.0	(180)	(34)	336.9	(340)	(43)	337.6	(270)	(33)
20	337.4	(280)	(44)	337.3	(200)	(35)	337.0	(180)	(31)	337.0	(340)	(45)	337.9	(270)	(33)
21	337.3	290	44	337.3	180	40		180	28	336.9	340	46	337.8	270	33
22	337.2	(290)	(43)	337.1	(180)	(45)				337.0			337.9	(270)	(39)
23		(280)	(41)	337.2	(180)	(50)							337.9	(270)	(45)
24		280	40	337.1	180	55							338.1	270	51

MACQUARIE ISLAND CO_2 AND SURFACE WIND DATA

YEAR:- 1980

DATE	19 AUGUST			29 AUGUST			30 AUGUST			21 SEPTEMBER			22 SEPTEMBER		
TIME AEST	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)
01	338.0	(270)	(57)				338.2	(330)	(32)				338.5	(310)	(37)
02	337.8	(270)	(65)				338.1	(330)	(35)				338.4	(310)	(37)
03	337.7	270	72				338.1	340	39				338.2	320	37
04	337.6	(270)	(65)				338.2	(340)	(37)				337.6	(320)	(37)
05	337.6	(270)	(57)				338.1	(340)	(35)				337.6	(320)	(37)
06	337.6	270	50				338.1	340	33				337.9	320	37
07	337.6	(270)	(54)				337.8	(310)	(29)				338.1	(300)	(34)
08	337.5	(270)	(58)				338.0	(280)	(26)				337.9	(280)	(32)
09	337.3	270	62				337.9	250	22				337.5	260	29
10	337.1	(260)	(52)				337.5	(250)	(23)				336.9	(260)	(35)
11	337.1	(250)	(43)				337.4	(250)	(25)				–	(270)	(40)
12		240	33	339.3	290	31		250	26	337.7	330	33	–	270	46
13				338.0	(310)	(29)				338.1	(340)	(37)	–	(280)	(44)
14				338.0	(320)	(26)				–	(350)	(42)	337.7	(280)	(42)
15				337.9	340	24				–	360	46	338.2	290	40
16				337.8	(340)	(31)				–	(360)	(49)	338.2	(290)	(43)
17				338.1	(340)	(37)				–	(360)	(52)	338.4	(290)	(47)
18				338.3	340	44				–	360	55	338.1	290	50
19				337.9	(340)	(48)				–	(340)	(50)	338.2	(280)	(49)
20				337.8	(340)	(53)				338.3	(320)	(44)	338.1	(280)	(49)
21				337.9	340	57				337.8	300	39	338.1	270	48
22				337.9	(330)	(47)				338.3	(300)	(38)	338.5	(270)	(49)
23				337.9	(330)	(38)				338.2	(300)	(38)	338.5	(270)	(50)
24				338.0	320	28				337.8	300	37	338.1	270	51

DATE	23 SEPTEMBER			30 SEPTEMBER			1 OCTOBER			15 OCTOBER			11 NOVEMBER		
TIME AEST	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr
01	338.6	(270)	(50)				338.1	(280)	(38)						
02	338.1	(270)	(49)				338.2	(280)	(38)				338.6	270	28
03	338.1	270	48				338.8	290	37				338.9	(270)	(28)
04	337.9	(270)	(50)				338.7	(300)	(34)				338.9	(270)	(29)
05	338.1	(270)	(53)				338.9	(310)	(31)				339.0	270	29
06	338.2	270	55				339.3	320	28				339.1	(270)	(28)
07	337.7	(270)	(54)				339.6	(330)	(28)				338.3	(270)	(26)
08	337.7	(270)	(52)				338.3	(330)	(29)				337.4	270	(24)
09	337.7	270	51				338.5	340	29				337.6	(270)	(23)
10	337.7	(270)	(52)				338.0	(340)	(27)				337.8	(270)	(21)
11	337.8	(270)	(54)				337.9	(350)	(24)				337.5	270	20
12	337.1	270	55		270	55	338.5	350	22				337.4	(280)	(23)
13	337.7	(270)	(50)	337.6	(270)	(55)							338.3	(280)	(26)
14		(270)	(45)	337.6	(270)	(55)							338.2	290	29
15		270	40	337.9	270	55				339.3	340	44	338.2	(290)	(28)
16				338.0	(270)	(53)				338.1	(340)	(43)	338.2	(290)	(27)
17				337.9	(270)	(52)				338.4	(340)	(41)	338.0	290	26
18				338.1	270	50				338.6	340	40	338.8	(300)	(24)
19				338.3	(270)	(46)				338.6	(340)	(39)	338.7	(310)	(22)
20				338.2	(270)	(43)				338.4	(340)	(38)	340.0	320	20
21				338.1	270	39				338.7	340	37	339.8	(330)	(20)
22				338.3	(270)	(39)				339.0	(340)	(36)	339.2	(330)	(20)
23				338.2	(270)	(39)				338.5	(330)	(34)	340.0	340	20
24				338.2	270	39					330	33	339.4	(350)	(22)

MACQUARIE ISLAND CO_2 AND SURFACE WIND DATA

YEAR:- 1980

DATE	12 NOVEMBER			20 NOVEMBER			21 NOVEMBER			22 NOVEMBER			2 DECEMBER		
TIME AEST	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)
01	339.2	(350)	(24)				337.9	(290)	(50)	340.3	(270)	(30)			
02	338.4	360	26				338.0	290	44	341.1	270	28			
03	338.3	(360)	(23)				338.4	(300)	(43)	340.9	(250)	(21)			
04	338.3	(360)	(21)				337.9	(310)	(41)	340.5	(240)	(15)			
05	338.4	360	18				338.0	320	40	340.9	220	8			
06	338.2	(350)	(18)				338.2	(320)	(40)	339.7	(230)	(11)			
07	339.2	(350)	(18)				338.0	(320)	(39)	339.0	(230)	(15)			
08	339.0	340	18				337.9	320	39	338.0	240	18			
09	339.5	(330)	(22)				338.0	(320)	(39)						
10	340.1	(320)	(26)				337.9	(320)	(40)						
11		(320)	(30)	337.4	320	50	337.9	320	40						
12		(310)	(34)	337.6	(330)	(54)	337.9	(310)	(40)						
13		(300)	(39)	337.6	(330)	(58)	337.9	(300)	(40)						
14		(290)	(43)	337.6	340	62	338.1	290	40					280	33
15		(290)	(47)	337.8	(320)	(66)	338.4	(290)	(38)					(280)	(33)
16		(280)	(51)	337.6	(310)	(69)	338.3	(280)	(37)					(280)	(33)
17		270	55	337.9	290	73	338.7	280	35					(280)	(33)
18				337.7	(290)	(67)	339.1	(280)	(34)				338.0	(270)	(33)
19				337.7	(290)	(61)	339.6	(280)	(32)				338.7	(270)	(33)
20				337.9	290	55	340.2	280	31				339.0	270	33
21				338.2	(290)	(57)	340.1	(280)	(32)				337.9	(270)	(34)
22				338.4	(290)	(59)	340.2	(280)	(32)				338.2	(270)	(34)
23				337.9	290	61	340.7	280	33				338.0	270	35
24				338.0	(290)	(55)	340.1	(280)	(31)				338.5	(280)	(34)

DATE	3 DECEMBER			19 DECEMBER			20 DECEMBER			25 DECEMBER			26 DECEMBER		
TIME AEST	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr
01	338.8	(280)	(34)				337.5	(110)	(40)				337.8	(330)	(29)
02	338.8	290	33				337.4	110	40				337.9	320	29
03	338.8	(300)	(32)				337.4	(120)	(38)				337.6	(320)	(29)
04	338.7	(310)	(30)				337.7	(130)	(35)				338.1	(320)	(29)
05	338.8	320	29				337.5	140	33				337.5	320	29
06	338.4	(330)	(32)				337.4	(130)	(33)				336.8	(300)	(32)
07	338.5	(330)	(34)				338.0	(120)	(33)				336.2	(290)	(34)
08	338.3	340	37				337.9	110	33		320	31	336.1	270	37
09	338.6	(340)	(37)				337.3	(110)	(32)		(330)	(30)	336.1	(270)	(36)
10	338.0	(340)	(37)				337.3	(110)	(32)	336.9	(330)	(30)	335.5	(270)	(34)
11	337.7	340	37	337.7	140	40	337.1	110	31	337.4	340	29	336.4	270	33
12	337.6	(350)	(37)	337.5	(140)	(39)	337.1	(110)	(24)	337.2	(340)	(29)	336.7	(280)	(34)
13	337.6	(350)	(37)	337.3	(140)	(38)	337.1	(110)	(18)	337.4	(340)	(29)	336.9	(280)	(36)
14	337.5	360	37	337.4	140	37	337.2	110	11	337.2	340	29	337.1	290	37
15	337.6	(360)	(37)	337.1	(140)	(38)	337.1	(110)	(10)	337.6	(340)	(30)	337.0	(290)	(39)
16	338.5	(360)	(37)	337.4	(140)	(39)	337.2	(110)	(10)	337.7	(340)	(32)	337.1	(300)	(42)
17	338.3	360	37	337.2	140	40		110	9	338.0	340	33		300	44
18				337.1	(140)	(41)				338.1	(340)	(34)			
19				337.3	(140)	(41)				338.4	(340)	(36)			
20				337.4	140	42				338.4	340	37			
21				337.5	(130)	(41)				338.4	(340)	(34)			
22				337.4	(120)	(41)				338.3	(340)	(32)			
23				337.5	110	40				338.1	340	29			
24				337.5	(110)	(40)				338.1	(330)	(29)			

