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DIVISION of FISHERIES and OCEANOGRAPHY

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SATELLITE - TRACKED BUOY DATA REPORT I

WESTERN AUSTRALIAN RELEASES 1975 AND 1976

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I. INTRODUCTION

Twelve CSIRO buoys were tracked by the NASA satellite NIMBUS-6 in 1975/76 after being released in Western Australian waters as part of a programme to further the understanding of the migration of western rock lobster larvae.

This report is the result of a desire to make the Western Australian buoy data available, with minimum delay, to individuals with an interest in the ocean circulation of the area. Its publication follows lengthy and tedious editing of the computer data files.

II. THE SATELLITE

NIMBUS-6 (Kirwan *et al.* 1976) is in a sun-synchronous 1100 km altitude polar orbit which crosses the equator northward bound at local noon and southward at midnight. The orbit period is about 107 min. Each orbit crosses the equator 27° longitude further west than the previous orbit. A Random Access Measurement System (RAMS) is used for data acquisition and buoy location. It operates as follows: the buoy transmit terminals (BTT) transmit for 1 sec with a repetition rate of about once per minute. The transmissions each contain a four-digit identifier and four eight-digit data words. The data are recorded by the satellite during the fly-by of about 20 min. Buoy positions are determined by Doppler shifts of the transmissions occurring during the fly-by. Because of the random transmissions, up to 200 buoys can be located in the satellite's field of view at the one time. Since the successive orbits are closer together in east-west distance at higher latitudes we have obtained as many as 6 fixes in a day, although 1 or 2 good fixes per day is the norm. The accuracy of location is ± 5 km rms. Further information is given by Sissala (1975).

III. THE BUOYS

The buoys were 4.5 m PVC/fibreglass spars (Cresswell, 1976, 1977; Cresswell *et al.* 1977) which were drogued by a 7.2 m parachute at 20 m depth. Each transmit terminal was powered by a 'Philips' BPX47A solar panel which charged a 4.5 amp-hr 12V 'Sonnenschein' sealed lead-acid battery. An exception was buoy 0131 which had a 'Mallory' dry cell.

The buoys all measured sea surface temperature. Other data channels were used to monitor the current shunted from the solar panel and both the on and off load battery voltages. Buoy 0107 also carried an atmospheric pressure sensor.

The performance of the buoys as assessed at June 1977 is:

- 0107 Lifetime 22 days. Recovered with flooded transmitter one year later from the beach in the Great Australian Bight.
- 0131 Lifetime 230 days. Ceased operating due to its dry cell reaching discharge.
- 0140 Lifetime 196 days. Washed ashore and was recovered with flooded transmitter.
- 0176 Lifetime 1 year. This was released on the continental shelf and went aground in the Abrolhos Is. It was recovered and released again after a new drogue had been fitted. It travelled in the South Equatorial Current to within 200 km of Madagascar. Its temperature sensor failed 2 weeks before the buoy itself failed.
- 0201 Lifetime 27 days. Washed ashore and was recovered with a flooded transmitter.
- 0237 Lifetime 280 days. This was the first buoy to be released. Its temperature measurements were unreliable and are not presented here. The buoy developed an intermittent fault.
- 0415 Lifetime 195 days. It ran aground on the south coast and was not found.
- 0423 Lifetime 120 days. It also ran aground on the south coast and was not found.
- 0713 Lifetime exceeds 1 year. It drifted for over 200 days and then spent over 200 days operating while aground in the Great Australian Bight. It has now been recovered intact and will be used in the Tasman Sea.
- 0725 Lifetime 270 days. Ceased working in early 1977 near Timor.
- 1054 Lifetime exceeds 490 days. It ran aground in the Abrolhos Is. and its temperature circuit failed at that time. A new drogue was fitted and it now continues to operate in the Tasman Sea.
- 1104 Lifetime exceeds 300 days. It is drifting westward in the South Equatorial Current.

Another buoy, 1062, was released in 1976 and did not work in that year. It did, however, work for a 2 month period in 1977 and will be reported separately.

IV. DATA HANDLING

Boxes of data cards covering a one week period were received from NASA by post with a delay of 7-10 days. They were added to a computer file which was sorted every few weeks to test for bad fixes. Gaps in the card data were filled from computer listings of daily data which were posted by NASA independently of the cards.

V. DATA PRESENTATION

The data in this report are arranged numerically according to the buoy number and chronologically in sets of 60 day periods.

Data words from all orbits in a day were treated to determine the sea surface temperature according to

$$\text{Temperature} = (\text{word value} \times 30/256) + 5^{\circ}\text{C}.$$

This means that the temperature digitization steps are roughly 0.1°C . There is a non linearity over the 30°C range of at most 0.3°C which is however, different for different buoys. The non linearity has not been taken into account when preparing this report.

The speed plots give the speed between the first fix on one day to the first fix on the next day.

The size of the chart, 9° of latitude by 15° of longitude, is adequate to just contain 60 days travel for most buoys (buoy 0176 days 180-240, 1976 is an exception). The coastline and the shelf edge (200 m contour) were digitized by eye from charts of the area. The projection used is such that the distance corresponding to a degree of latitude is a constant 1.25 times that corresponding to a degree of longitude.

A 16 mm movie has been made of a computer display depicting the movements of the buoys up to day 200, 1976. It effectively reveals the fluid interplay between the waters carrying the various buoys. A copy can be made available on loan from CSIRO, Cronulla.

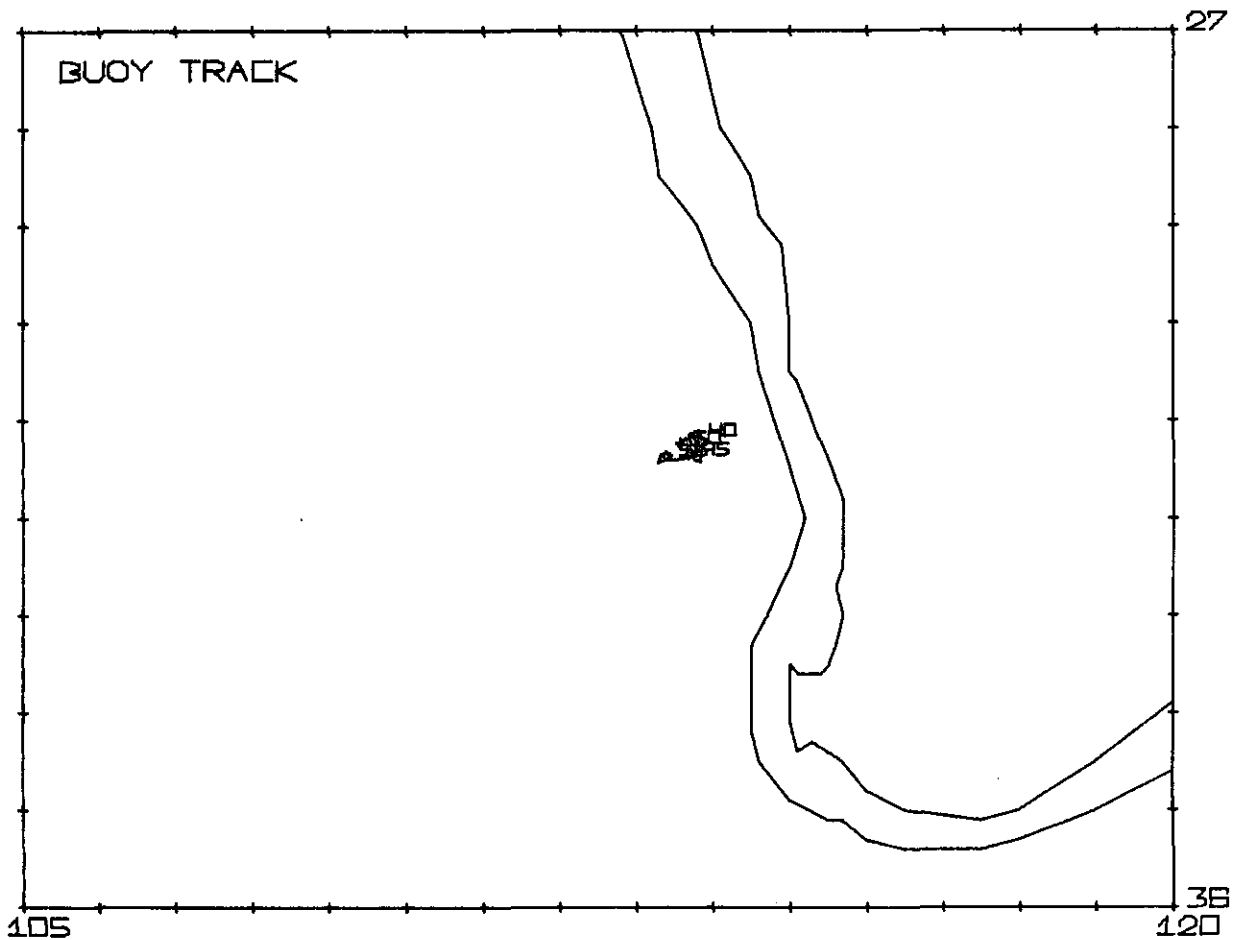
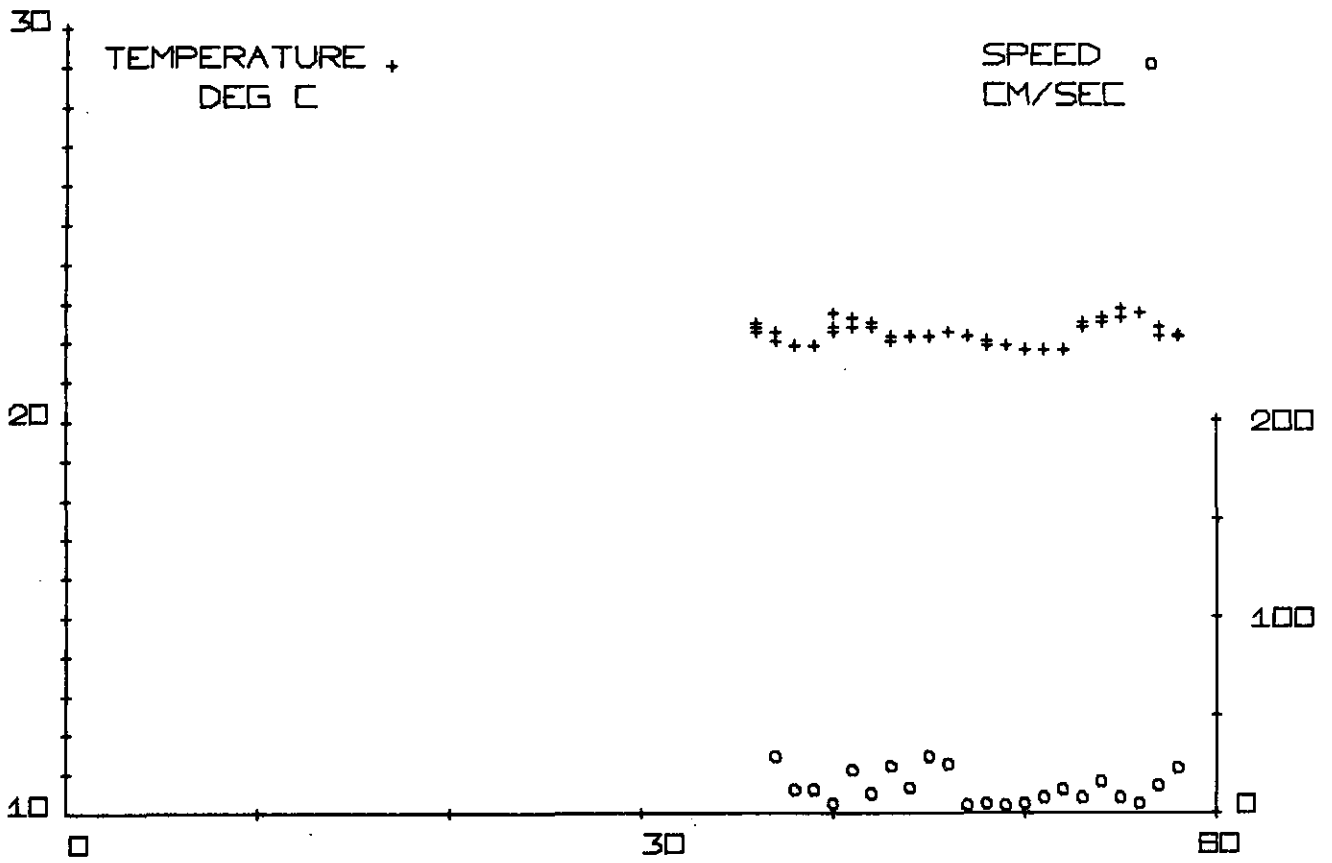
Acknowledgements

We wish to thank David Crooks for considerable computing assistance, Gary Richardson and his assistants for the buoy electronic work, and John Wood for the buoy rigging.

VI. REFERENCES

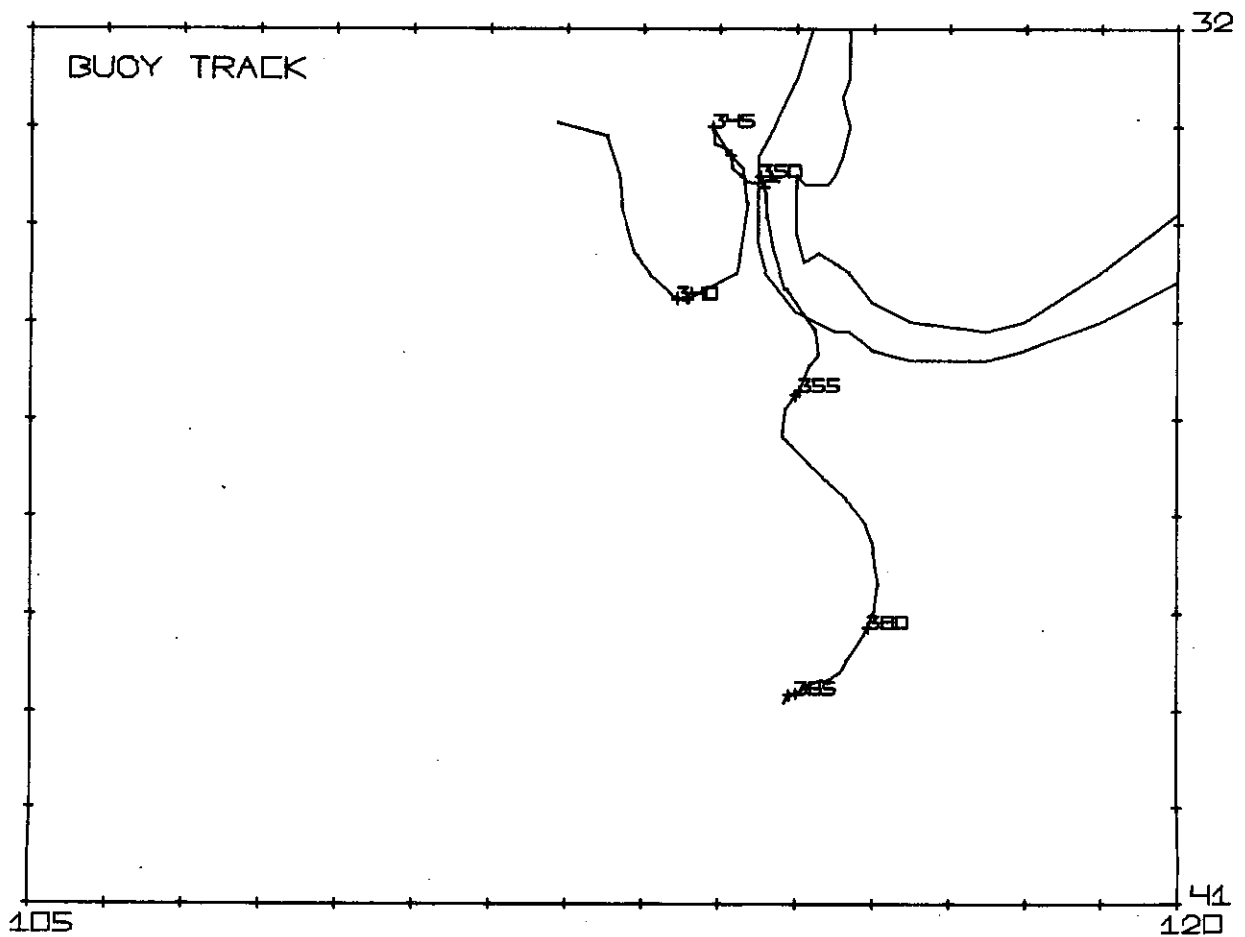
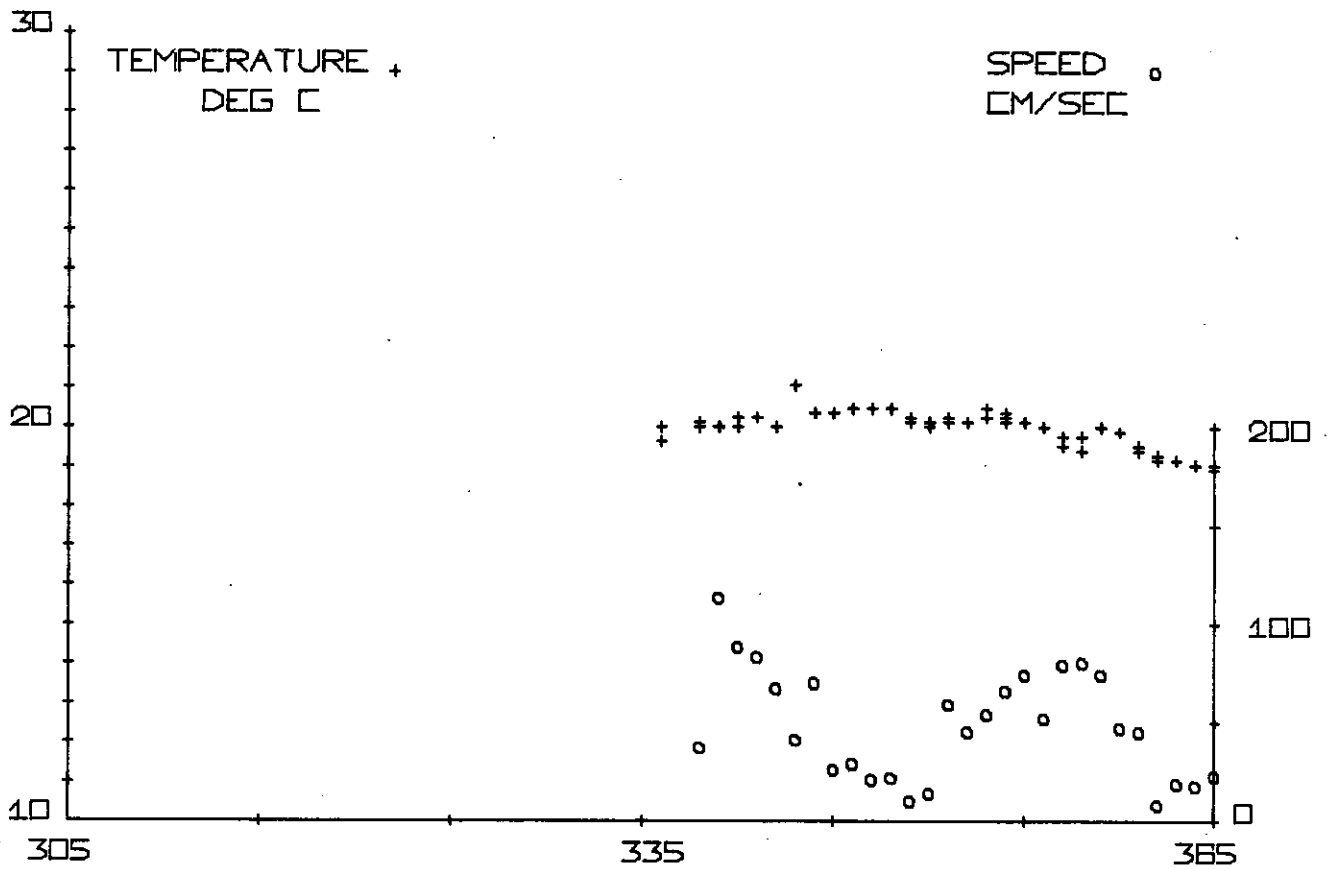
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BUOY 107 DAYS 0- 60 1976



BUOY 131

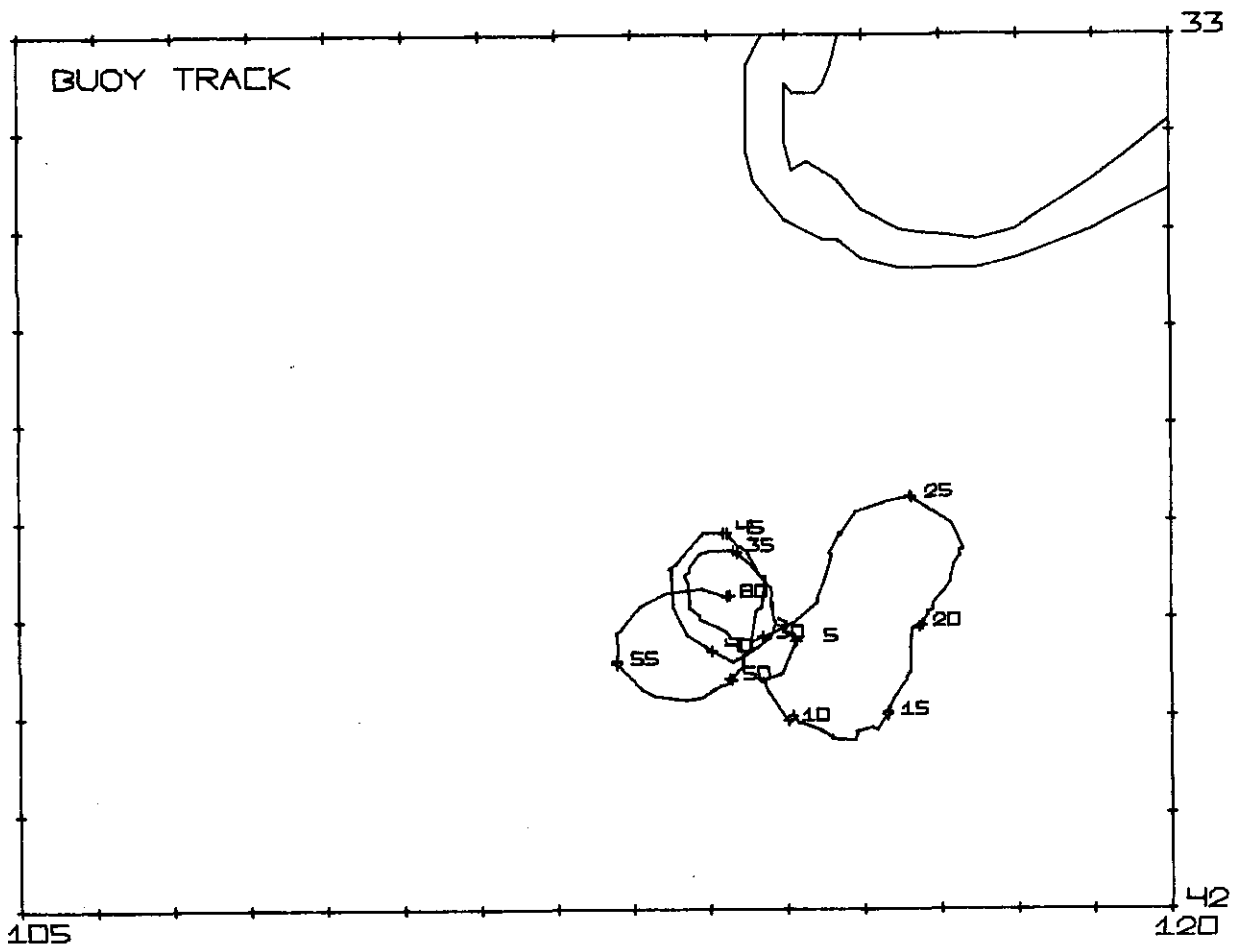
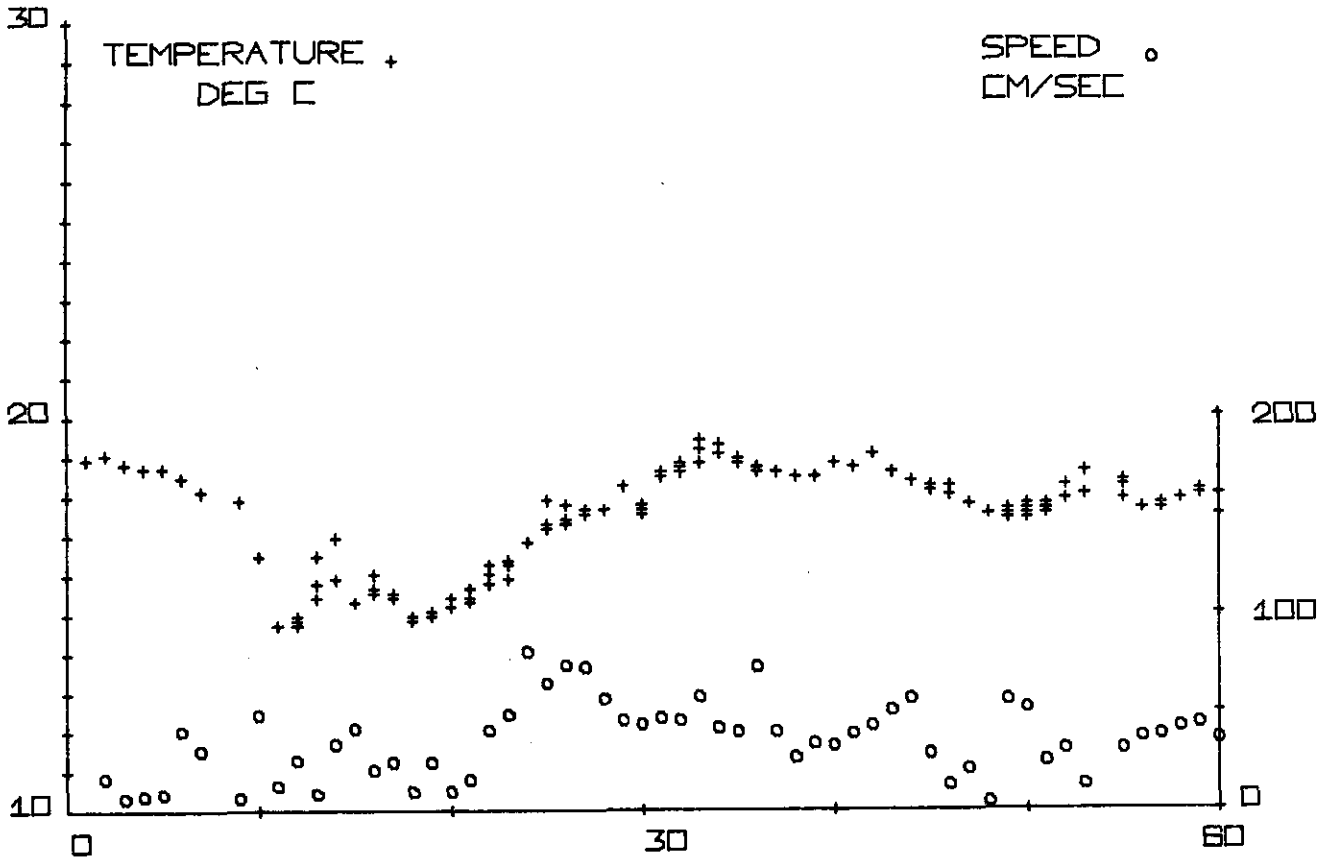
DAYS 305-365 1975



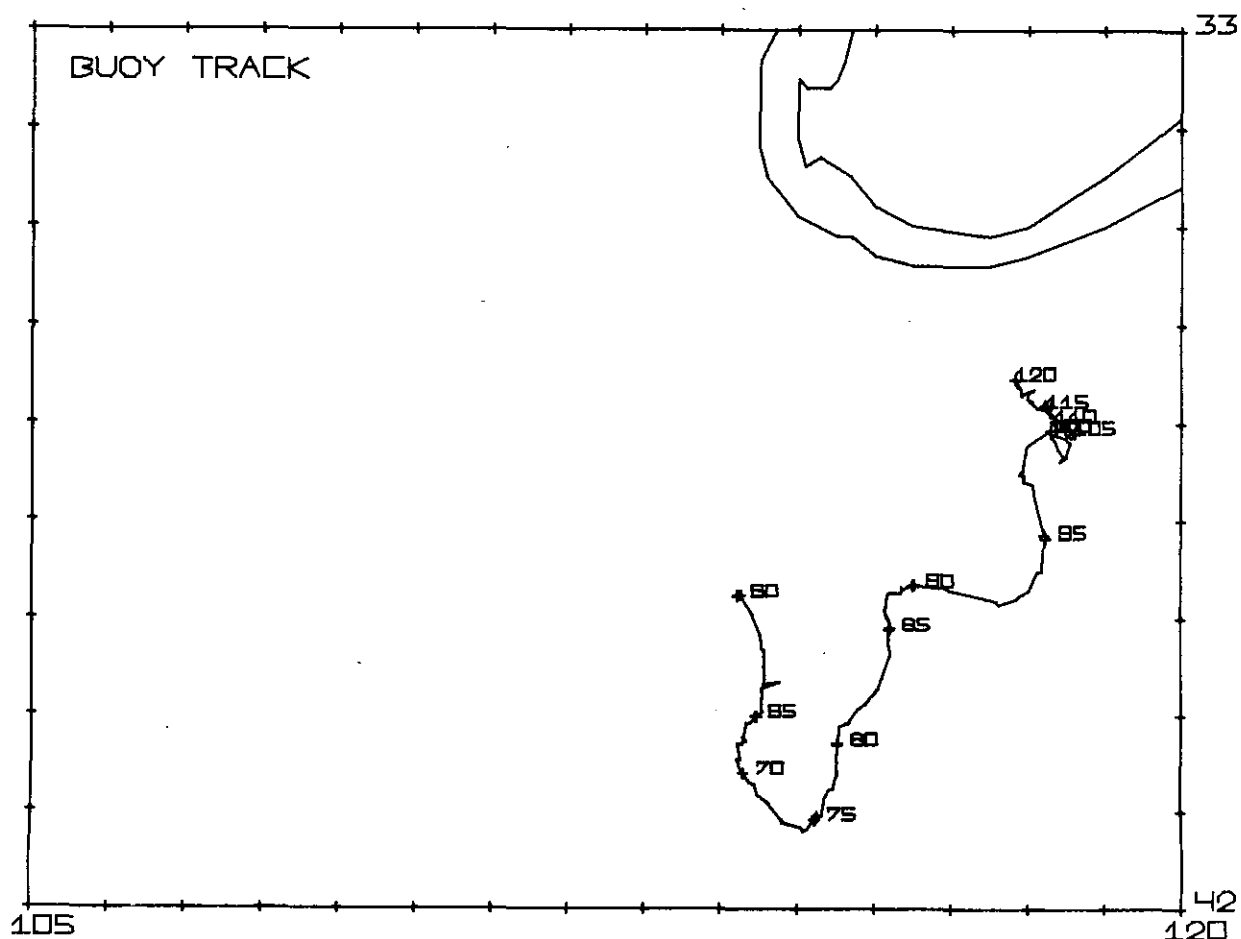
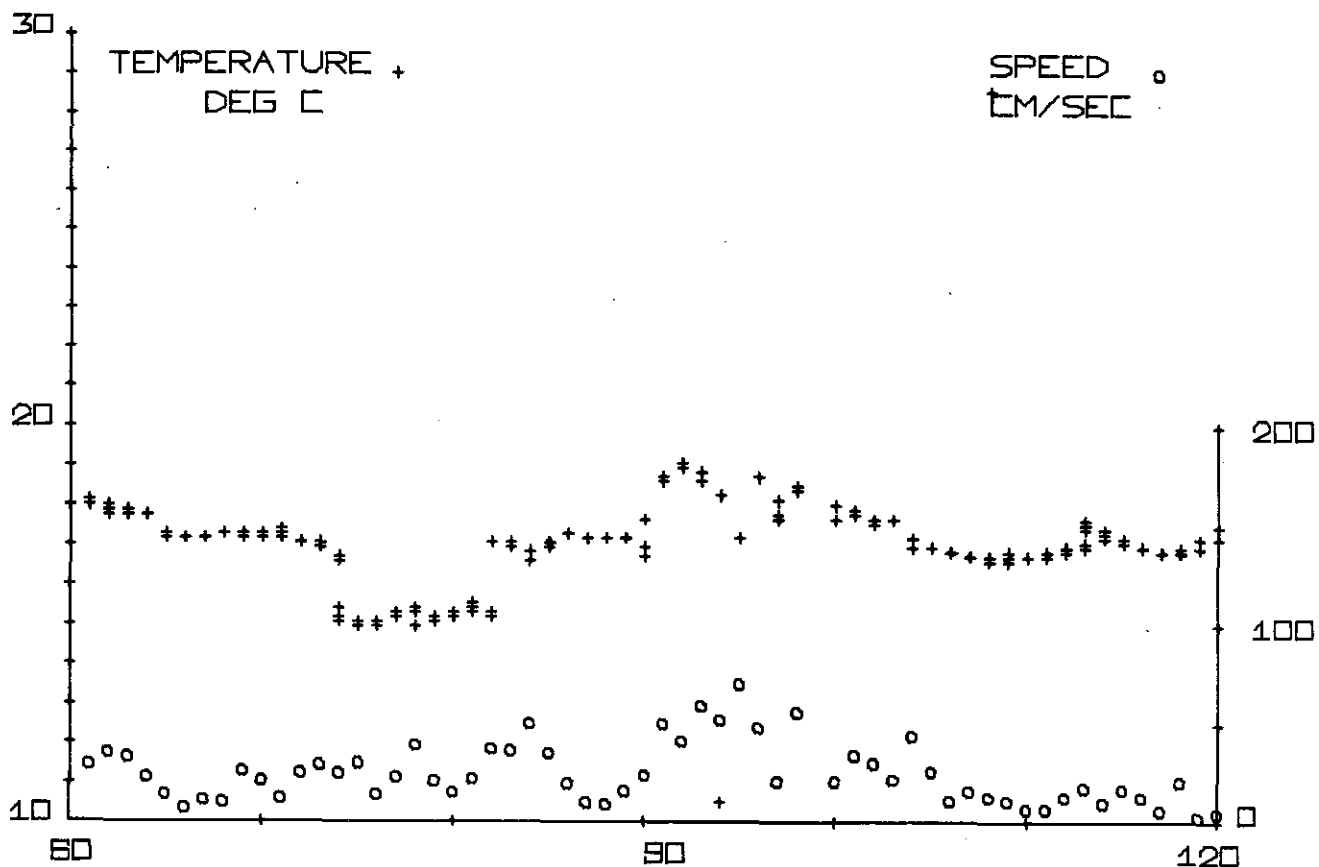
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DAYS

0 - 60 1976

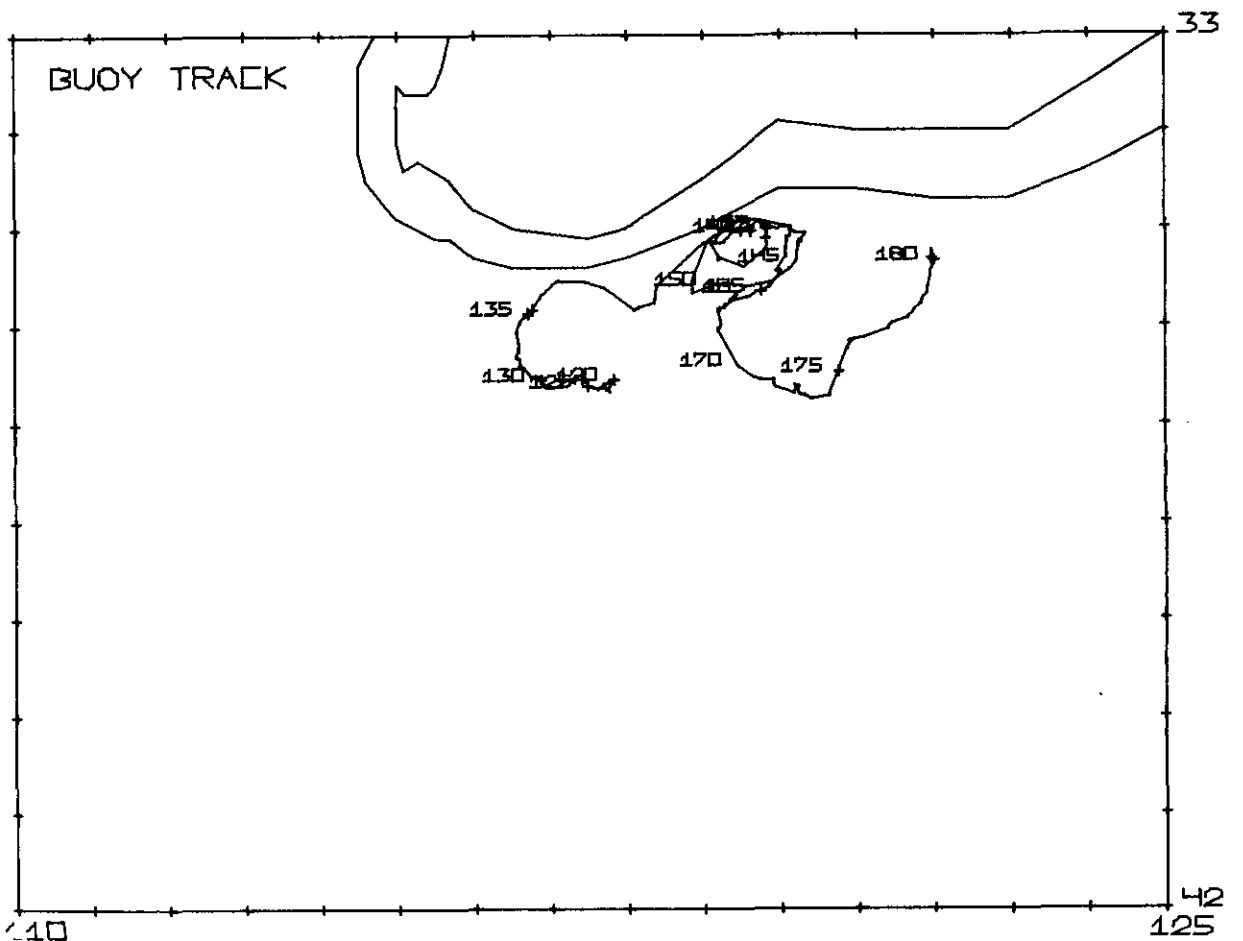
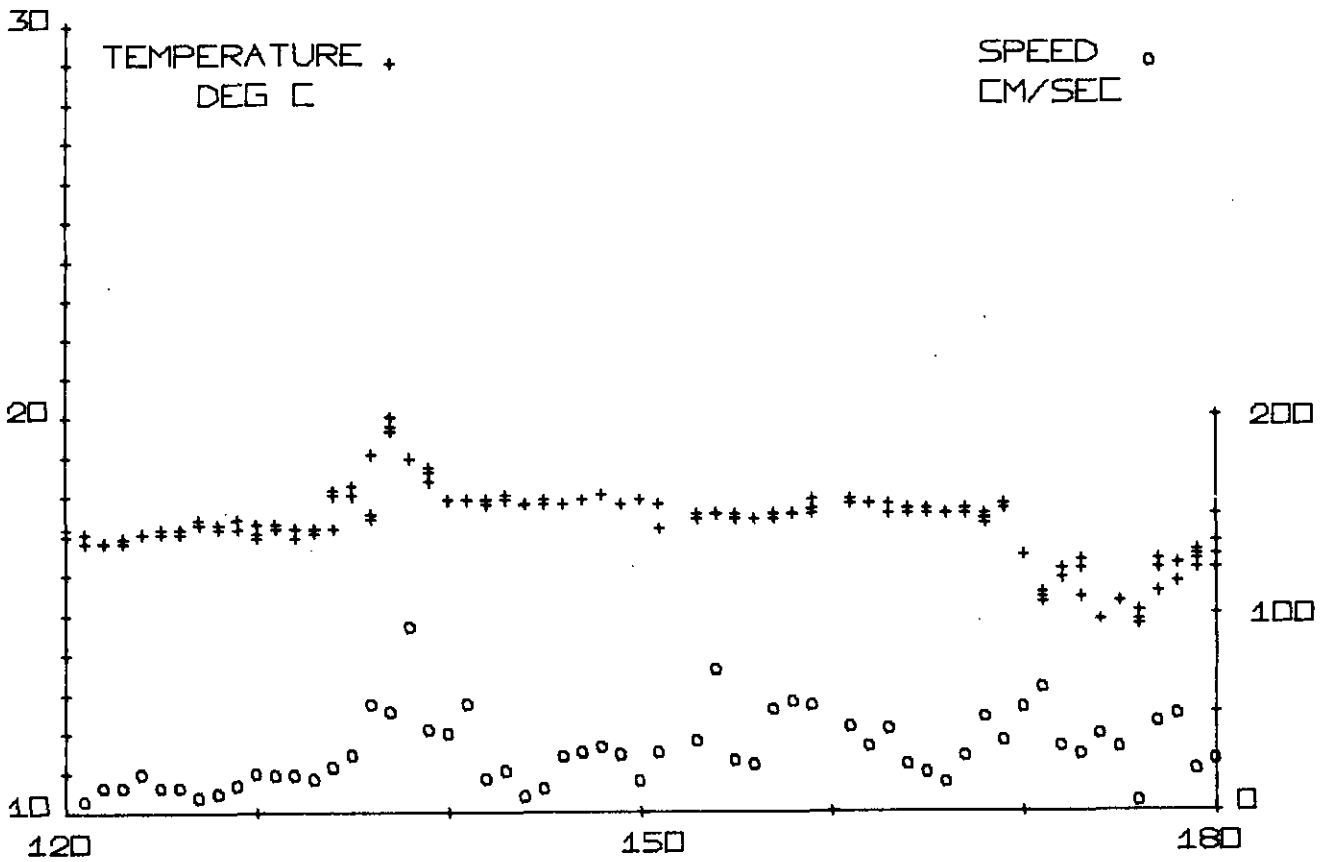


