

8. THE USE OF SATELLITE CLOUD PHOTOGRAPHS OVER ANTARCTICA IN NOVEMBER 1969

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The interpretation of photographs taken from cloud observing satellites is greatly assisted over many land areas by the availability of photographs taken under cloud free conditions. Nowhere is this more important than in the Antarctic where the underlying ice sheet greatly increases the usual difficulty of cloud photograph analysis. Around the Antarctic continent, a knowledge of the appearance of the coastline is valuable because it is then usually fairly easy to distinguish between the fast ice and the pack. An example illustrating the benefits of this is given by O'Neal (1968) who used ESSA III frames to prepare a mosaic of cloud free photographs over Antarctica.

In the analysis of the chart series for November 1969, the use of APT photographs obtained at the US Antarctic base at McMurdo ($77^{\circ} 51'S$, $166^{\circ} 40'E$) was described by Phillipot *et al* (1971). A station at this high latitude can effectively monitor the entire continent throughout a 24-hour period at this time of the year because of the continuous daylight. A total of about 1500 photographs was obtained during the month, and although many of these were of poor quality, a good representation of different sectors of the coastline was obtained at different times. A number of these (from the NIMBUS satellite) have been used to construct a gridded mosaic of the coastal sector. These are shown separately for East and West Antarctica in Fig 8.1.

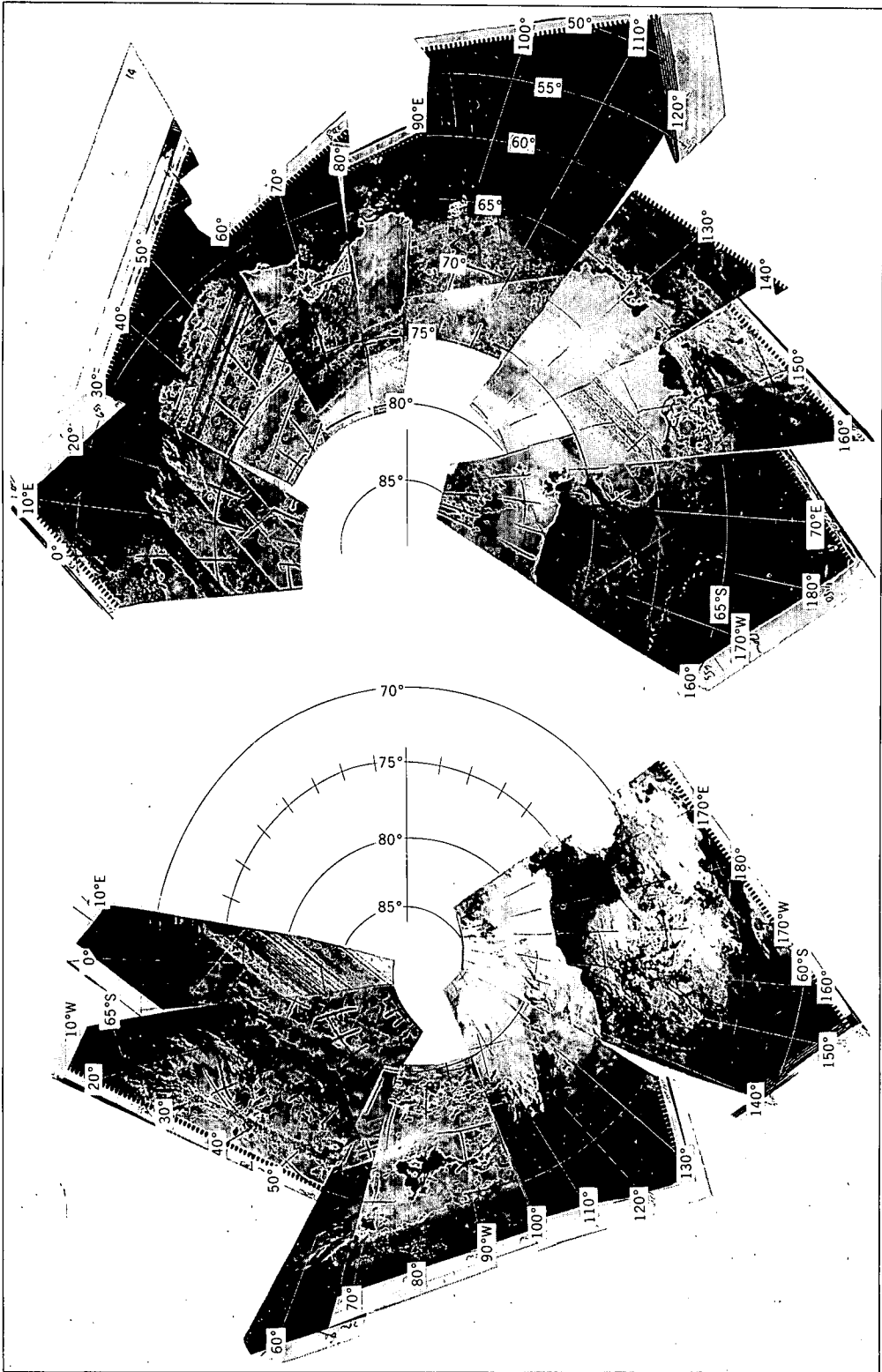
The picture quality is generally not good enough to extend the coverage into the continental interior, although in the analysis of the chart series considerable use was made of such photographs. This is illustrated by an example. An APT cloud photograph taken at 19.52.32 GMT on 8 November 1969, with the satellite sub-point located approximately 300 n mi (550 km) southeast of Halley Bay is shown in Fig 8.2. Two cloud whirls appear to be shown, one near $77^{\circ}S$ $27^{\circ}W$ (*ie*, near Halley Bay) and the other near $82^{\circ}S$ $35^{\circ}E$.