MACQUARIE ISLAND CO_2 AND SURFACE WIND DATA

YEAR:- 1981

DATE	13 JANUARY			14 JANUARY			28 JANUARY			29 JANUARY			14 FEBRUARY		
TIME AEST	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)
01				337.5	(270)	(55)				337.9	(280)	(44)			
02				337.6	270	51				337.8	290	48			
03				337.5	(270)	(52)				337.9	(290)	(47)			
04				337.6	(270)	(52)				337.8	(290)	(45)			
05				337.3	270	53				337.7	290	44			
06				337.0	(270)	(52)				337.4	(290)	(46)			
07				336.7	(270)	(52)				337.3	(290)	(48)			
08				336.4	270	51				337.3	290	50			
09				–	(270)	(52)				337.1	(280)	(46)			
10				336.1	(270)	(53)				336.1	(280)	(43)			
11	337.4	320	37	336.3	270	55	337.1	270	44	335.8	270	39	337.0	340	48
12	337.5	(320)	(41)	336.2	(270)	(53)				335.7	(270)	(41)	337.2	(340)	(53)
13	337.0	(320)	(46)	336.4	(270)	(52)				335.8	(270)	(42)	337.1	(340)	(57)
14	337.3	320	50	336.4	270	51		270	42	335.9	270	44	337.2	340	62
15	337.4	(320)	(52)	336.5	(270)	(50)	336.1	(270)	(45)	336.1	(270)	(40)	336.9	(330)	(55)
16	337.5	(320)	(53)	336.8	(270)	(49)	336.3	(270)	(47)	336.3	(270)	(37)	337.0	(330)	(47)
17	337.4	320	55	336.8	270	48	336.9	270	50	336.4	270	33	336.4	320	40
18	337.2	(320)	(56)	337.3			336.8	(270)	(46)	336.9	(280)	(37)	336.8	(320)	(36)
19	337.1	(320)	(56)				337.3	(270)	(41)		(280)	(42)	337.0	(320)	(32)
20	336.9	320	57				337.4	270	37		290	46	336.8	320	28
21	336.9	(300)	(59)				337.8	(270)	(37)				337.3	(320)	(30)
22	337.5	(290)	(60)				337.7	(270)	(37)				337.2	(320)	(31)
23	337.7	270	62				338.0	270	37				337.1	320	33
24	337.4	(270)	(58)				338.0	(280)	(41)				337.1	(320)	(32)

DATE	15 FEBRUARY			28 FEBRUARY			1 MARCH			13 MARCH			21 MARCH		
TIME AEST	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)
01	337.2	(320)	(32)				337.8	(340)	(44)						
02	337.1	320	31				337.8	(340)	(42)						
03	337.1	(320)	(35)				338.2	340	40						
04	337.2	(320)	(40)				338.1	(320)	(34)						
05	337.1	320	44				338.0	(290)	(28)						
06	336.9	(320)	(48)				337.9	270	22						
07	336.8	(320)	(51)				338.2	(270)	(23)						
08	336.7	320	55				337.7	(270)	(25)						
09	336.5	(320)	(54)				336.9	270	26					320	22
10	336.4	(320)	(52)				337.2	(270)	(30)					(320)	(23)
11	336.3	320	51	339.9	340	33	336.9	(270)	(33)				337.2	(320)	(23)
12	336.3	(310)	(46)	339.8	(340)	(33)	337.3	270	37	336.8	250	22	337.9	320	24
13	336.4	(300)	(42)	339.1	(340)	(33)	337.5	(270)	(43)	337.5	(260)	(24)	337.3	(320)	(25)
14	336.4	290	37	339.0	340	33	337.1	(270)	(49)	337.5	(260)	(27)	337.6	(320)	(27)
15	336.6	(290)	(39)	338.9	(340)	(36)	337.5	270	55	337.8	270	29	337.7	320	28
16	336.6	(300)	(42)	339.4	(340)	(39)	337.3	(270)	(52)	338.1	(270)	(29)	337.9	(320)	(28)
17		300	44	337.8	340	42	337.9	(270)	(49)	339.0	(270)	(28)	338.5	(320)	(28)
18				338.4	(340)	(44)		270	46	338.8	270	28	337.9	320	28
19				338.0	(340)	(46)							337.6	(310)	(29)
20				337.9	340	48							337.7	(300)	(30)
21				338.8	(340)	(48)							337.6	290	31
22				338.3	(340)	(47)							337.6	(280)	(32)
23				338.1	(340)	(46)							338.7	(280)	(35)
24				338.2	340	46							338.8	270	37

MACQUARIE ISLAND CO_2 AND SURFACE WIND DATA

YEAR:- 1981

DATE	22 MARCH			31 MARCH			12 APRIL			18 APRIL			19 APRIL		
TIME AEST	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)
01	339.3	(290)	(32)										337.5	(330)	(36)
02	338.7	(300)	(27)										337.5	(350)	(34)
03	339.6	320	22										337.3	360	33
04	339.2	(320)	(23)										337.2	(350)	(31)
05	338.6	(320)	(23)										337.1	(340)	(28)
06	339.1	320	(24)										337.1	320	26
07	339.0	(330)	(27)										337.8	(320)	(27)
08	338.5	(330)	(30)										337.4	(320)	(28)
09	337.8	340	33		310	59		330	37		240	11	337.3	320	29
10	337.6	(340)	(32)	336.5	(300)	(58)	337.2	(330)	(38)	337.4	(250)	(26)	337.1	(320)	(29)
11	337 2	(340)	(30)	337.0	(300)	(56)	337.3	(340)	(39)	337.5	(260)	(40)		(310)	(29)
12	337.0	340	29	337.0	290	55	337.1	340	40	336.9	270	55		310	29
13	336.8	(340)	(32)	337.0	(280)	(57)	337.2	(340)	(43)	336.9	(270)	(55)			
14	336.5	(340)	(34)	336.5	(280)	(60)	337.1	(340)	(45)	337.1	(270)	(55)			
15	336.7	340	37	337.1	270	62	337.0	340	48	337.1	270	55			
16	336.6	(340)	(37)	338.1	(270)	(58)	337.0	(340)	(49)	337.4	(270)	(48)			
17	336.6	(340)	(37)	338.0	(270)	(55)	337.2	(340)	(50)	337.8	(270)	(40)			
18	336.8	340	37	338.0	270	51	337.2	340	51	337.9	270	33			
19	336.8	(340)	(38)							337.7	(280)	(32)			
20		(330)	(39)							337.6	(280)	(32)			
21		330	40							337.6	290	31			
22										337.6	(300)	(33)			
23										337.7	(310)	(35)			
24										337.6	320	37			