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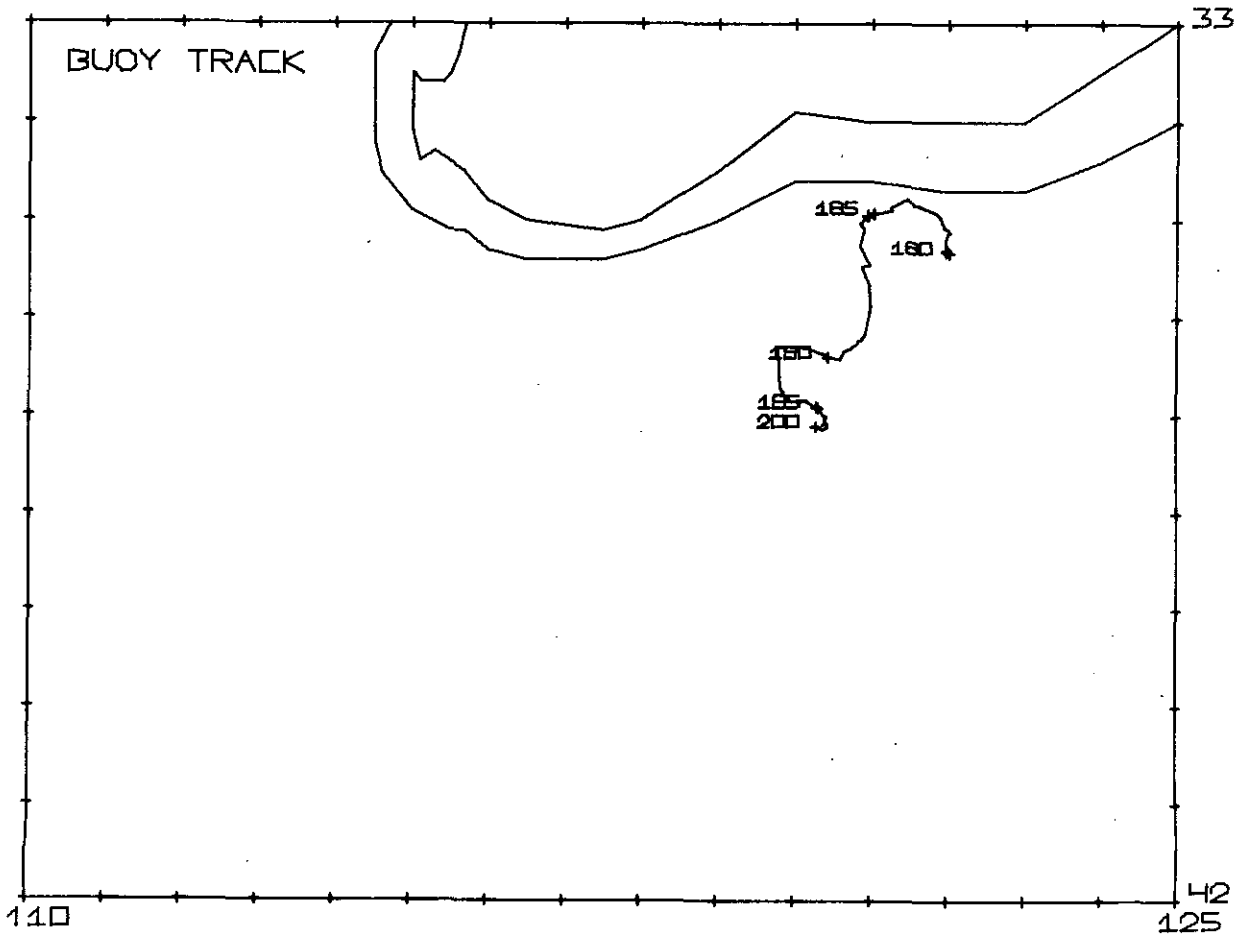
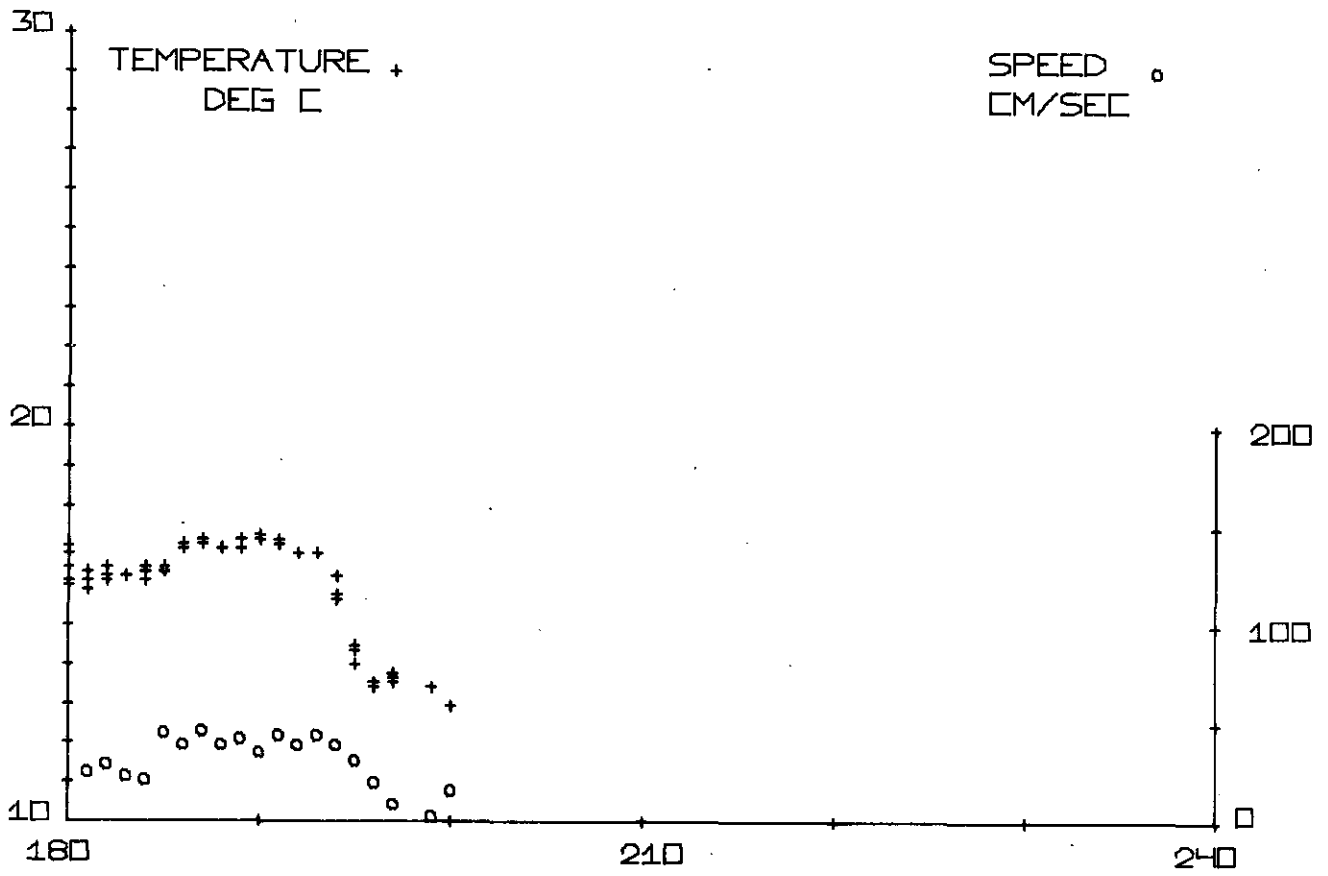