Assistance in the interpretation of the feature near the coast is given by the observations at Halley Bay ($75^{\circ} 30'S$, $26^{\circ} 39'W$). A plot of the three-hourly surface observations and the two upper air ascents (to the 700 mb level) made between 1200 GMT, 8 November and 1200 GMT, 9 November 1969 are shown in Fig 8.3(a). These show that a surface cyclone, probably slowly filling, moved southwards across the coast west of Halley Bay shortly before 1800 GMT on 8 November 1969, and also that the depression was active enough to affect the wind regime through a significantly deep layer.

No inland station is located close enough to the cloud feature near $82^{\circ}S$, $35^{\circ}E$ to provide supporting evidence, but comparison with cloud photographs of the area taken at other times shows that it is unlikely that some feature on the snow surface is being viewed. Since the Halley Bay observations confirm the coastal feature it is reasonable to conclude that another weak cyclone centre has been detected. The surface analysis in this sector for 0000 GMT 9 November 1969 is shown in Fig 8.3(b).

In conclusion therefore this exercise shows the need to develop the facility for interpreting cloud photographs over the Antarctic continent. In the example given, the existence of the inland cyclone, and the extensive cloud mass, would have been undetected without the satellite photograph, and a set of cloud free photographs is obviously valuable.

A great deal more information could no doubt be deduced from the photographs, but few analysts have much experience of conditions in the Antarctic, and of those who do, probably few have extensive experience in interpreting cloud photographs. A combination of the two skills would materially advance the understanding of meteorological processes over the Antarctic continent.



(a) West Antarctic

(b) East Antarctic

Fig 8.1. A mosaic of photographs obtained during November 1969 showing coastal sector of the Antarctic continent under nearly cloud free conditions.