DATE	4 MAY			9 MAY			10 MAY			17 MAY			23 MAY		
TIME AEST	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)
01							339.0	(340)	(12)						
02							338.1	(310)	(25)						
03							337.9	290	37						
04							338.2	(300)	(36)						
05							338.1	(310)	(34)						
06							338.0	320	33						
07							337.8	(330)	(29)						
08							338.0	(350)	(26)						
09		300	51		310	46	337.8	360	22		290	51			
10		(310)	(51)		(310)	(42)	337.7	(360)	(22)	337.4	(290)	(54)			
11	337.0	(310)	(50)	338.6	(320)	(37)	337.7	(360)	(22)	337.5	(290)	(56)	337.8		
12	336.9	320	50	337.9	320	33	337.4	360	22	337.6	290	59	337.7	290	18
13	337.2	(320)	(47)	338.0	(320)	(32)	337.5	(360)	(23)	337.6	(280)	(52)	338.0	(300)	(22)
14	337.1	(320)	(45)	338.2	(320)	(30)	337.6	(360)	(25)	337.3	(280)	(44)	337.9	(310)	(25)
15	337.1	320	42	338.1	320	29	337.4	360	26	-	270	37	337.7	320	29
16	337.1	(310)	(43)	338.1	(330)	(25)	337.6	(360)	(25)	-	(270)	(36)	337.7	(320)	(30)
17	337.1	(300)	(43)	338.2	(350)	(22)	337.6	(360)	(23)	338.0	(270)	(34)	337.7	(320)	(30)
18	337.1	290	44	338.1	360	18	337.7	360	22	338.2	270	33	337.6	320	31
19				338.3	(360)	(19)									
20				338.2	(360)	(21)									
21				338.0	360	22									
22				338.1	(360)	(15)									
23				338.2	(360)	(7)									
24				338.7	360	0									

MACQUARIE ISLAND CO_2 AND SURFACE WIND DATA

YEAR:- 1981

DATE	30 MAY			7 JUNE			8 JUNE			15 JUNE			20 JUNE		
TIME AEST	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)
01							338.3	(260)	(21)						
02							338.0	(260)	(25)						
03							337.9	270	28						
04							338.0	(270)	(28)						
05							337.9	(270)	(29)						
06							338.0	270	29						
07							337.8	(270)	(29)						
08							337.9	(270)	(29)						
09		240	18				337.8	270	29					280	15
10	337.2	(240)	(21)				337.4	(270)	(32)					(280)	(17)
11	337.2	(250)	(23)				337.6	(270)	(34)	337.3			338.9	(290)	(20)
12	337.3	250	26	337.0	180	22	337.6	270	37	337.5	360	4	338.8	290	22
13	337.2	(220)	(23)	336.8	(180)	(21)	337.4	(270)	(36)	338.0	(350)	(6)	338.2	(280)	(22)
14	337.3	(190)	(21)	337.5	(180)	(19)	337.4	(270)	(34)	337.7	(350)	(9)	338.3	(280)	(22)
15	337.8	160	18	337.5	180	18	337.9	270	33	337.9	340	11	338.8	270	22
16	337.7	(180)	(16)	337.7	(180)	(19)	338.0	(270)	(29)	340.7	(320)	(20)	339.5	(280)	(24)
17	338.3	(200)	(15)	337.9	(180)	(21)	338.2	(270)	(26)	338.3	(290)	(28)	338.8	(280)	(26)
18	338.7	220	13	337.9	180	22	338.1	270	22	338.1	270	22	337.9	290	28
19				337.9	(200)	(21)									
20				338.8	(230)	(19)									
21				338.7	250	18									
22				339.1	(250)	(18)									
23				338.7	(250)	(18)									
24				338.7	250	18									

DATE	27 JUNE			6 JULY			7 JULY			12 JULY			18 JULY		
TIME AEST	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)
01							338.5	(320)	(23)						
02							338.5	(320)	(21)						
03							338.2	320	18						
04							338.1	(320)	(20)						
05							338.2	(320)	(22)						
06							338.2	320	24						
07							338.4	(320)	(25)						
08							338.7	(320)	(27)						
09				338.3	340	35	338.6	320	28		310	11		330	40
10				337.7	(350)	(34)	338.5	(300)	(24)		(300)	(13)		(330)	(42)
11	339.9			338.0	(350)	(34)	338.6	(290)	(19)	340.2	(280)	(16)	338.2	(340)	(44)
12	339.7	290	18	337.7	360	33	338.7	270	15	340.6	270	18	338.3	340	46
13	340.3	(280)	(17)	337.8	(350)	(35)	339.0	(230)	(14)	339.1	(290)	(17)	338.4	(340)	(46)
14	340.8	(280)	(16)	337.8	(350)	(37)	338.6	(200)	(12)	339.0	(300)	(16)	338.4	(340)	(46)
15	340.3	270	15	337.9	340	39	338.3	160	11	339.0	320	15	338.3	340	46
16	339.8	(270)	(16)	338.0	(350)	(41)	338.4	(160)	(16)	338.4	(330)	(15)	338.4	(340)	(47)
17	340.1	(270)	(17)	338.2	(350)	(42)	338.3	(160)	(21)	338.1	(330)	(15)	338.6	(340)	(47)
18	339.1	270	18	337.9	360	44	338.2	160	26	338.1	340	15	338.3	340	48
19				337.6	(350)	(37)									
20				338.5	(330)	(29)									
21				338.7	320	22									
22				338.5	(320)	(23)									
23				338.2	(320)	(25)									
24				338.4	320	26									

MACQUARIE ISLAND CO_2 AND SURFACE WIND DATA

YEAR:- 1981

DATE	31 JULY			6 AUGUST			7 AUGUST			12 AUGUST			21 AUGUST		
TIME AEST	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)
01							337.9	(320)	(31)						
02							337.5	(310)	(31)						
03							339.2	290	31						
04							338.9	(300)	(34)						
05							338.8	(310)	(37)						
06							338.9	320	40						
07							338.7	(310)	(38)						
08							339.1	(300)	(35)						
09	338.2	160	33		340	37	338.6	290	33		180	28			
10	337.9	(160)	(32)		(350)	(39)	339.5	(290)	(34)		(190)	(27)			
11	338.2	(160)	(32)	338.4	(350)	(42)	339.2	(290)	(36)	337.6	(190)	(25)			
12	338.1	160	31	338.1	360	44	338.4	290	37	338.0	200	24	339.8	360	40
13	338.0	(170)	(24)	338.7	(360)	(40)	338.7	(290)	(31)	337.9	(210)	(23)	339.0	(360)	(41)
14	338.0	(170)	(16)	338.7	(360)	(37)	340.2	(290)	(24)	337.7	(210)	(23)	338.9	(360)	(43)
15	338.1	180	9	338.3	360	33	341.5	290	18	338.7	220	22	339.0	360	44
16	338.4	(180)	(10)	338.4	(360)	(37)	337.0	(280)	(14)	338.4	(210)	(27)	337.6	(360)	(42)
17	339.6	(180)	(10)	338.1	(360)	(40)	338.0	(260)	(11)	338.3	(190)	(32)	338.4	(360)	(39)
18	339.2	180	11	338.5	360	44	340.2	250	7	338.5	180	37	338.3	360	37
19				338.6	(350)	(39)									
20				338.7	(330)	(34)									
21				338.5	320	29									
22				338.6	(330)	(30)									
23				339.6	(330)	(30)									
24				338.9	340	31									

DATE	27 AUGUST			4 SEPTEMBER			5 SEPTEMBER			11 SEPTEMBER			17 SEPTEMBER		
TIME AEST	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)
01							340.0	(220)	(16)						
02							339.8	(220)	(21)						
03							338.5	220	26						
04							338.2	(210)	(30)						
05							338.7	(190)	(33)						
06							338.5	180	37						
07							338.9	(210)	(32)						
08							338.6	(240)	(27)						
09		340	40		170	9	339.0	270	22		350	46	338.3	340	33
10		(340)	(39)		(210)	(15)	339.1	(250)	(21)	338.6	(350)	(52)	338.3	(340)	(35)
11	337.9	(340)	(38)	338.1	(250)	(22)	339.8	(240)	(19)	337.9	(360)	(58)	339.1	(340)	(38)
12	339.1	340	37	342.0	290	18	337.7	220	18	338.6	360	64	339.6	340	40
13	338.1	(340)	(38)	341.4	(280)	(21)	338.1	(240)	(24)	338.9	(350)	(59)	338.7	(340)	(40)
14	338.2	(340)	(38)	341.7	(260)	(14)	339.1	(250)	(31)	338.8	(350)	(53)	338.8	(340)	(40)
15	338.2	340	39	337.5	250	7	339.2	270	37	339.4	340	48	339.0	340	40
16	338.3	(340)	(37)	338.0	(230)	(10)	338.4	(270)	(34)	338.6	(320)	(44)	338.3	(330)	(38)
17	338.8	(340)	(35)	340.6	(220)	(12)	338.8	(270)	(31)		(290)	(41)	339.0	(330)	(35)
18	338.9	340	33	339.7	200	15	337.3	270	28		270	37	338.2	320	33
19				338.3	(190)	(19)									
20				337.5	(190)	(24)									
21				338.9	180	28									
22				339.0	(190)	(22)									
23				339.2	(210)	(17)									
24				338.8	220	11									