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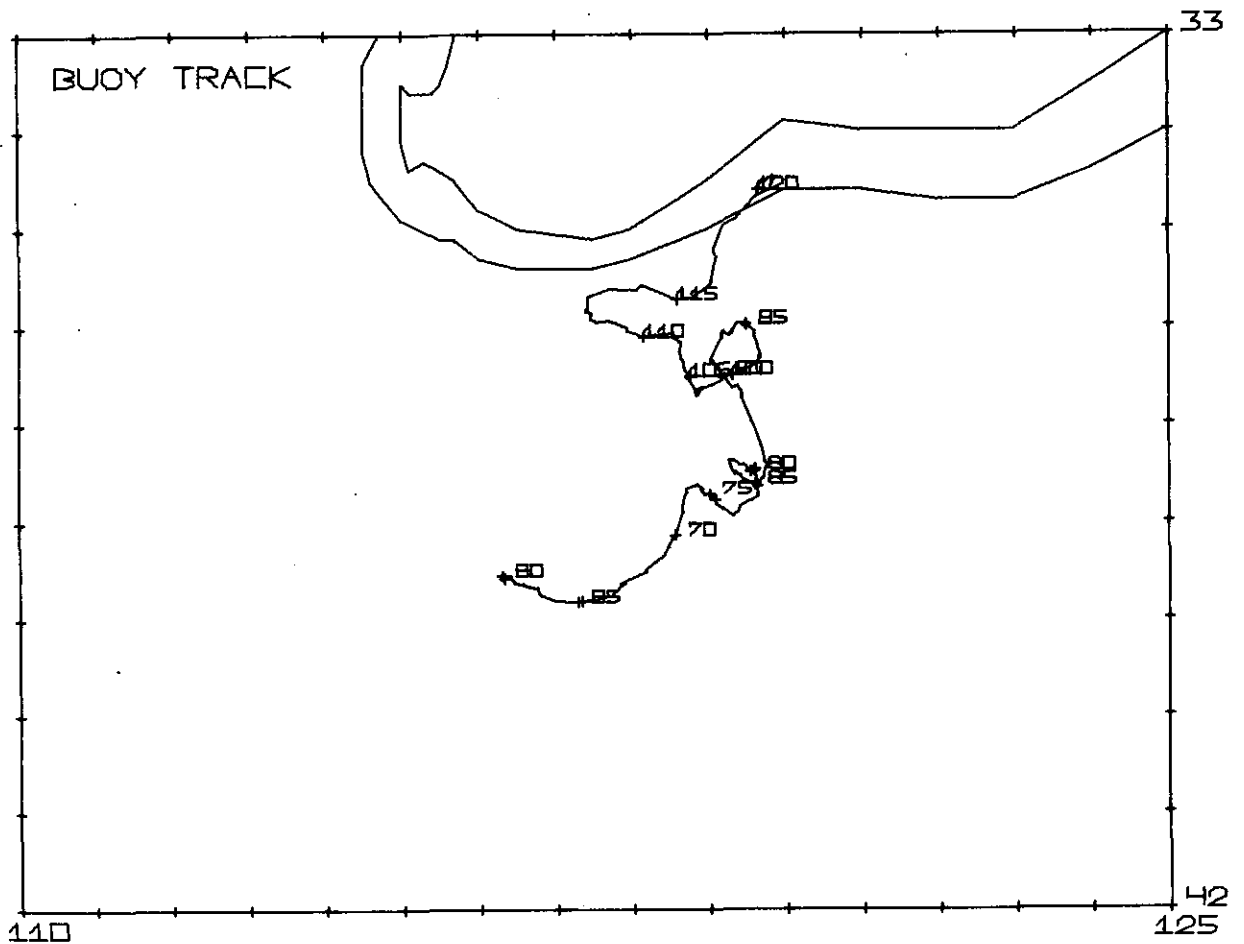
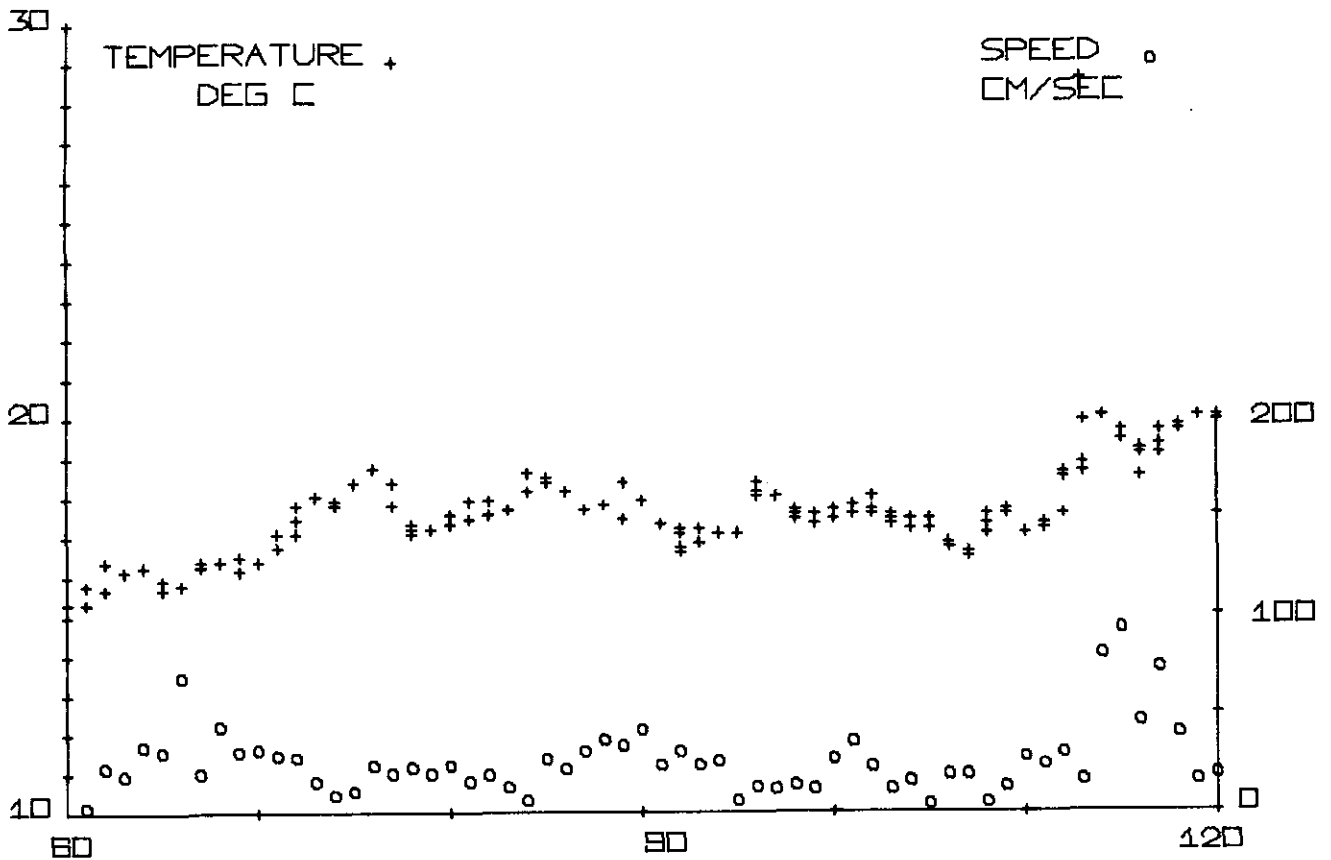
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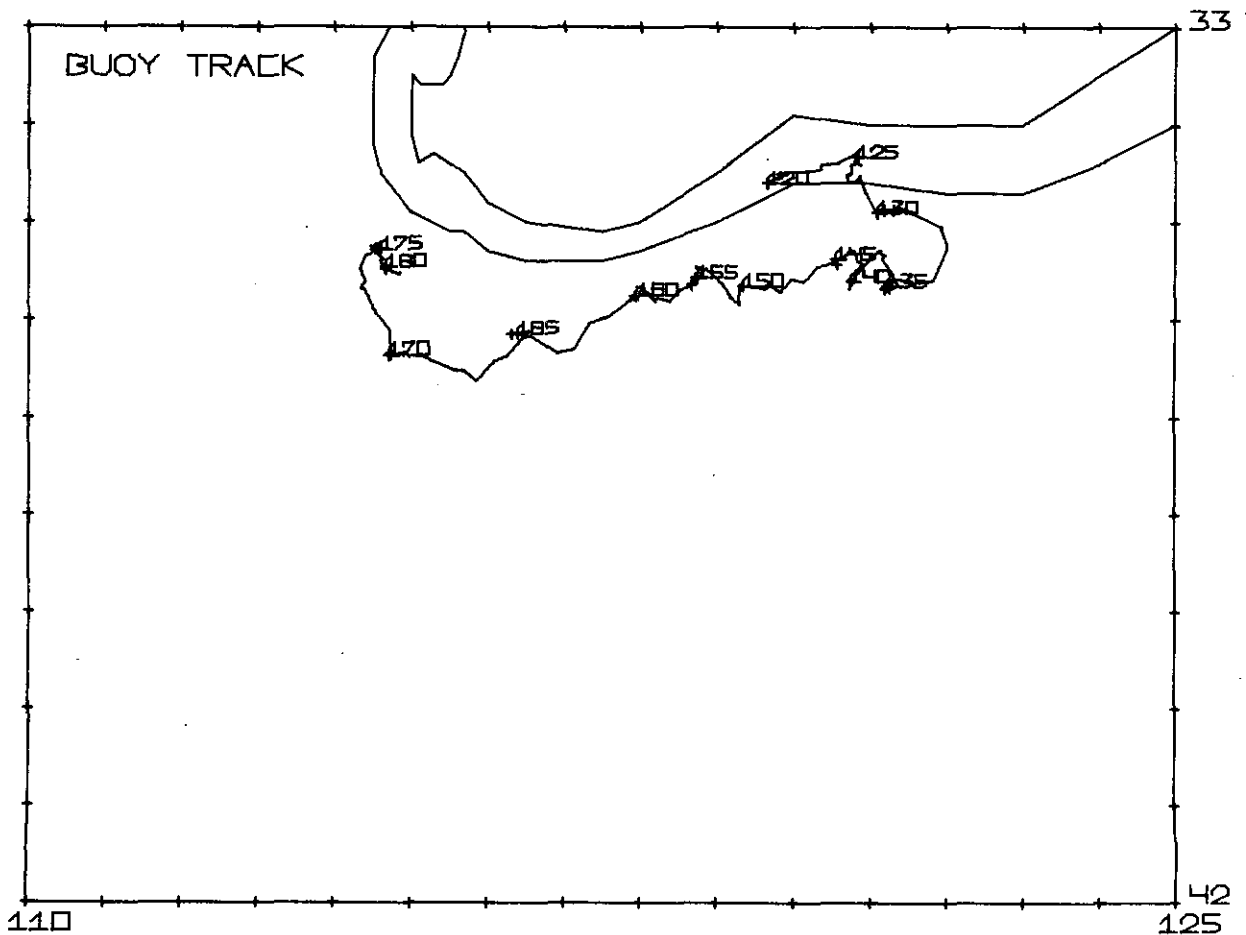
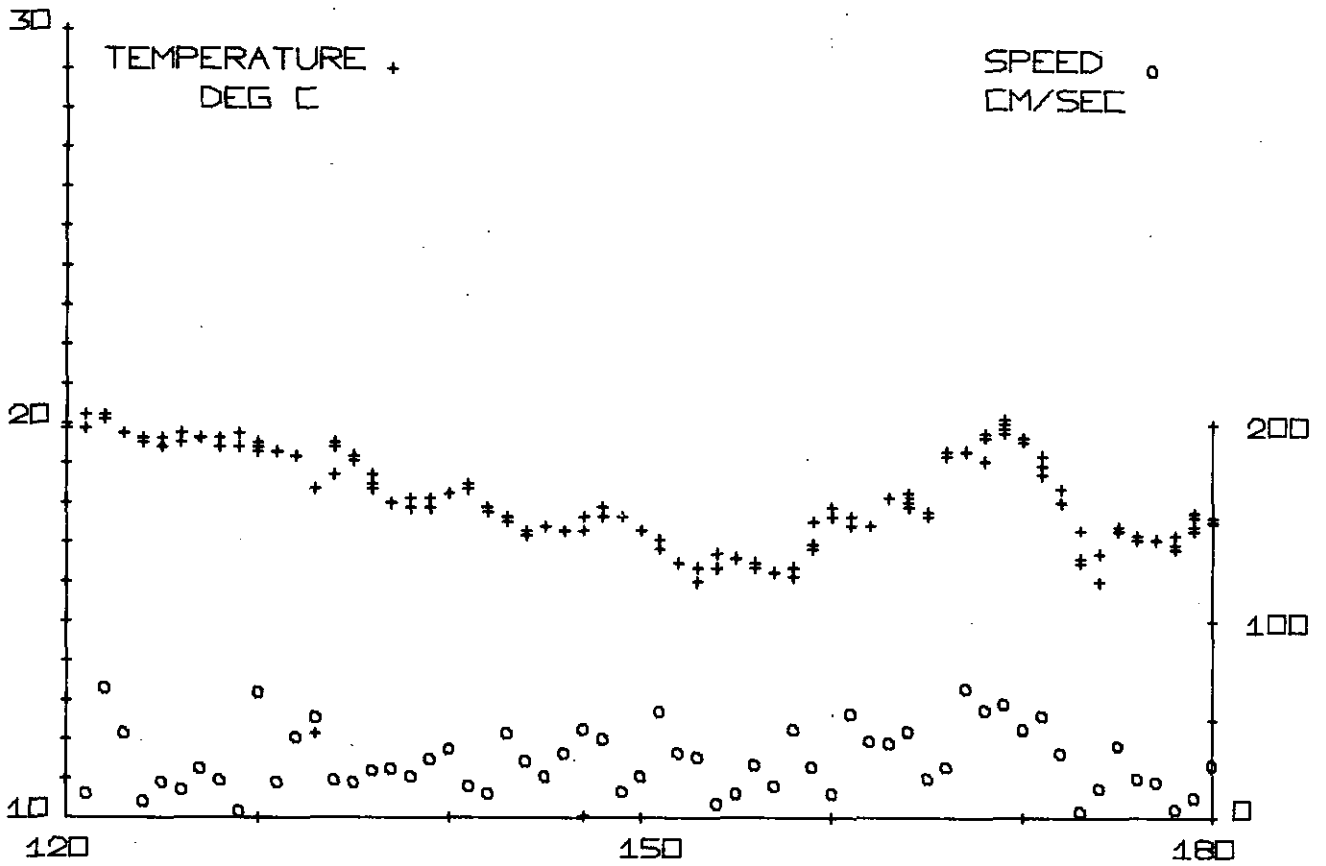
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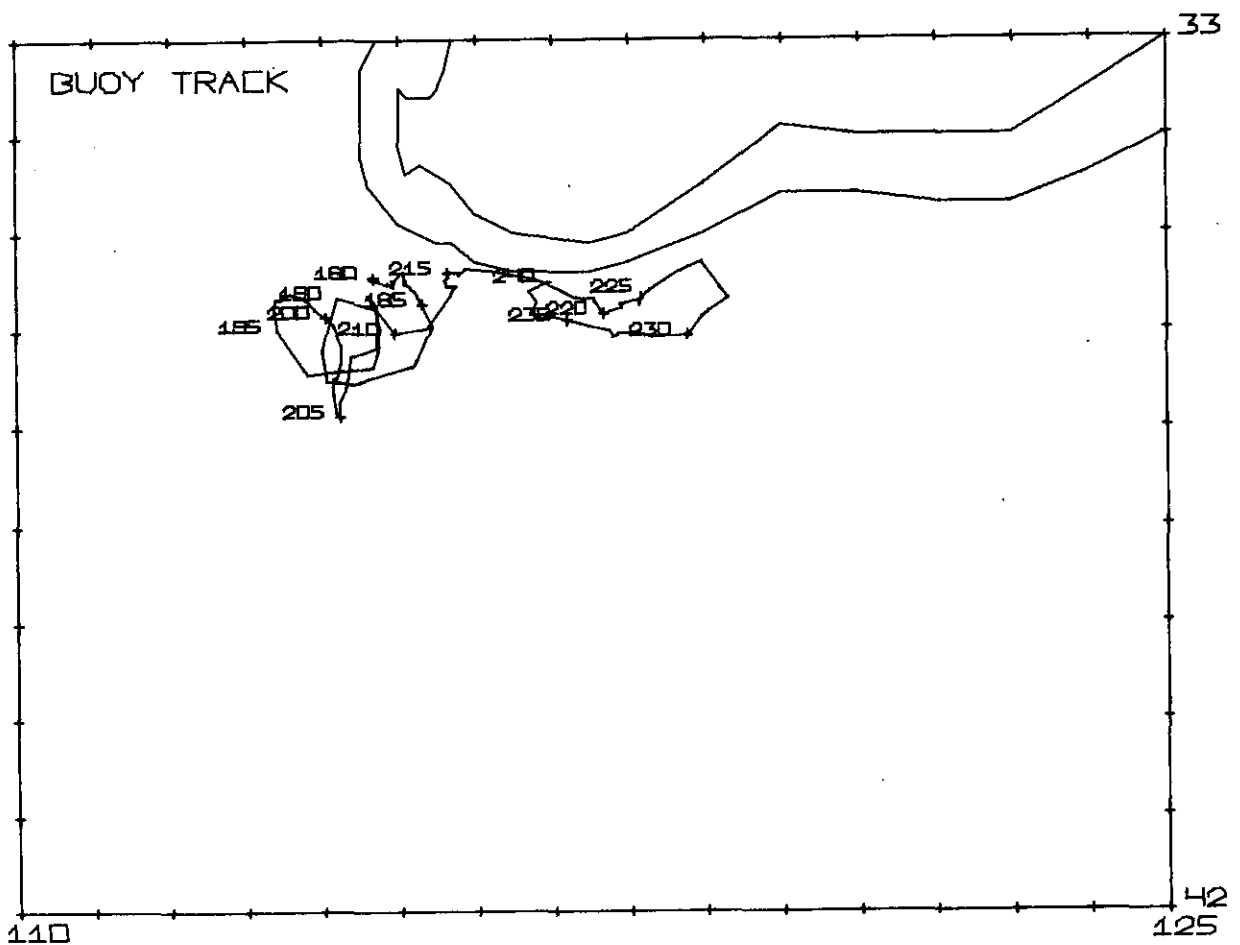
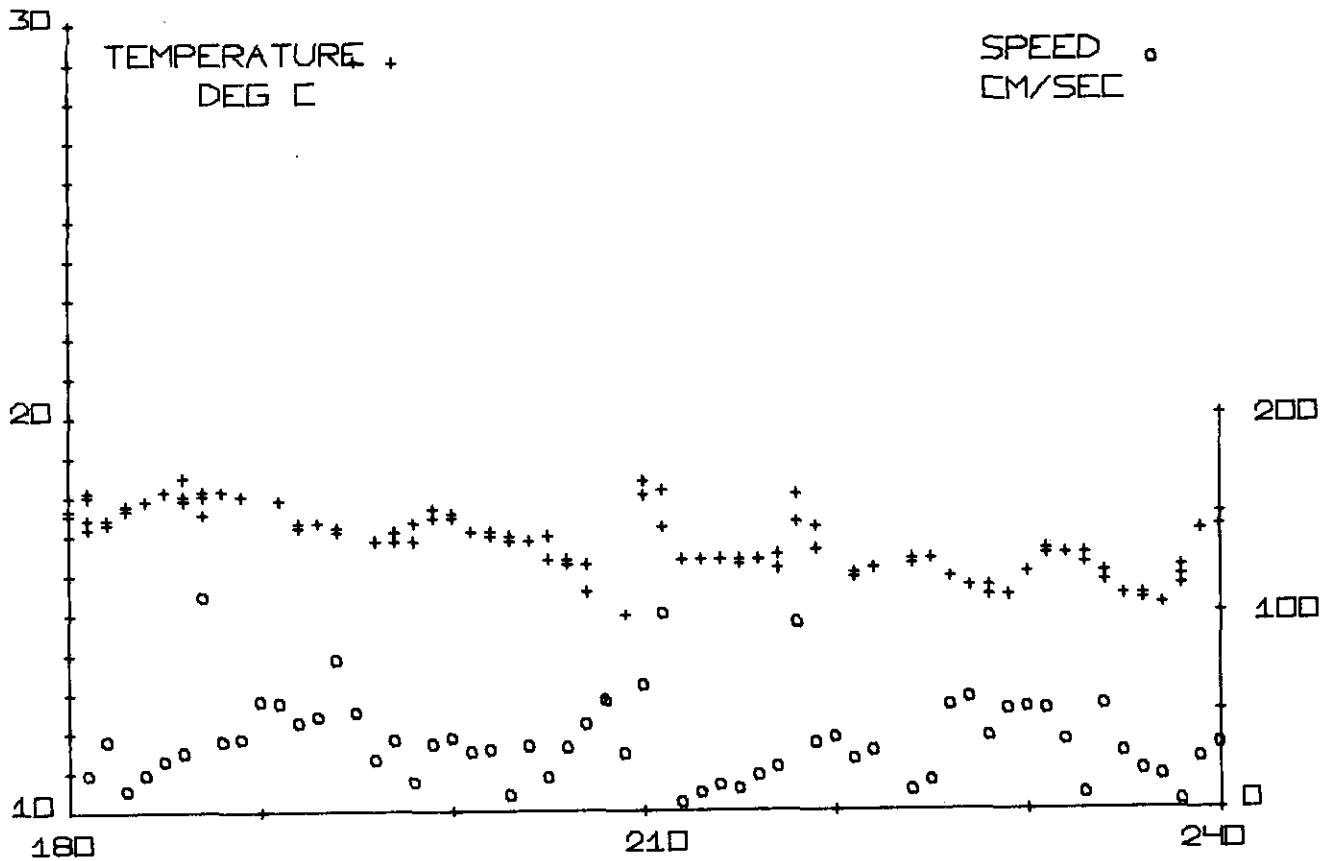
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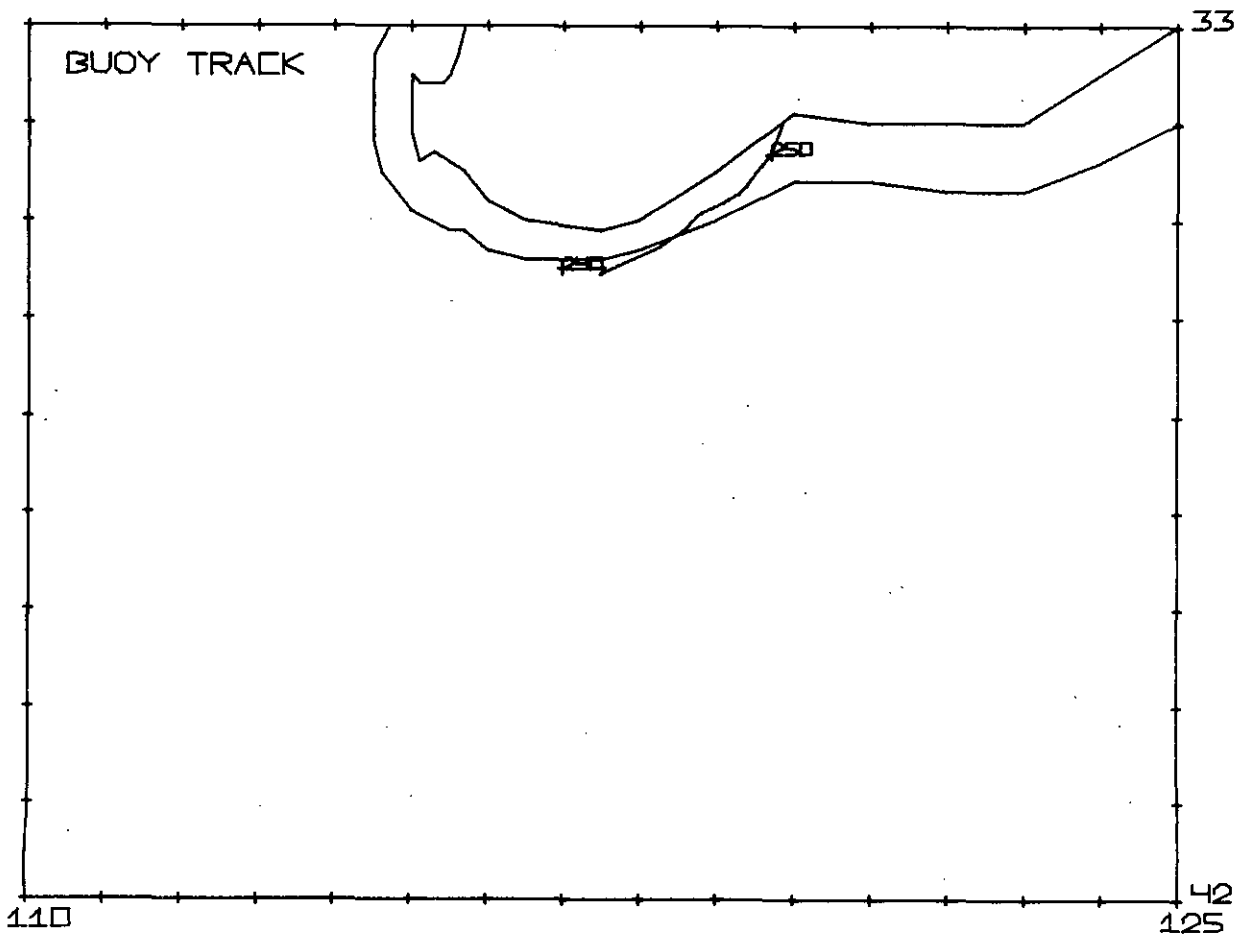
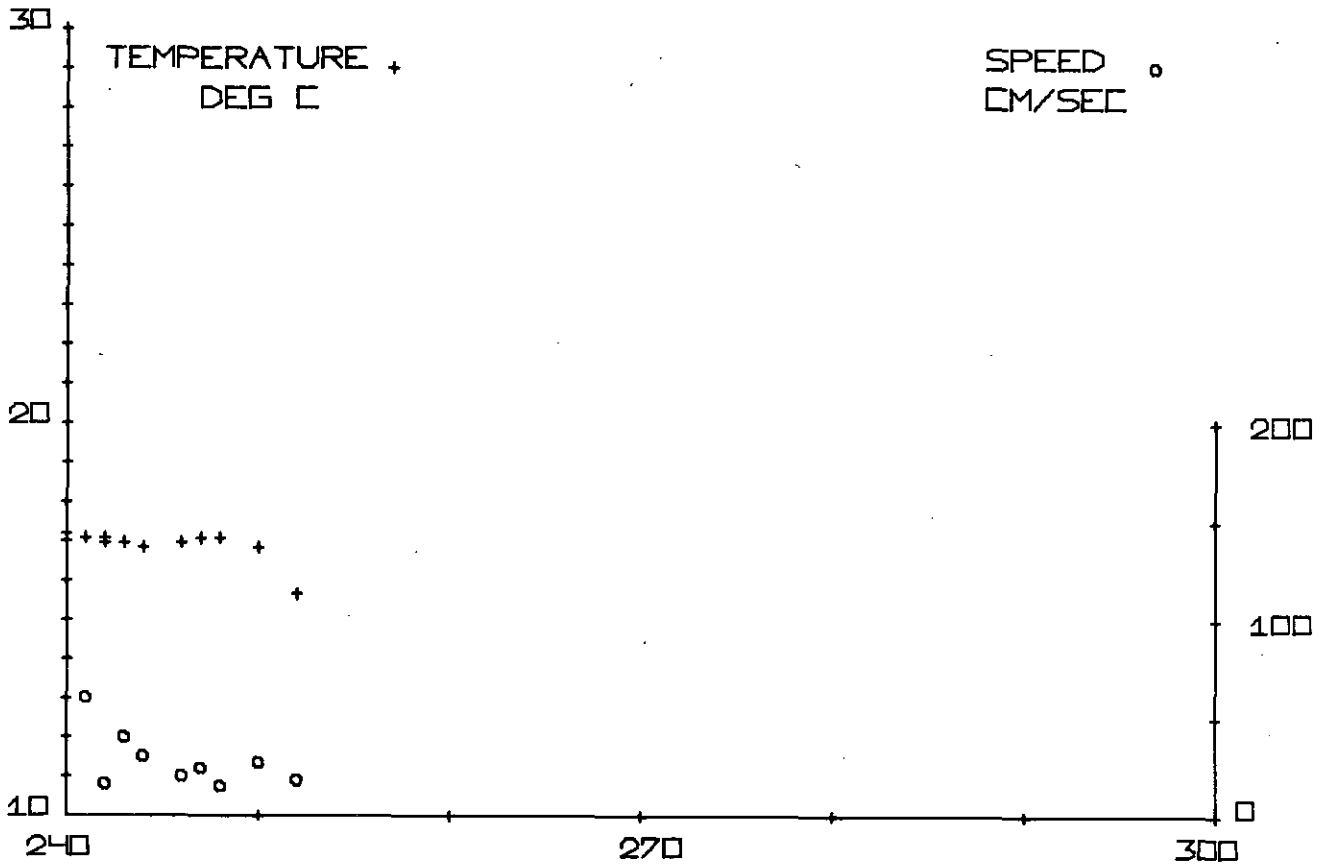
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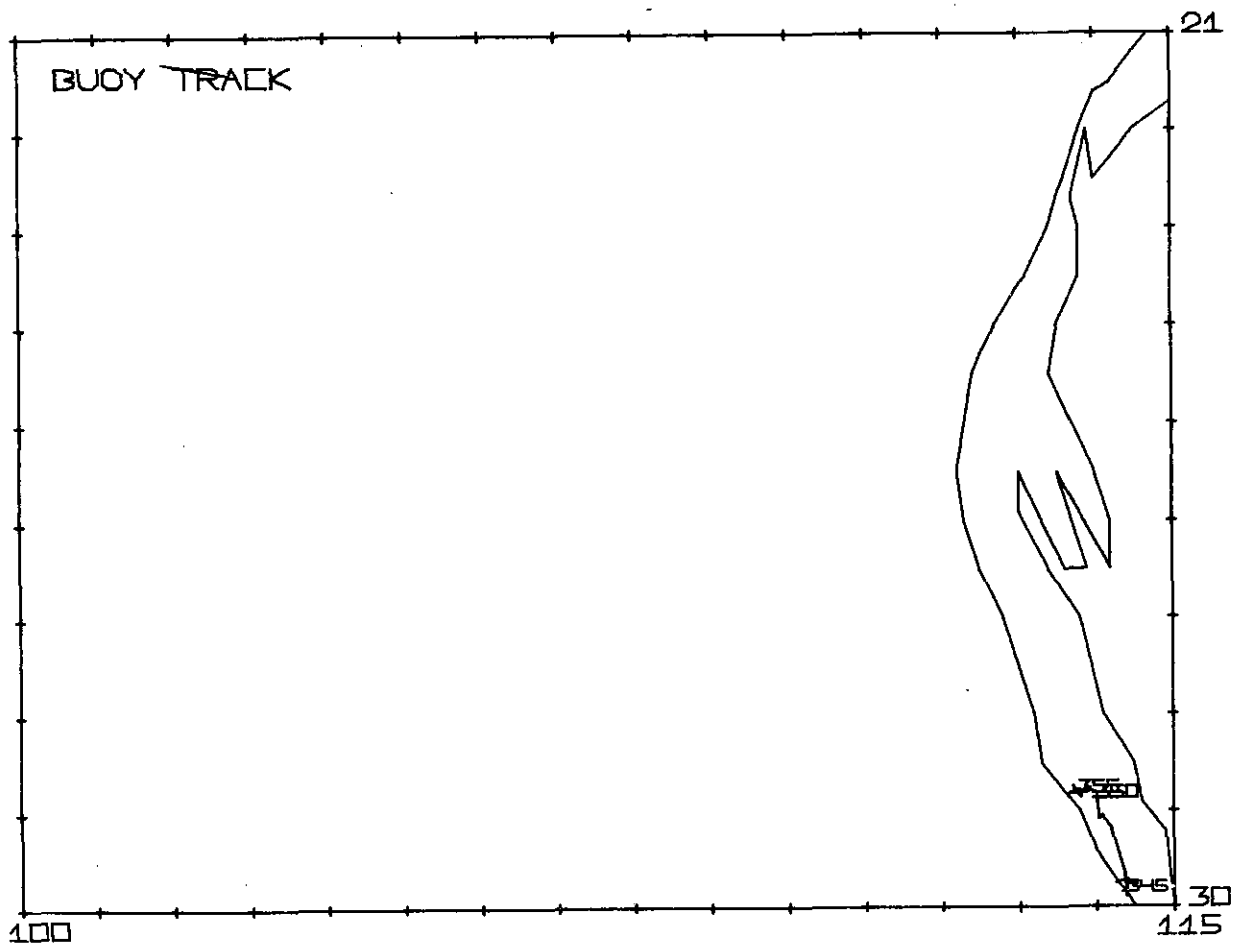
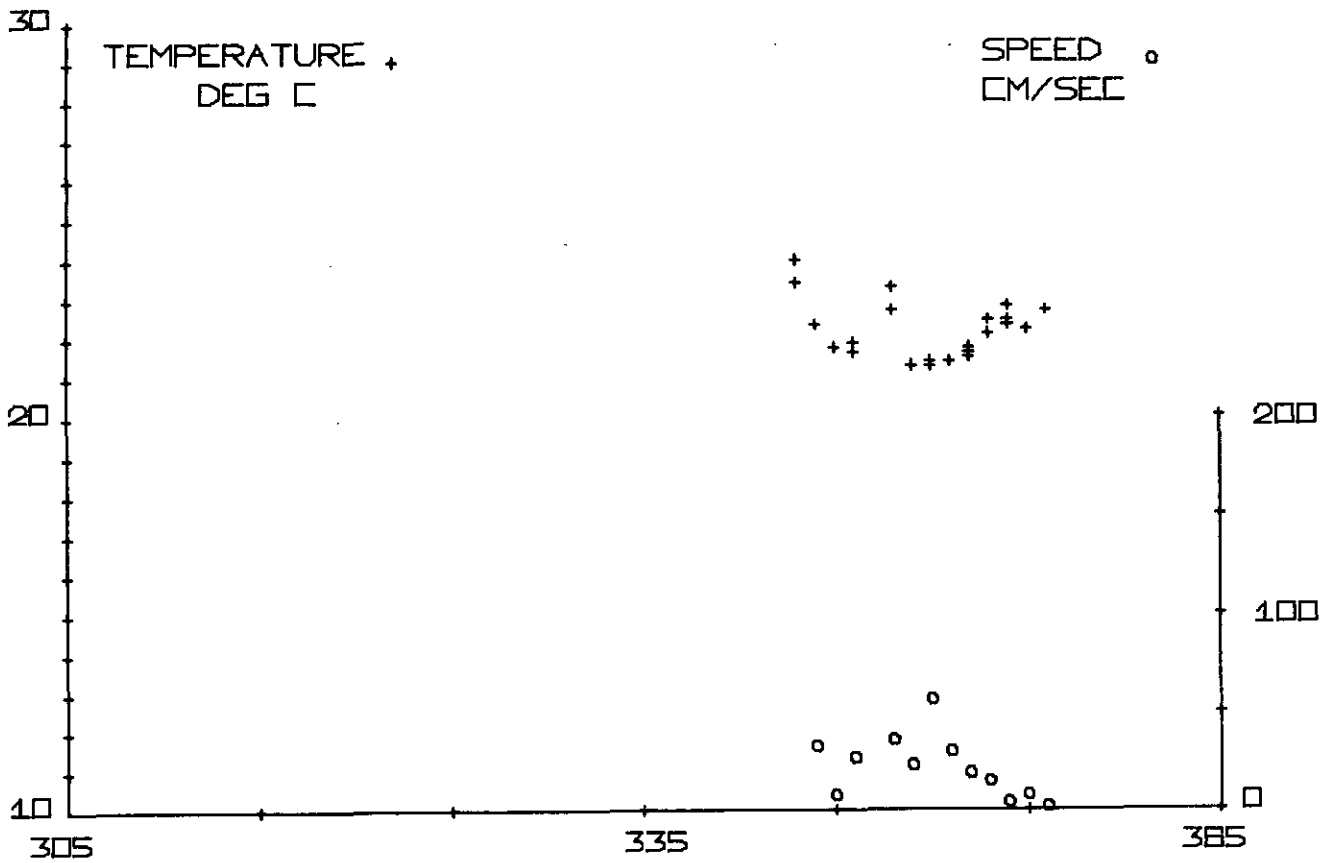
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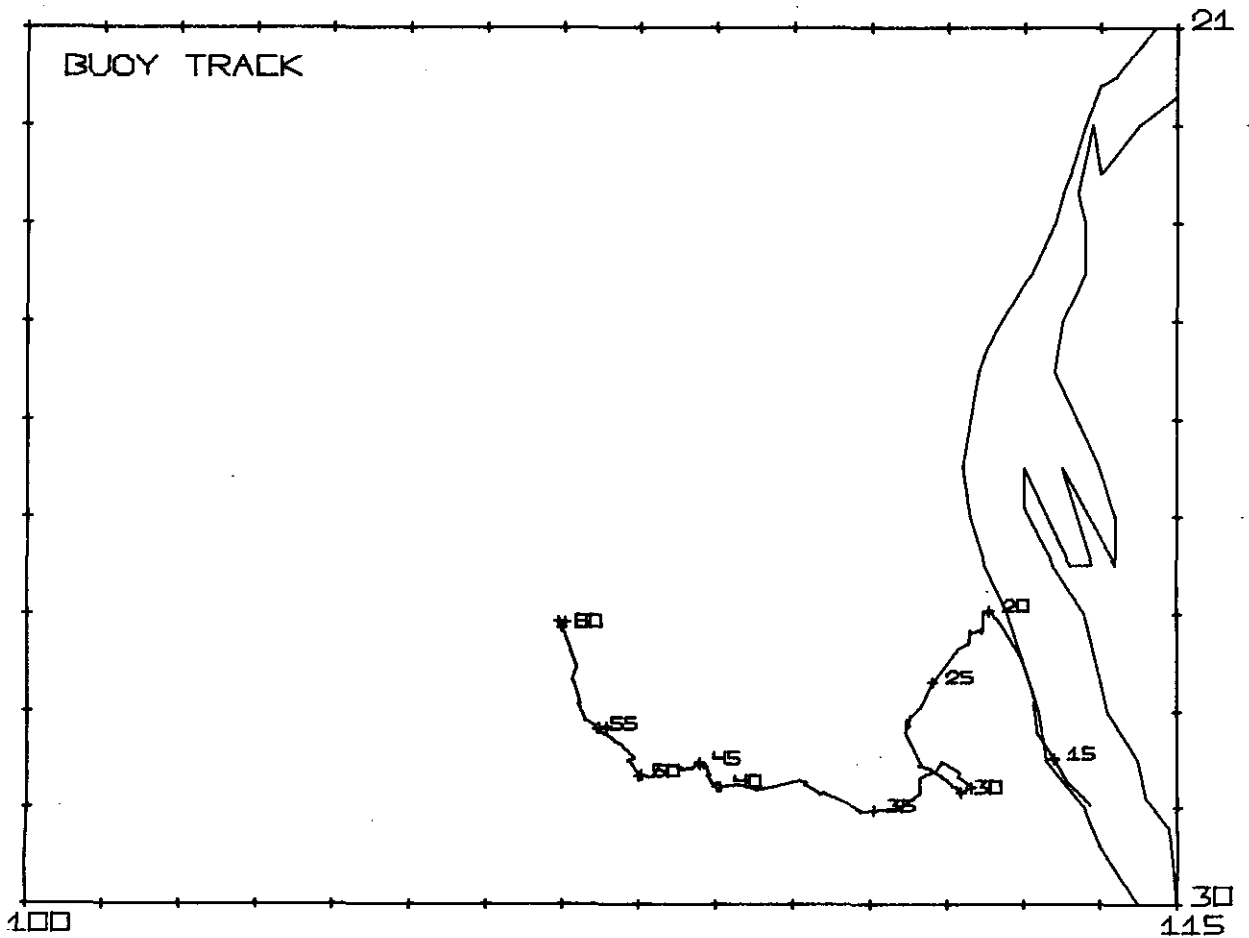
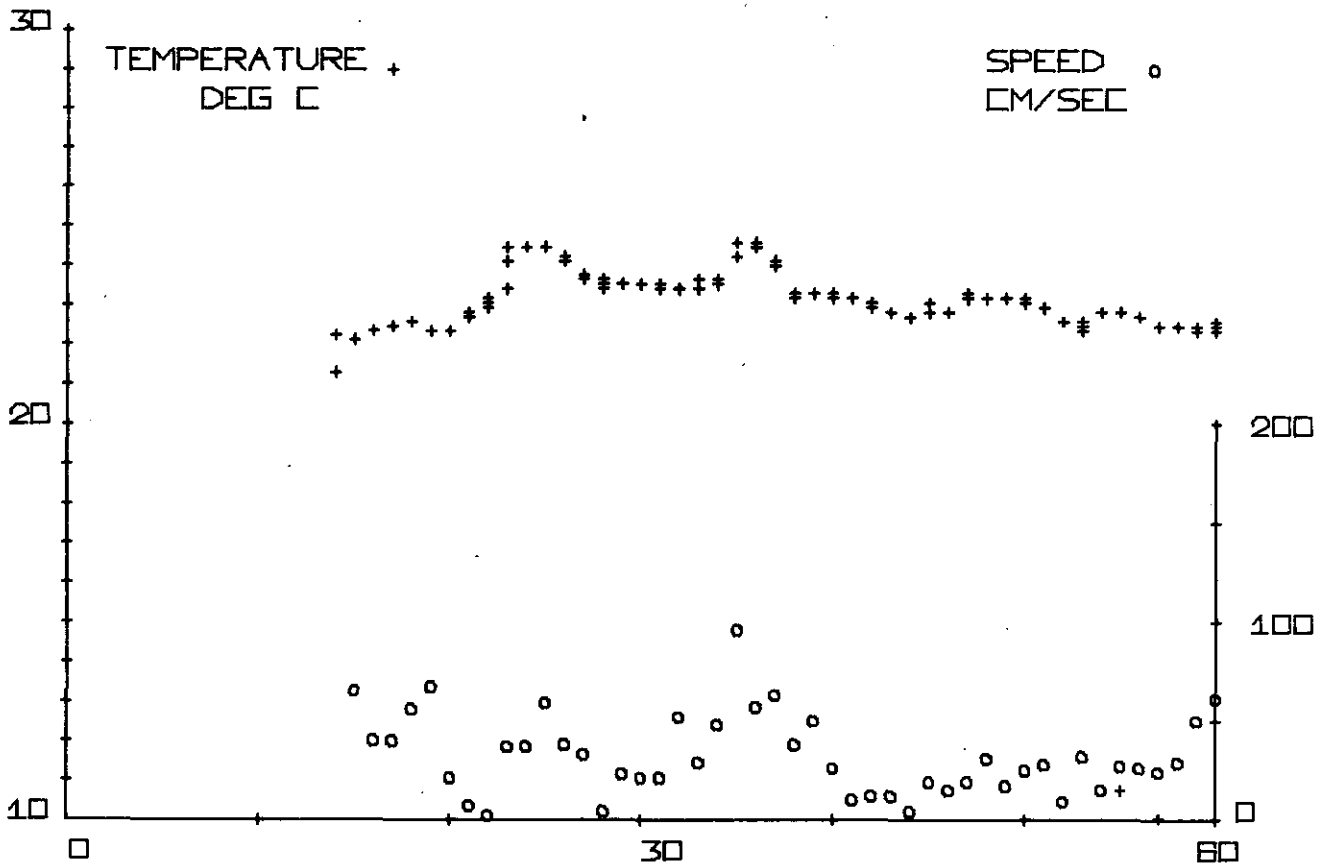
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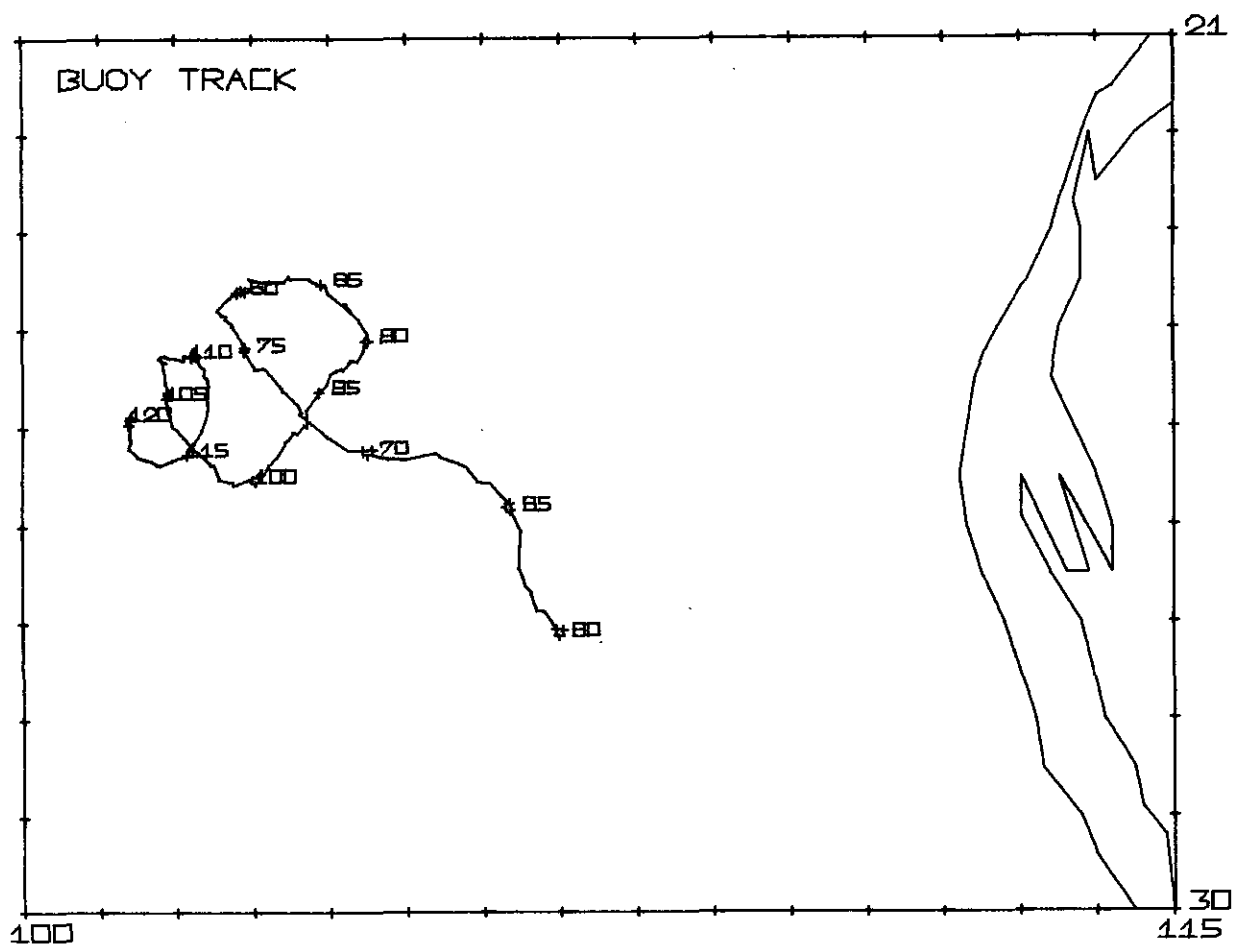
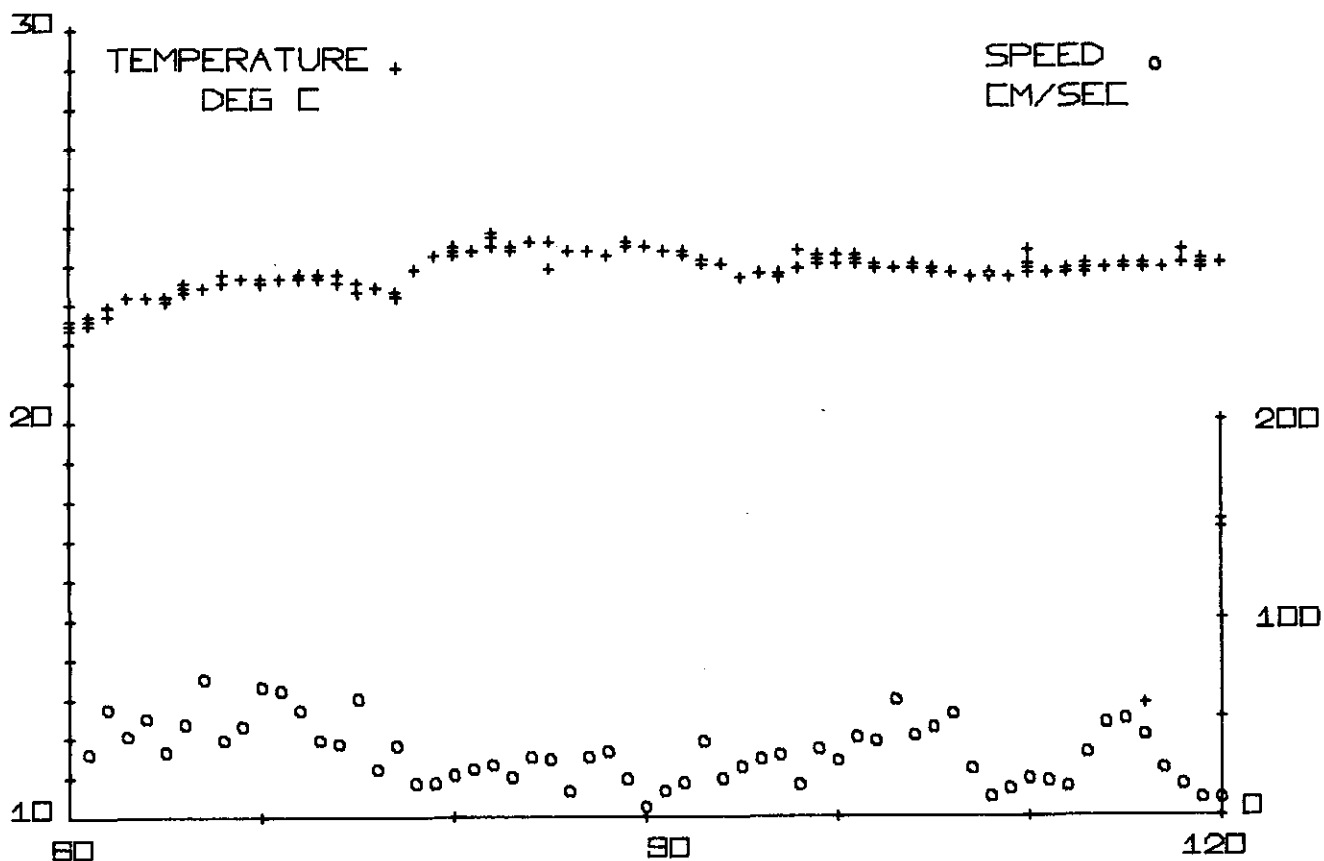
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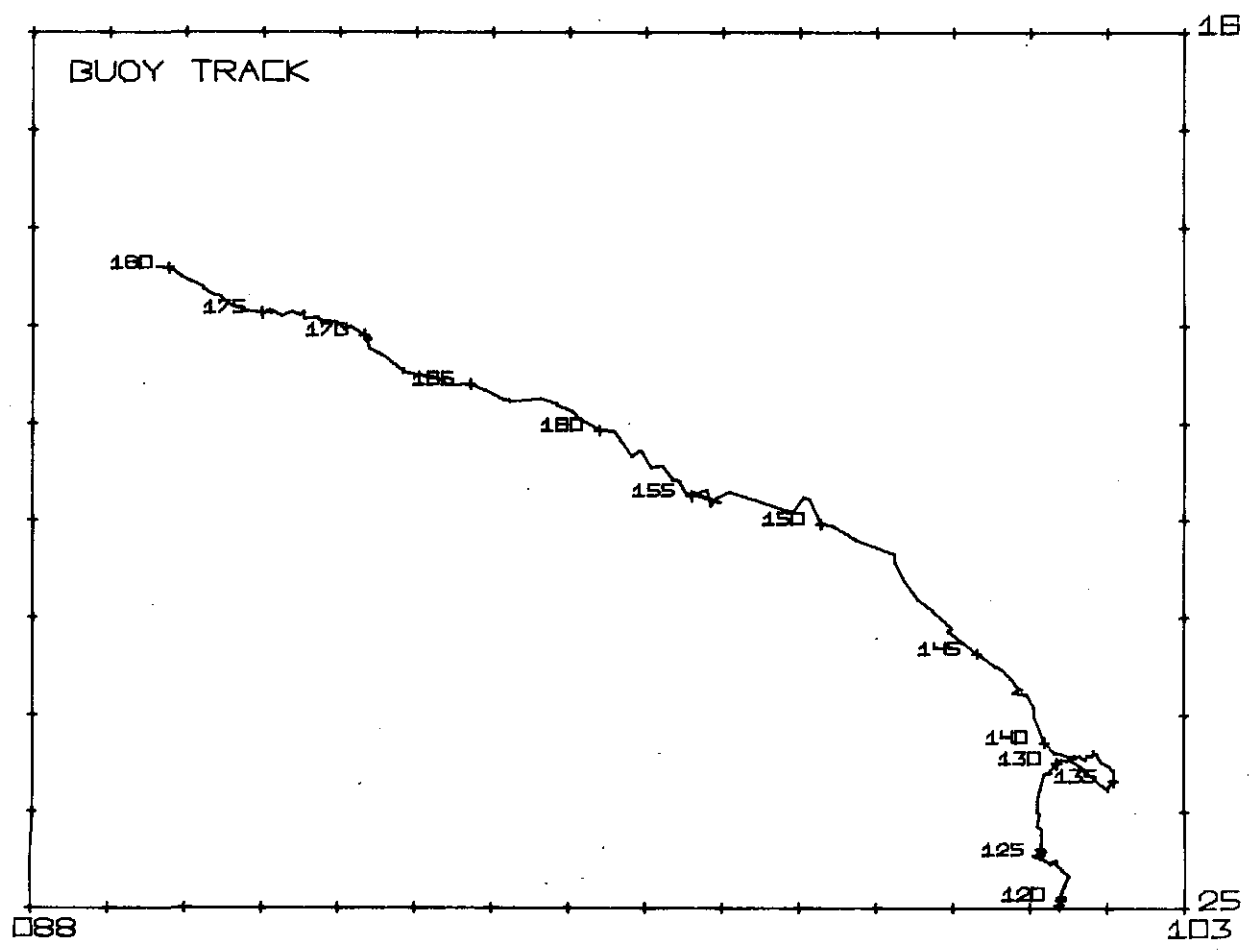
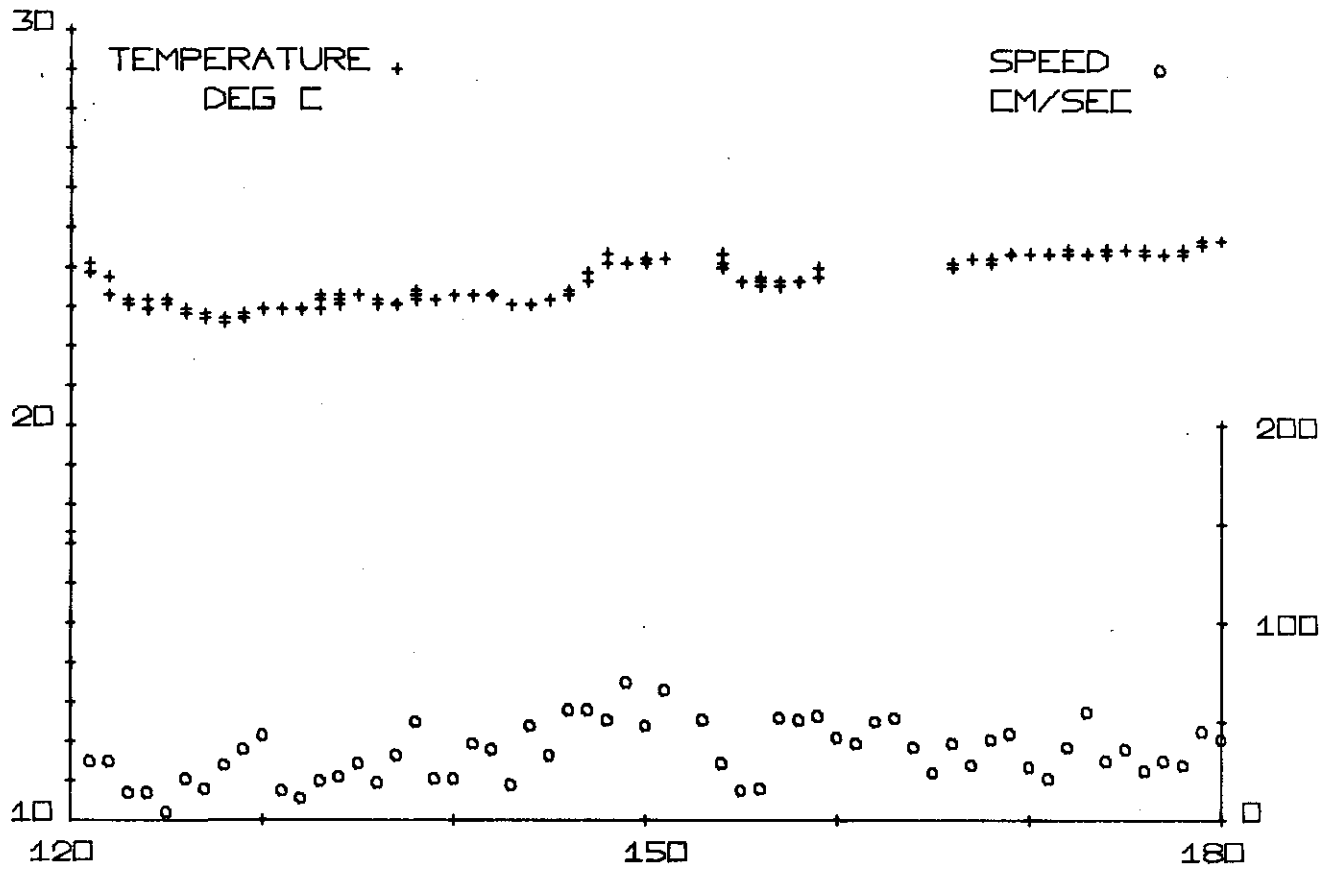
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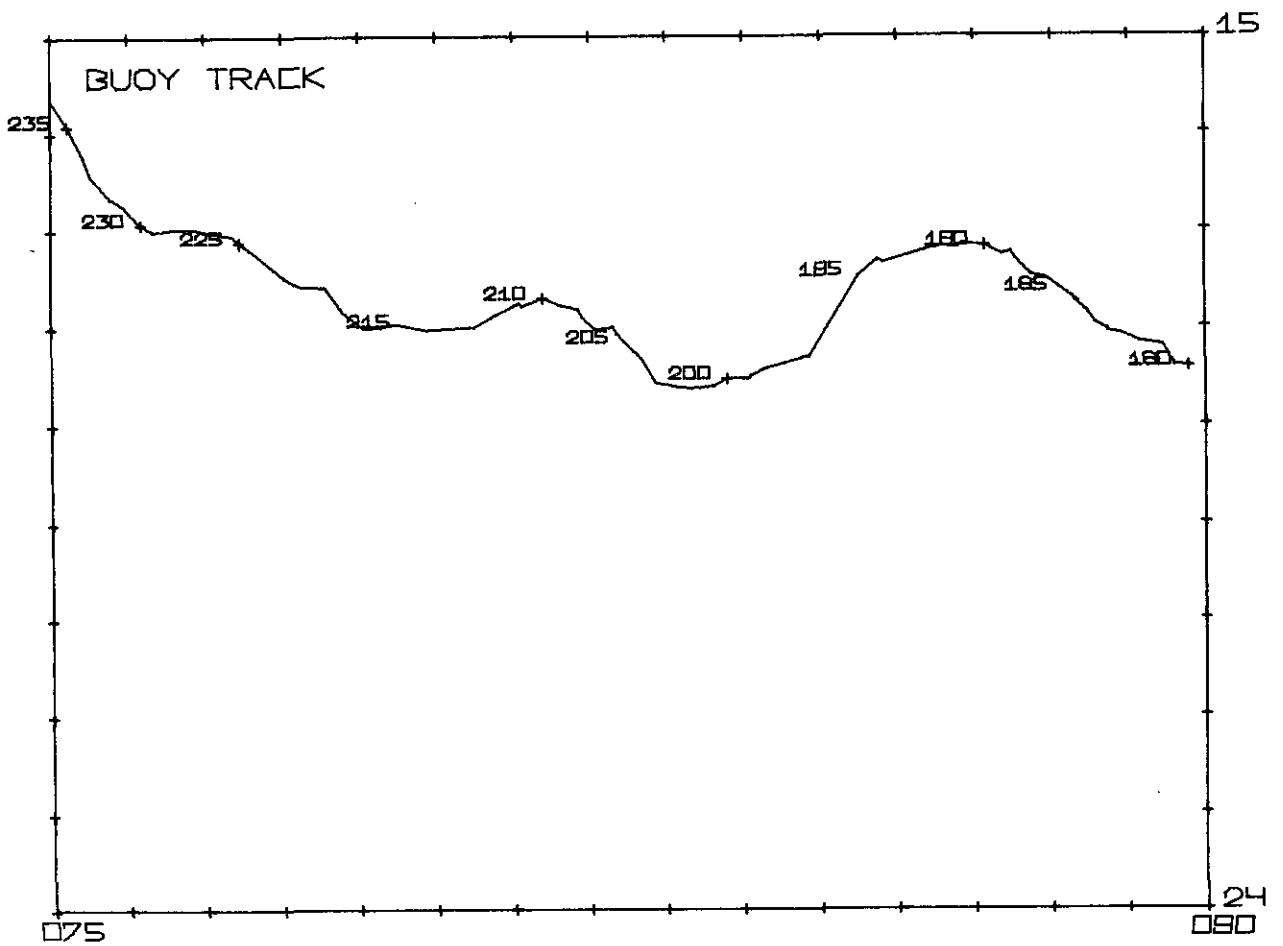
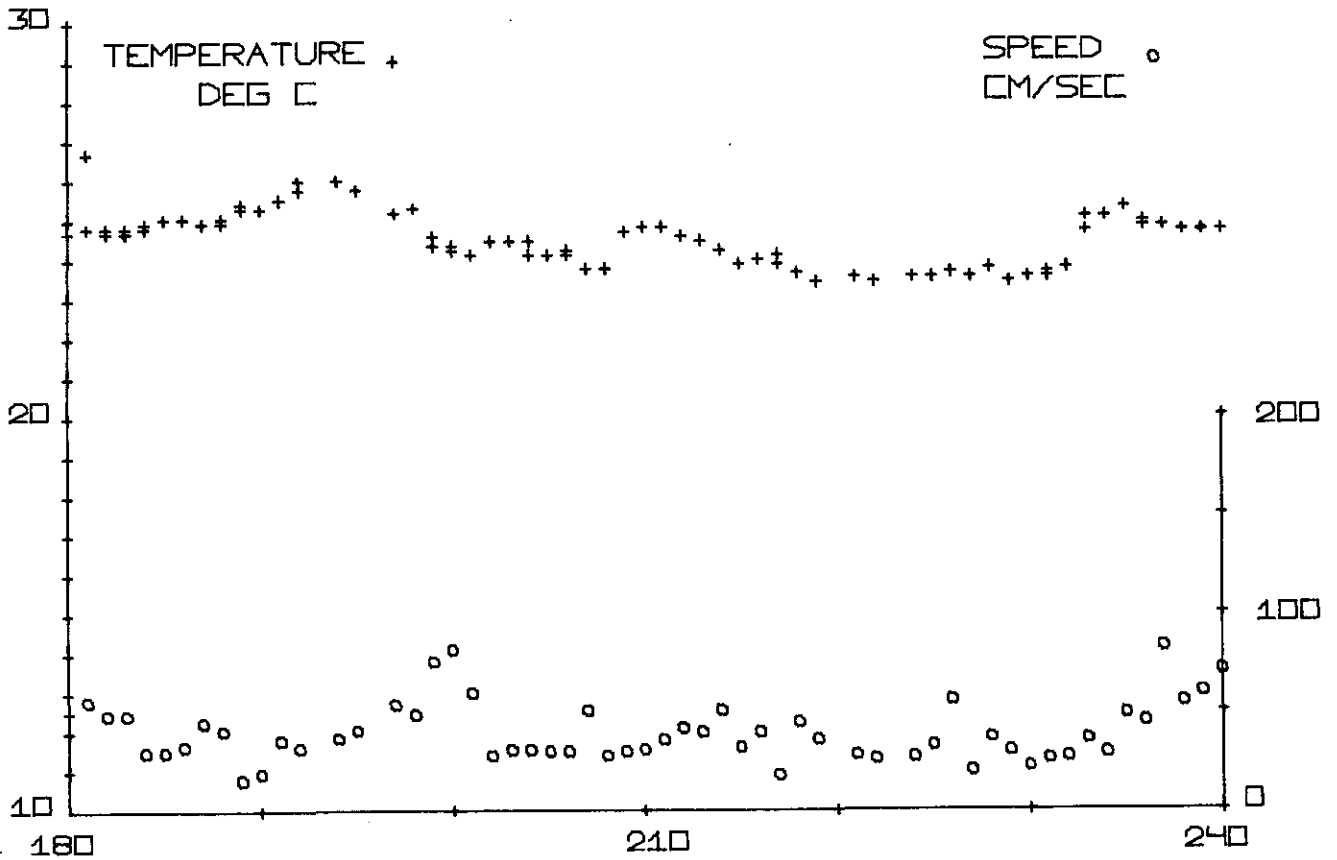
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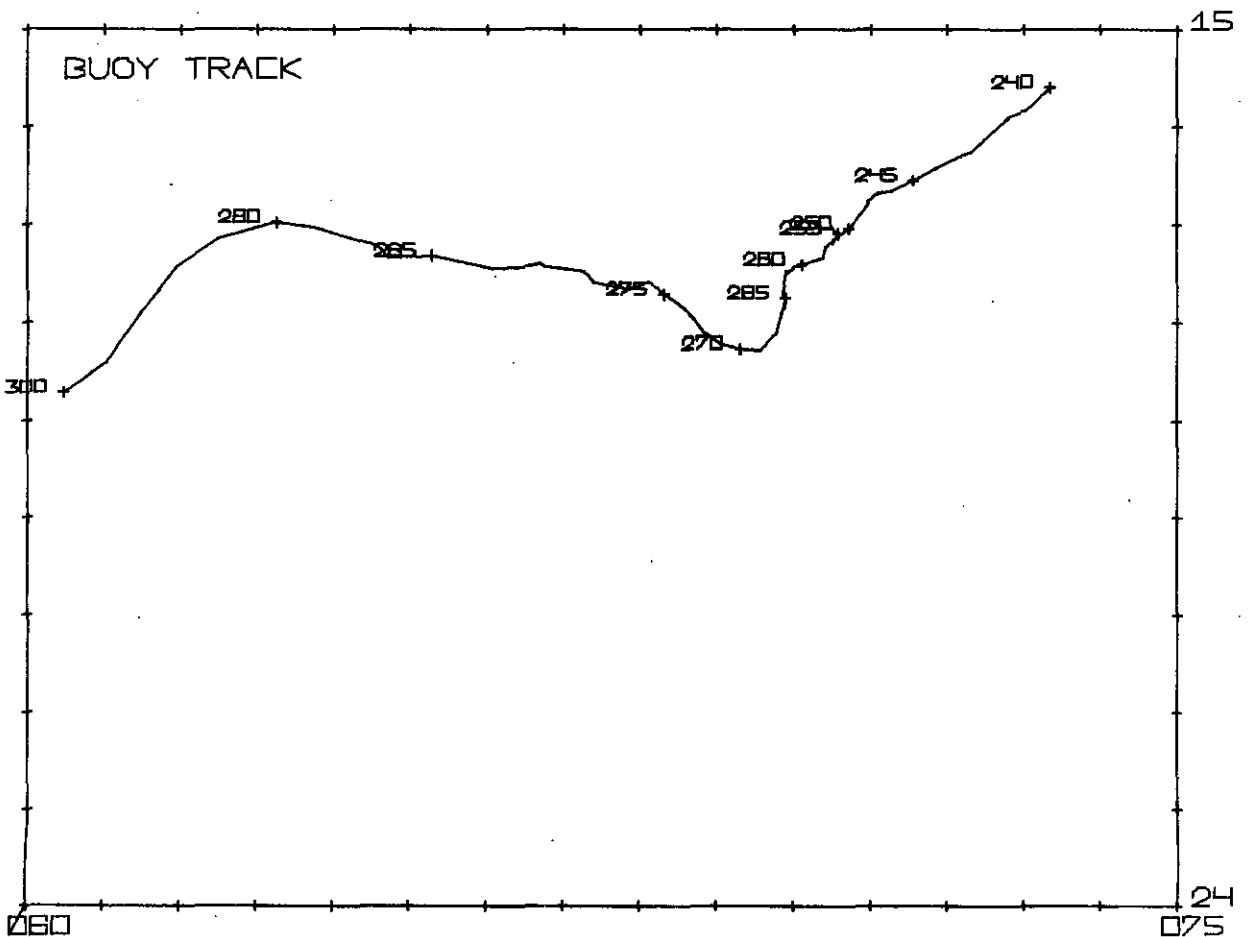
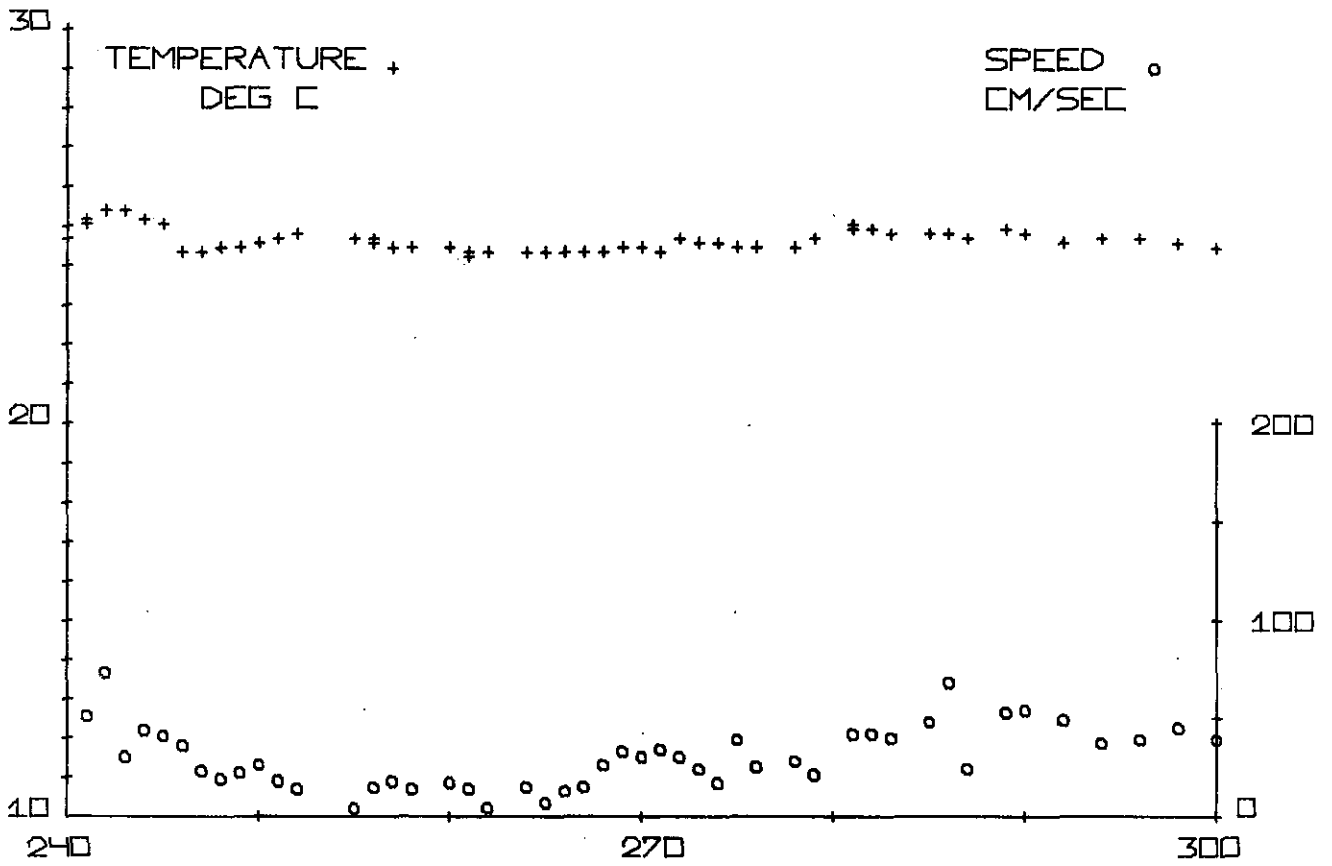
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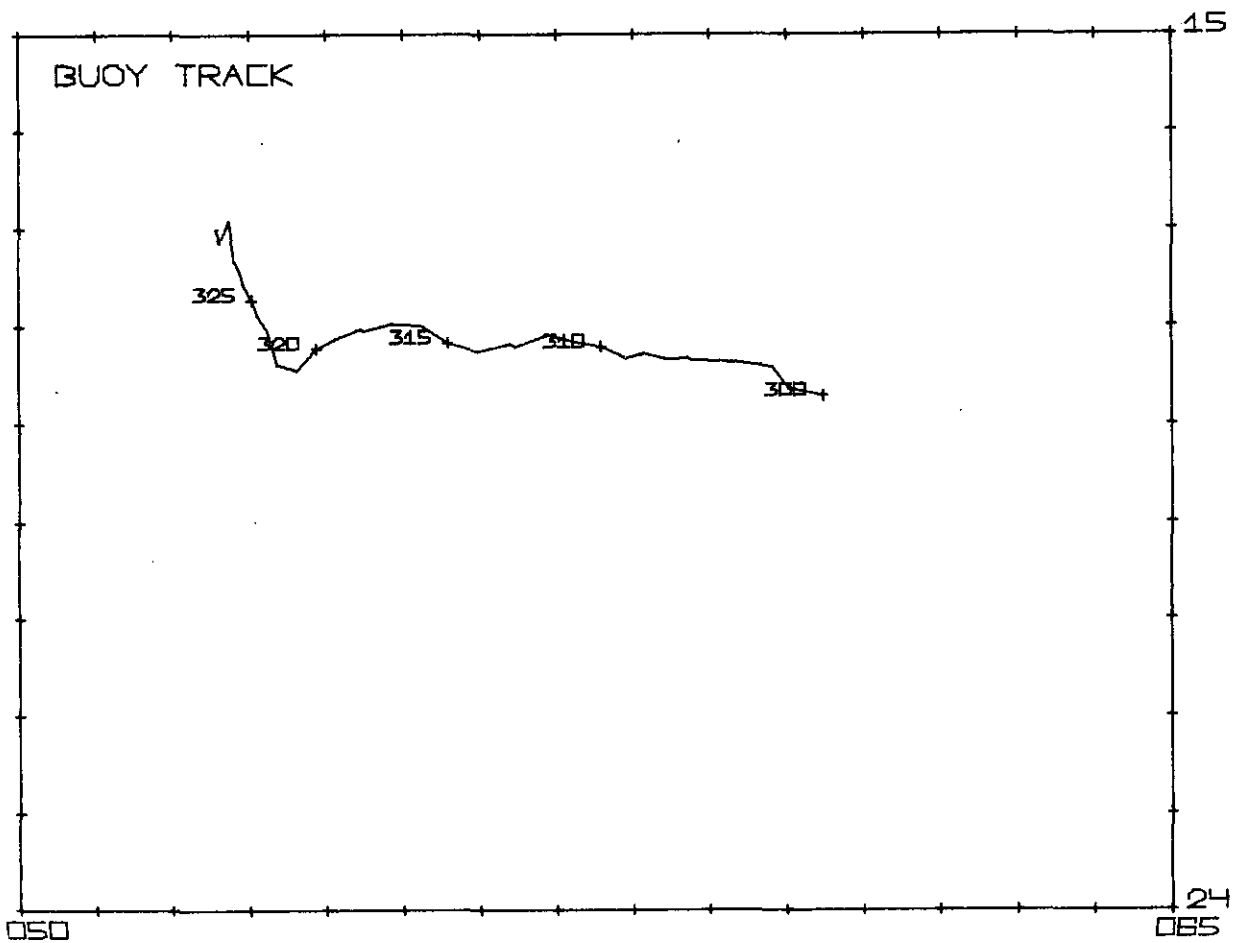
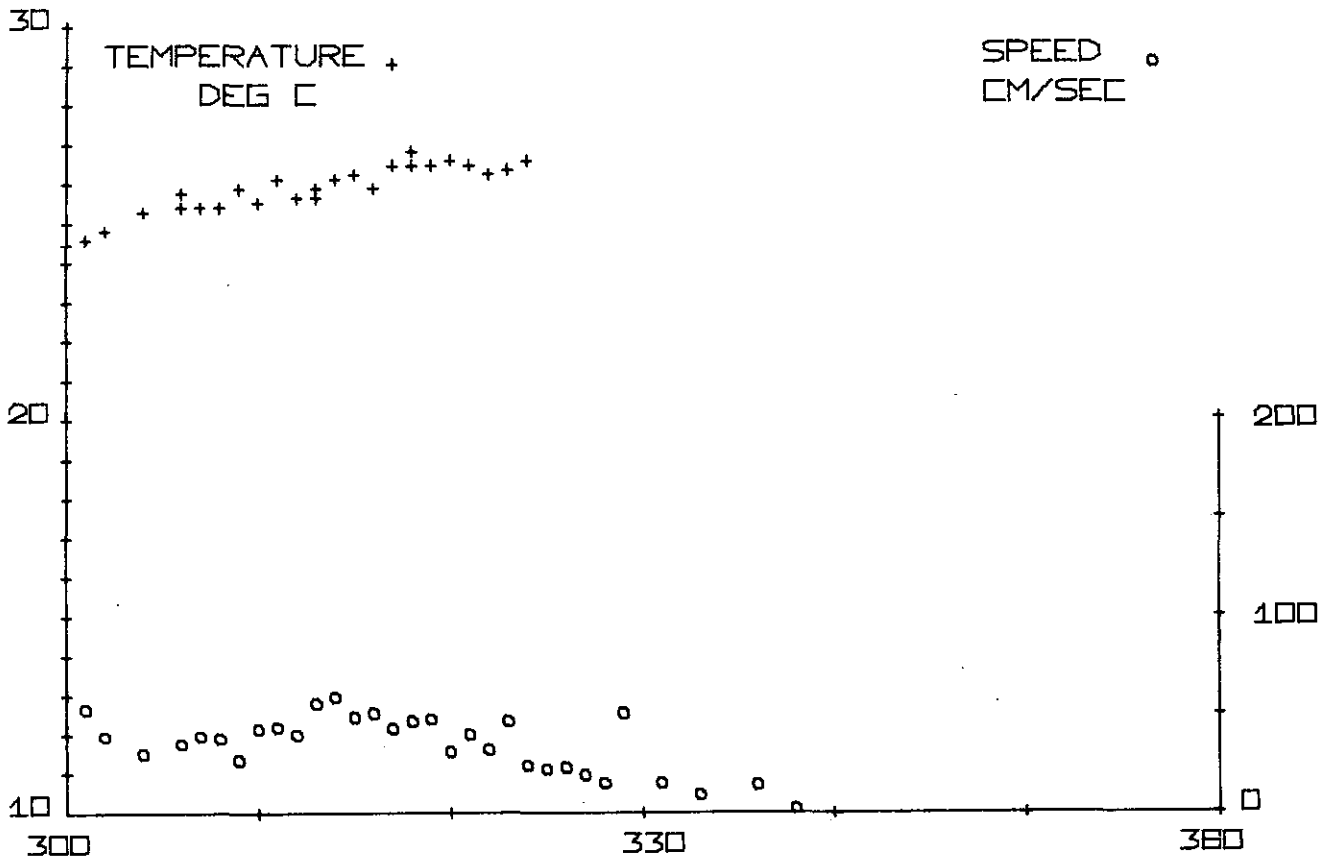
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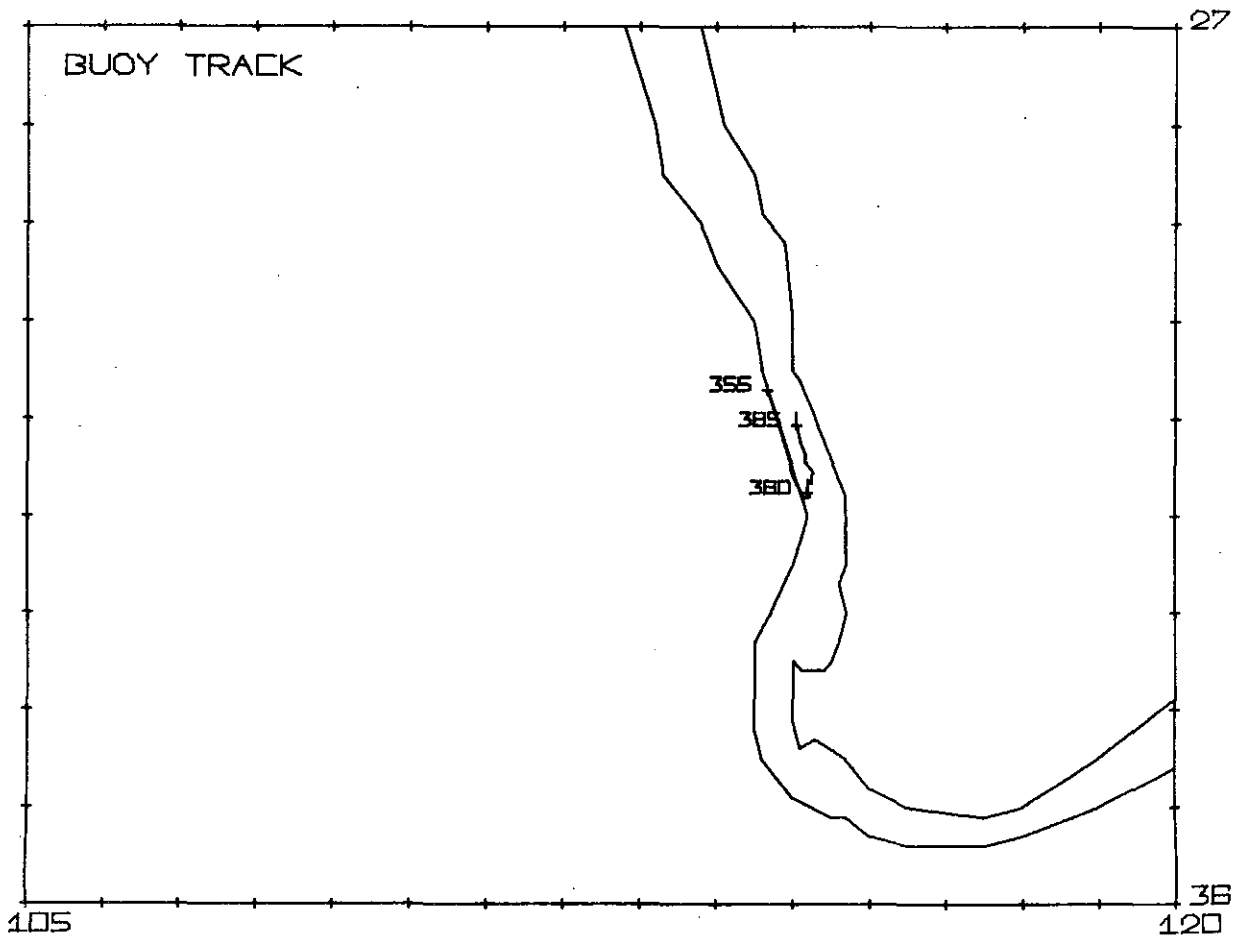
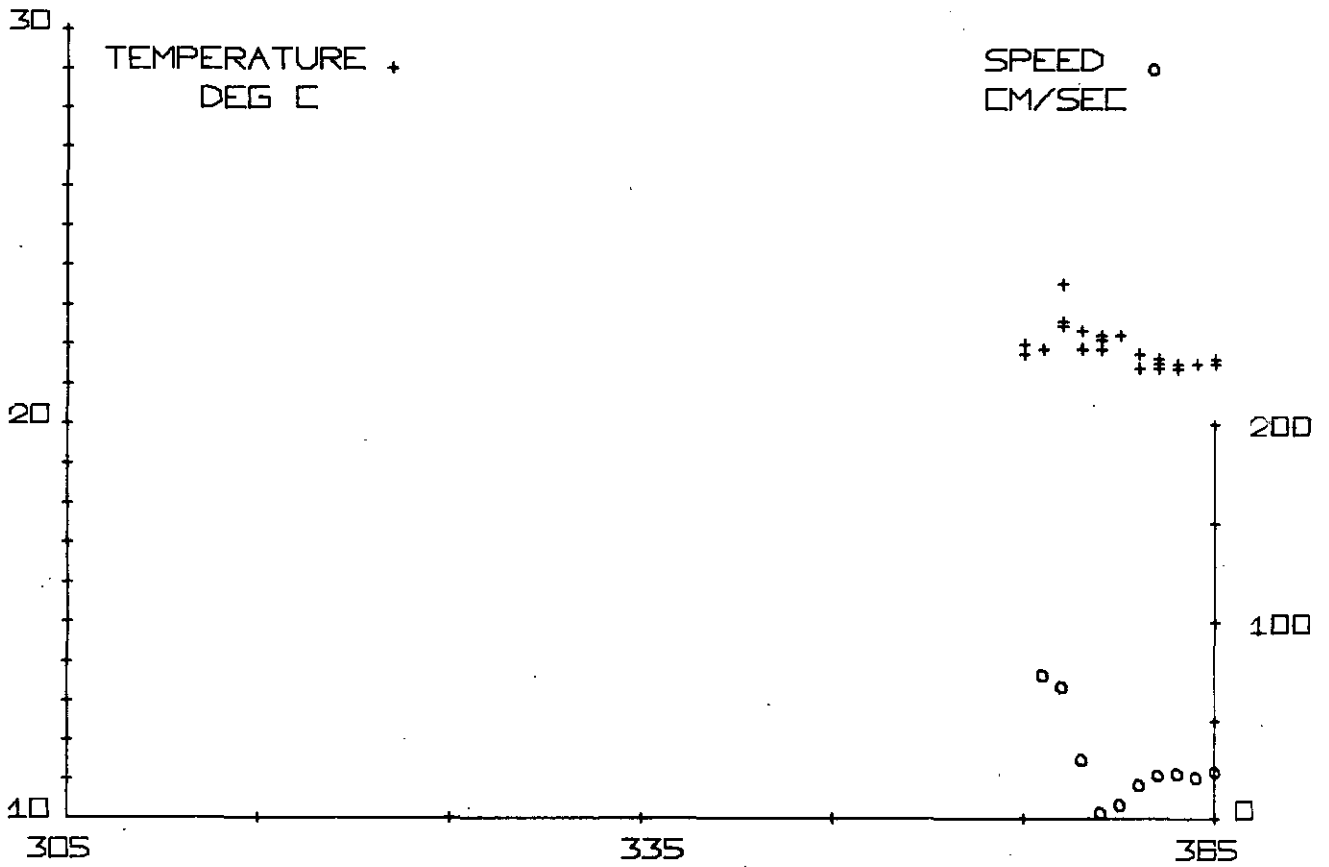


