10. Assessment of Results

10a. General issues

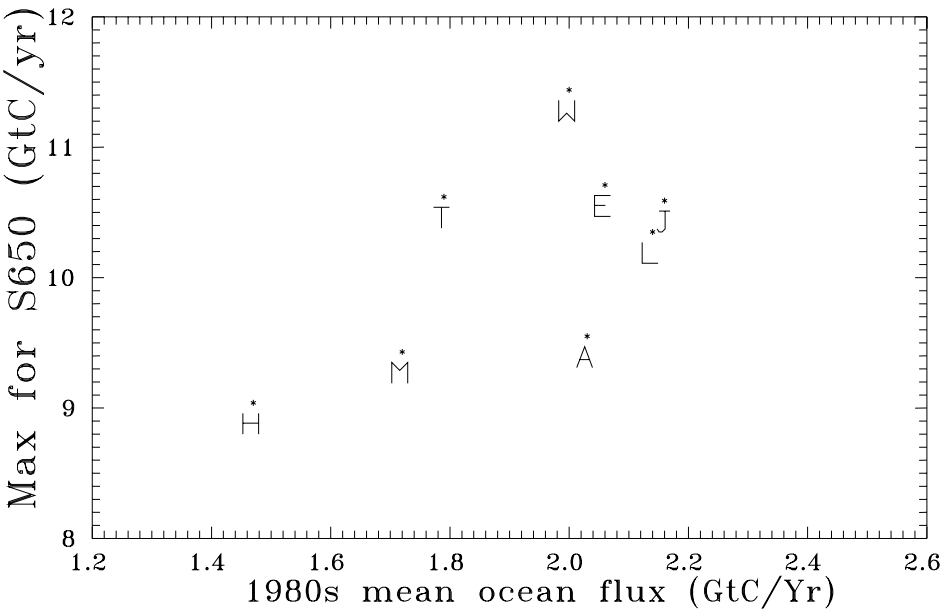

Figure 10.1. Relation between future fossil emissions and current oceanic uptake.

The results tabulated in the preceding sections and the appendices show a relatively wide range of projections. It is, however, possible to discern a few general characteristics.

The forward projections are very tightly grouped, while the stabilisation cases show a much wider proportional spread. This comes from two well-understood mathematical characteristics of the problems. Firstly, inverse calculations (i.e., the stabilisation calculations) amplify uncertainties much more than forward calculations. Secondly, since all the models are tuned to fit the historical record which has been a period of increasing emissions, they will tend to agree with each other (and be expected to be most accurate) when projecting the consequences of a similar period of future growth in emissions. This is a consequence of the models being only weakly non-linear and the growth being near to exponential. The differences between models will become apparent when they are used for calculations (whether forward or inverse) involving periods of significant decreases in emissions as required for stabilisation.

The curves for the integrated emissions (Figure 8.6a, b for S650 and Figures E.13a,b to E.16a,b for the other cases) show that for the distant future, the terrestrial storage component plays a more minor role than in many estimates of the current atmospheric budget. The bulk of the fossil emissions are partitioned (roughly equally) between the atmosphere and the oceans. This suggests that the current value of the ocean carbon uptake may be related to the long-term partitioning between the atmosphere and ocean and therefore also related to the emissions consistent with specified atmospheric concentrations. This is explored in Figure 10.1 which plots the maximum emissions for S650 against the mean ocean carbon uptake of the 1980s for those models for which the information was provided. Figure 10.1 shows a general positive

correlation, with a scatter that indicates that other inter-model differences are also important. The results for Model B (not shown) lie well away from the general trend, but these are not comparable because of the different way in which the atmospheric budget is treated. For model A, the modellers (J. Lloyd, personal communication) regard the departure from the general trend as due to the mechanistic formulation of the terrestrial component, rather than the use of the low eddy-diffusion coefficient discussed in Section 6.

10b. The IPCC report on Radiative Forcing of Climate Change

This report documents the calculations that were contributed in response to distribution of the specifications contained in Appendix A. The purpose of this exercise was to obtain input for the IPCC report on Radiative Forcing of Climate Change (IPCC, 1994) and the Full Scientific Assessment (IPCC, 1995). These reports contain only a subset of the results presented here, although the discussion drew on the wider set of results. As well as being selective in the cases displayed, the IPCC reports also involved selection of models. The IPCC reports included all models that complied with the specifications. Those excluded were:

Model C This did not partition the fluxes and so the degree of compliance with the budget specification could not be defined.

Model F Terrestrial biota only and so only a small number of the results were applicable.

Model G The inverse calculations failed to follow the specified profiles.

Models R* and T Included climatic feedback and so are not directly comparable to other results.

Models O, P, V and Z These were ocean-only models and so only a small number of results could be used.

We therefore used Models A, E, H, J, L, M, Q, R and W for all cases where results were contributed. We also include the forward calculations from Model G. For the inverse calculations we also use the ocean flux calculations from O, P, V and Z and the fertilisation fluxes from F. The ocean-only models and the biota-only model could also be used for determining the respective 'sub-system' impulse responses. Models F_2 and Z were received too late for full discussion.

One important difference between the presentation used in this report and IPCC (1994) is that the latter presents results in terms of total anthropogenic fluxes, $Q(t)$. The reasons for this are:

- The total flux is the more relevant quantity for the objectives of the Framework Convention on Climate Change.
- The calculated totals are largely independent of the partitioning between fossil and land-use and so are of greater generality than is implied by the form or presentation used in this report.

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