MACQUARIE ISLAND CO_2 AND SURFACE WIND DATA

YEAR:- 1981

DATE	24 SEPTEMBER			4 OCTOBER			8 OCTOBER			9 OCTOBER			10 OCTOBER		
TIME AEST	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)
01										337.6	(320)	(41)	337.1	(320)	(53)
02										339.2	(320)	(41)	338.0	(320)	(50)
03										338.7	320	40	337.4	320	48
04										338.3	(330)	(41)	337.7	(330)	(48)
05										338.5	(330)	(43)	338.2	(330)	(48)
06										338.1	340	44	339.0	340	48
07										338.9	(330)	(44)	338.4	(330)	(47)
08										339.1	(330)	(44)	339.0	(330)	(45)
09		090	22	337.9	270	18	339.0	160	18	338.4	320	44	338.1	320	44
10	338.4	(090)	(21)	338.0	(270)	(22)	338.6	(170)	(16)	336.9	(330)	(46)	340.1	(320)	(42)
11	339.6	(090)	(19)	337.3	(270)	(25)	338.8	(170)	(15)	339.6	(330)	(49)	338.2	(320)	(39)
12	340.1	090	18	338.6	270	29	334.5	180	13	339.6	340	51	338.9	320	37
13	339.8	(090)	(23)	338.5	(280)	(25)	337.7	(210)	(12)	337.5	(340)	(51)	339.2	(300)	(36)
14	338.6	(090)	(28)	339.4	(280)	(22)	339.5	(240)	(12)	339.0	(340)	(50)	343.8	(290)	(36)
15	341.2	090	33	342.3	290	18	340.5	270	11	339.0	340	50	343.0	270	35
16	338.2	(090)	(32)	341.4	(290)	(23)	341.4	(280)	(15)	339.2	(340)	(50)	339.3	(280)	(38)
17	338.7	(090)	(30)	339.1	(290)	(28)	342.4	(280)	(18)	338.3	(340)	(50)	339.7	(280)	(41)
18	338.1	090	29	338.7	290	33	345.1	290	22	338.3	340	50	341.6	290	44
19				339.0	(300)	(31)	342.0	(300)	(25)	337.9	(340)	(49)			
20				339.8	(310)	(30)	341.3	(310)	(28)	339.0	(340)	(47)			
21					320	28	338.8	320	31	337.8	340	46			
22							339.6	(320)	(35)	338.1	(330)	(49)			
23							338.8	(320)	(38)	337.5	(330)	(52)			
24							339.4	320	42	337.1	320	55			

MACQUARIE ISLAND CO_2 AND SURFACE WIND DATA

YEAR: 1982

DATE	24 MARCH			14 APRIL			16 APRIL			17 APRIL			17 MAY		
TIME AEST	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)
01										339.0	(320)	(56)			
02										338.7	(320)	(58)			
03										338.7	320	59		280	55
04										339.0	(320)	(55)		(280)	(53)
05										338.9	(320)	(50)	338.8	(270)	(50)
06					320	40				338.9	320	46	340.0	270	48
07					(310)	(42)				339.6	(320)	(45)	341.0	(260)	(47)
08				340.3	(310)	(44)				339.3	(320)	(45)	338.9	(260)	(47)
09					300	46				343.2	320	44	339.1	250	46
10					(300)	(44)				339.3	(320)	(43)	338.8	(240)	(37)
11				339.5	(290)	(42)				339.3	(320)	(41)	339.2	(230)	(27)
12		320	48		290	40				339.4	320	40	338.9	220	18
13		(320)	(46)							339.9	(320)	(40)	340.2	(240)	(19)
14		(320)	(45)							343.0	(320)	(40)	340.6	(250)	(21)
15		(320)	(43)							340.0	320	40	340.6	270	22
16		(310)	(41)							339.8	(320)	(40)	340.9	(290)	(26)
17	338.2	(310)	(39)							341.0	(320)	(40)	342.1	(320)	(29)
18	338.9	(310)	(38)					300	48	339.5	320	40	340.1	340	33
19	339.1	(310)	(37)				338.7	(300)	(50)				339.5	(350)	(32)
20	339.2	(310)	(35)				338.2	(290)	(53)				340.1	(350)	(30)
21	339.2	(300)	(33)				338.6	290	55				340.3	360	29
22	339.2	(300)	(31)				338.6	(300)	(55)				339.5	(350)	(39)
23	339.2	(300)	(30)				338.5	(310)	(55)				339.6	(350)	(49)
24		300	28				338.7	320	55				339.0	340	59

DATE	18 MAY			2 JUNE			29 JUNE			11 JULY			27 JULY		
TIME AEST	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)
01	339.3	(340)	(58)		(300)	(40)									
02	339.9	(340)	(56)	339.9	(300)	(43)									
03	340.1	340	55	340.1	290	46							340.8	320	50
04	340.6	(320)	(42)	339.8	(290)	(43)							340.2	(320)	(52)
05	341.0	(300)	(28)	339.8	(290)	(40)							340.4	(320)	(53)
06		280	15	339.8	290	37				341.5	270	44	340.4	320	55
07				340.0	(280)	(43)					(270)	(45)	341.4	(320)	(55)
08				339.8	(280)	(49)					(270)	(45)	344.0	(320)	(55)
09				339.2	270	55		320	33	340.1	270	46	341.5	320	55
10				339.6	(280)	(48)	340.4	(310)	(32)	339.6	(270)	(42)	340.6	(310)	(56)
11				339.5	(280)	(40)	339.7	(290)	(30)	340.0	(270)	(37)	340.4	(300)	(58)
12				339.5	290	33	339.7	270	29	340.8	270	33	340.0	290	59
13				339.5	(290)	(37)	339.5	(270)	(31)	340.4	(280)	(31)	340.0	(310)	(59)
14				339.5	(290)	(42)	340.4	(270)	(33)	340.8	(280)	(28)	339.9	(320)	(59)
15				339.8	290	46	340.1	270	35	340.5	290	26	340.2	340	59
16				339.5	(300)	(46)	340.3	(270)	(30)	341.0	(300)	(28)	340.1	(320)	(49)
17				340.0	(300)	(46)	340.2	(270)	(25)	341.0	(310)	(31)	340.3	(290)	(38)
18					310	46		270	20	339.9	320	33	340.0	270	28
19										339.8	(310)	(32)	339.6	(290)	(27)
20										339.9	(310)	(30)	340.0	(300)	(27)
21											300	29	339.8	320	26
22													339.9	(320)	(28)
23													340.6	(320)	(31)
24													339.9	320	33

MACQUARIE ISLAND CO_2 AND SURFACE WIND DATA

YEAR: 1982

DATE	28 JULY			11 AUGUST			12 AUGUST			25 AUGUST			26 AUGUST		
TIME AEST	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)
01	340.2	(320)	(32)				339.9	(290)	(54)				343.6	(290)	(57)
02	340.5	(320)	(30)				340.0	(290)	(52)				339.6	(290)	(60)
03	339.7	320	29				339.8	290	51				339.5	290	62
04	339.9	(320)	(28)				340.5	(280)	(51)				339.4	(290)	(65)
05		(320)	(27)				340.5	(280)	(51)				339.8	(290)	(67)
06		(310)	(26)				341.2	270	51				339.6	290	70
07		(310)	(26)				340.7	(270)	(46)				339.5	(280)	(67)
08		(310)	(25)				339.8	(270)	(42)				339.4	(280)	(65)
09		310	24				339.8	270	37				340.2	270	62
10							339.7	(280)	(36)				338.6	(270)	(68)
11							339.7	(280)	(36)				339.2	(270)	(75)
12					290	40	341.1	290	35				339.1	270	81
13					(290)	(43)	341.1	(290)	(36)				339.9	(280)	(76)
14				341.6	(290)	(45)	341.7	(290)	(37)				339.8	(290)	(72)
15				340.0	290	48	341.1	(290)	(38)				339.3	(300)	(65)
16				340.1	(290)	(47)	342.2	(290)	(39)					(300)	(62)
17				340.7	(290)	(47)	350.8	(280)	(40)					(310)	(58)
18				340.7	290	46	342.5	(280)	(41)	340.6	340	44		320	53
19				340.0	(290)	(49)	340.0	(280)	(42)	339.9	(340)	(49)			
20				339.6	(290)	(52)	339.1	(280)	(43)	339.6	(340)	(54)			
21				339.8	290	55	339.6	280	44	339.8	340	59			
22				340.3	(290)	(55)	340.0	(280)	(43)	339.0	(320)	(58)			
23				340.2	(290)	(55)	339.8	(270)	(43)	339.3	(310)	(56)			
24				339.6	290	55		270	42	339.9	290	55			