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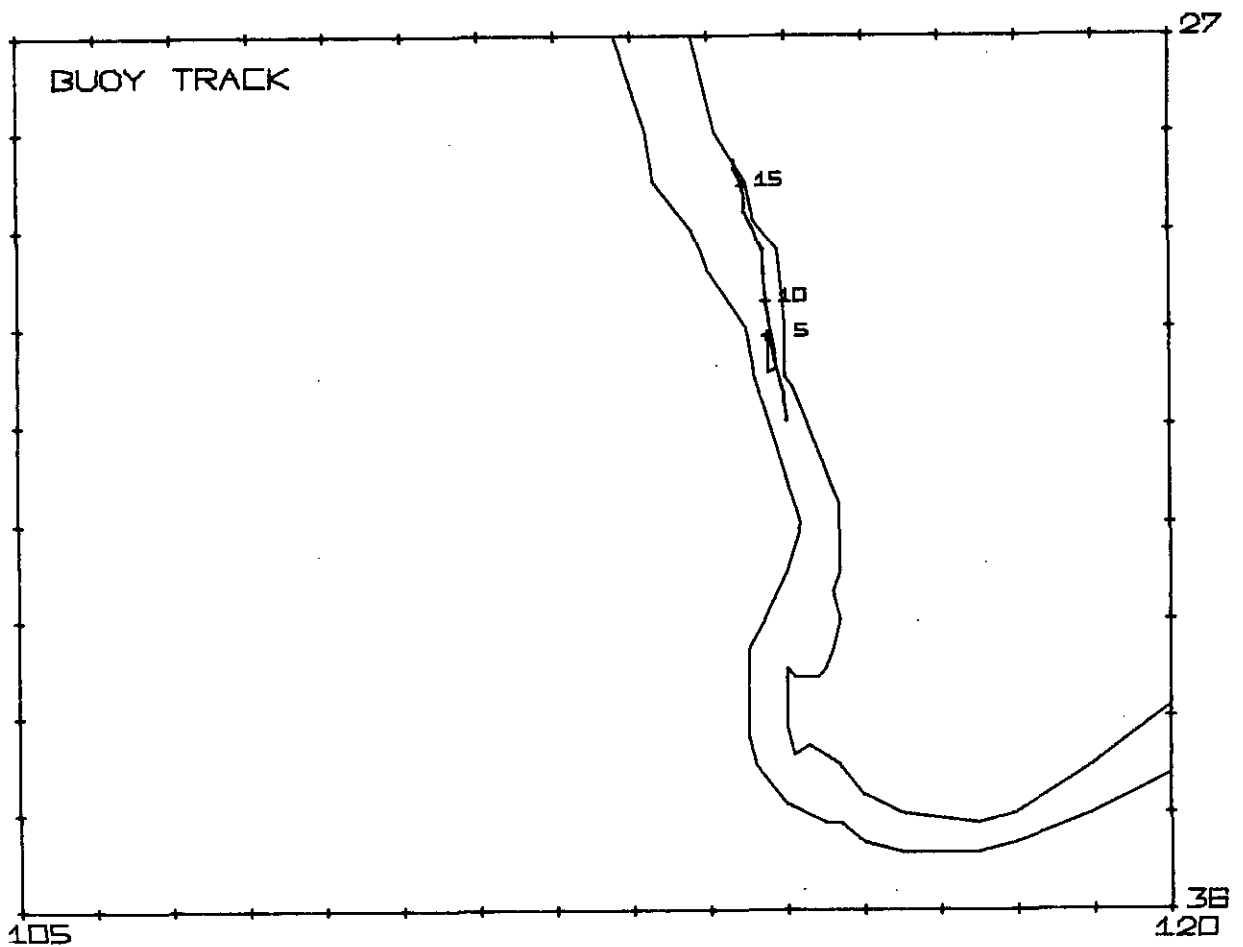
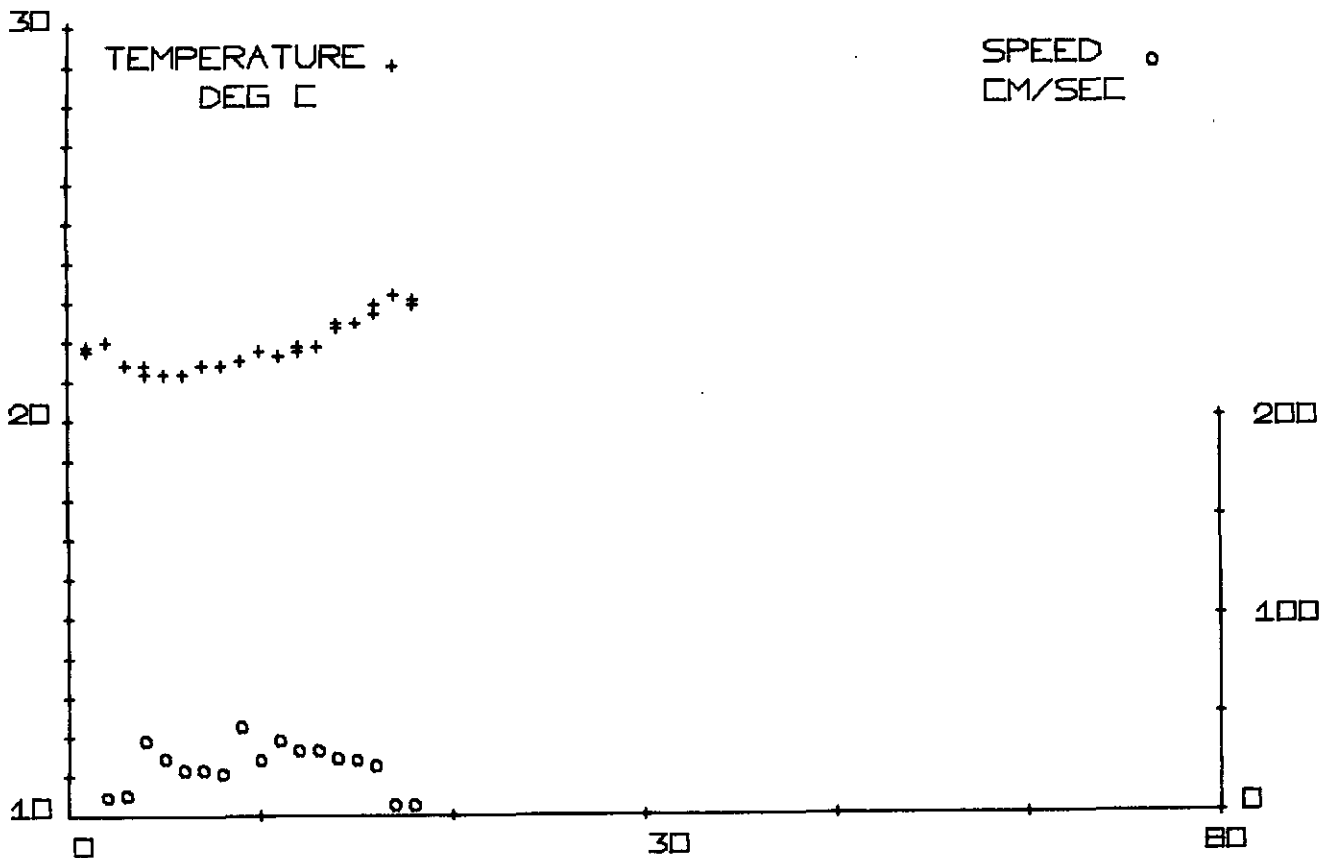


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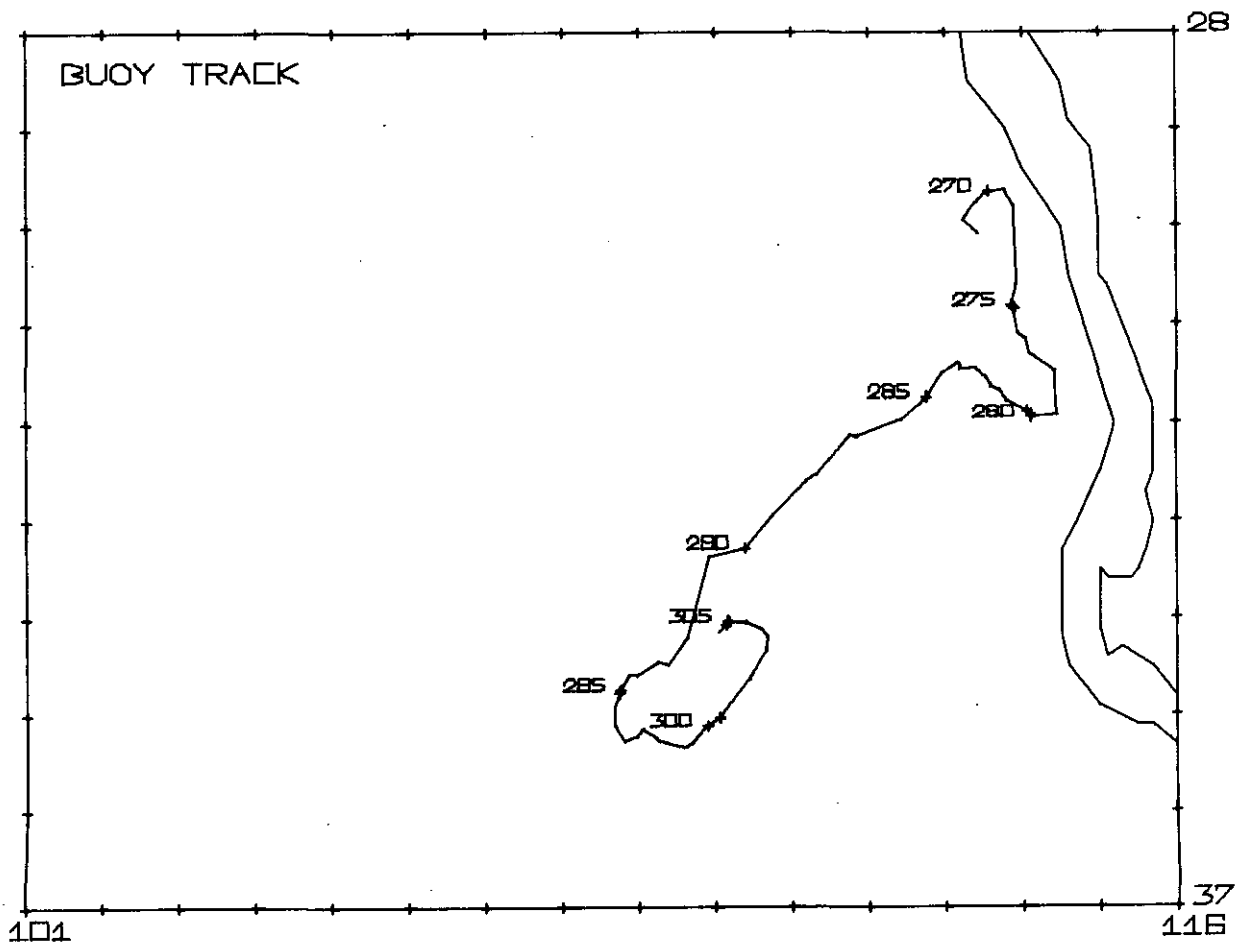
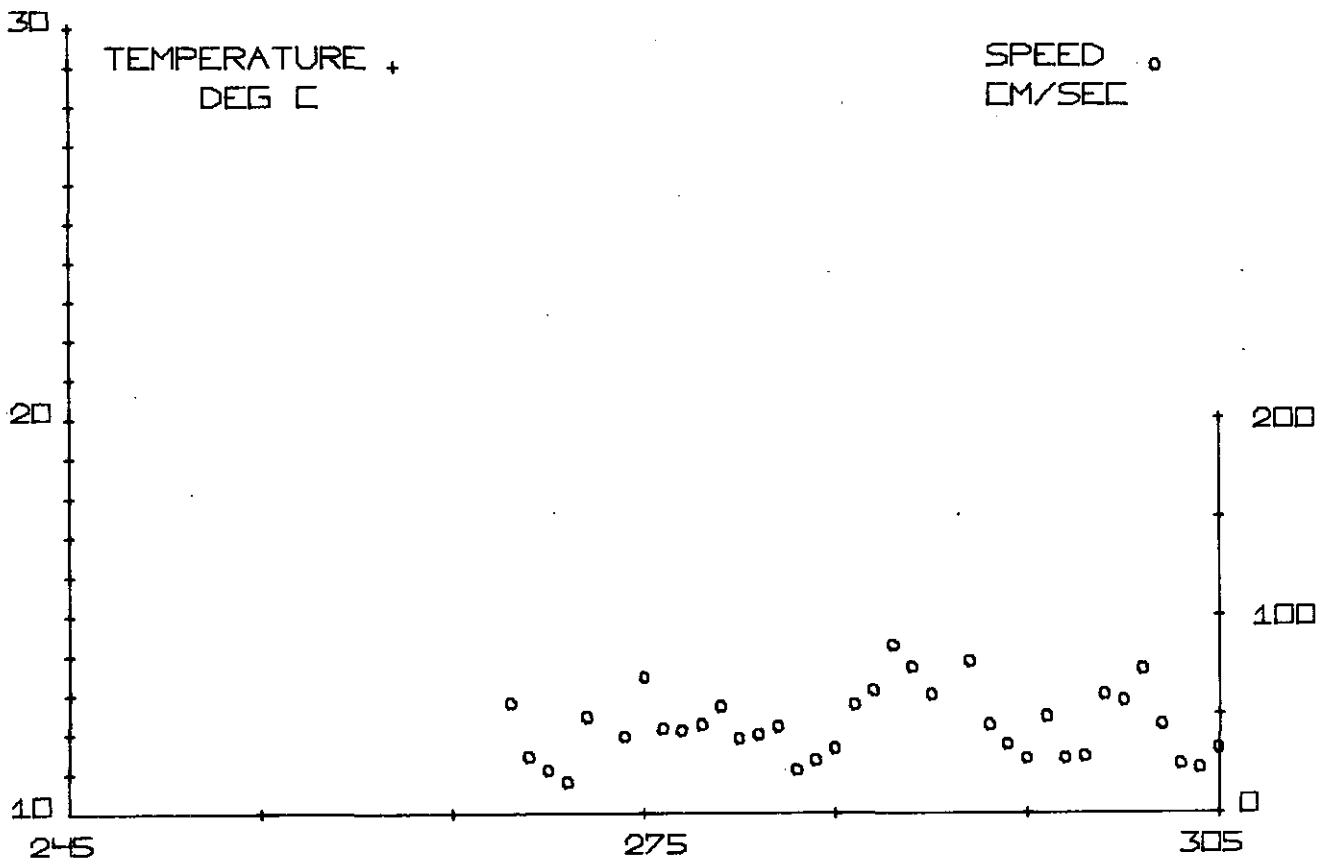


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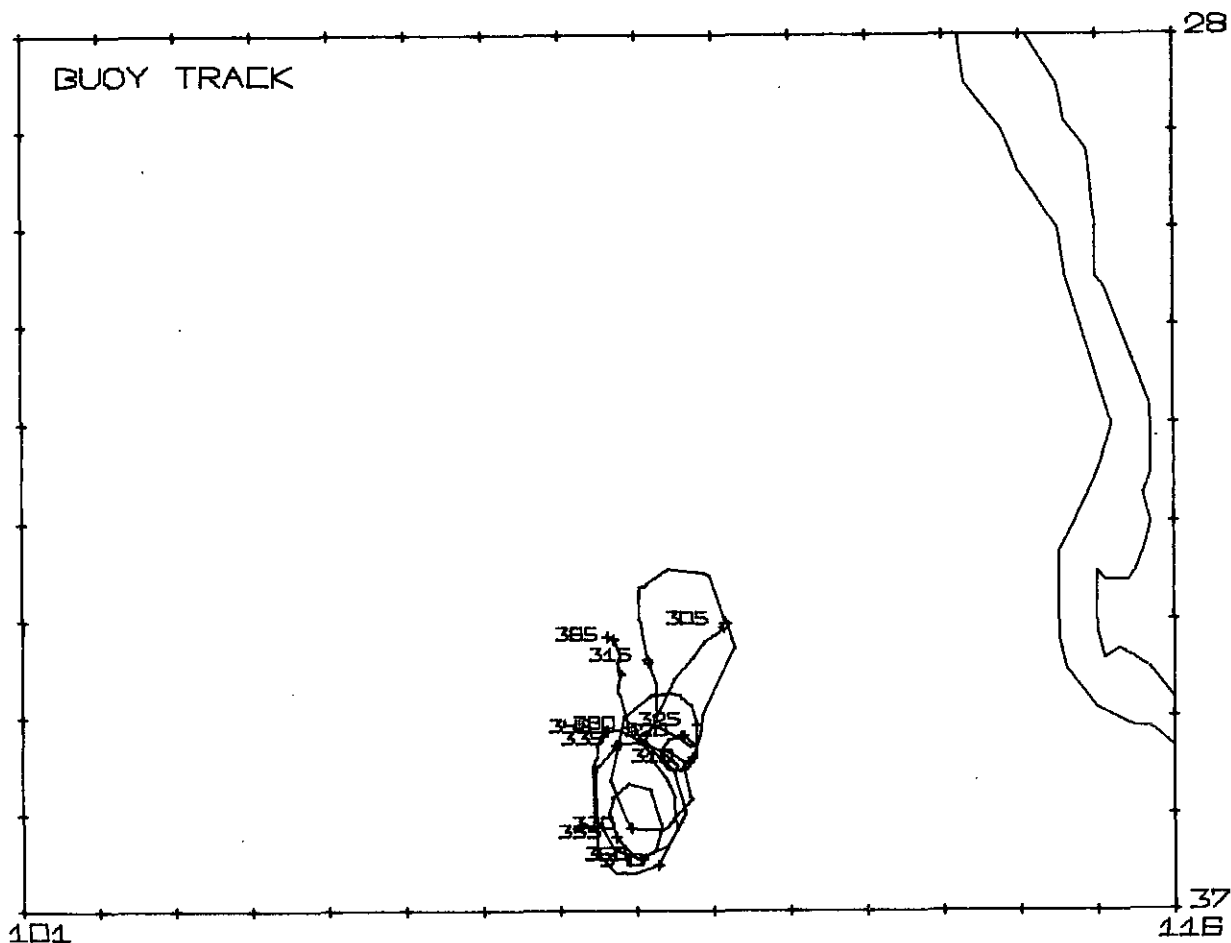
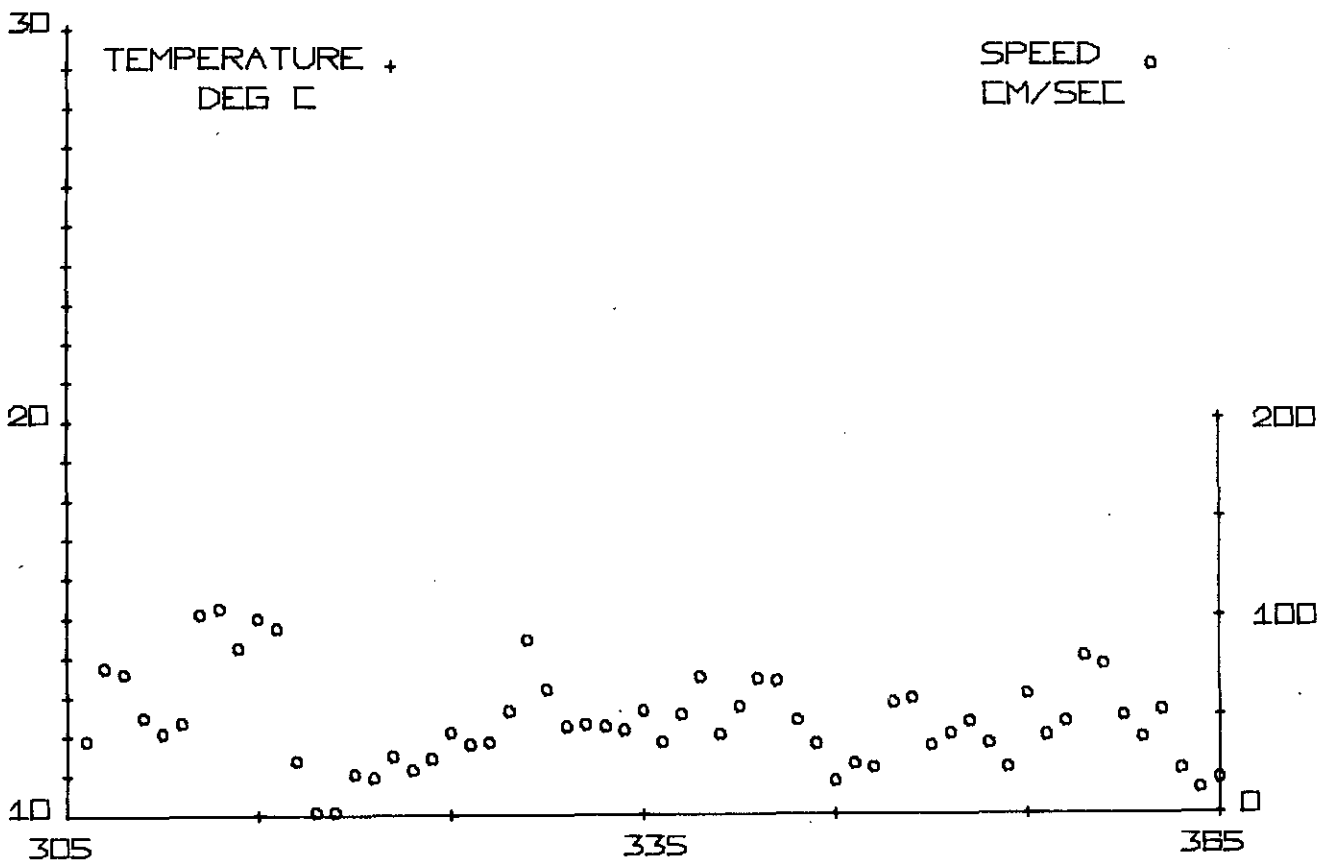


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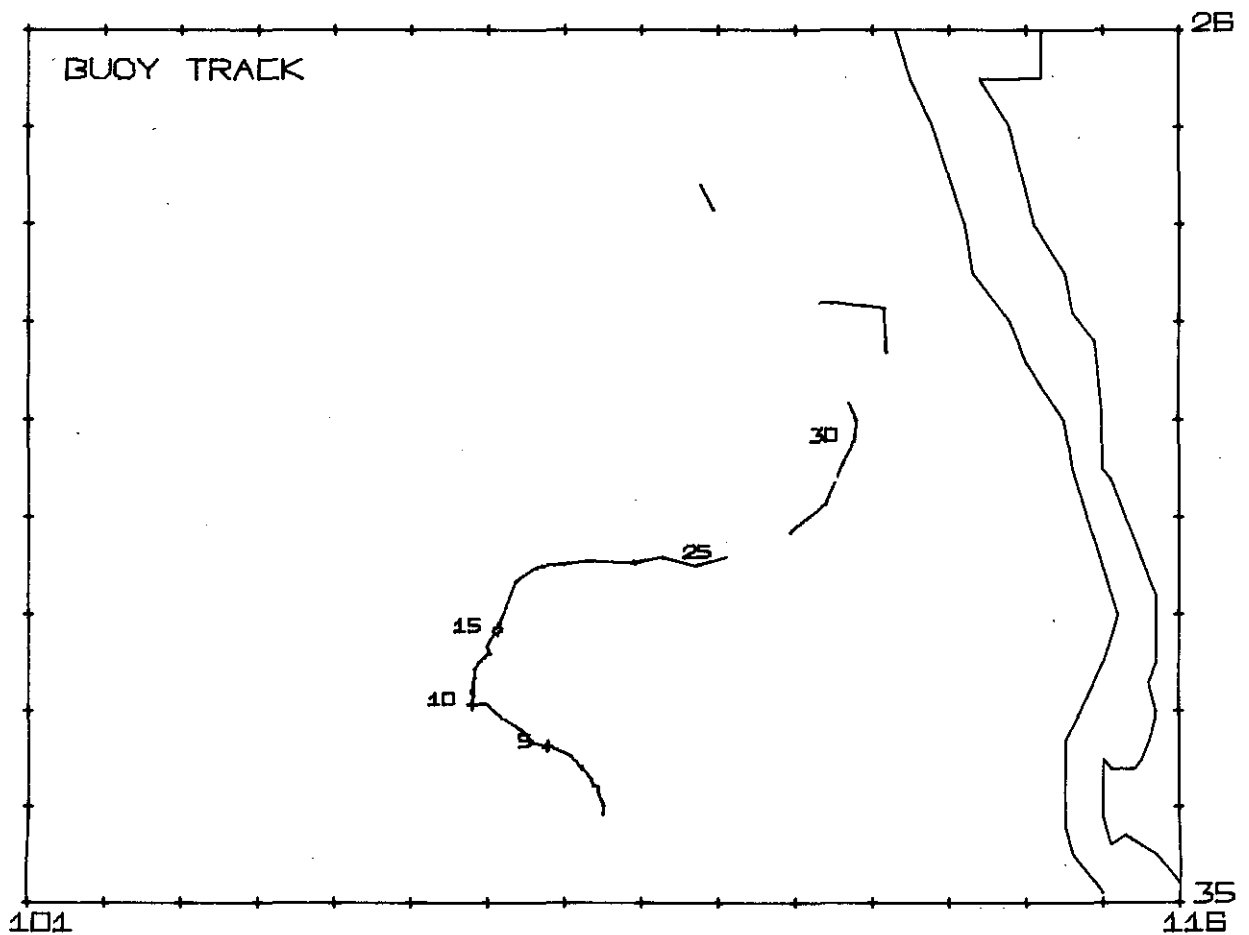
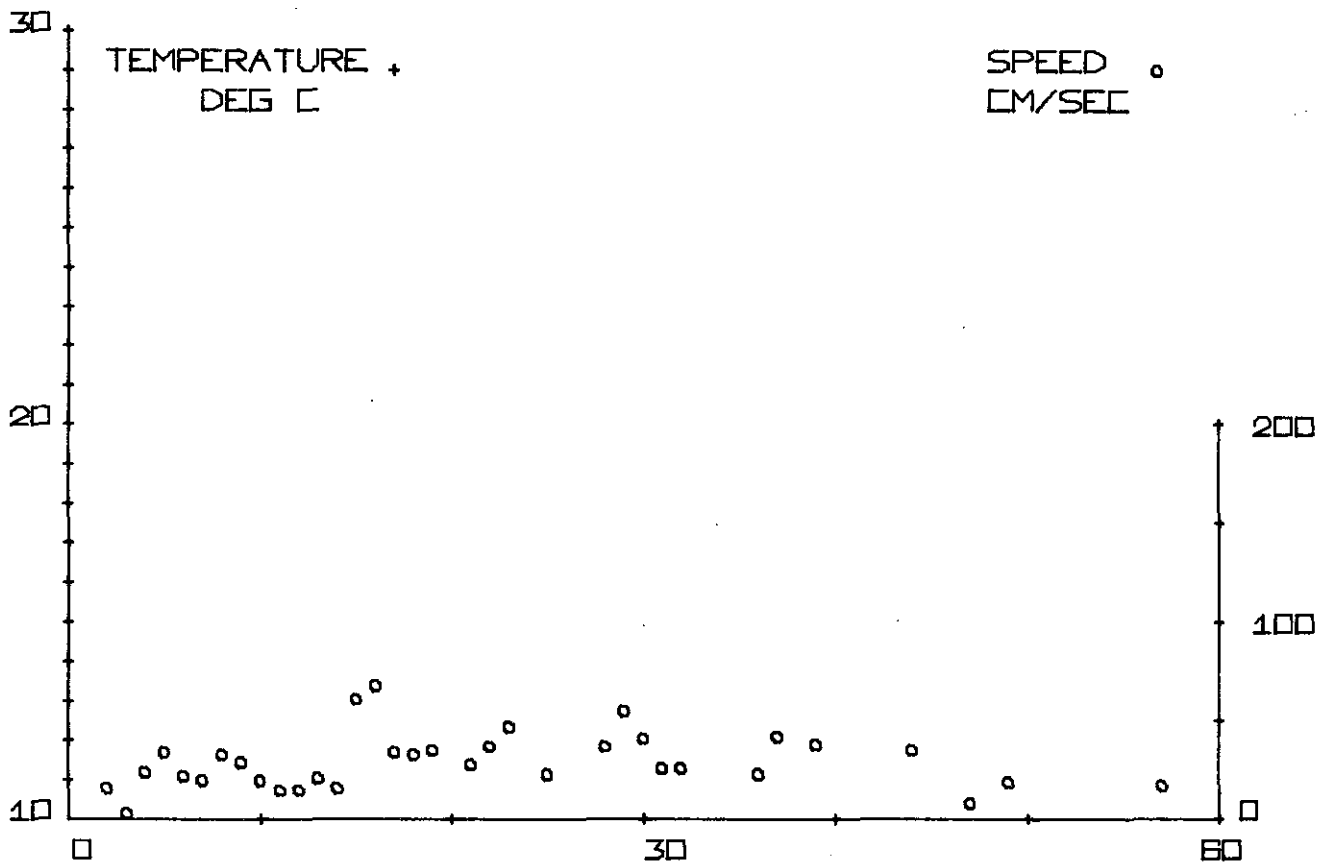
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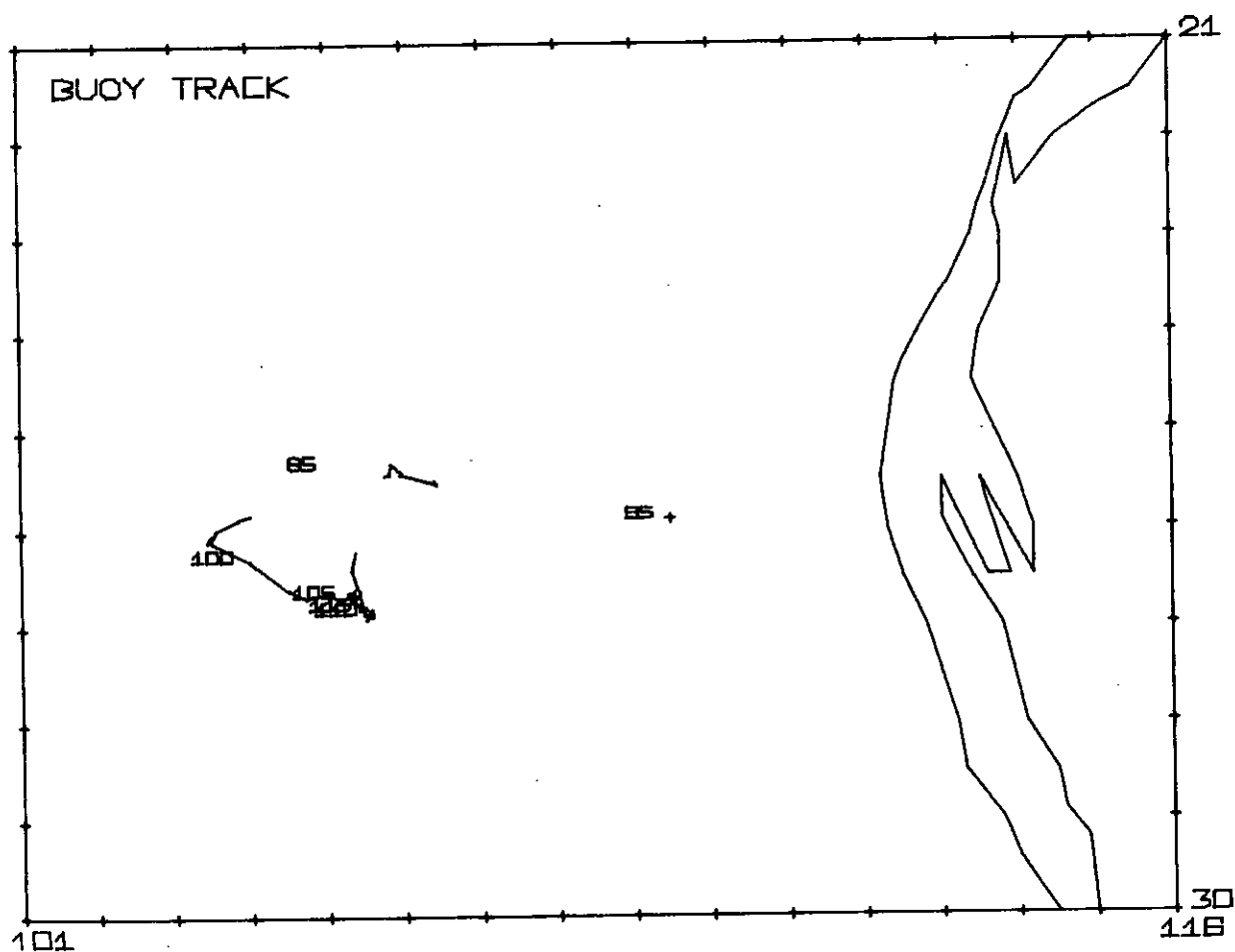
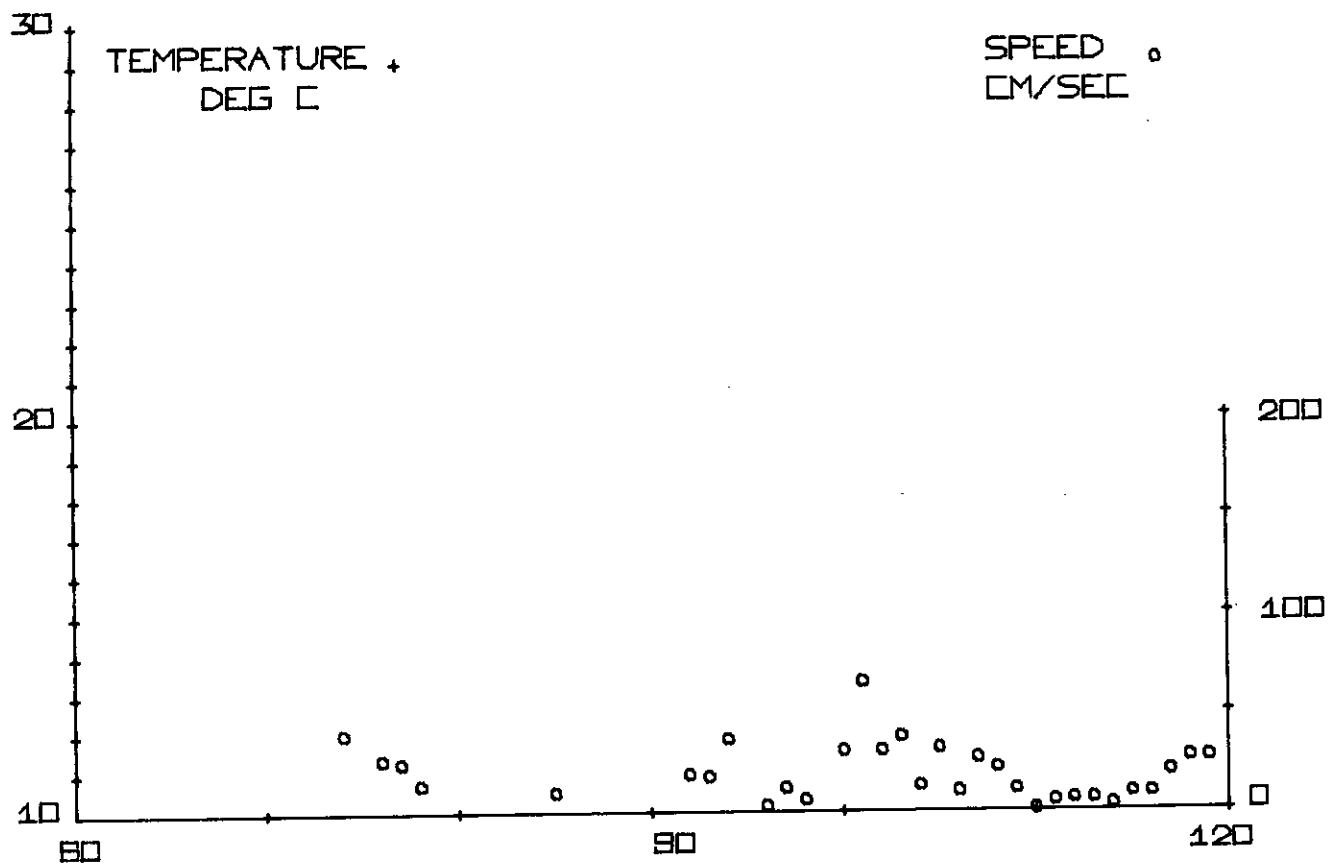
BUOY 237 DAYS 305-365 1975