DATE	27 SEPTEMBER			10 NOVEMBER			11 NOVEMBER			22 NOVEMBER			9 DECEMBER		
TIME AEST	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)
01							340.8	(270)	(43)						
02							340.8	270	48						
03							340.7	(280)	(48)						
04							341.1	(280)	(48)						
05							341.1	290	48						
06		290	44				340.8	(280)	(45)						
07		(290)	(45)				340.4	(280)	(43)						
08	341.7	(290)	(47)				340.8	270	40		290	35		250	37
09	341.0	290	48				340.5	(290)	(35)		(300)	(33)		(260)	(38)
10	341.0	(300)	(53)				341.1	(320)	(31)	342.3	(310)	(30)	340.6	(260)	(38)
11	341.1	(310)	(59)	345.2	270	53	342.0	340	26	341.0	320	28	339.5	270	39
12	340.9	320	64	344.4	(270)	(51)	341.6	(350)	(25)	341.6	(310)	(27)	339.2	(270)	(39)
13	341.0	(320)	(63)	341.4	(270)	(50)	342.0	(350)	(23)	340.9	(300)	(25)	339.3	(270)	(40)
14	341.3	(320)	(63)	342.2	270	48	340.4	360	22	341.4	290	24	338.8	270	40
15	340.7	320	62	341.5	(270)	(53)	341.0	(350)	(22)	340.3	(290)	(22)	339.2	(260)	(41)
16	340.7	(310)	(63)	341.1	(270)	(57)		(350)	(22)	340.7	(290)	(20)	340.0	(260)	(43)
17	340.7	(300)	(65)	340.5	270	62		340	22	340.9	290	18	340.1	250	44
18	341.0	290	66	340.7	(270)	(63)				342.0	(290)	(19)			
19	341.3	(290)	(61)	341.0	(270)	(65)					(290)	(21)			
20		(300)	(56)	340.7	270	66					(300)	(22)			
21		300	51	341.5	(270)	(55)					(300)	(23)			
22				341.2	(270)	(44)					(300)	(25)			
23				341.8	270	33					300	26			
24				341.0	(270)	(38)									

YEAR: 1982

MACQUARIE ISLAND CO_2 AND SURFACE WIND DATA

DATE	18 DECEMBER			19 DECEMBER			28 DECEMBER								
TIME AEST	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)	CO_2 (ppmv)	W/D	W/S (km/hr)
01				339.9	(280)	(41)									
02				340.0	290	40									
03				340.1	(280)	(40)									
04				339.8	(280)	(39)									
05				340.0	270	39									
06				340.1	(270)	(38)									
07				339.6	(270)	(38)									
08				339.3	270	37									
09				339.7	(270)	(37)									
10				339.1	(270)	(37)									
11	340.8	290	42	338.7	270	37	339.5	270	39						
12	339.6	(290)	(43)	338.9	(270)	(34)	338.4	(280)	(39)						
13	339.5	(290)	(45)	339.8	(270)	(31)	338.8	(280)	(40)						
14	339.4	290	46	339.1	270	28	338.8	290	40						
15	339.7	(290)	(42)	339.4	(260)	(25)	338.8	(280)	(40)						
16	339.3	(290)	(39)	339.6	(260)	(23)	338.8	(280)	(39)						
17	339.7	290	35		250	20		270	39						
18	339.9	(290)	(37)												
19	340.0	(290)	(40)												
20	339.8	290	42												
21	339.7	(280)	(43)												
22	339.6	(280)	(43)												
23	339.6	270	44												
24	340.2	(280)	(43)												

APPENDIX 7

CO_2 data set from CSIRO shipboard monitoring program.

Tabulation of all CO_2 concentrations and auxilliary data from flask samples collected on board ships traversing the Southern Ocean between Australia and Antarctica during the years 1977 through 1982.

Analysis for CO_2 was performed on NDIR gas analysers at CSIRO and concentrations are expressed in parts per million by volume (ppmv) with respect to the WMO 1981 CO_2 Calibration Scale. When necessary, a carrier-gas correction has been applied to all values based on comparisons of instrument response to WMO Central CO_2 Laboratory CO_2/N_2 and CO_2/Air Secondary Standards as described in Pearman et al. (1983).

All samples were chemically dried either at time of sampling or prior to analysis using granular magnesium perchlorate (Dehydrite) as the drying agent.

Times of sampling are listed in Greenwich Mean Time (Z).

CO_2 MONITORING DATA FROM SHIPS

SAMPLING DATE	SHIP	TIME (Z)	POSITION		CO_2 CONCENT. (ppmv)	WIND		AIR TEMPERATURE		COMMENTS
			LATITUDE	LONGITUDE		DIRECTION (Degree)	SPEED (Km/hr)	D.B. (°C)	W.B. (°C)	
4-12-77	Nella Dan	2255	45°28'S	139°15'E	332.0	245	64	-	-	
6-12-77	" "	0620	50°00'	136°43'	332.7	250	29	-	-	
7-12-77	" "	2310	54°54'	130°45'	333.1	270	73	-	-	
13-12-77	" "	0200	60°27'	90°00'	333.1	120	44	-	-	
14-12-77	" "	0655	65°03'	90°31'	332.6	090	55	-	-	
10-11-79	Nella Dan	0700	42°10'	139°54'	338.9	030	28	15.1	-	
13-11-79	" "	0421	50°55'	126°14'	336.0	280	31	5.2	-	
15-11-79	" "	0721	55°00'	114°05'	336.5	320	40	2.5	-	
20-11-79	" "	0215	63°02'	78°36'	337.3	050	15	- 1.0	-	In pack ice.
23-1-80	Nella Dan	0230	60°00'	90°33'	335.6	070	14	-	-	
"	" "	"	"	"	335.2	"	"	-	-	
25-1-80	" "	1130	54°07'	108°18'	335.2	280	43	-	-	
"	" "	"	"	"	335.1	"	"	-	-	
28-1-80	" "	0215	47°09'	125°38'	335.6	230	36	-	-	
"	" "	"	"	"	335.5	"	"	-	-	
11-1-81	Nella Dan	0646	44°53'	139°41'	336.3	240	33	13.8	13.1	
12-1-81	" "	2256	52°20'	136°38'	337.3	250	48	6.0	5.2	
"	" "	2302	"	"	337.1	"	"	"	"	
15-1-81	" "	0005	60°14'	131°02'	336.8	340	26	3.7	3.0	
21-1-81	" "	0433	65°19'	87°59'	336.8	110	37	-0.4	0.1	
20-1-81	Thala Dan	0153	56°26'S	122°27'E	337.0	090	18	5.4	5.0	
"	" "	0203	"	"	336.6	"	"	"	"	
1-2-81	" "	0210	64°25'	120°20'	336.5	135	22	2.4	0.9	
"	" "	0225	"	"	336.2	"	"	"	"	
3-2-81	" "	0335	66°05'	140°10'	336.2	090	26	0.2	-0.5	
"	" "	0345	"	"	336.5	"	"	"	"	
8-2-81	" "	0022	60°25'	151°56'	337.2	045	33	4.0	3.0	
"	" "	0031	"	"	336.8	"	"	"	"	
13-2-81	" "	1158	50°13'	155°32'	336.2	360	37	11.2	10.0	
"	" "	1208	"	"	336.7	"	"	"	"	
14-2-81	" "	2153	45°14'	151°34'	336.4	338	33	16.7	13.7	
"	" "	2203	"	"	337.1	"	"	"	"	
9-3-81	Nella Dan	0505	64°58'	62°12'	337.6	230	33	2.1	- 0.1	No inlet hose used
"	" "	0510	"	"	337.1	"	"	"	"	" " " "
12-3-81	" "	0440	60°01'	74°28'	339.1	230	37	1.3	0.2	Sampled on lee side
15-3-81	" "	0605	54°59'	100°02'	337.6	290	33	4.4	1.8	
"	" "	0611	"	"	337.7	"	"	"	"	
23-3-81	" "	0220	50°07'	133°47'	337.7	360	61	10.5	9.6	
9-11-81	Nella Dan	2322	48°32'S	139°19'E	338.7	-	Calm	10.0	8.7	
"	" "	2328	"	"	339.4	"	"	"	"	
11-11-81	" "	0443	52°00'	132°04'	338.8	045	18	5.5	5.5	Light rain
16-11-81	" "	0406	58°02'	104°37'	339.4	270	5	0	-0.7	
19-11-81	" "	0400	57°29'	79°47'	340.2	270	36	-0.4	-1.0	
27-11-81	" "	0854	63°04'	62°31'	339.4	270	4	0	-1.0	
13-1-82	Thala Dan	0308	45°12'	144°41'	338.4	280	18	14.1	12.8	
14-1-82	" "	2245	49°47'	141°07'	338.2	280	37	11.2	11.1	
16-1-82	" "	0610	54°09'	138°54'	338.2	250	28	6.5	5.5	
"	" "	0615	"	"	338.4	"	"	"	"	
19-1-82	" "	0414	59°00'	127°04'	338.7	340	55	4.8	3.4	
3-2-82	Thala Dan	0627	63°49'	115°35'	338.3	318	24	1.5	0.5	
6-2-82	" "	1327	59°08'	139°29'	338.9	320	55	4.8	3.5	
9-2-82	" "	0038	54°25'	159°00'	338.7	204	55	6.8	5.5	
"	" "	0043	"	"	338.9	"	"	"	"	

APPENDIX 8

CO_2 data set from CSIRO monitoring program at Wilbinga, Western Australia.