BUOY 237 DAYS 0- 60 1976

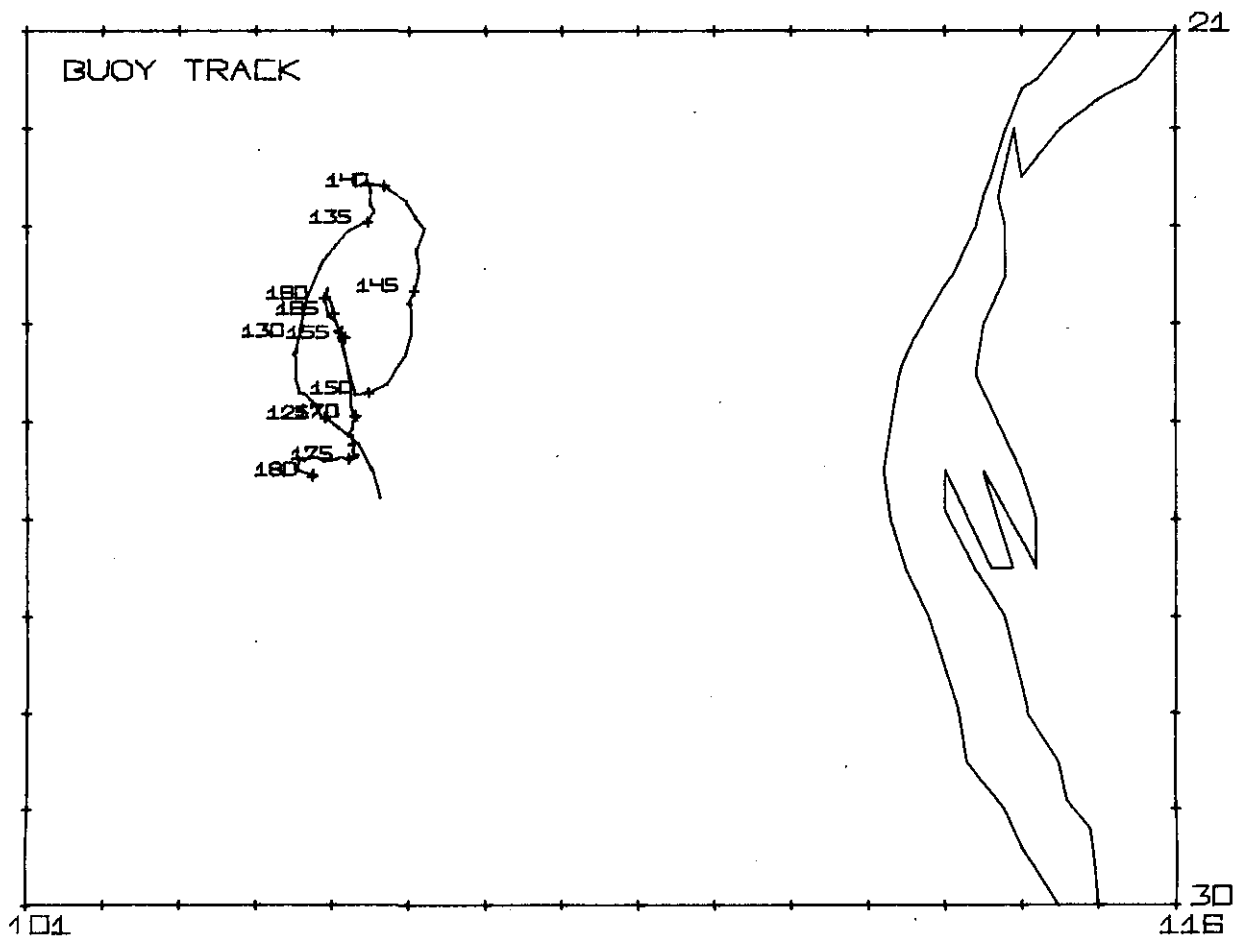
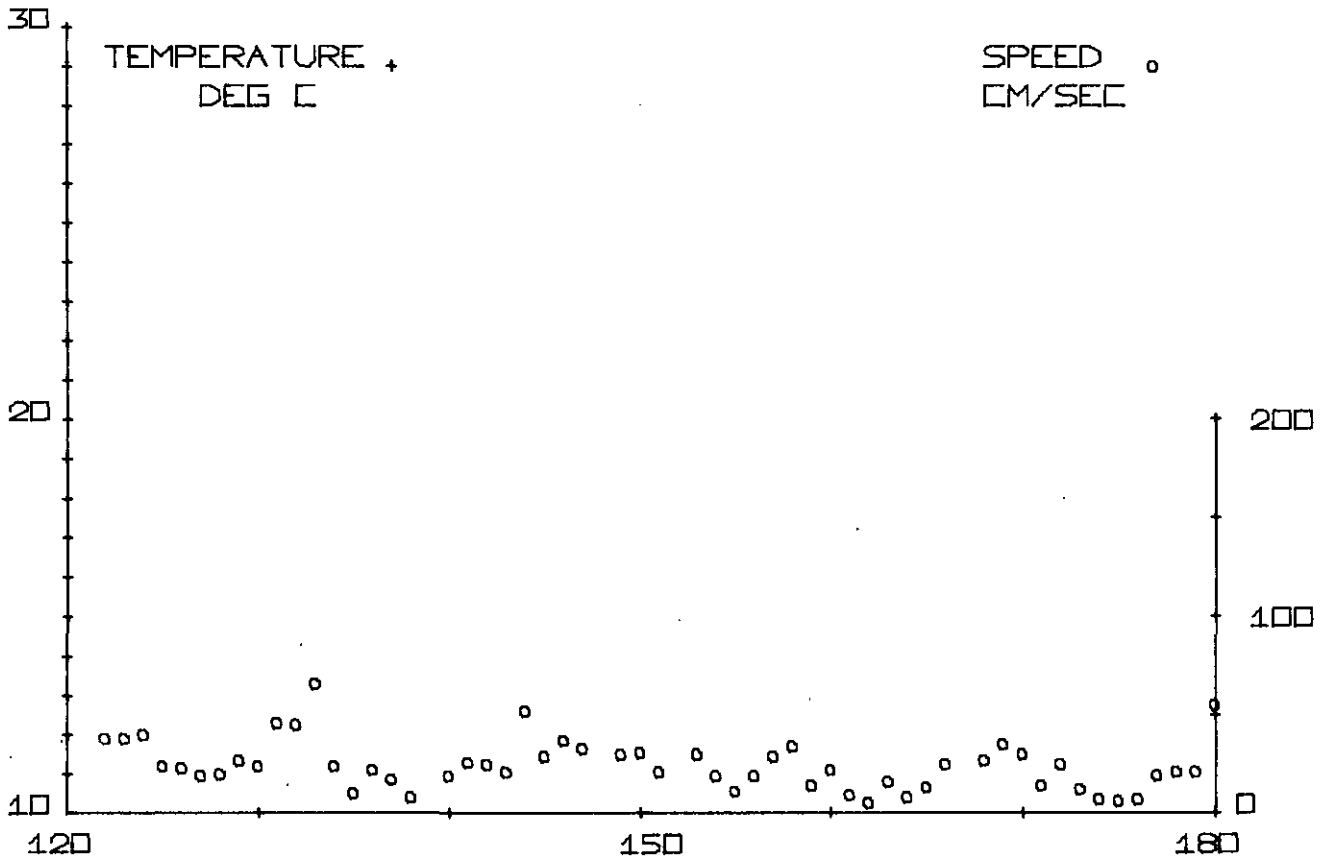


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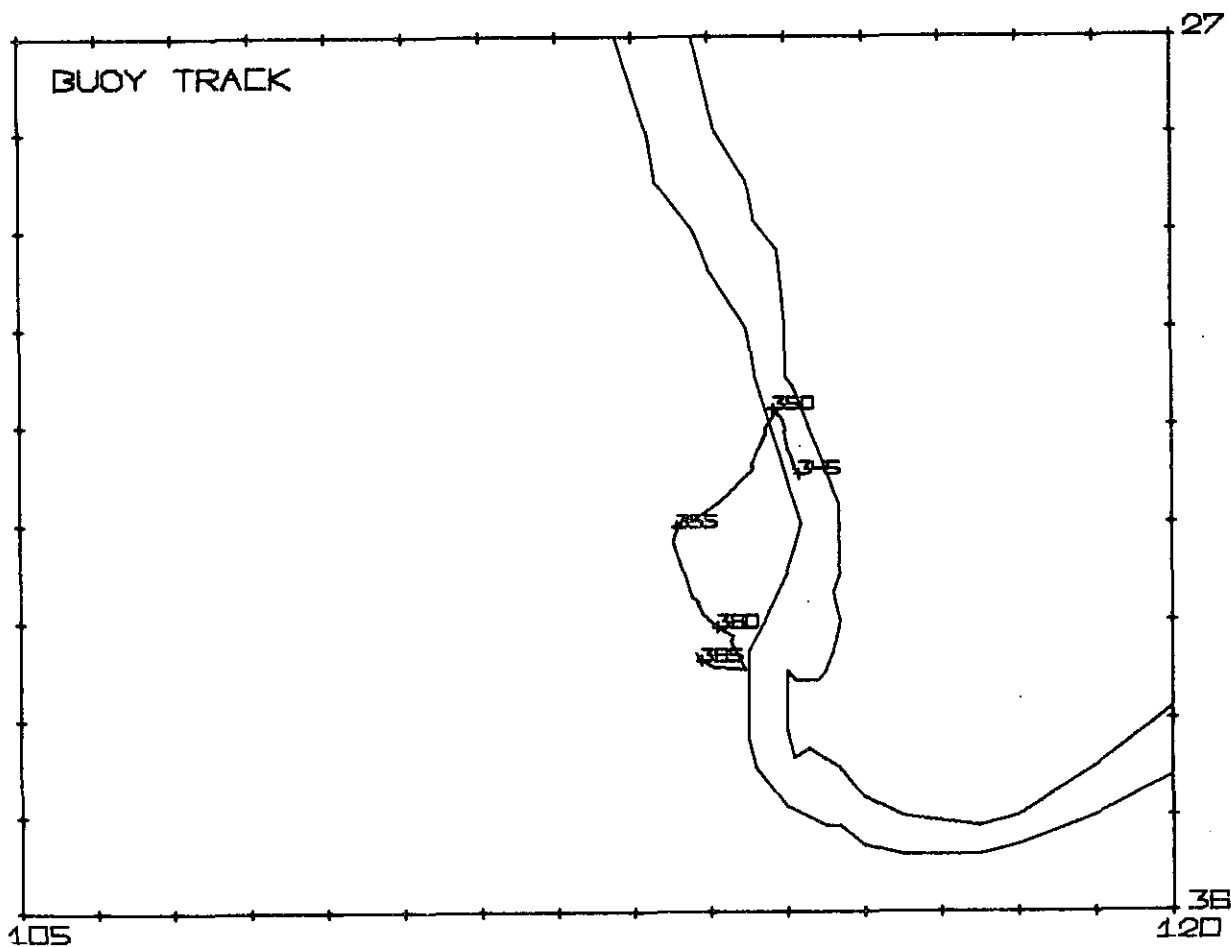
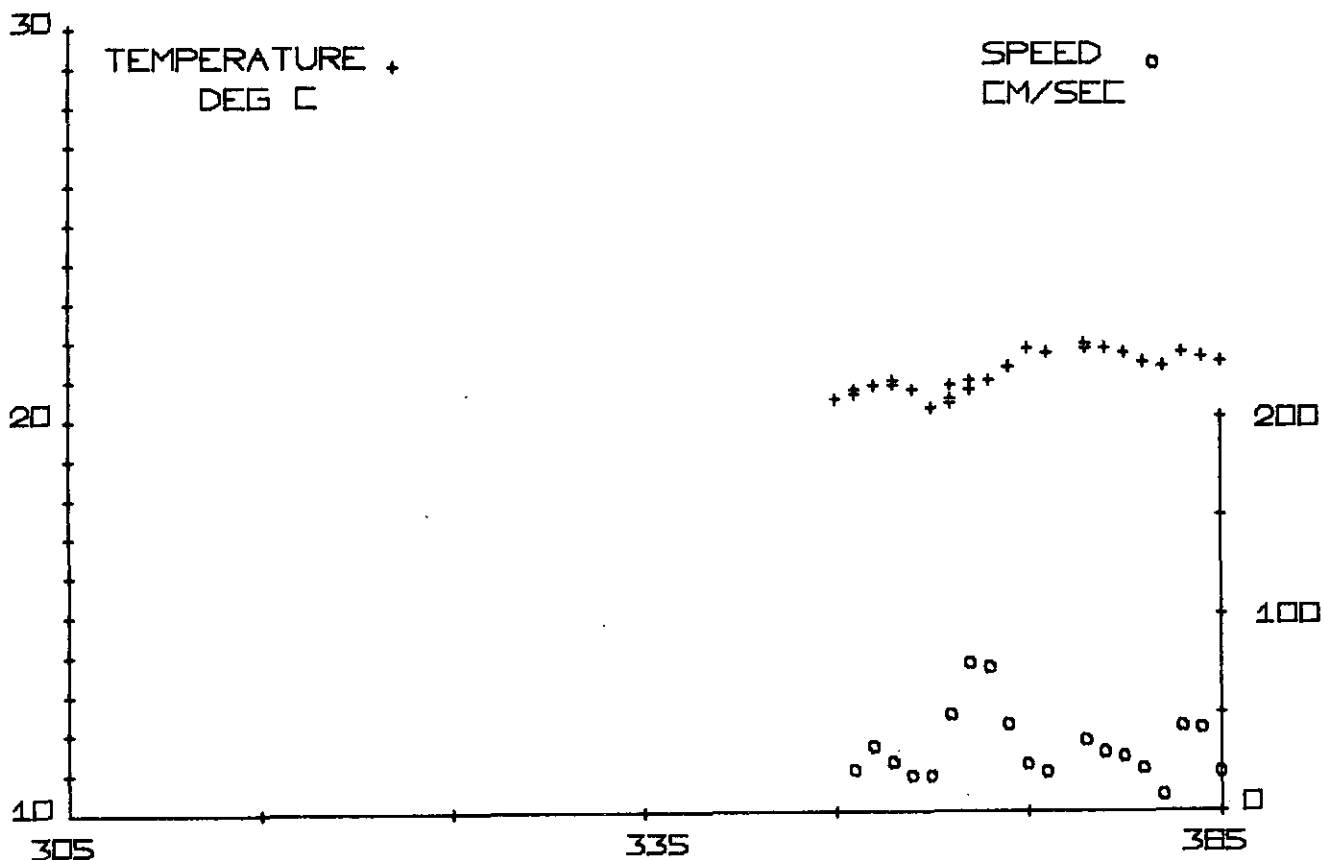


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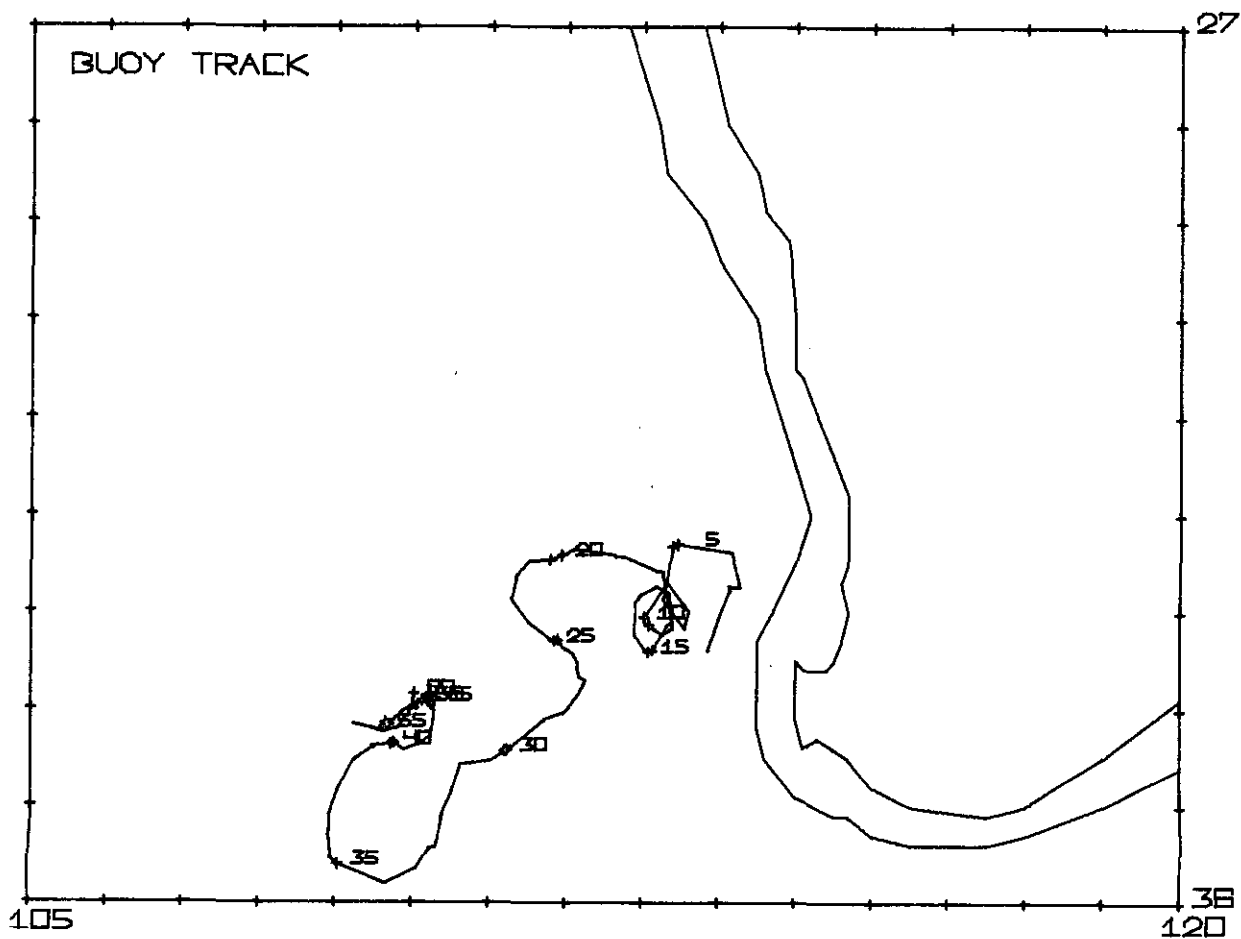
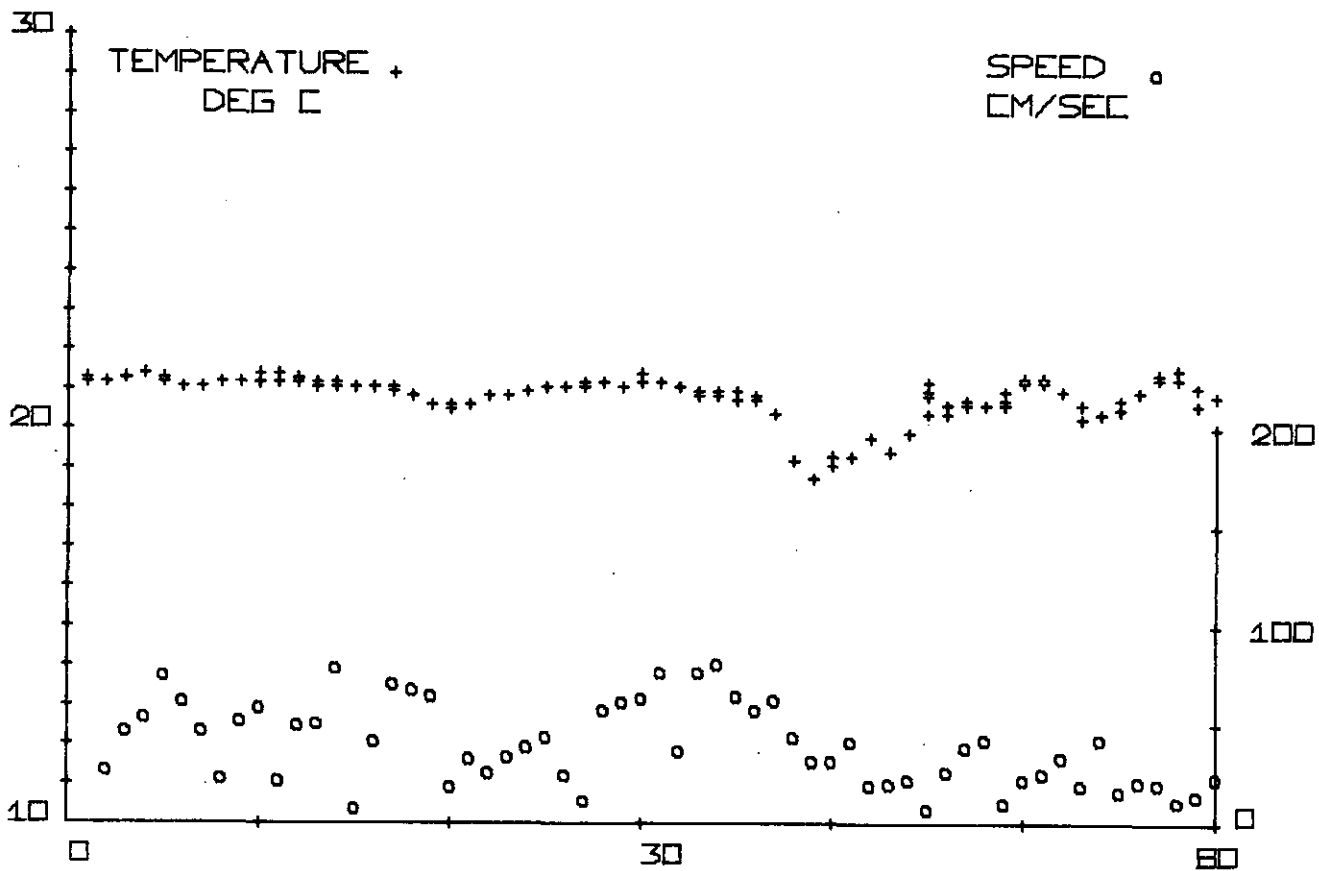
DAYS 120-180 1976



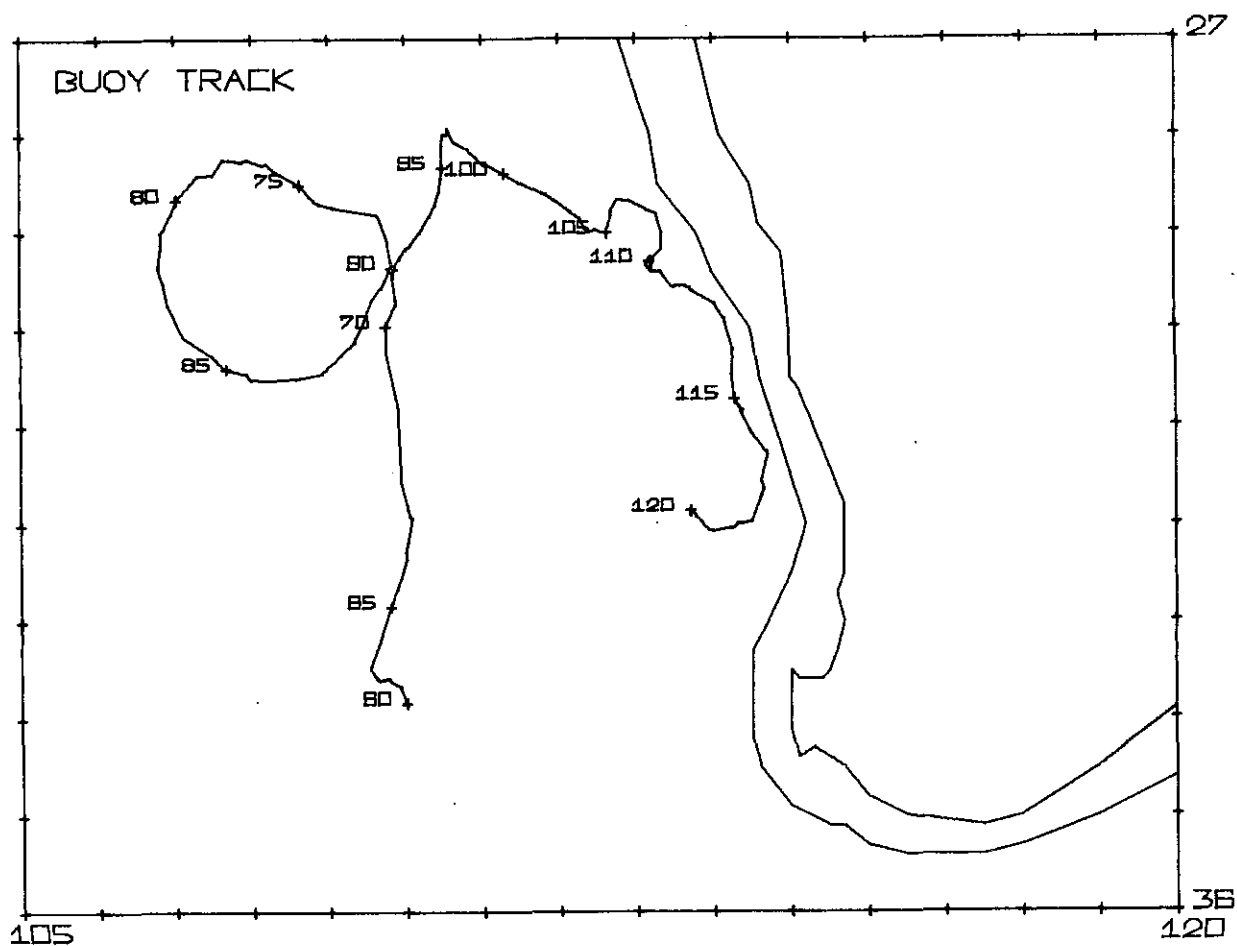
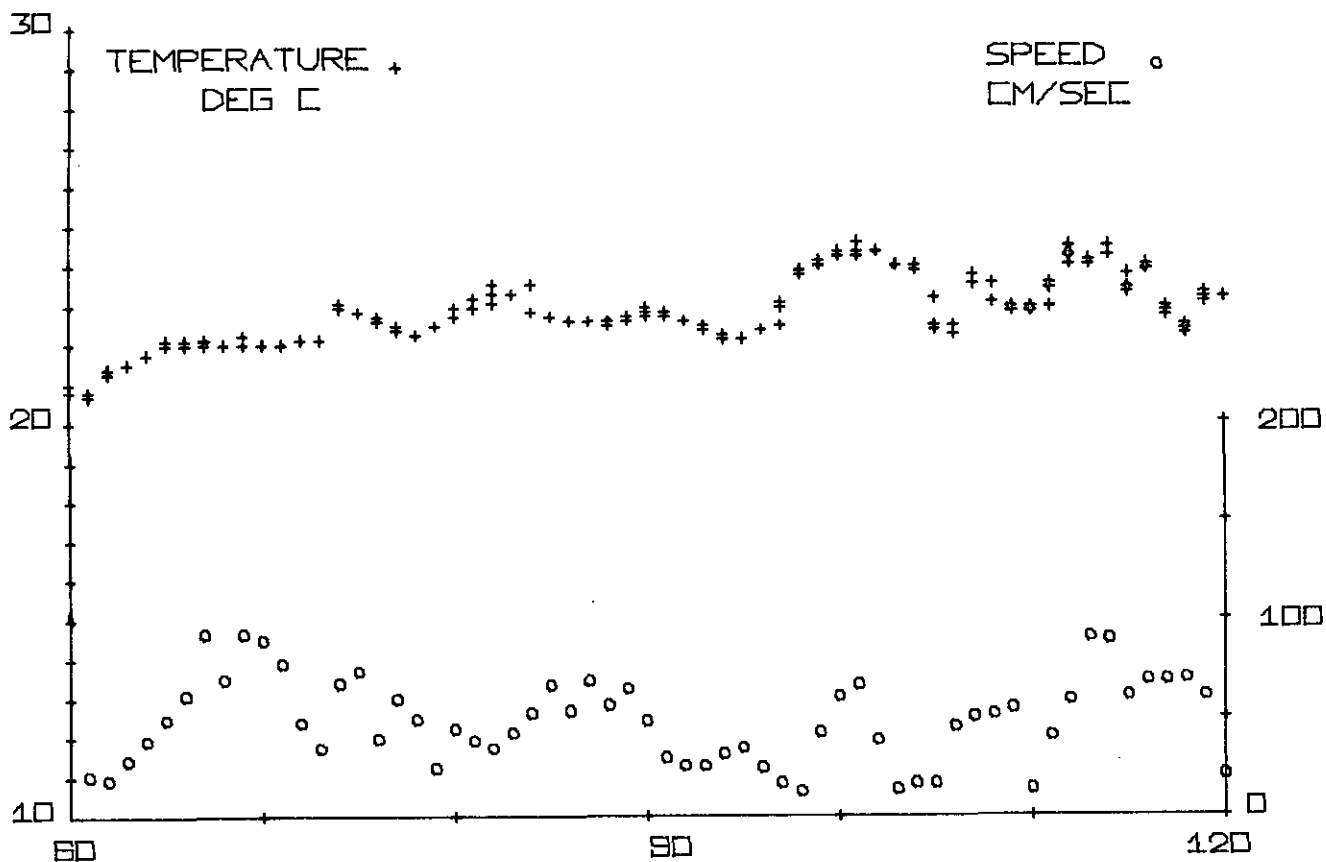
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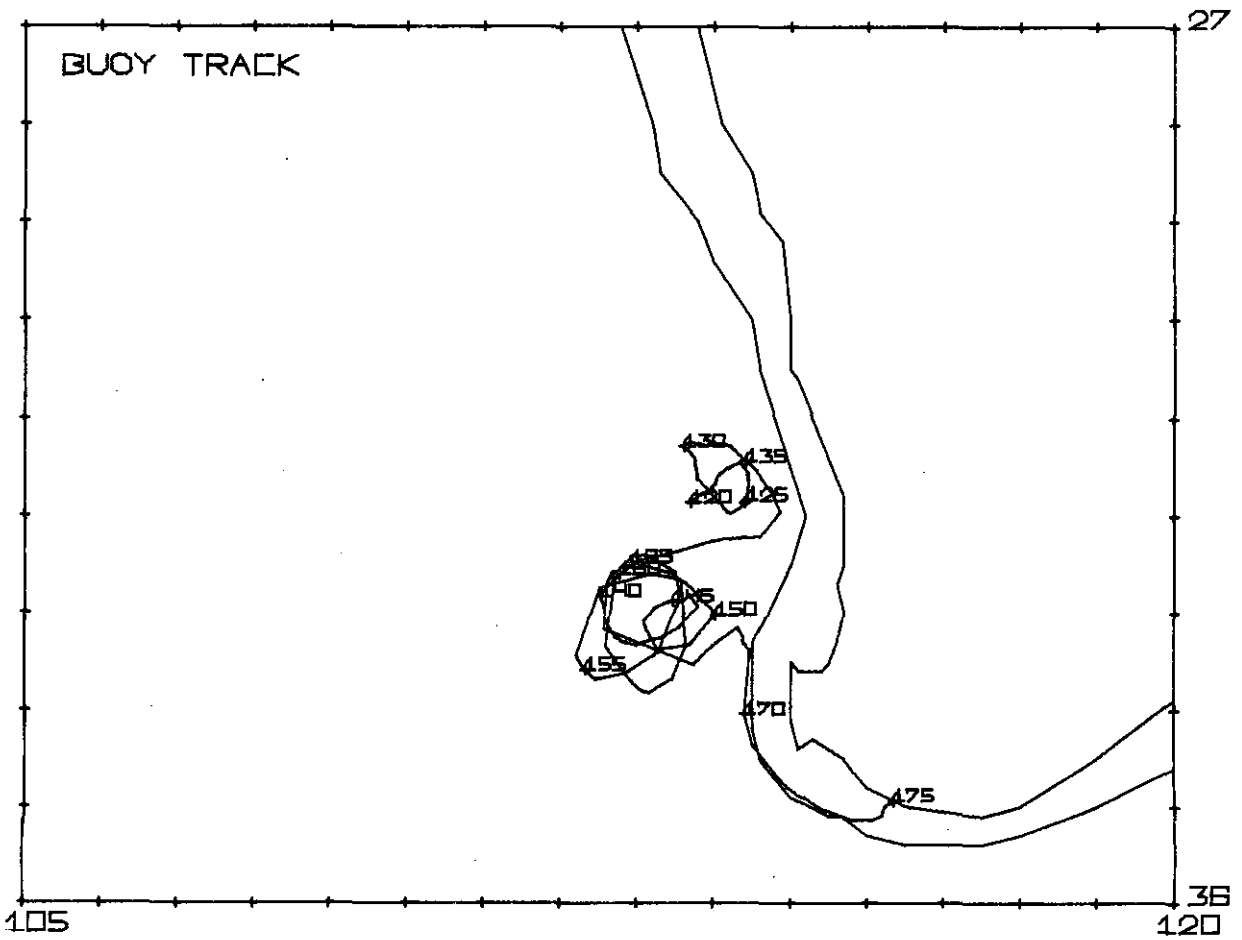
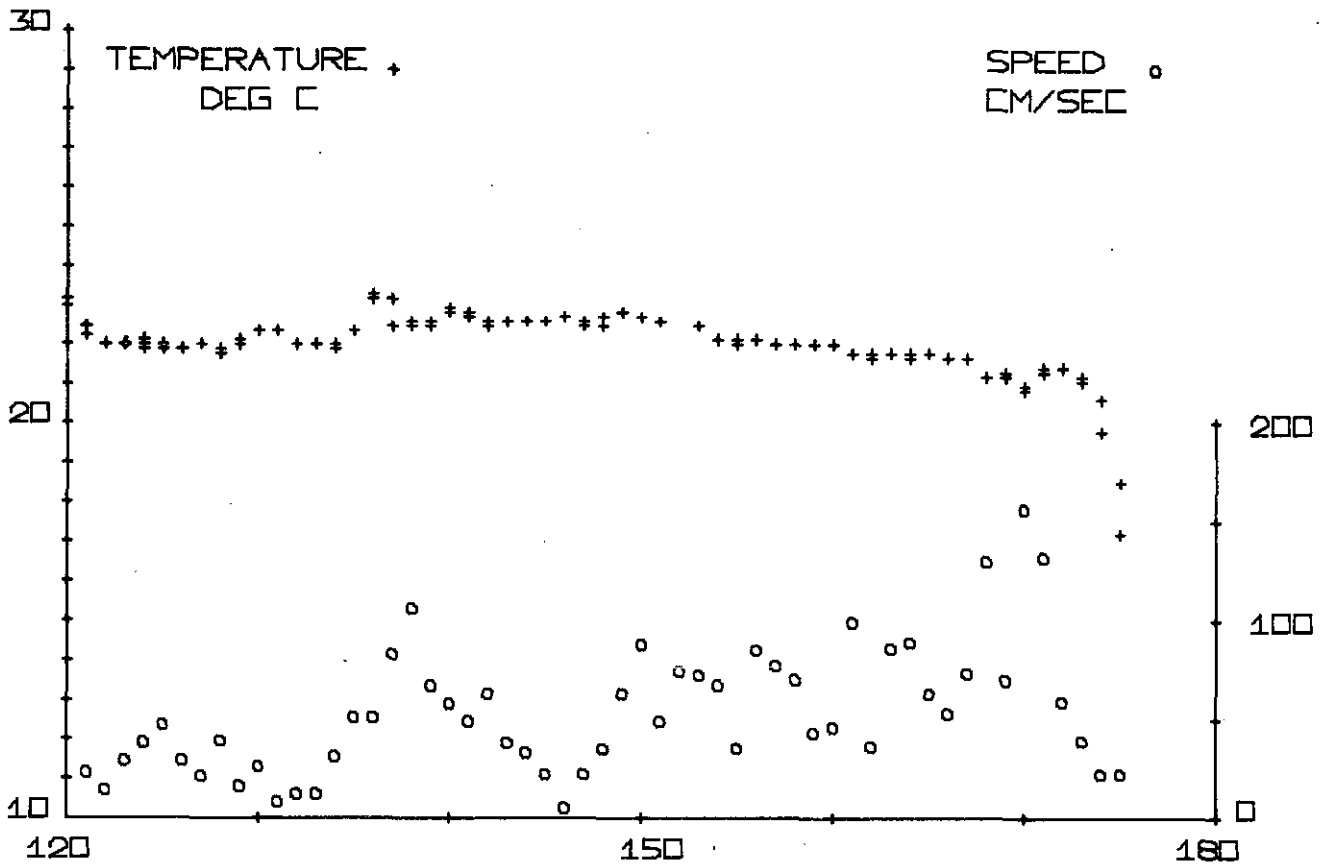
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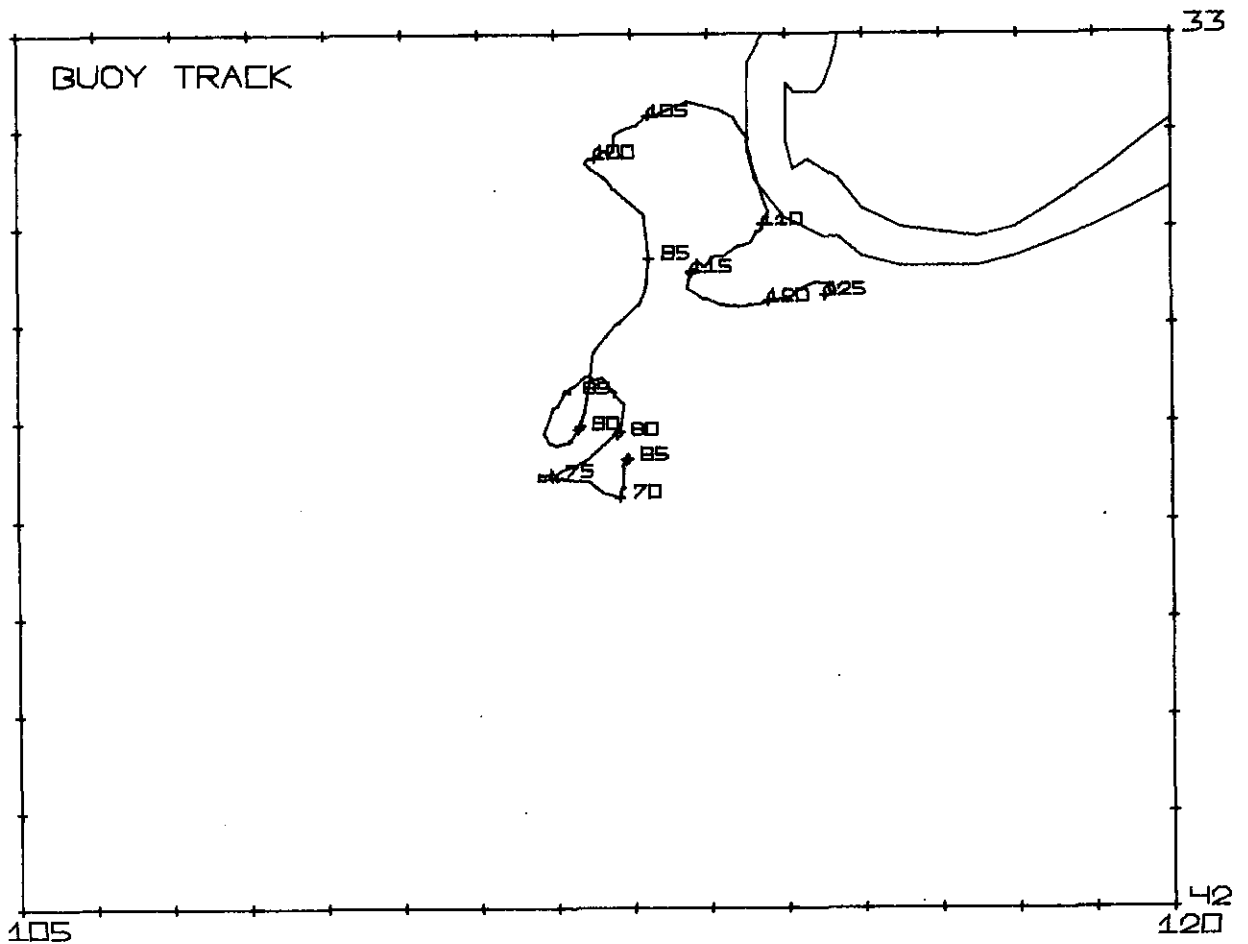
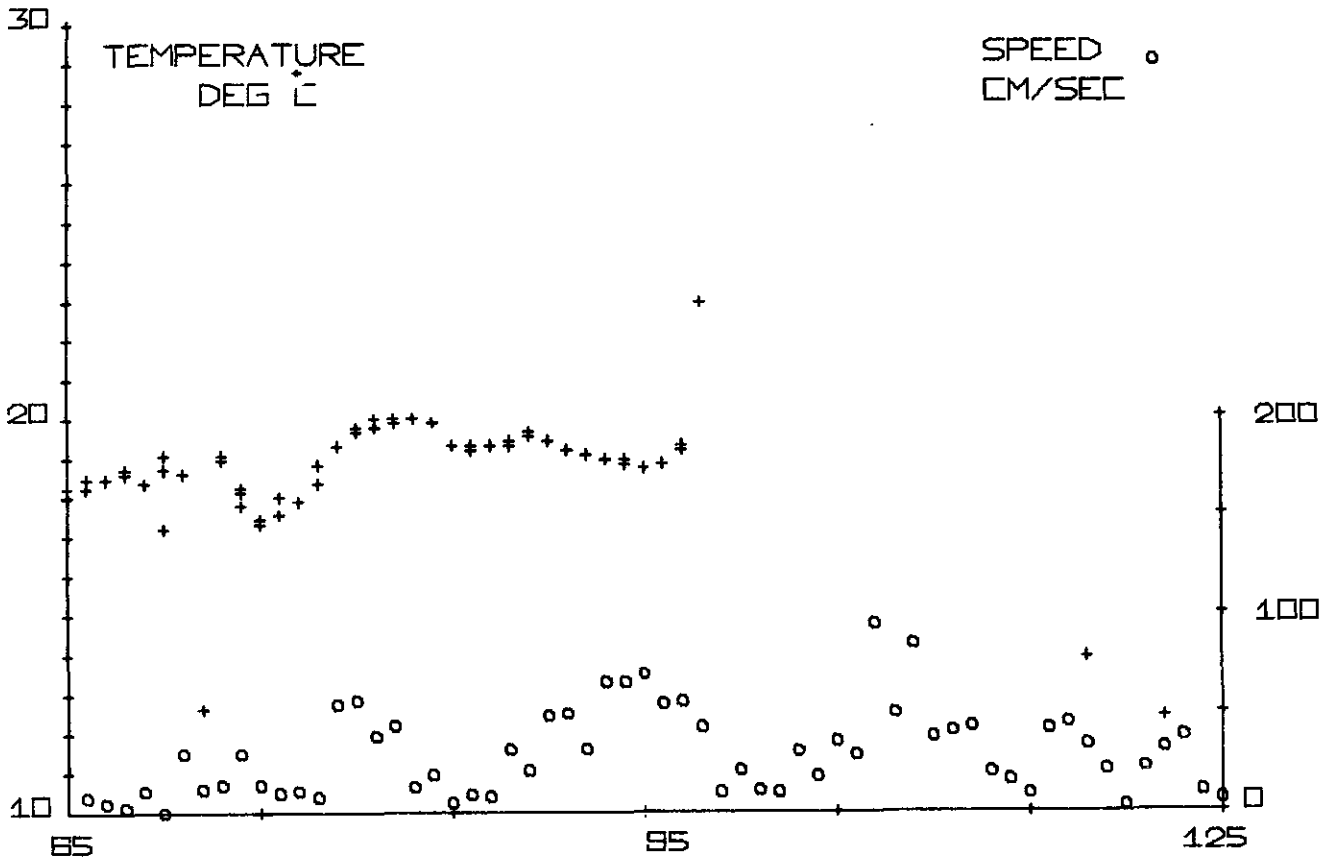
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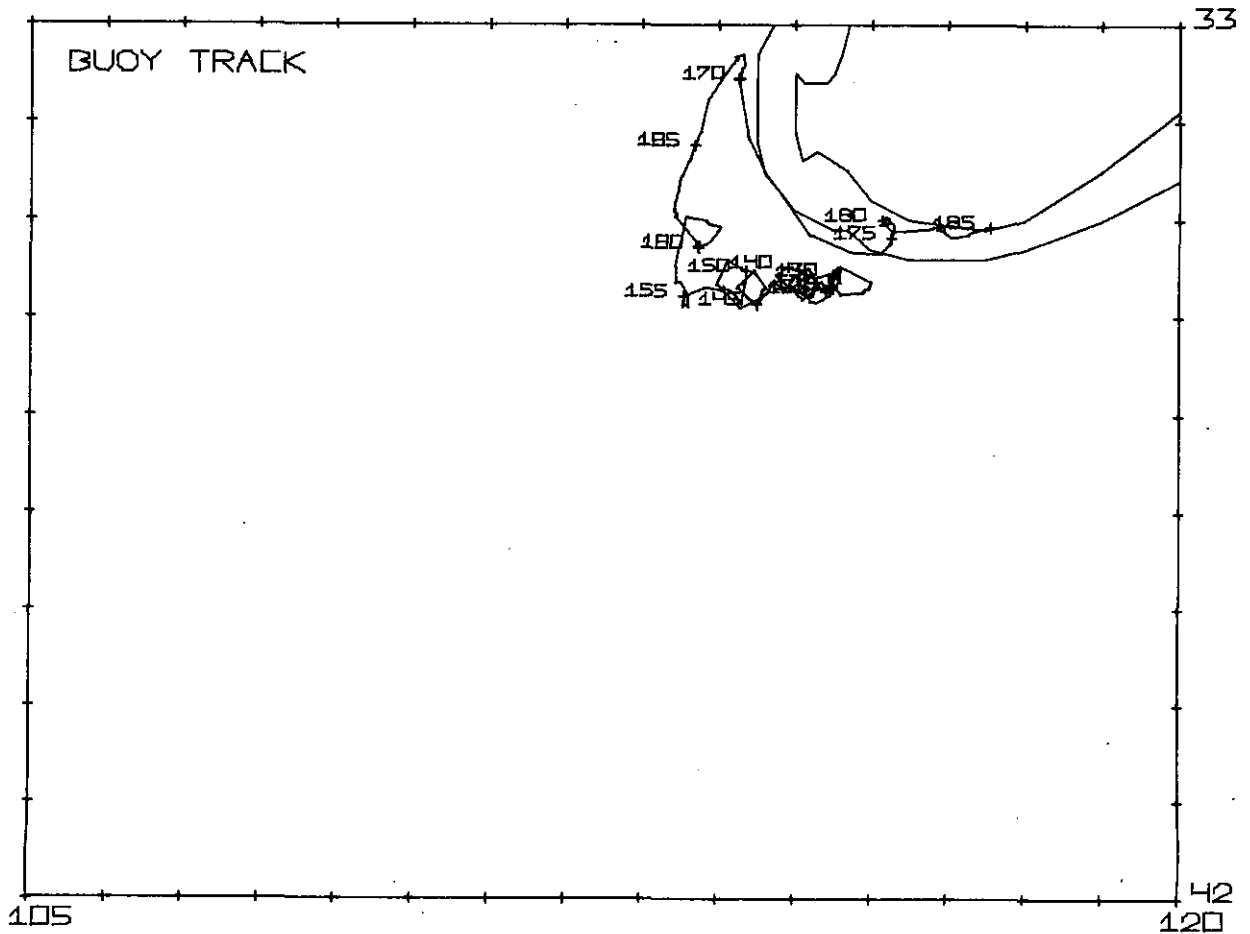
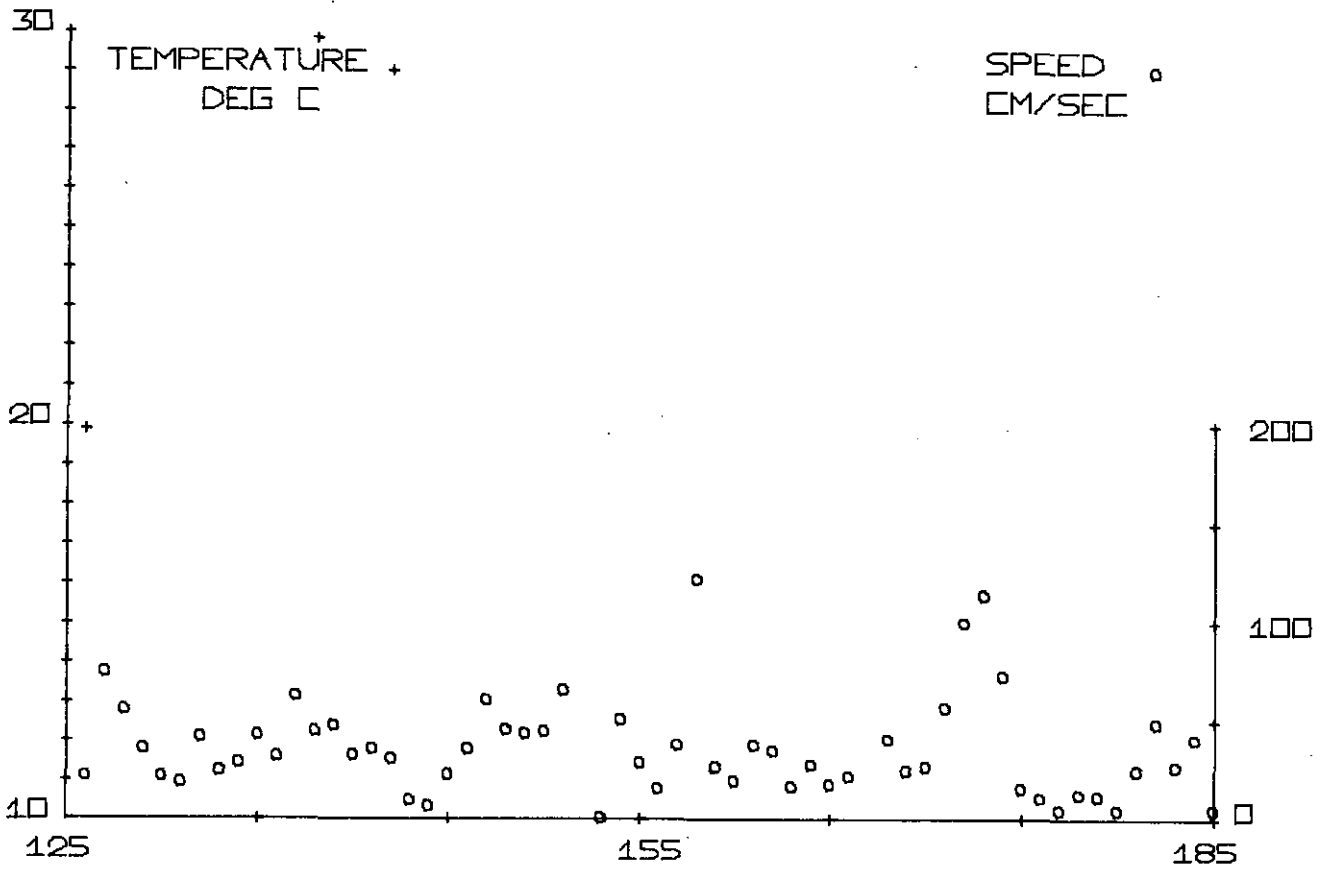


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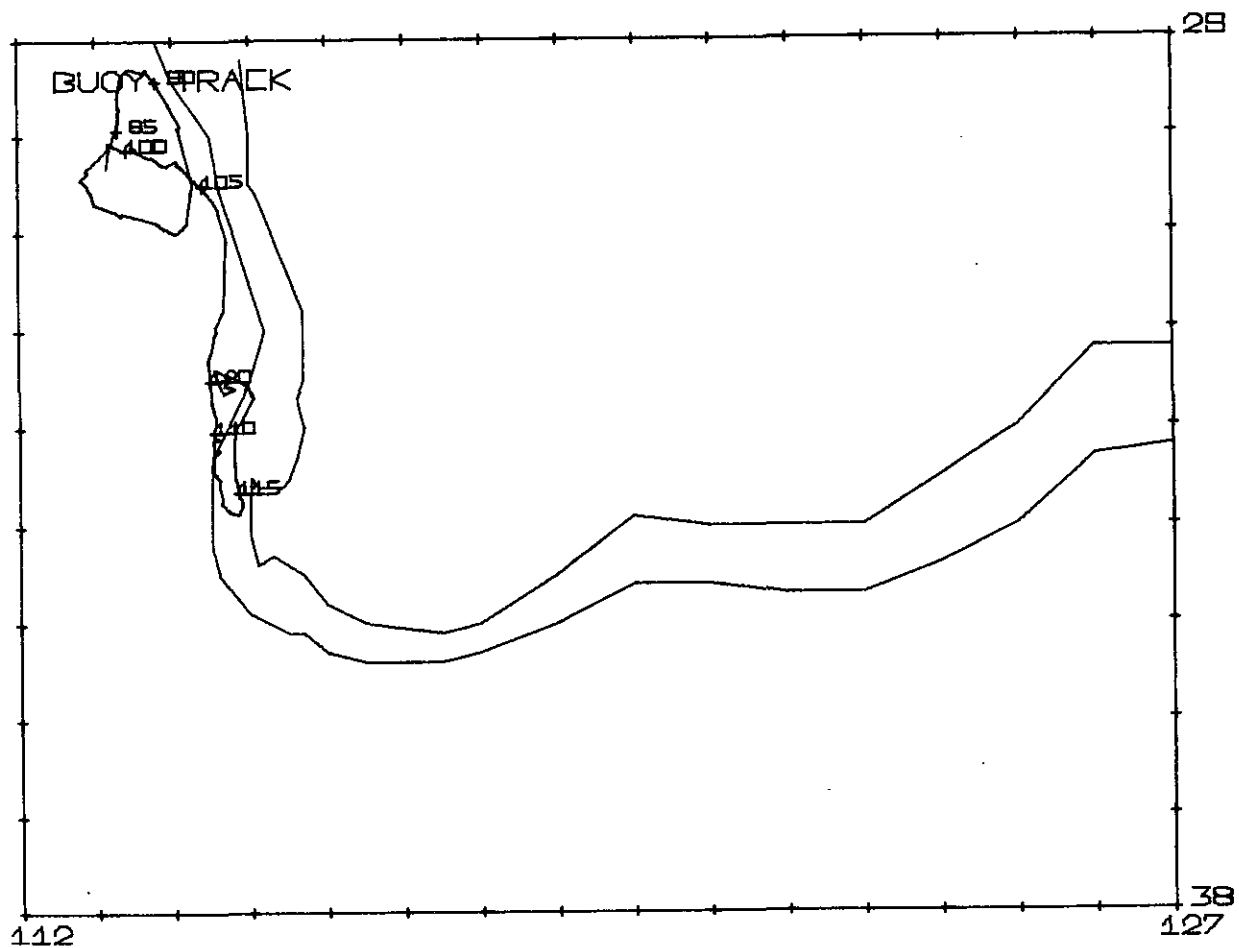
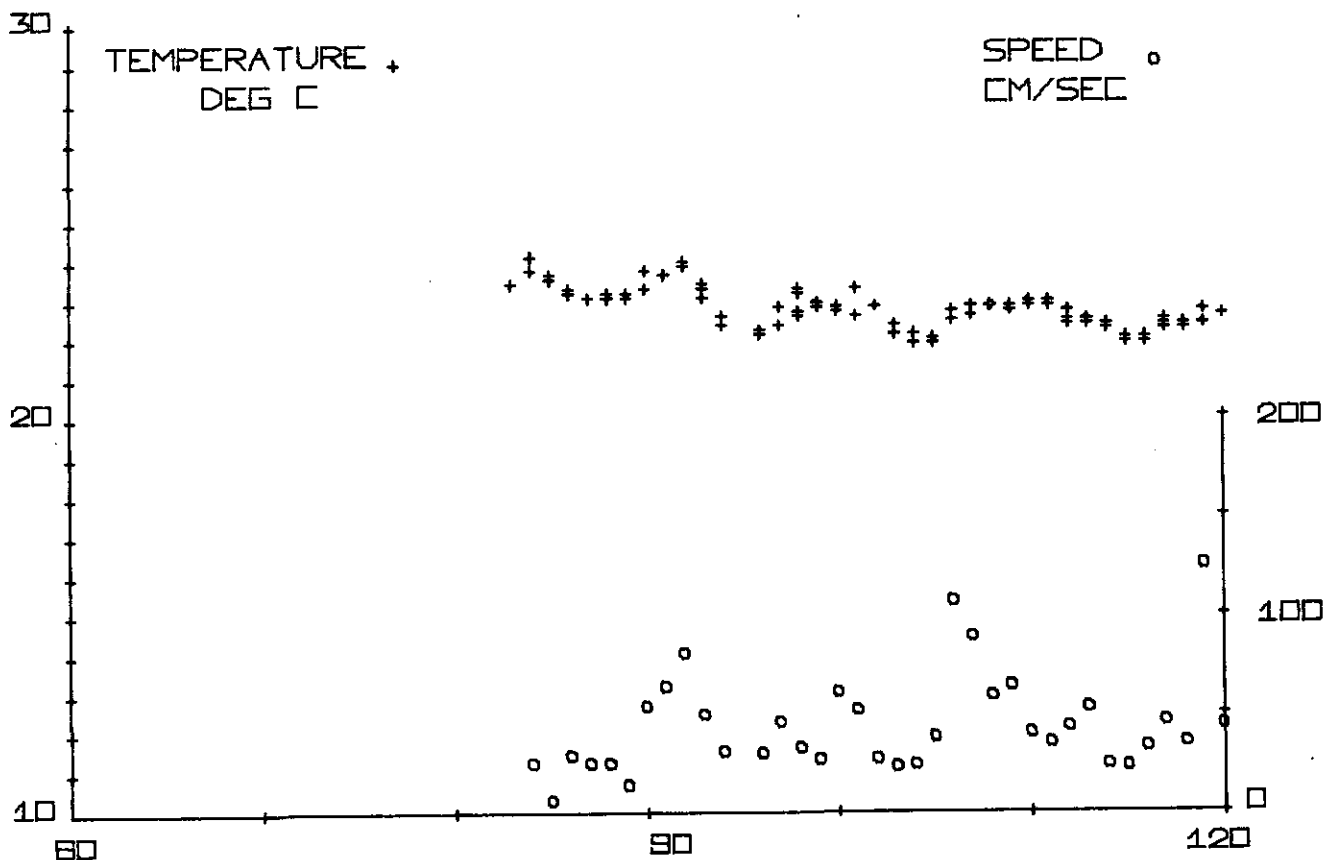


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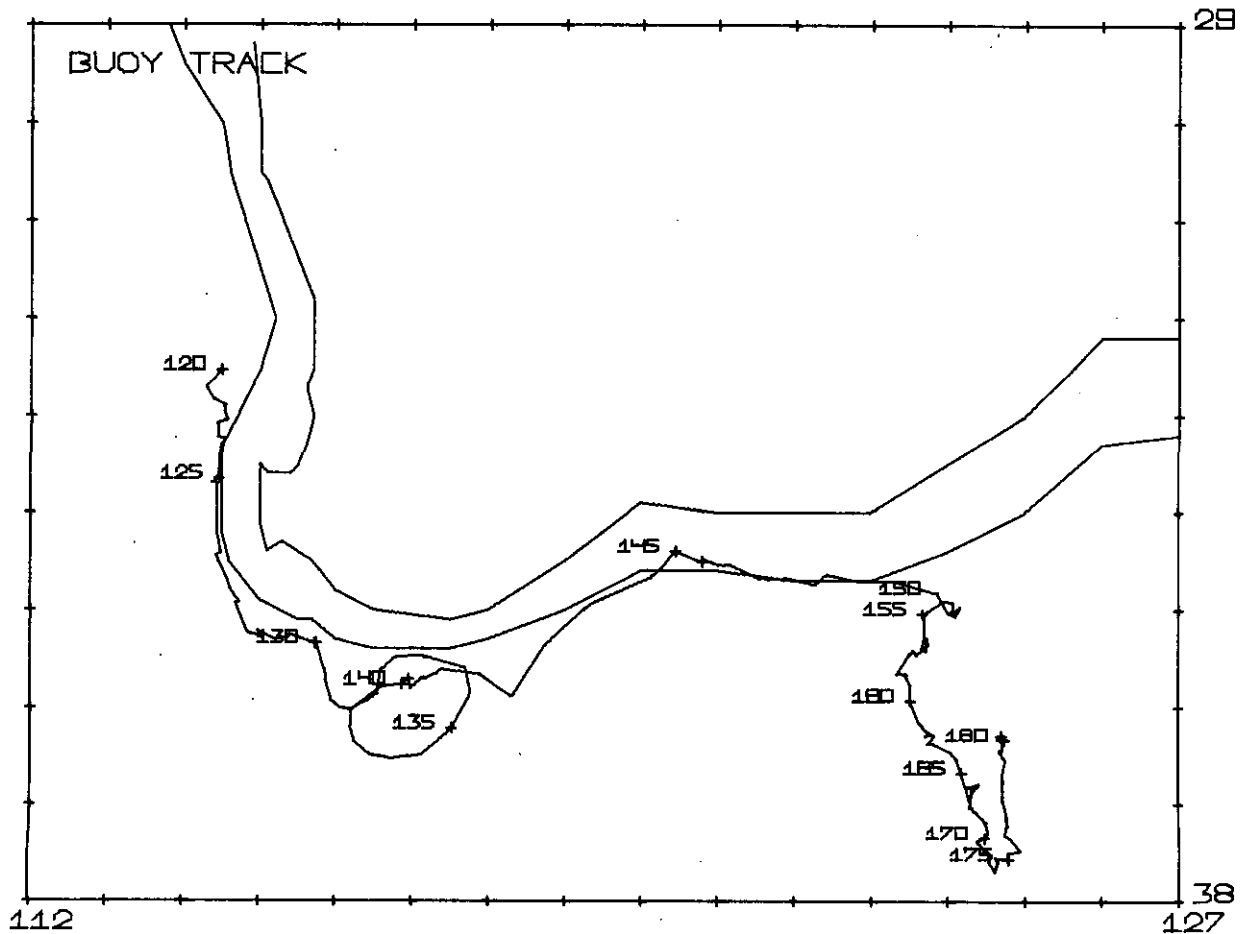
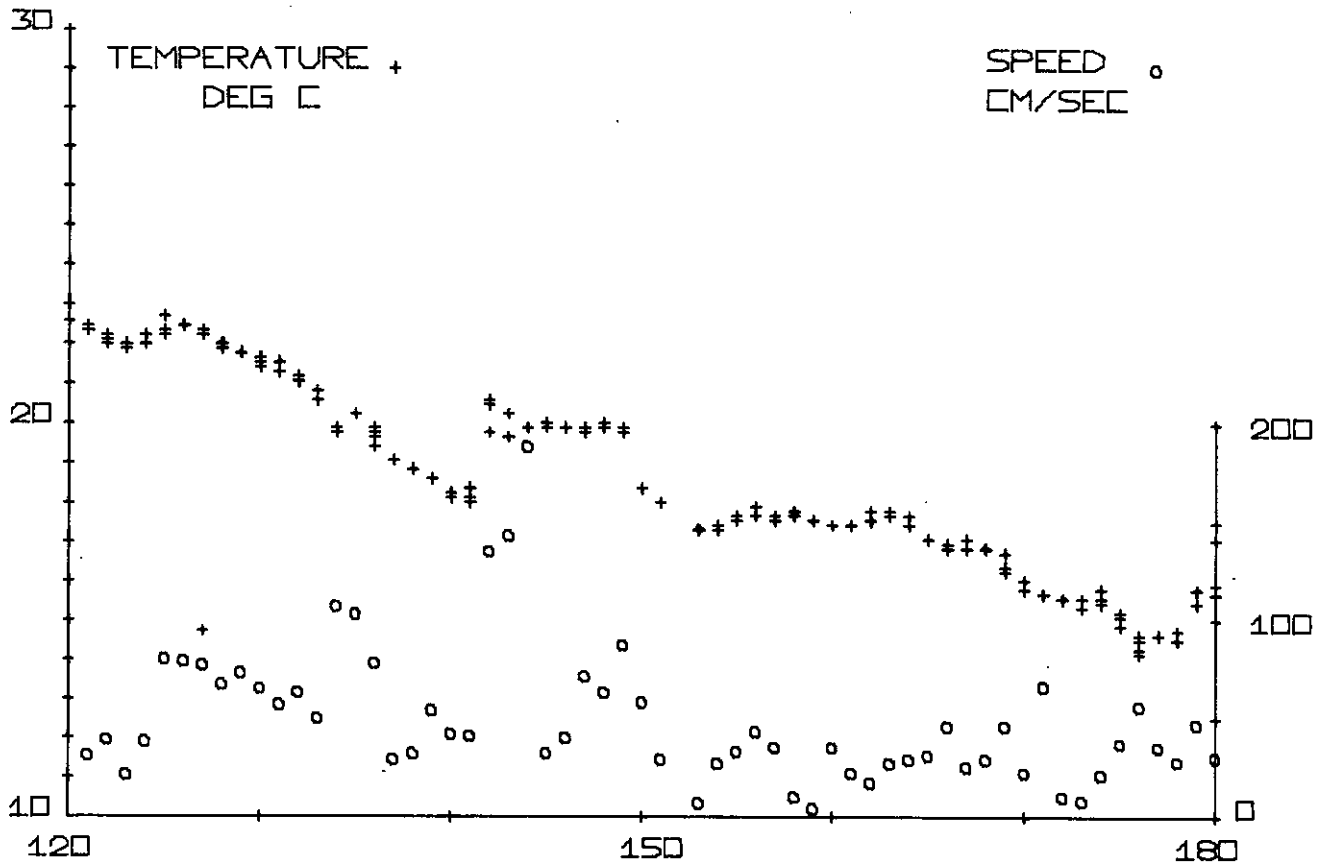
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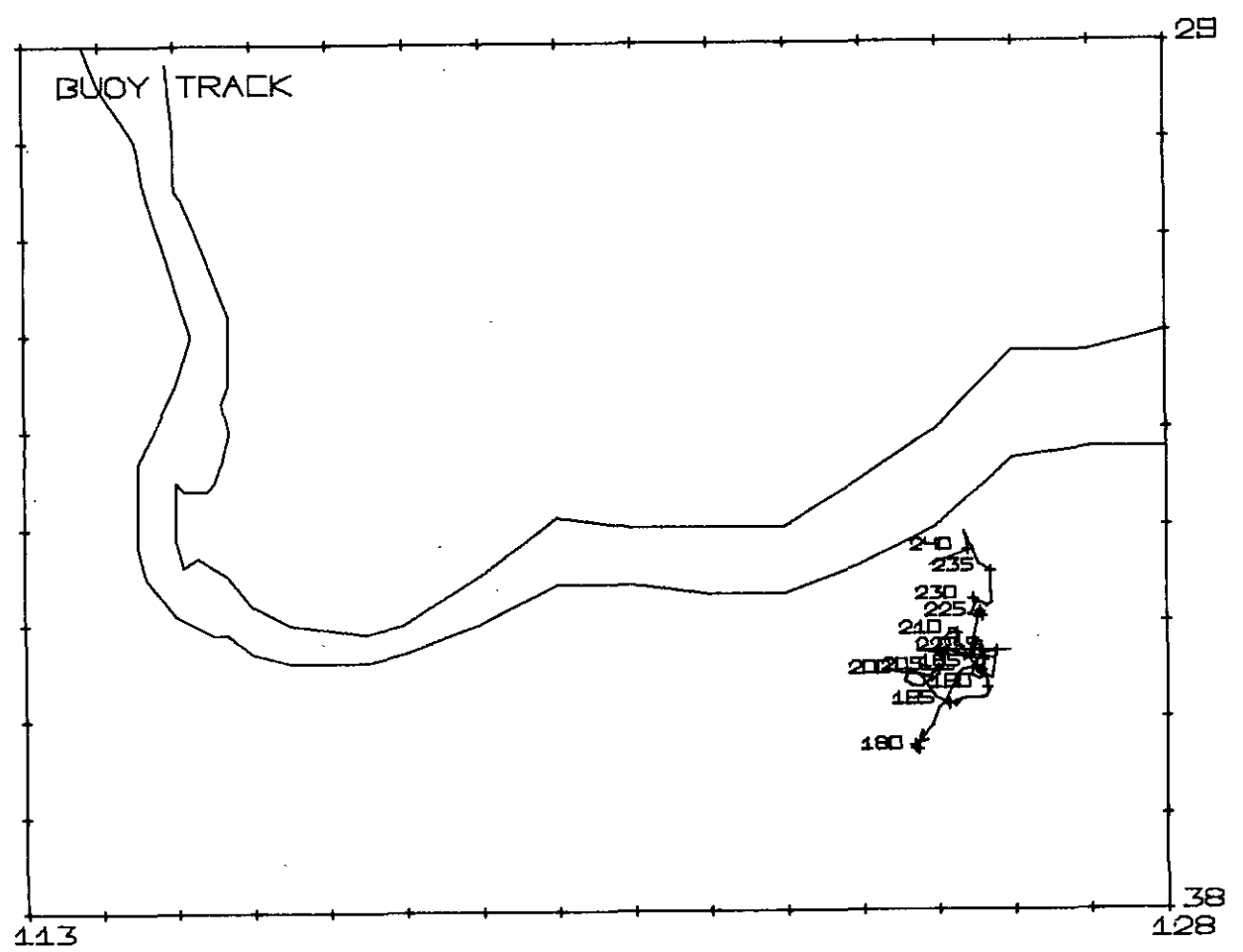
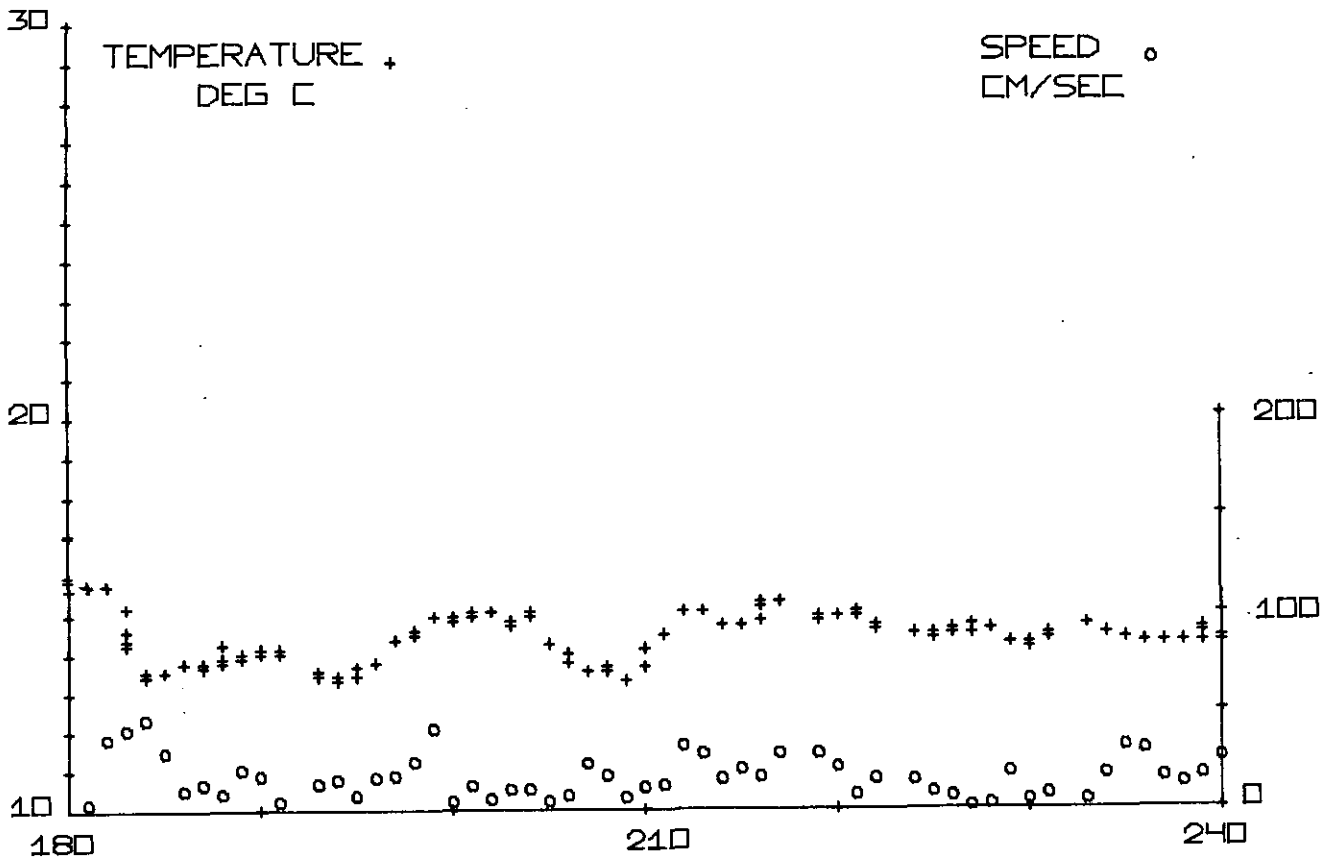
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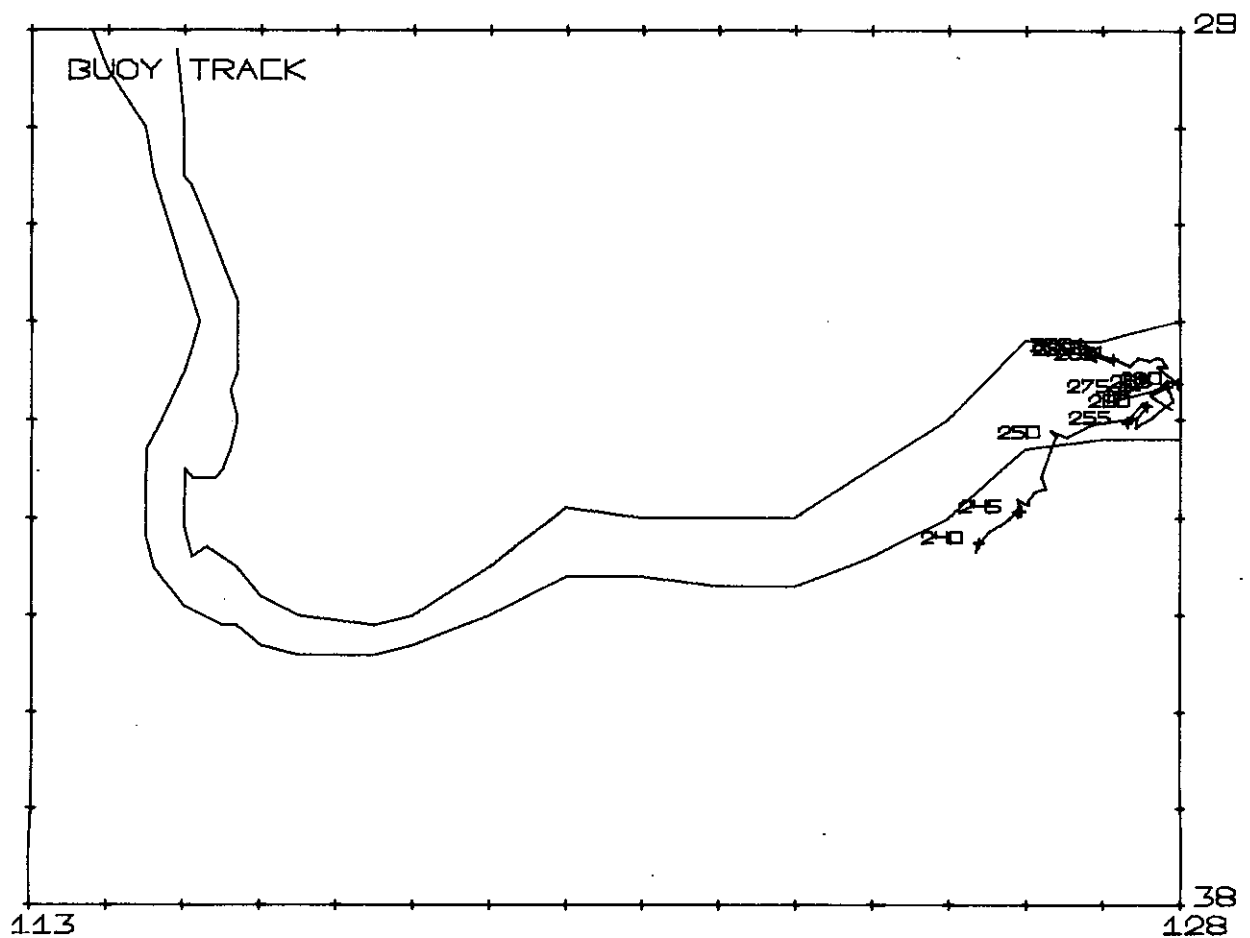
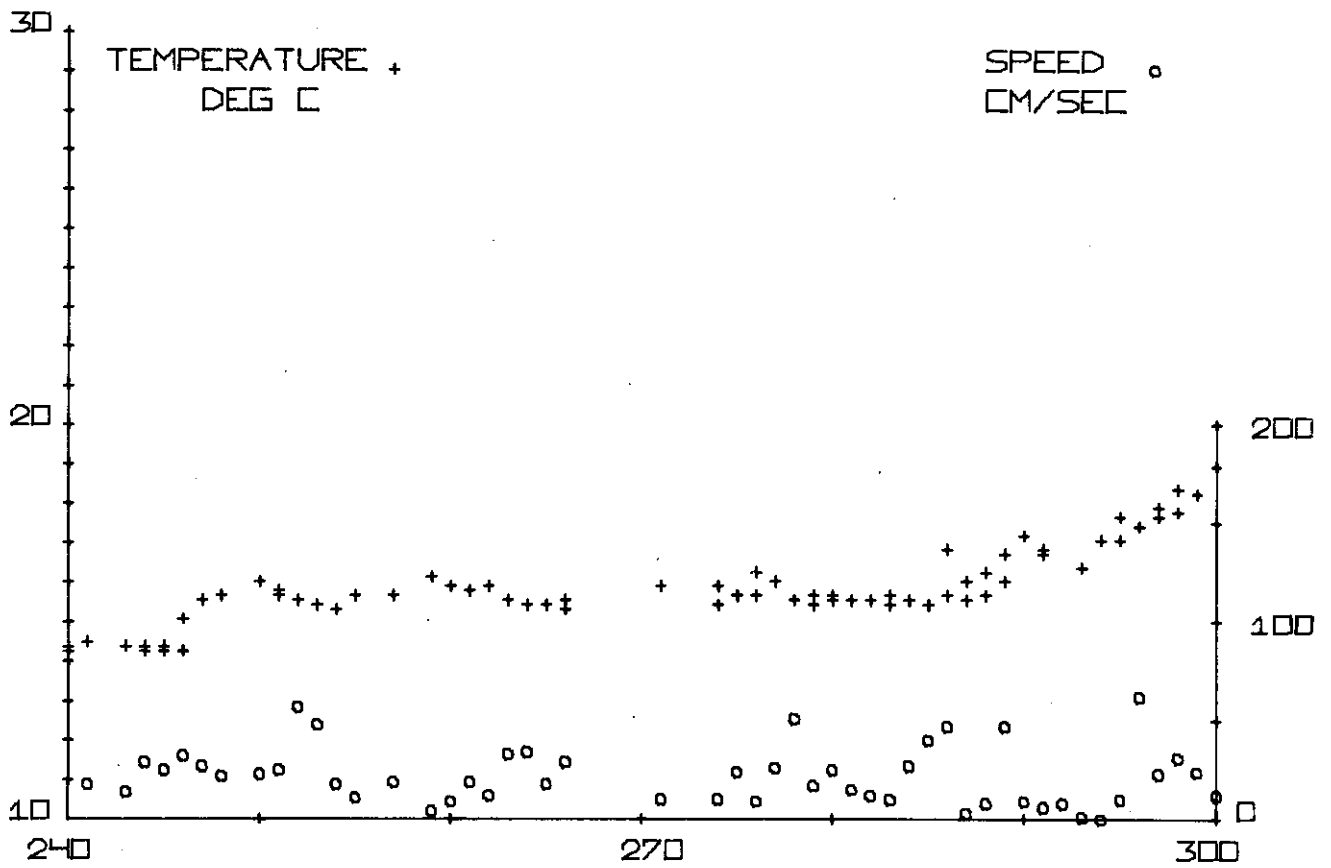
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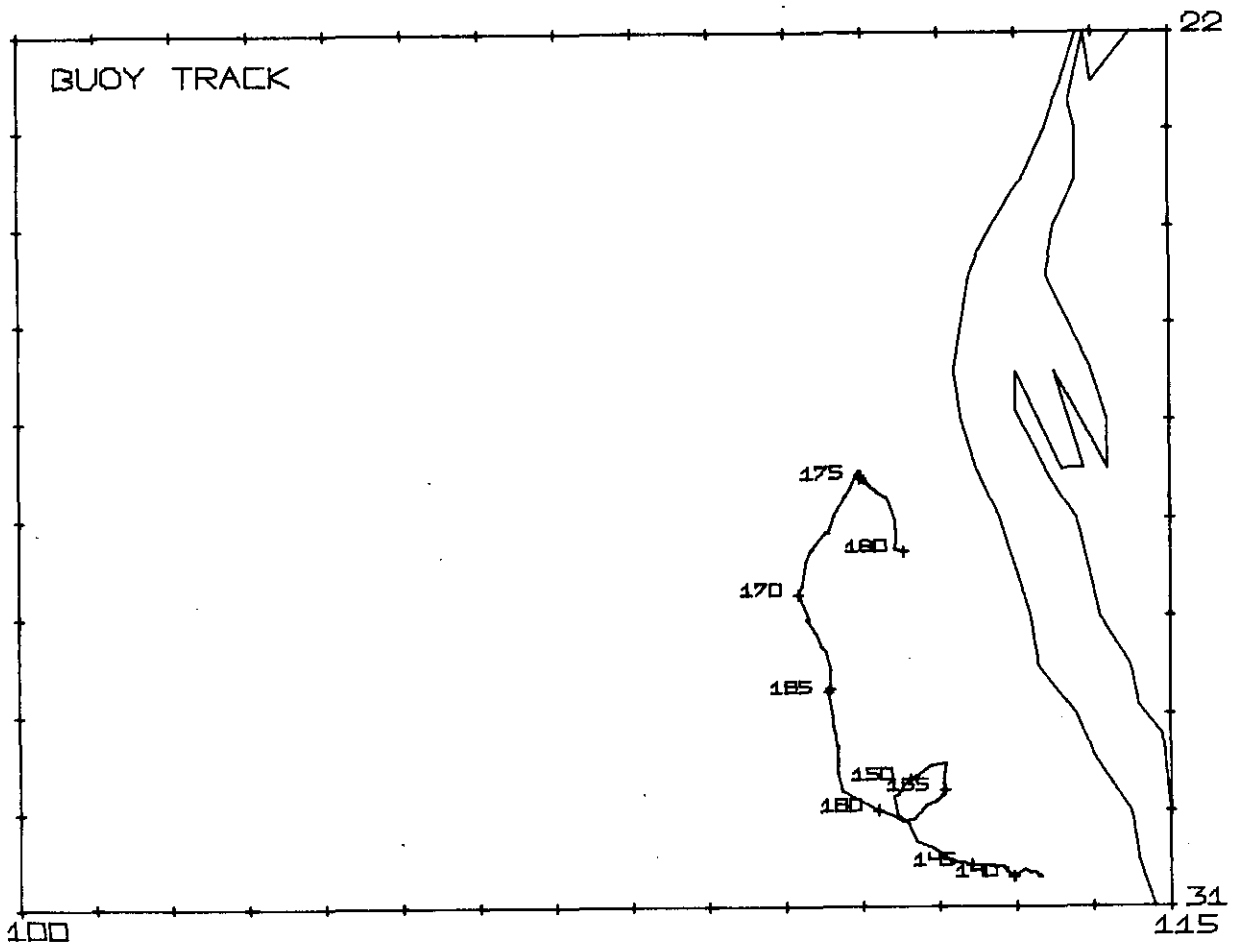
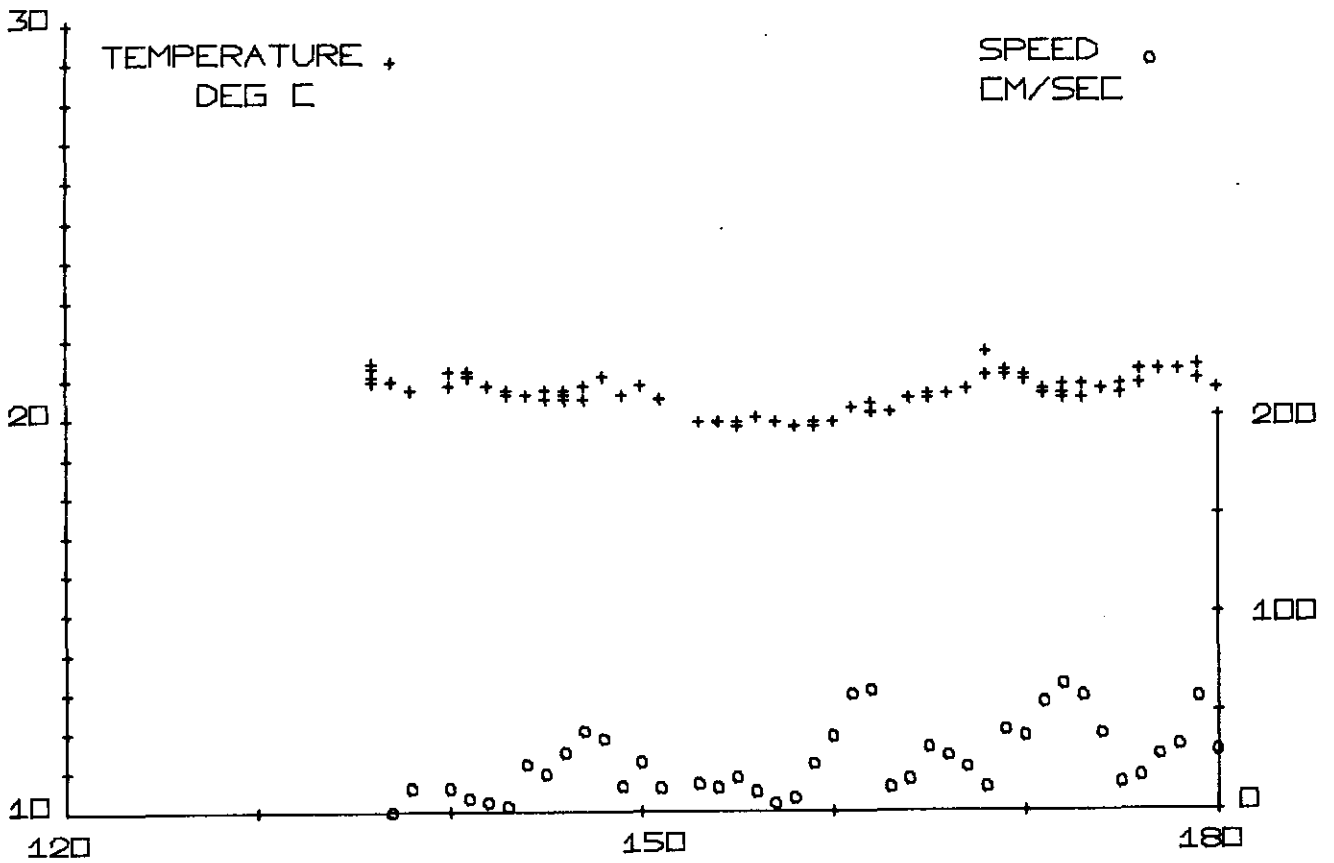
BUOY 713 DAYS 180-240 1978