Tabulation of all CO_2 concentrations and auxilliary data from flask samples collected at Wilbinga during the years 1979 through 1981.

Analysis for CO_2 was performed on NDIR gas analysers at CSIRO and concentrations are expressed in parts per million by volume (ppmv) with respect to the WMO 1981 CO_2 Calibration Scale. A carrier-gas correction has been applied to all values based on comparisons of instrument response to WMO Central CO_2 Laboratory CO_2/N_2 and CO_2/Air Secondary Standards as described in Pearman et al. (1983).

All samples were chemically dried at the time of sampling using granular magnesium perchlorate (Dehydrite) as the drying agent.

Meteorological data in the tabulation are derived from single observations by the operators within the time span of collecting a group of samples.

CO2 MONITORING DATA - WILBINGA,W.A.

SAMPLING DATE	TIME (Z)	CO2 CONCENTRATION (PPMV)	WIND DIRECTION (DEGREES)	WIND SPEED (KM/HR)	TEMP.	COMMENTS
27.03.79	0423	336.8	210	14	27.2	CLEAR,SUNNY.
	0429	337.1	210	14	27.2	"
	0434	337.2	210	14	27.2	"
	0545	337.7	210	14	26.6	"
08.05.79	0429	333.7	080	25	-	BROKEN CLOUD.
	0436	333.4	080	25	-	"
	0441	333.4	080	25	-	"
	0531	333.4	075	25	29.0	"
	0536	333.3	075	25	29.0	"
	0542	333.5	075	25	29.0	"
07.06.79	0411	331.2	045	22	21.4	CLEAR
	0416	330.7	045	22	21.4	"
	0421	331.2	045	22	21.4	"
	0504	331.4	040	22	22.7	"
	0509	330.6	040	22	22.7	"
10.07.79	0350	335.3	315	18	18.4	"
	0355	335.6	315	18	18.4	"
	0400	335.9	315	18	18.4	"
	0407	335.9	315	18	18.4	"
	0413	335.9	315	18	18.4	"
	0418	335.9	315	18	18.4	"
21.08.79	0345	334.6	230	13	19.8	OVERCAST.
	0350	335.1	230	13	19.8	"
	0356	335.6	230	13	19.8	"
	0504	335.8	210	7	-	"
	0508	335.1	210	7	-	"
11.09.79	0429	335.4	200	16	21.0	FINE,3/8 CLOUD.
	0526	335.5	200	16	21.0	"
11.10.79	0427	335.6	270	32	21.0	7/8 CLOUD.
	0430	335.5	270	32	21.0	"
	0435	335.5	270	32	21.0	"
	0439	335.5	270	32	21.0	"
	0444	335.6	270	32	21.0	"
13.11.79	0401	335.8	240	32	19.6	INTERM.SHOWERS 4/8 CLOUD.
	0405	335.6	240	32	19.6	"
	0409	335.7	240	32	19.6	"
	0434	335.5	240	32	21.0	"
	0438	335.5	240	32	21.0	"
	0442	335.5	240	32	21.0	"
19.12.79	0505	336.3	200	25	27.5	TRACE CLOUD.
	0510	336.0	200	25	27.5	"
	0515	335.8	200	25	27.5	"
	0551	335.9	200	25	27.5	"
	0556	335.7	200	25	27.5	"

CO2 MONITORING DATA - WILBINGA,W.A.

SAMPLING DATE	TIME (Z)	CO2 CONCENTRATION (PPMV)	WIND DIRECTION (DEGREES)	SPEED (KM/HR)	TEMP.	COMMENTS
15.01.80	0317	338.0	300	22	29.5	CLEAR
	0321	338.0	300	22	29.5	"
	0325	338.1	300	22	29.5	"
	0442	338.1	300	22	29.5	"
	0446	338.0	300	22	29.5	"
19.02.80	0101	338.5	190	29	30.4	5/8 CLOUD
	0105	338.5	190	29	30.4	"
	0110	339.3	190	29	30.4	"
	0154	338.8	190	29	30.4	"
	0158	339.2	190	29	30.4	"
20.03.80	0258	336.1	210	72	24.0	6/8 CLOUD,FRONT PASSING THROUGH.
	0308	335.9	210	72	24.0	"
	0313	336.0	210	72	24.0	"
	0318	335.8	210	72	24.0	"
	0323	335.8	210	72	24.0	"
22.04.80	0419	338.3	040	16	17.0	6/8 CLOUD,DRIZZLE-SHOWERS.
	0422	338.1	040	16	17.0	"
	0427	337.7	040	16	17.0	"
	0431	337.9	040	16	17.0	"
	0435	337.6	040	16	17.0	"
	0439	337.4	040	16	17.0	"
21.05.80	0437	334.7	330	32	22.0	TRACE CLOUD.
	0442	334.5	330	32	22.0	"
	0511	334.7	330	32	22.0	5/8 CLOUD.
	0516	334.6	330	32	22.0	"
23.06.80	0306	343.2	022	18	21.0	7/8 CLOUD.
	0314	346.3	022	18	21.0	"
	0318	341.8	022	18	21.0	"
	0322	341.0	022	18	21.0	"
22.07.80	0434	333.6	030	33	20.0	
	0438	333.9	030	33	20.0	
	0442	333.2	030	33	20.0	
	0446	333.8	030	33	20.0	
	0451	333.4	030	33	20.0	
	0456	333.6	030	33	20.0	
25.09.80	0501	337.5	200	36	21.0	CLEAR
	0506	338.0	200	36	21.0	"
	0510	337.9	200	36	21.0	"
	0521	338.7	200	36	21.0	"
	0526	338.2	200	36	21.0	"
	0530	339.0	200	36	21.0	"
27.11.80	0441	338.8	210	25	25.0	"
	0447	338.2	210	25	25.0	"
	0451	338.2	210	25	25.0	"
	0504	339.0	210	25	25.0	"
	0509	339.0	210	25	25.0	"
	0514	339.1	210	25	25.0	"
28.01.81	0425	338.1	115	32	C.30	"
	0438	337.9	115	32	C.30	"
	0615	338.0	115	32	C.30	"
	0619	337.7	115	32	C.30	"
04.03.81	0340	339.0	260	22	25.0	2/8 CLOUD.
	0356	338.5	260	22	25.0	"
	0400	337.1	260	22	25.0	"
06.04.81	0130	341.3	270	14	-	8/8 CLOUD.
	0138	341.2	270	14	-	"
	0142	340.8	270	14	-	"
	0146	340.5	270	14	-	"
	0150	341.5	270	14	-	"
06.06.81	0424	338.1	-	-	23.0	CLEAR.
	0428	337.1	-	-	23.0	"
	0432	337.1	-	-	23.0	"
	0518	337.1	-	-	23.0	"
	0526	337.6	-	-	23.0	"