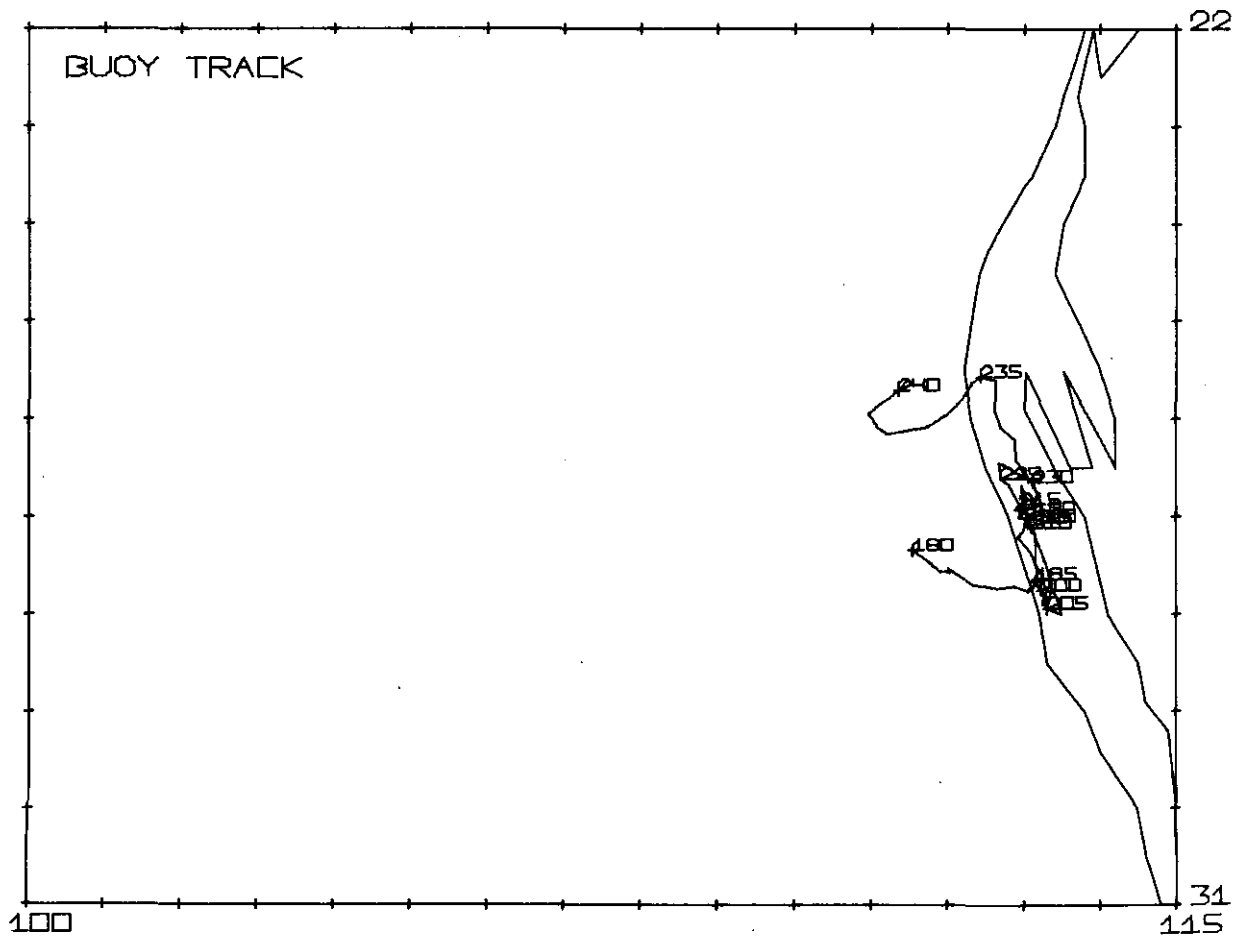
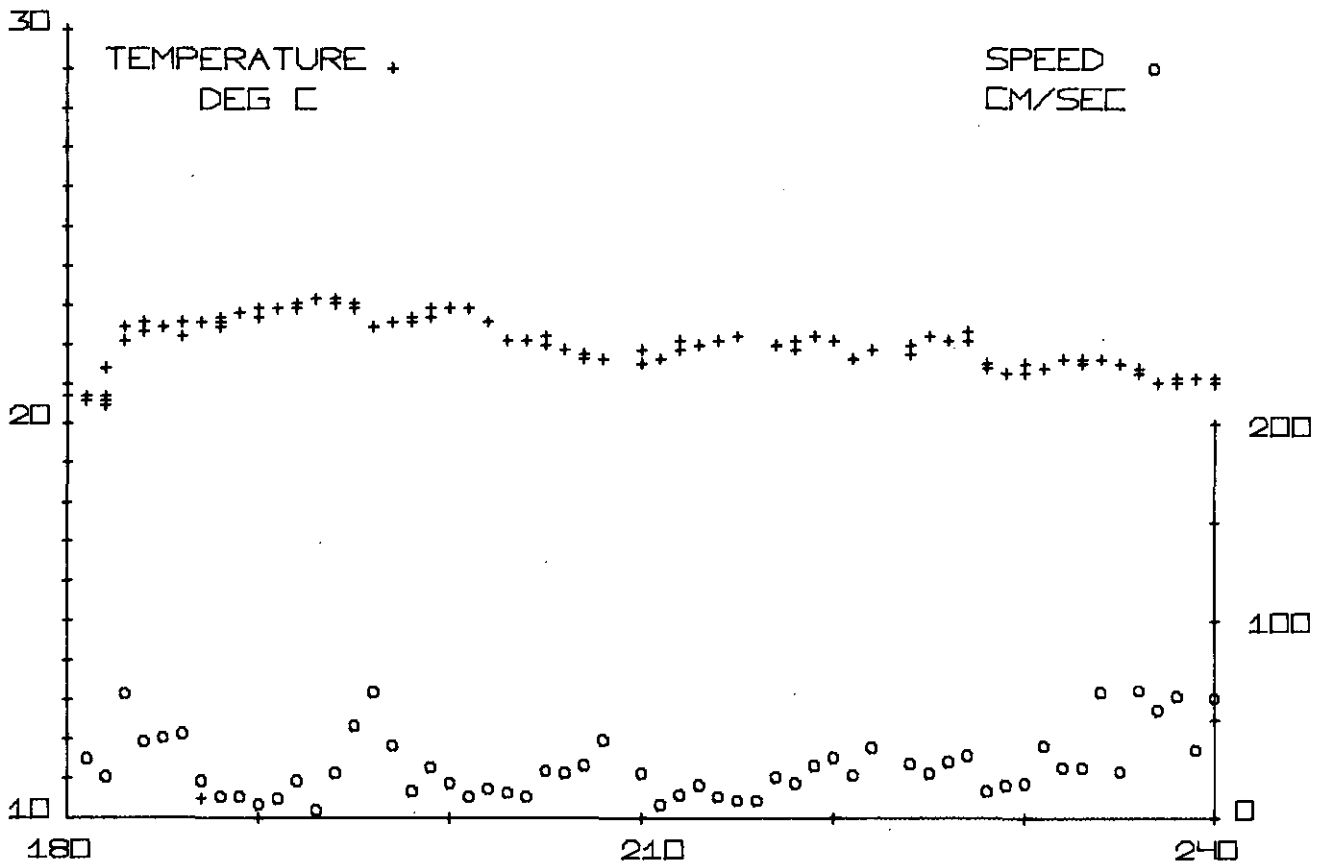
BUOY 713 DAYS 240-300 1976



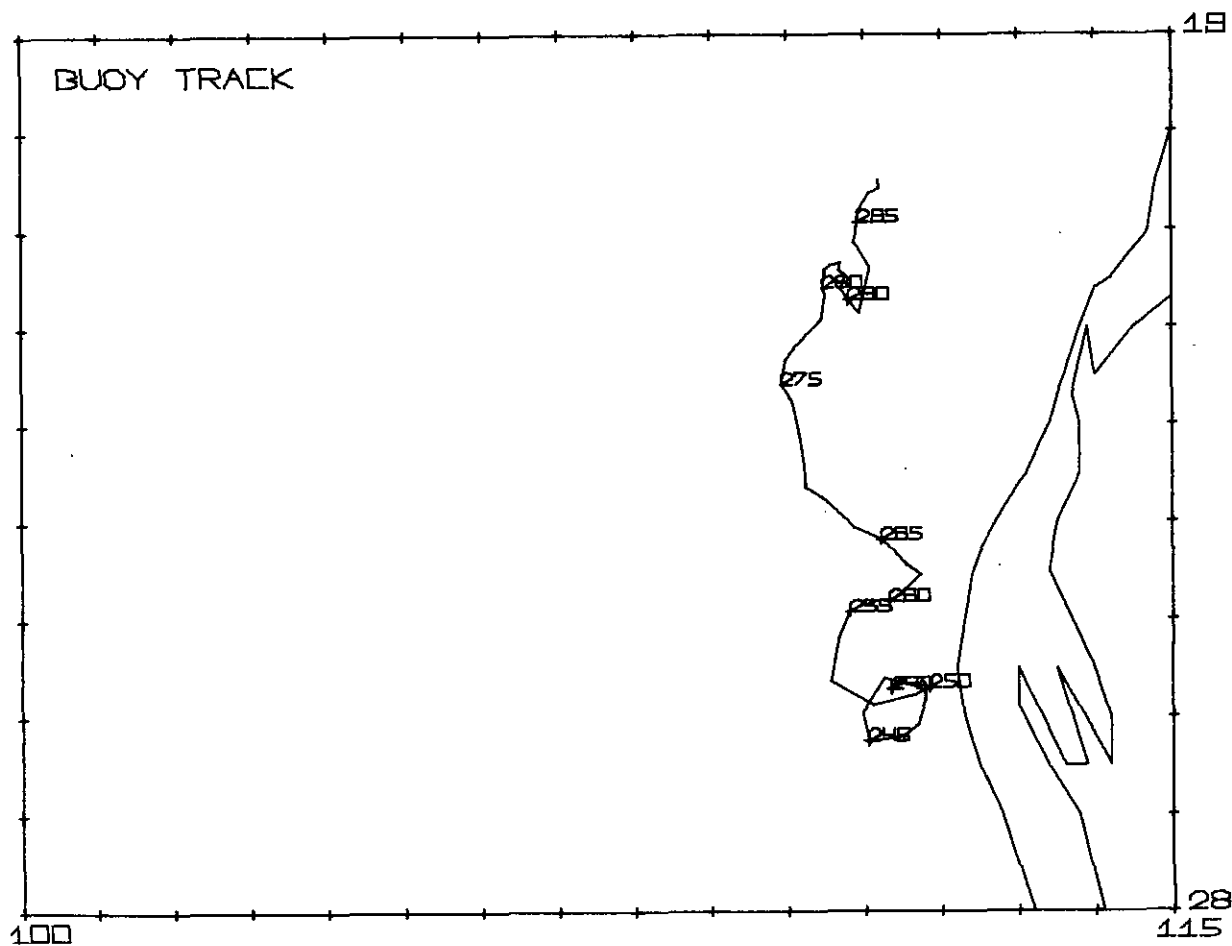
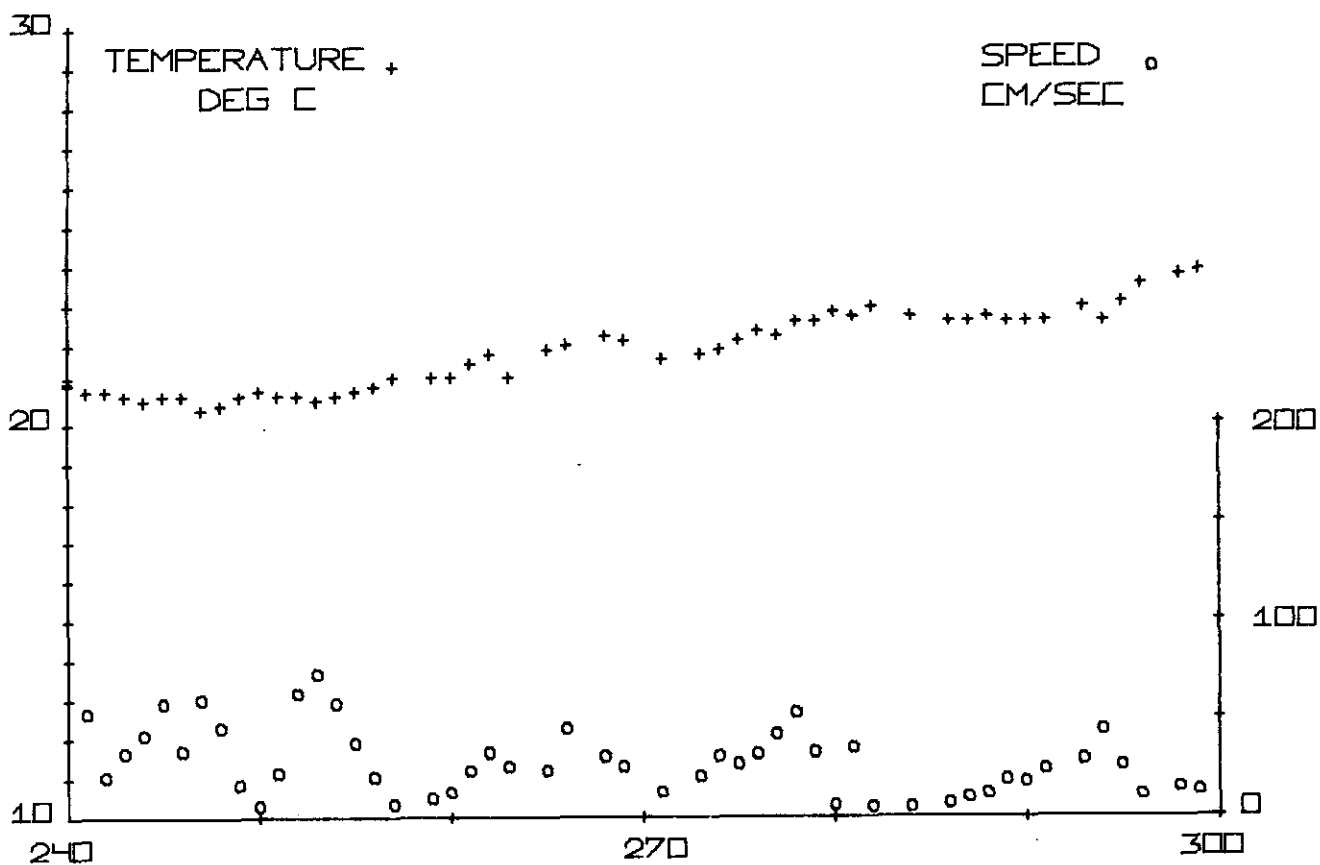
BUOY 725 DAYS 120-180 1976



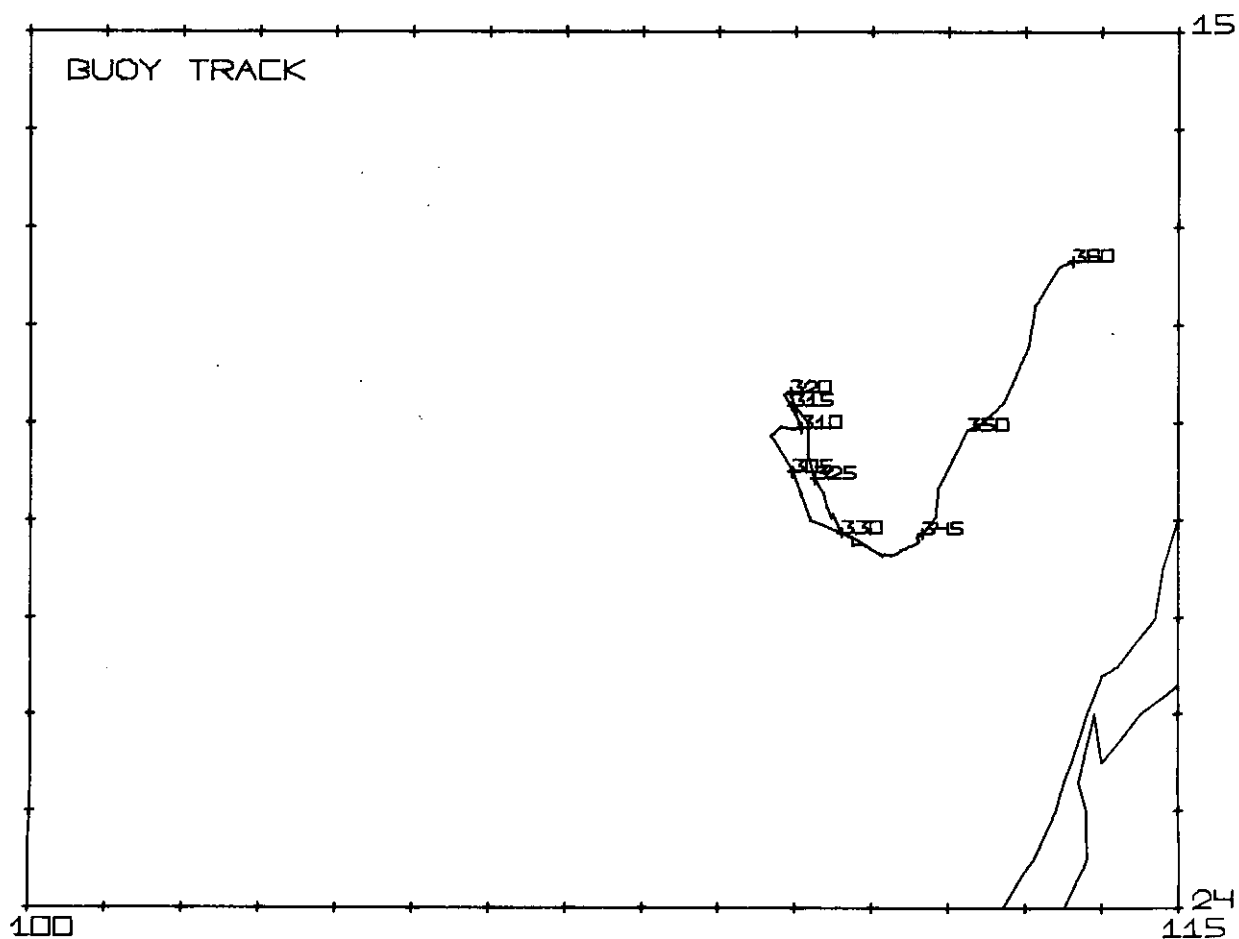
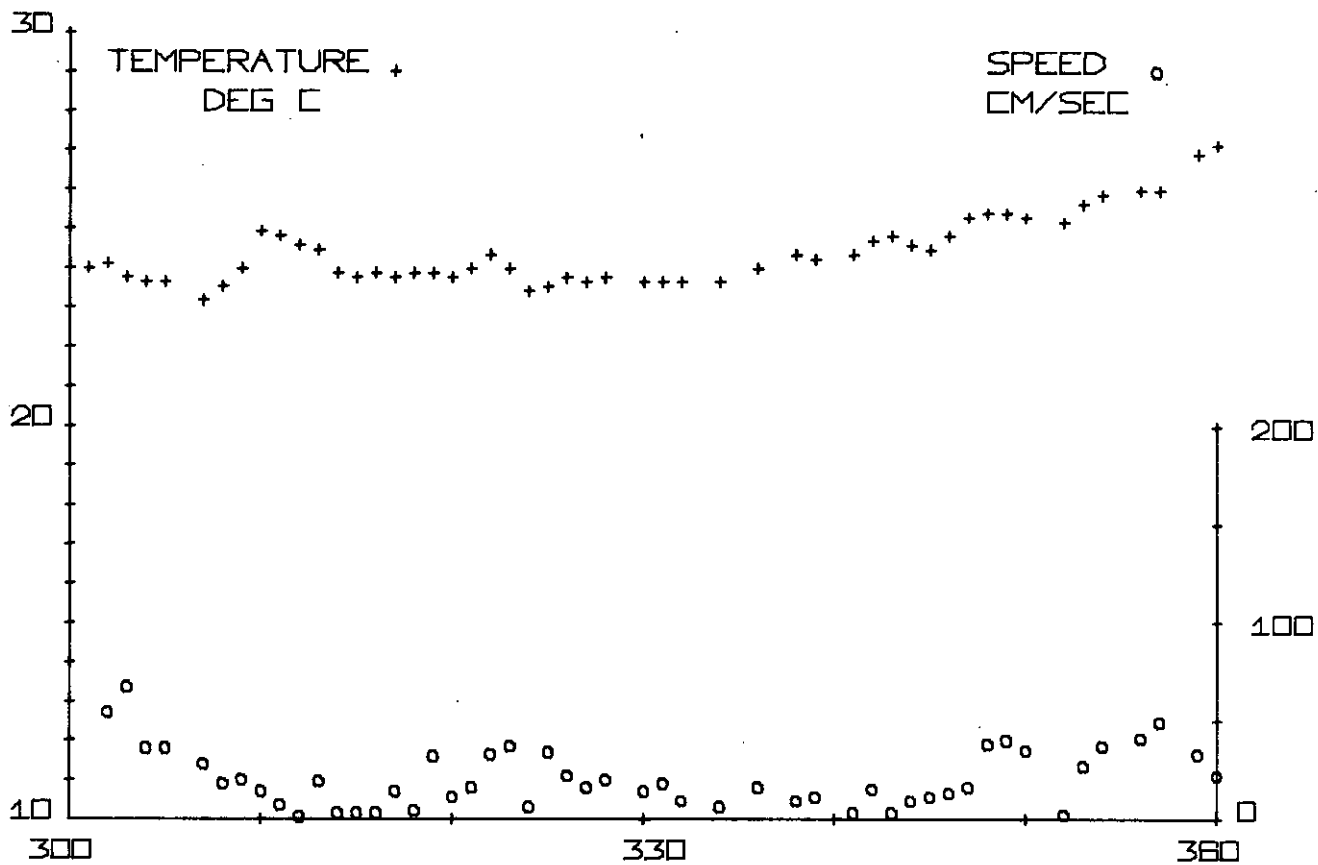
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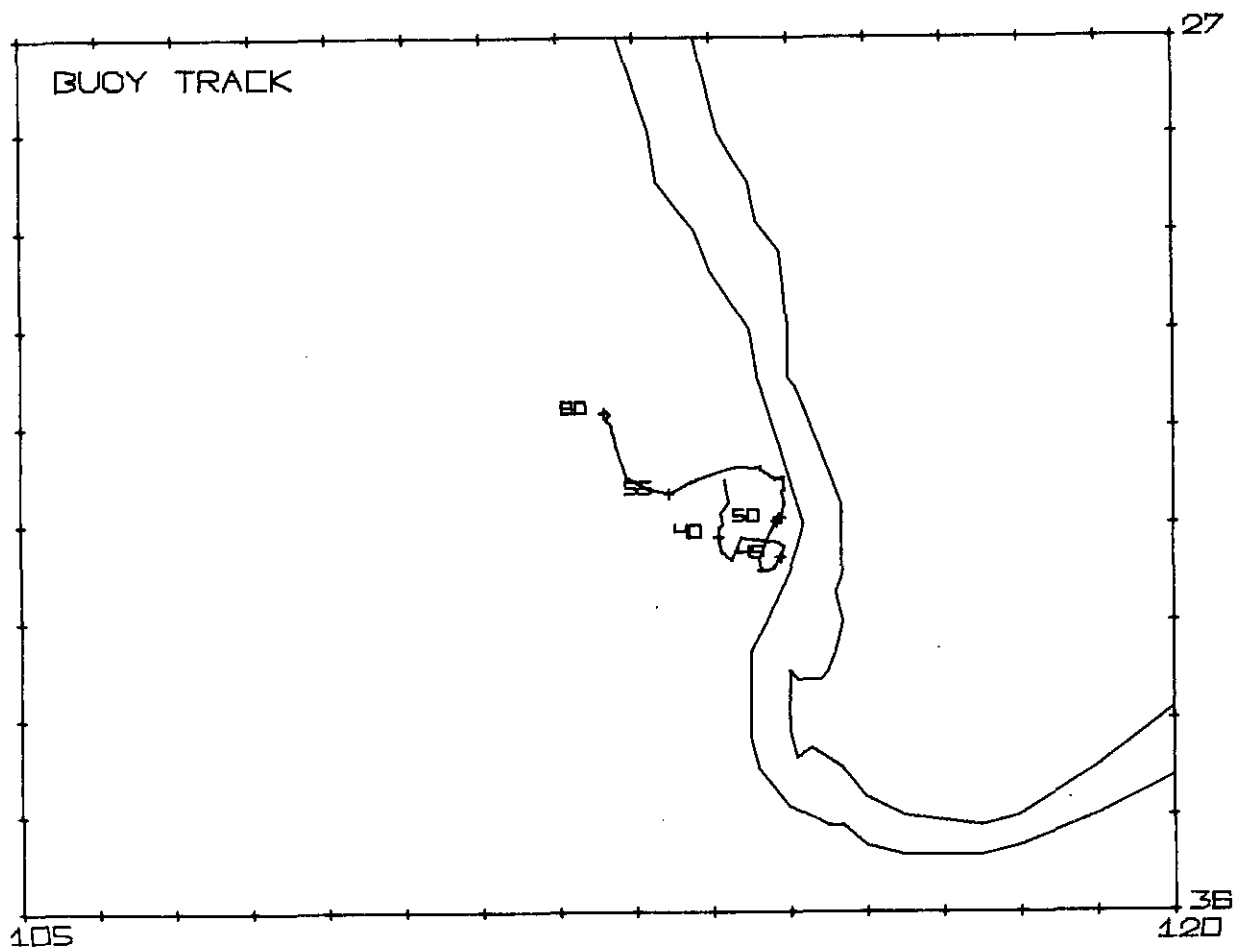
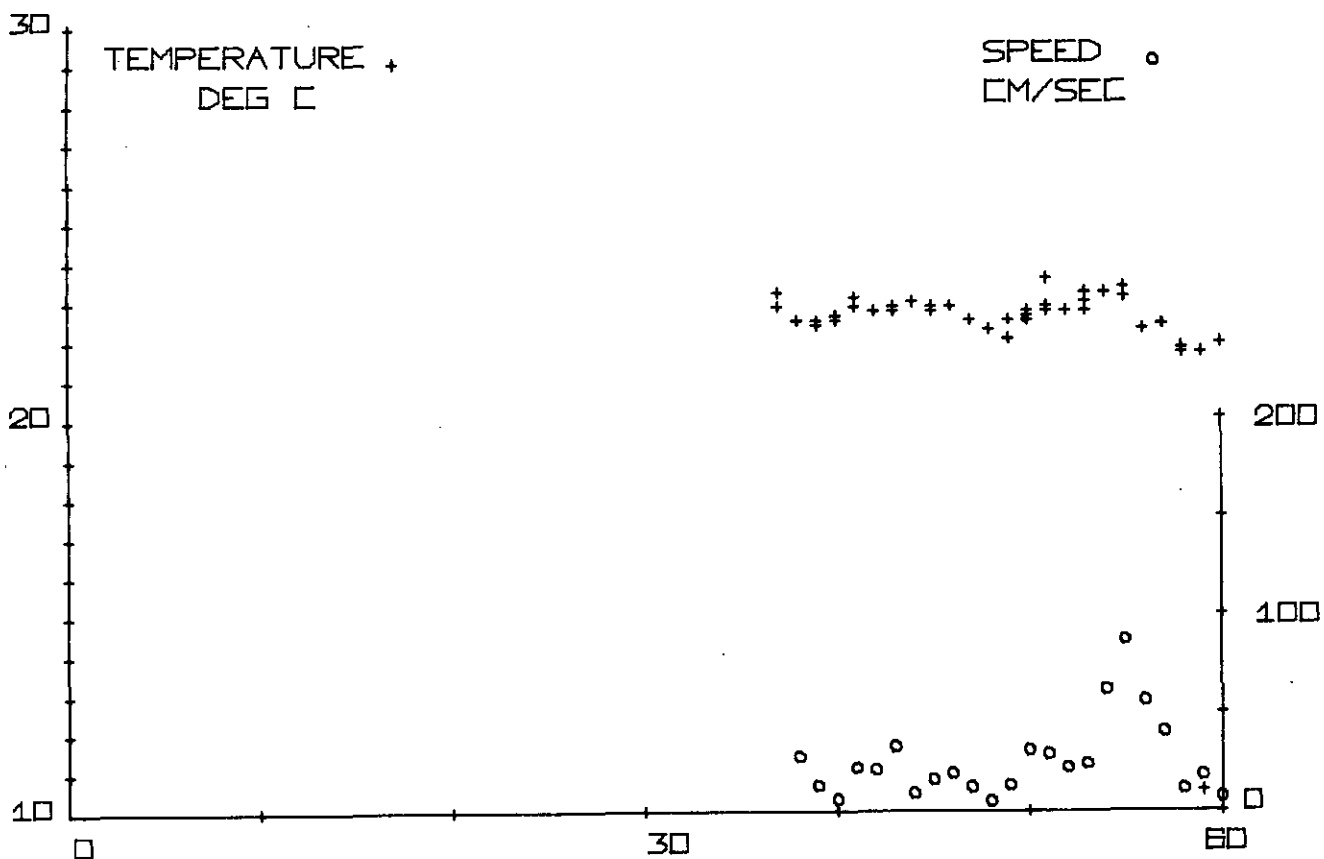
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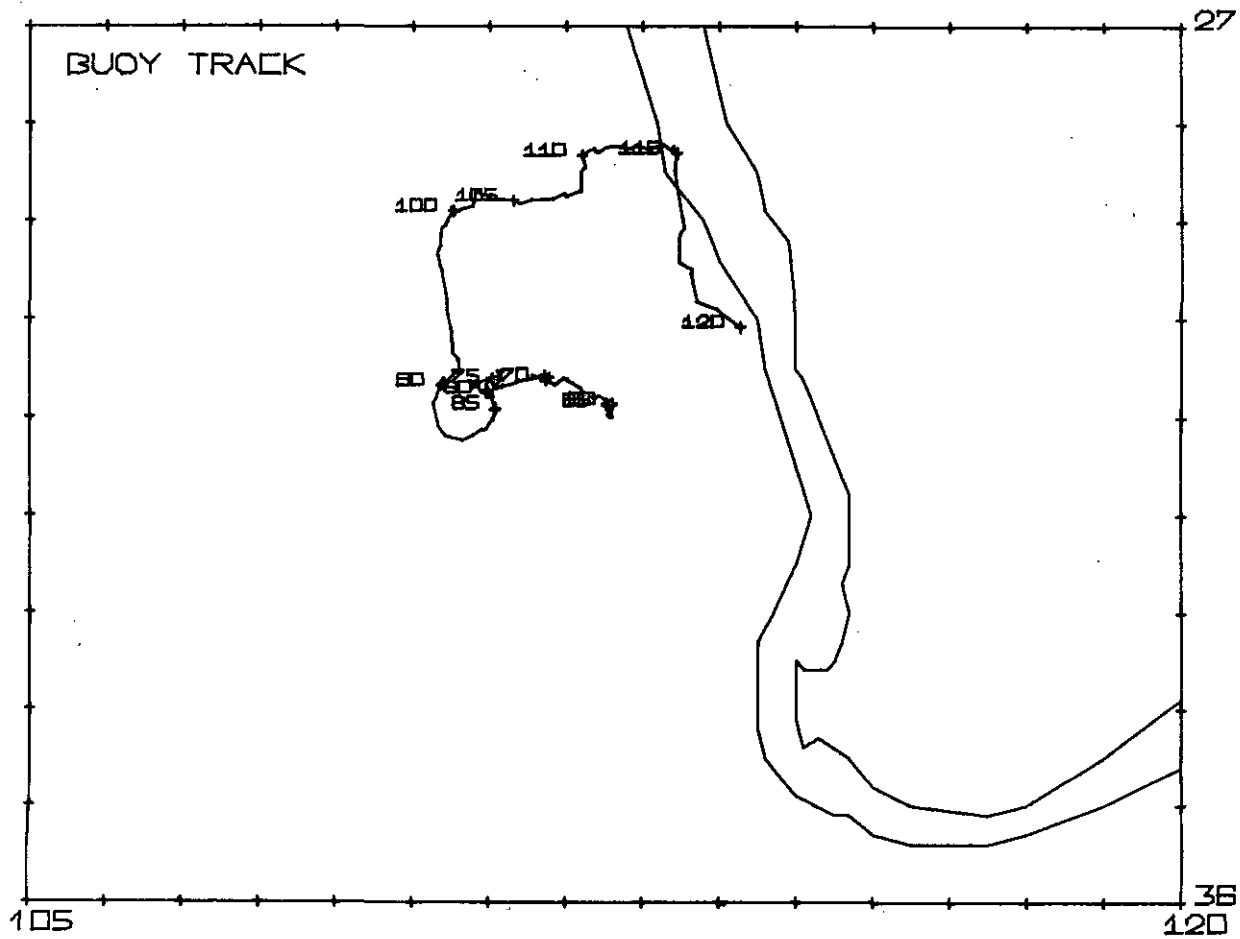
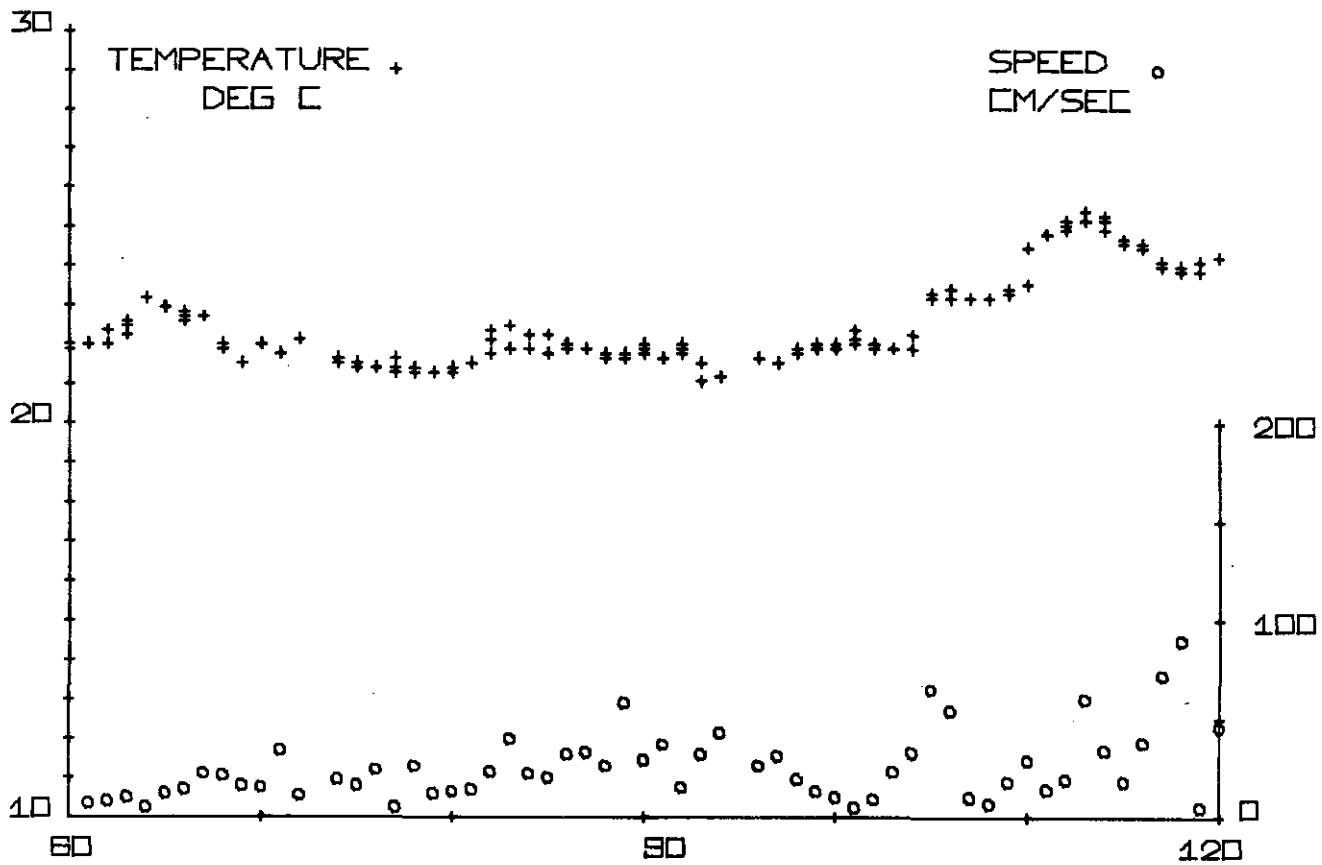
BUOY 1054

DAYS

0 - 60 1976

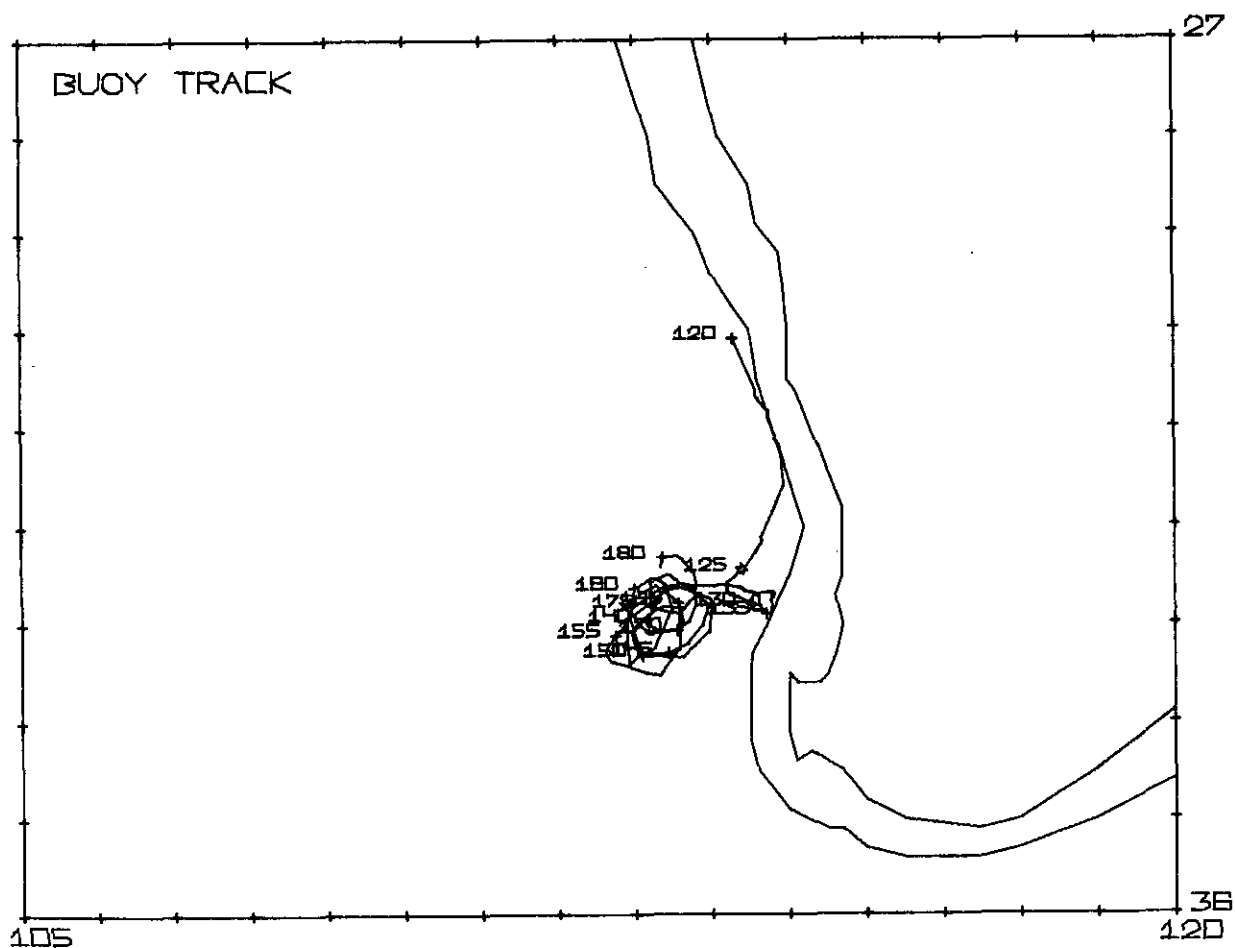
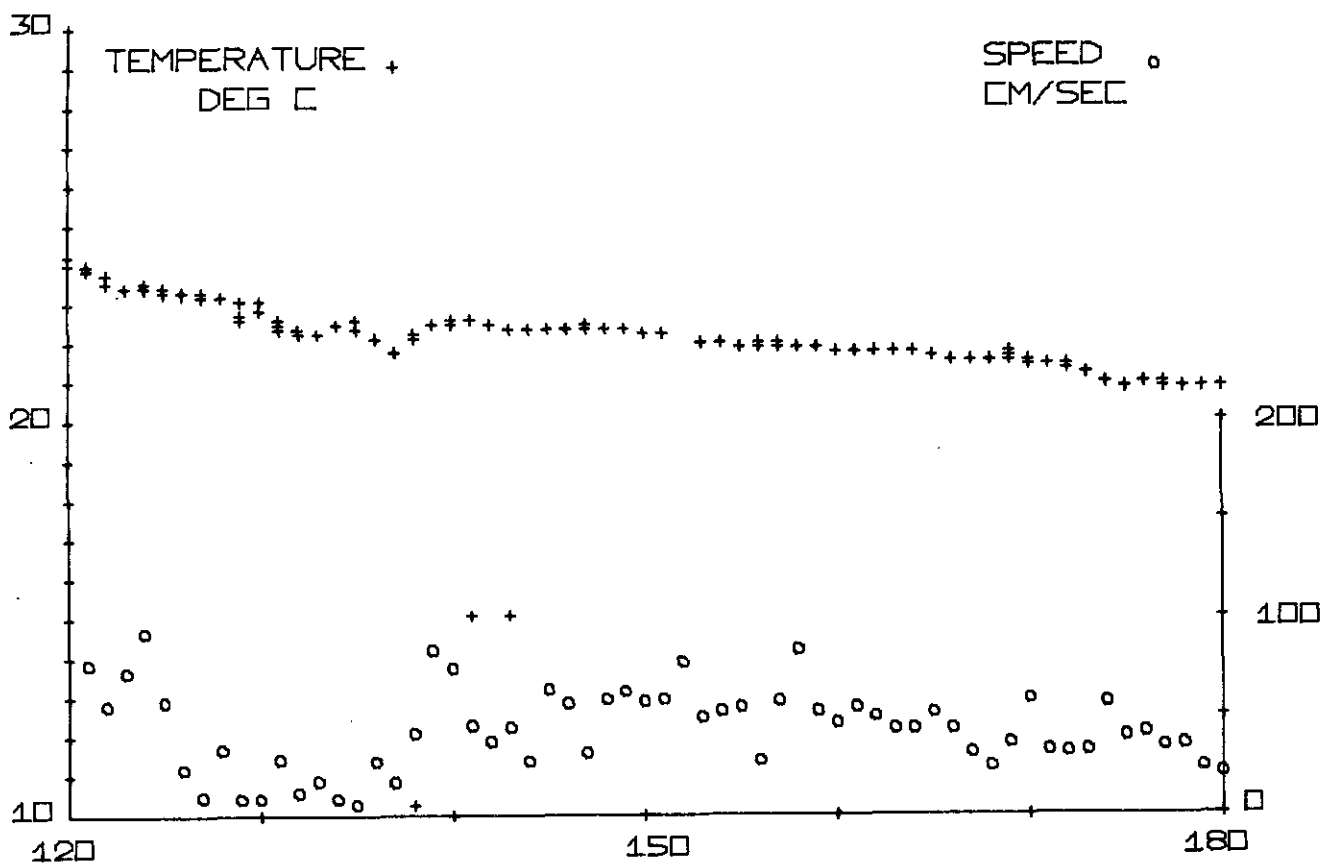


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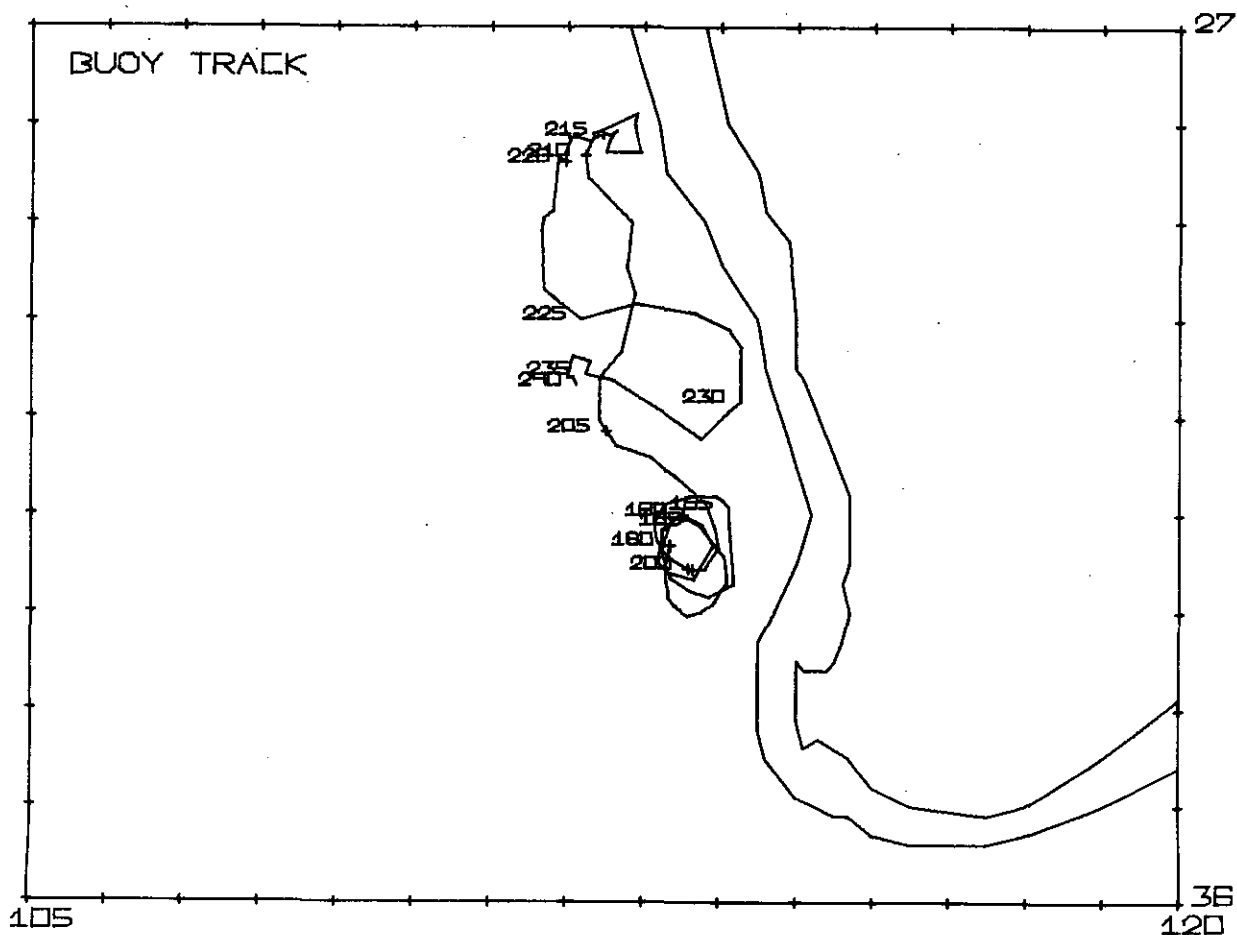
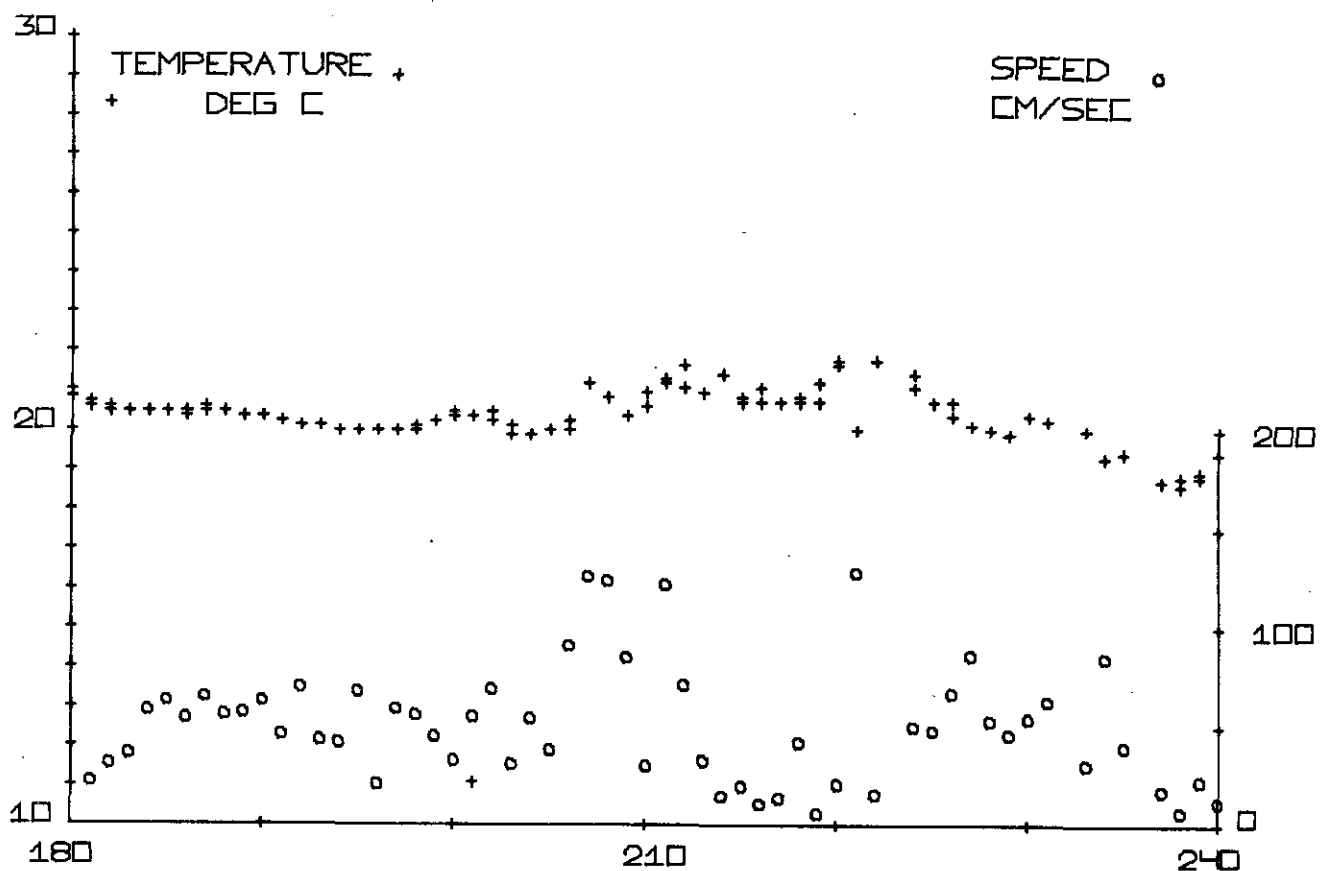
BUOY 1054

DAYS 120-180 1976

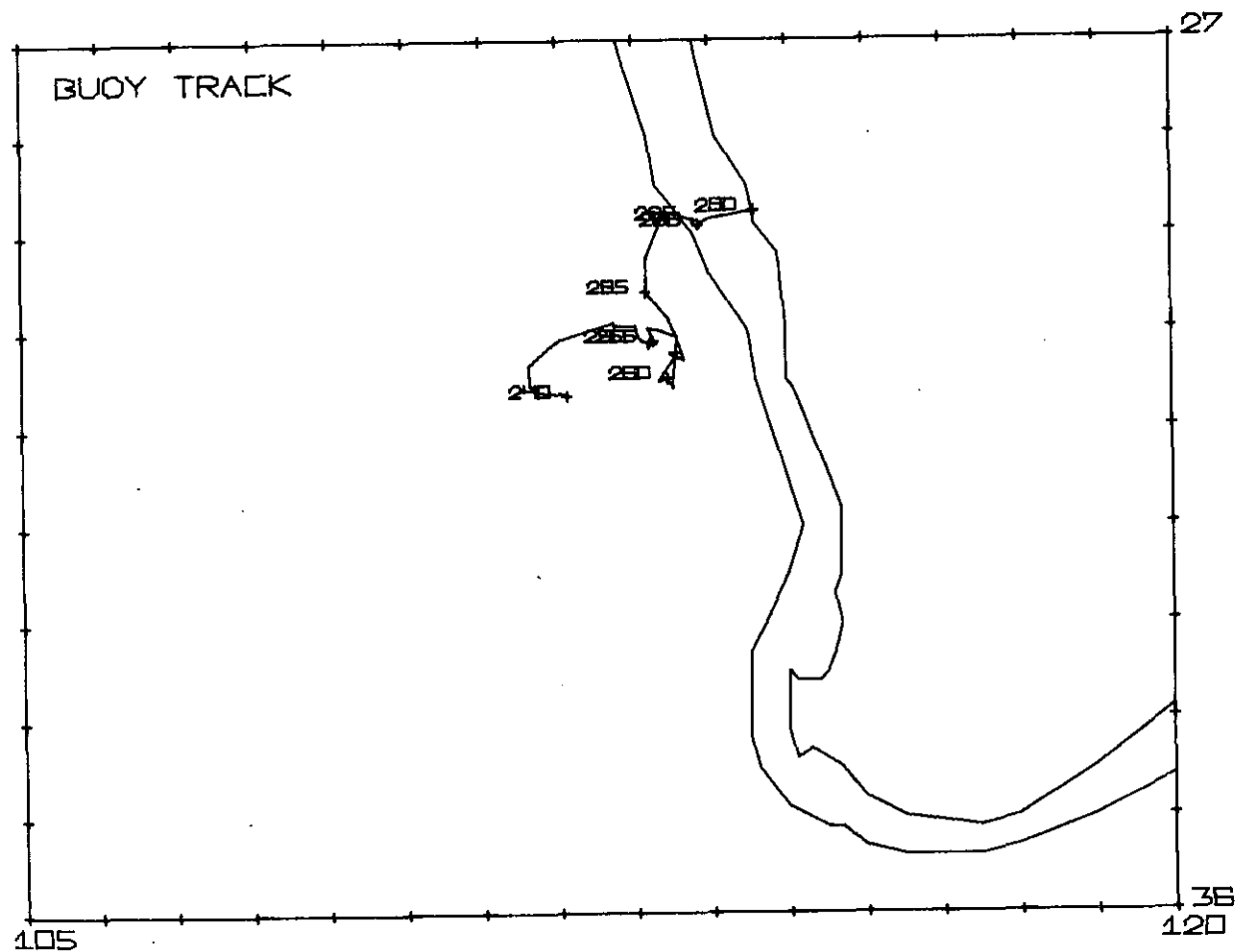
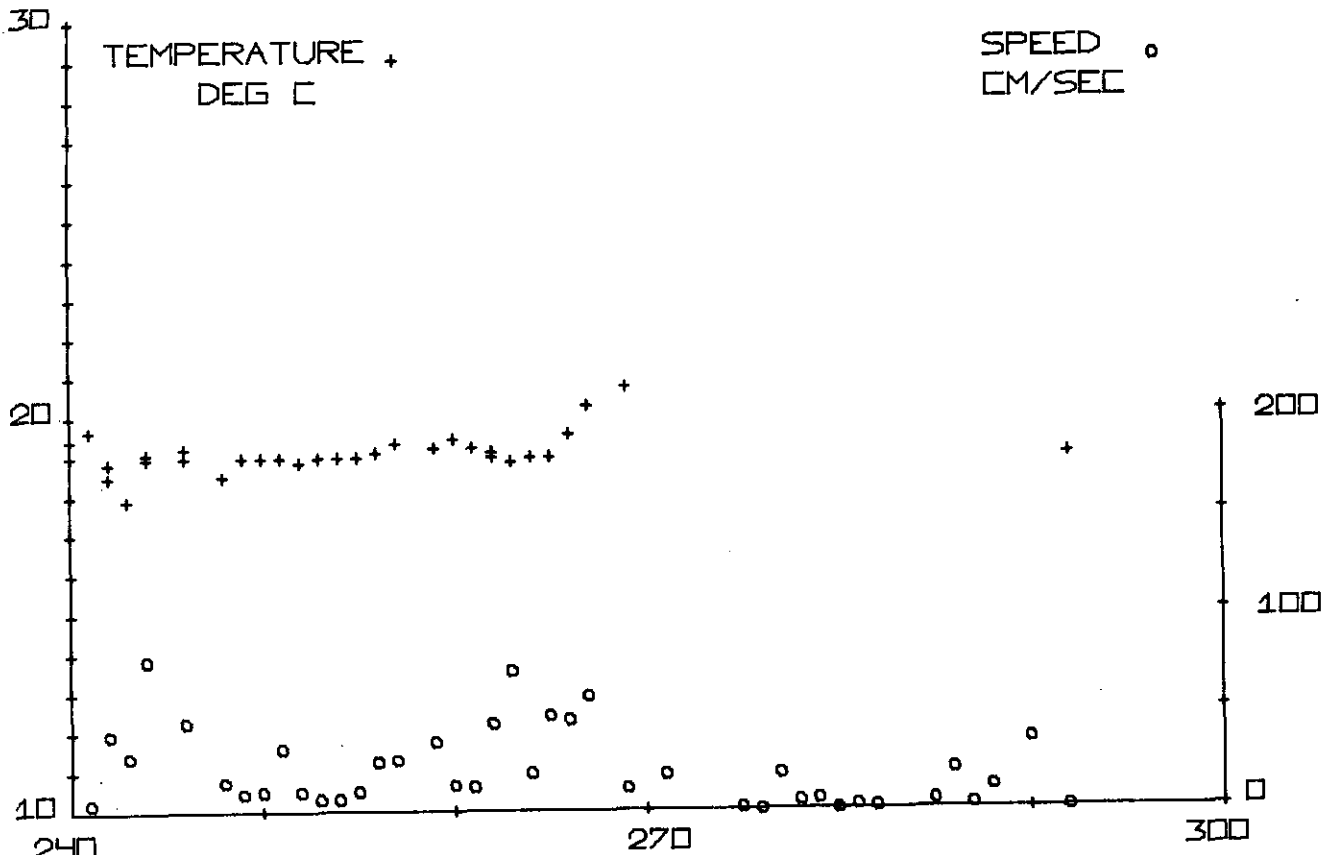


BUOY 1054

DAYS 180-240 1976

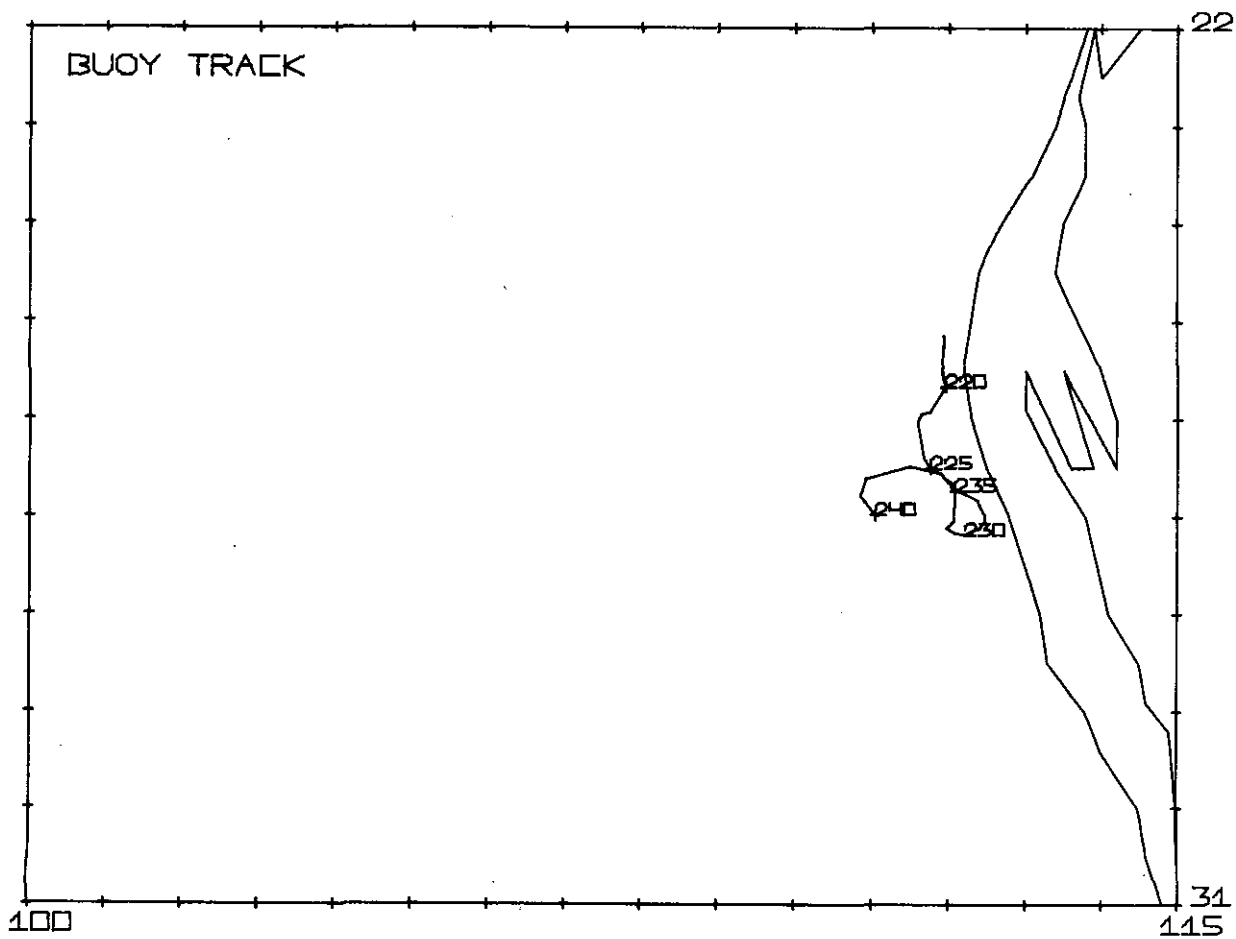
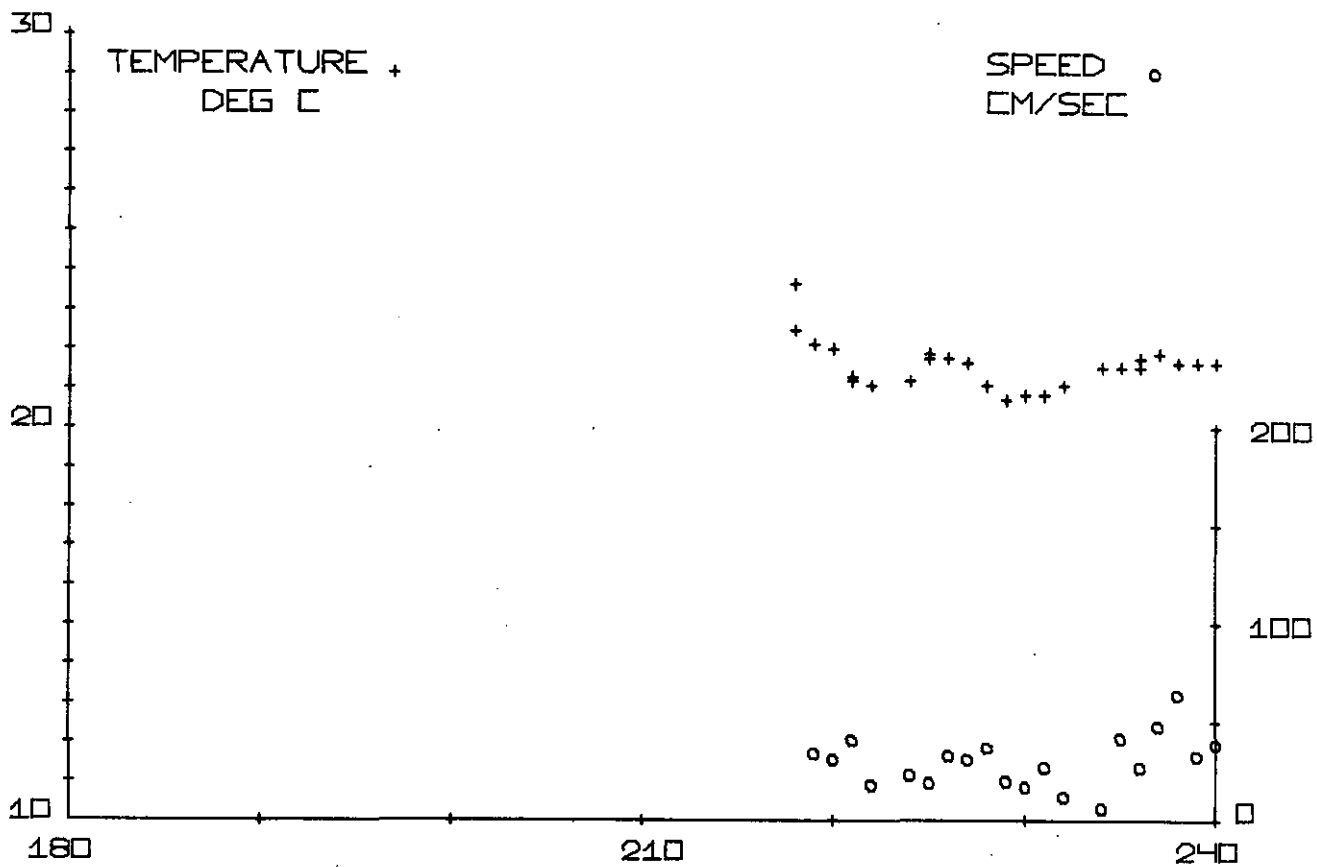


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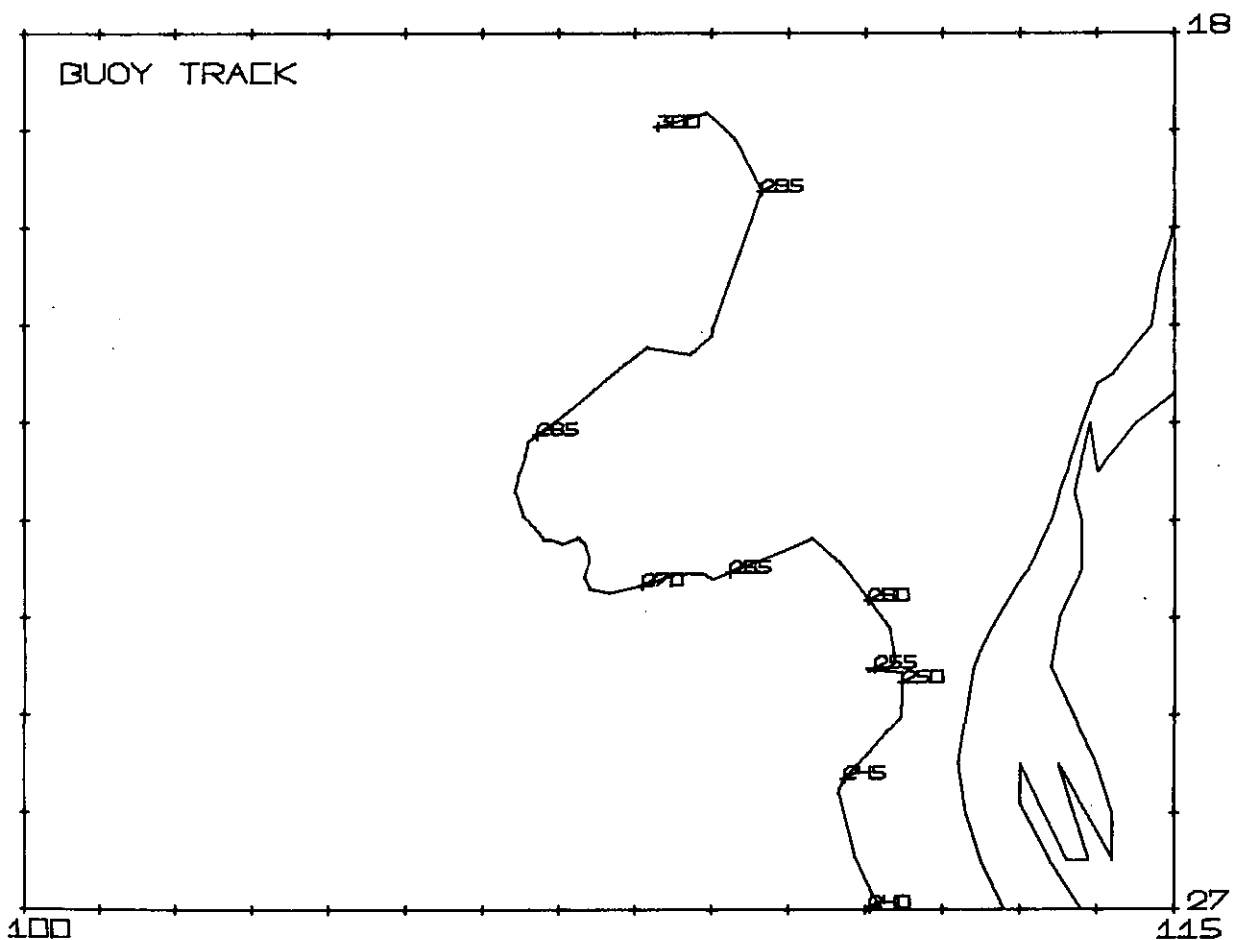
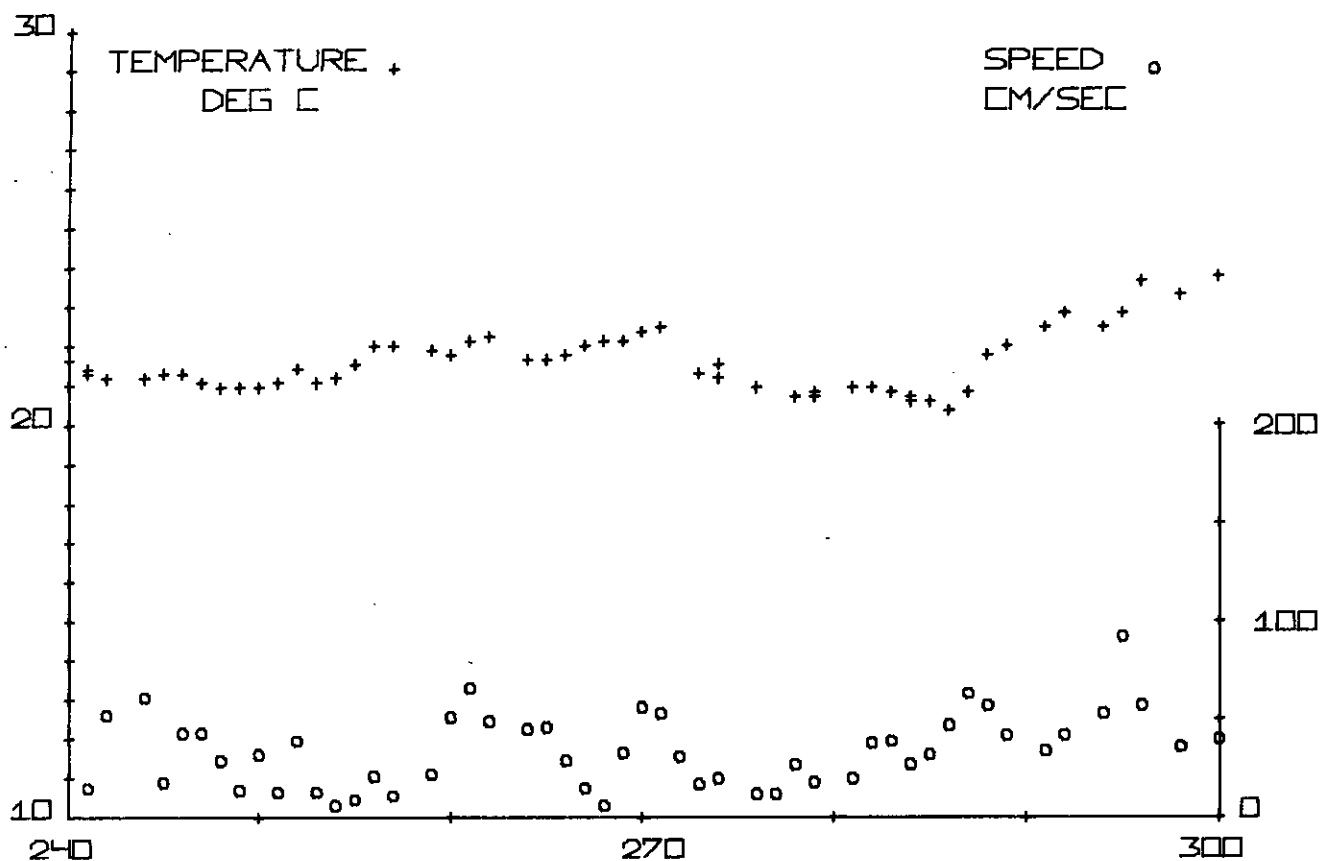
BUOY 1104

DAYS 180-240 1976



BUOY 1104

DAYS 240-300 1976



BUOY 1104

DAYS 300-360 1976