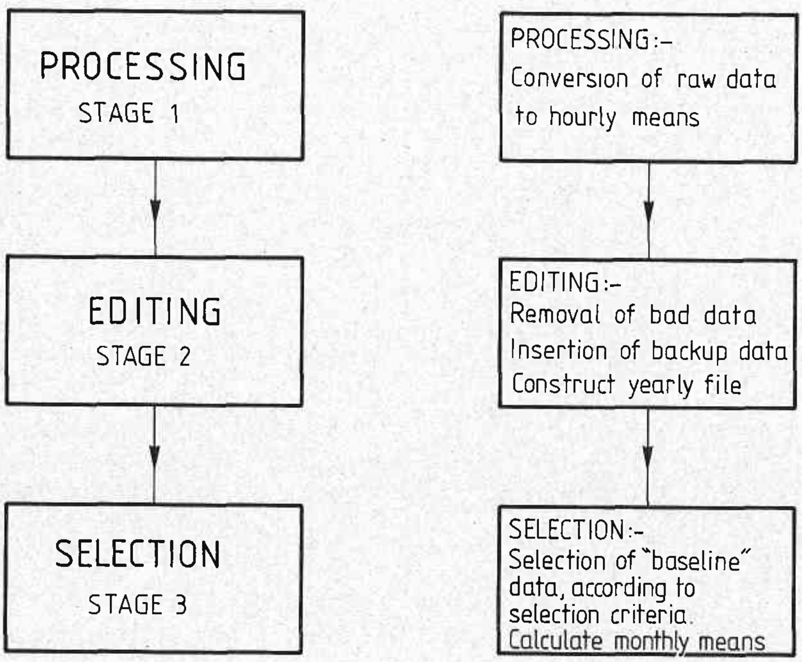
APPENDIX 9

Flowcharts depicting the logical flow of data processing for both Mark I and Mark II data sets from Cape Grim. This appendix has been divided into several sub-sections, each corresponding to a specific phase of the processing procedure.

In general, each flow diagram is preceded by a key chart showing the names and functions of the individual programs. Letters are used to denote programs, while computer files are represented by boxes. File names used have been indicated where appropriate and numbers within boxes indicate logic flow connections. A brief summary of each subsection follows:

Appendix No.	Function
9A	Data Processing Overview - Mark I and Mark II
9B	Program Key for Mark I Processing
9C	Flow Diagram for Mark I Processing
9D	Program Key for Editing
9E	Flow Diagram for Editing
9F	Program Key for Selection
9G	Flow Diagram for Selection
9H	Program Key for Mark II Data Processing
9I	Flow Diagram for Mark II Data Processing

APPENDIX 9A SYSTEM OVERVIEW



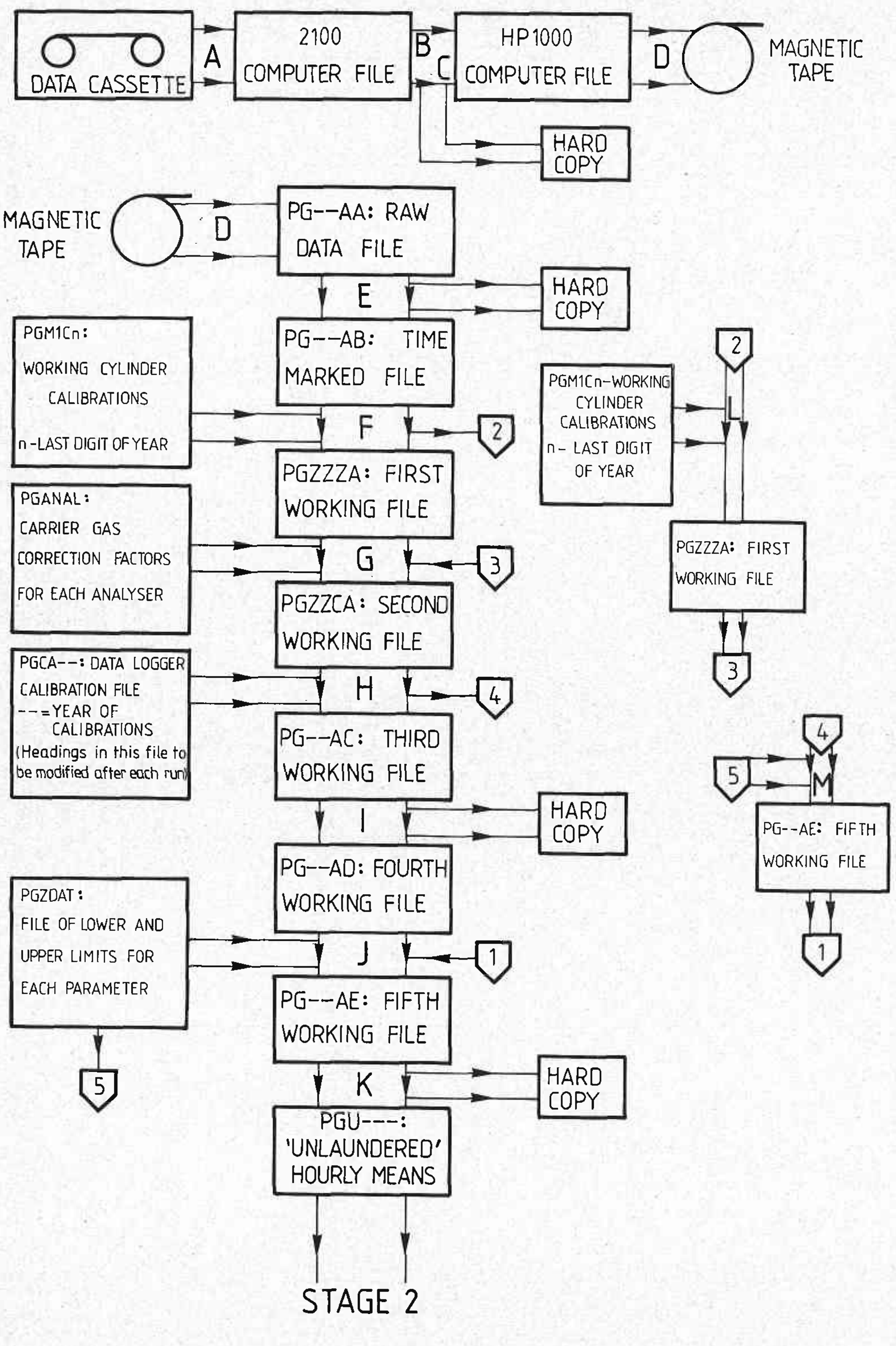
APPENDIX 9B

STAGE 1 - PROCESSING MARK I DATA

PROGRAM	PROGRAM NAME	FUNCTION	INPUT PARAMETERS
A	GRIM1	Reads data from cassettes	-
B	GRIM4	Transfers data to H/P1000 computer file	-
C	CGTRA	Transfers data to H/P1000 computer file	Name of H/P1000 computer file PG--AA
D	XXBAK	System magnetic tape utility	Varies with type of run
E	PGTIME	Time marks raw data file	Starting and finishing times of cassette data
F	PGMTCD	Computes uncorrected CO_2 values, transposes other values of raw data	Working cylinder calibrations, lower limit of CO_2
G	PGCARI	Applies carrier gas corrections to CO_2 values, transposes other values of raw data	Carrier gas correction factors for each analyser used. MK I or MK II data. MK II data format
H	PGREST	Computes meteorological values, transposes CO_2	Name of data logger calibration file. Data logger calibrations
I	PGFILE	Removes headings from 3rd working file and transposes data	-
J	PGOWLY	Computes hourly means and standard deviations of all parameters	Lower and upper limits for each parameter. Tape no. and version of run
K	PGDISP	Rearranges hourly means	Year of data being processed
L	PGMTMD	Computes CO_2 only - does not transpose other raw data	CO_2 lower rejection limit and working cylinder calibrations
M	PGOWMY	Computes hourly means for CO_2 only	-

APPENDIX 9C

STAGE 1:- PROCESSING. MARK I DATA



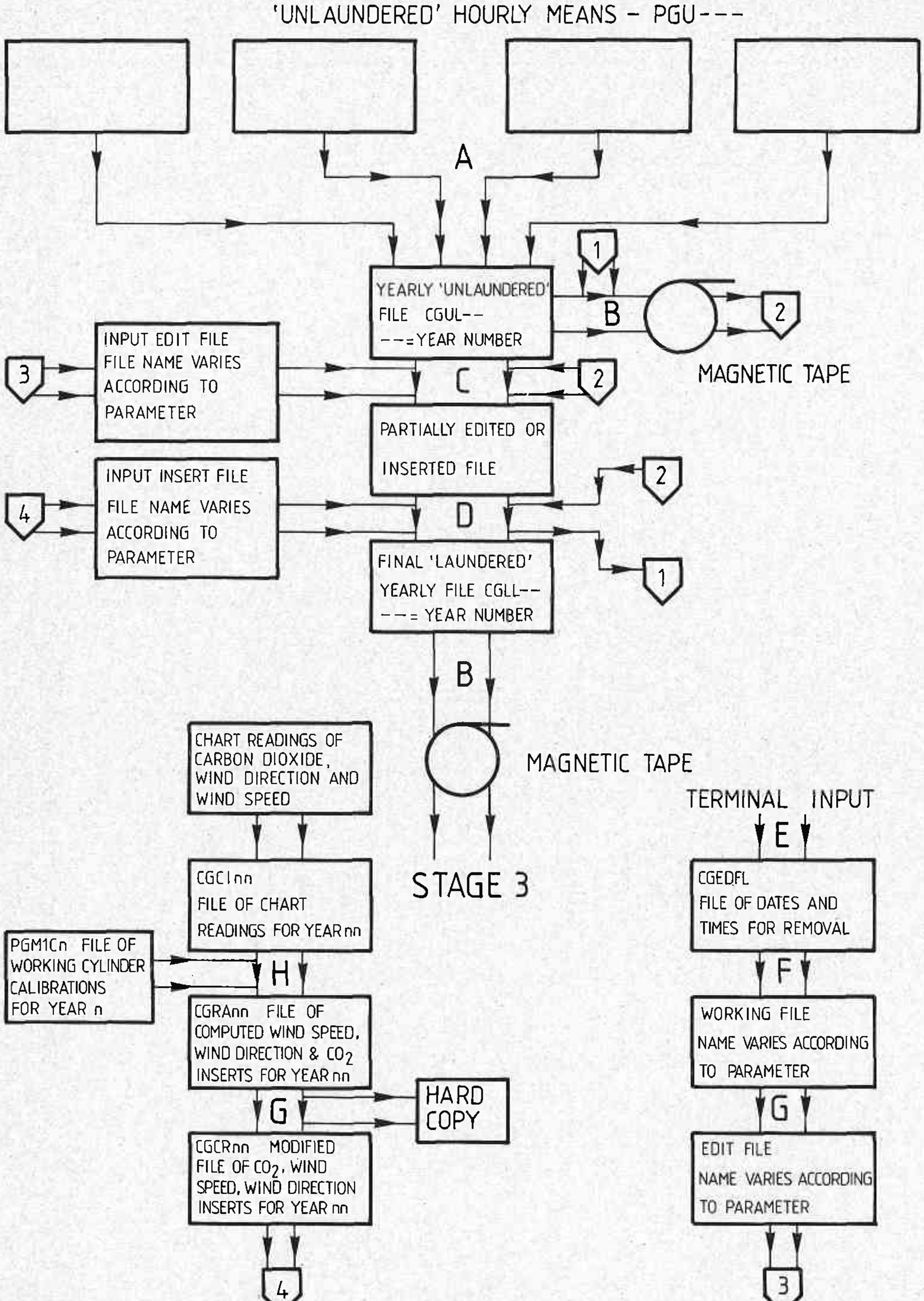
APPENDIX 9D

STAGE 2 - EDITING MARK I AND MARK II DATA

PROGRAM	PROGRAM NAME	FUNCTION	INPUT PARAMETERS
A	PGCAT	(Background) concatenate files	Input file names, cartridge no., output file name, cartridge no.
B	XXBAK	System Magnetic tape utility	Varies with type of run
C	PGEDIT	(Background) edits out bad values	Name input edit file name file to be edited name output file cartridge nos. param. to be edited
D	PGINST	(Background) inserts backup data	Name input insert file name file to be inserted; name output file; cartridge nos. param. to be edited
E	CGENIT	(Background) creates files of dates and times	
F	PGEDFT	(Background)	Input and output file names; output file size
G	EDIT	Insert headings; # of records to be edited; end of edit terminator	
H	PGCAPE	Converts chart readings to CO_2 concentrations and transposes w/d and w/s readings	File of carbon dioxide calibration values

APPENDIX 9E

STAGE 2: EDITING MARK 1 AND 2

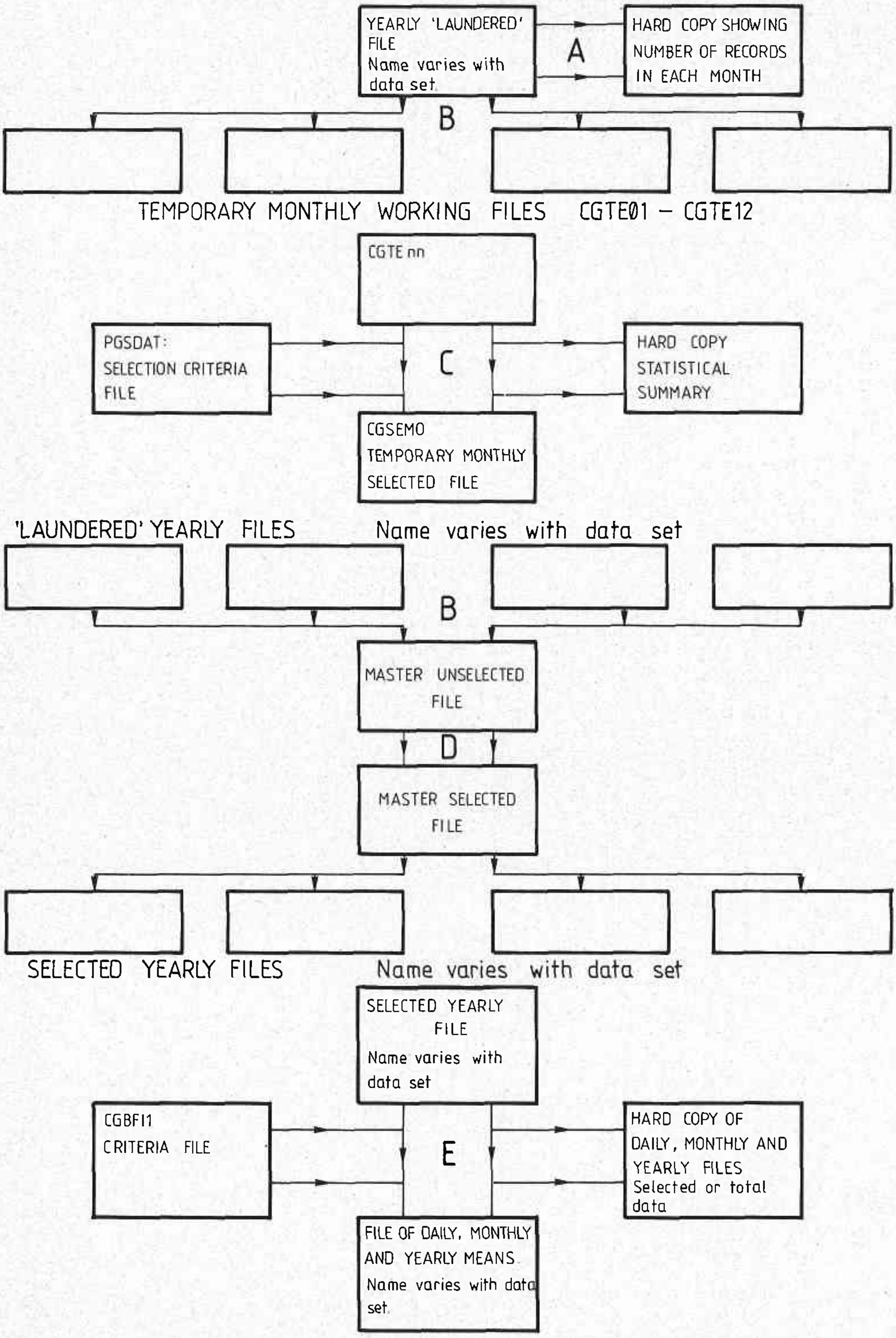


APPENDIX 9F

STAGE 3 - SELECTION

PROGRAM	PROGRAM NAME	FUNCTION
A	PGNREC	Determines number of records in monthly files
B	EDIT	Breaks yearly files into monthly files and concatenates yearly files
C	PGSEMS	Baseline section criteria program
D	CGBASE	Applies baseline selection criteria to unselected files
E	CGBULP	Produces monthly yearly and daily mean files

APPENDIX 9G **STAGE 3: SELECTION**



APPENDIX 9H

PROGRAM KEY FOR MARK II DATA PROCESSING

KEY	PROGRAM NAME	FUNCTION
A	NRTRN	Processes up to 6 millivolt data files, performs concatenation and conversion of raw data files to direct access file
B	NRPRO	Converts raw data to hourly means. Results are direct access files (one for each parameter)
C	NRCON	Converts hourly results files to sequential access files (Mark I compatable)

APPENDIX 9I

PROCESSING MARK 2 DATA