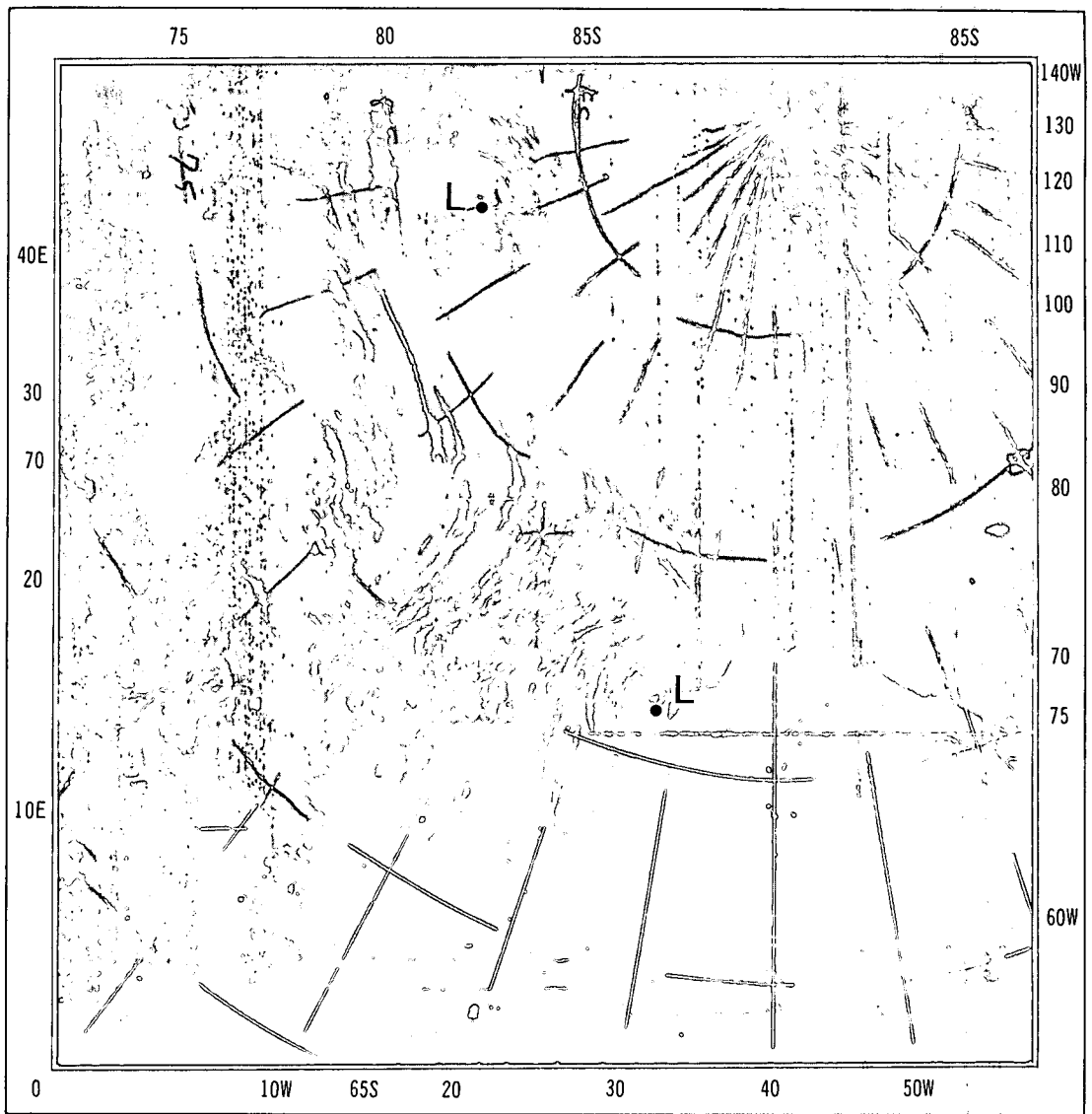


Fig 8.2 Mc Murdo APT cloud photograph taken at 19:52 32 GMT on 8 November 1969, with the satellite sub point located approximately 30 nautical miles south-east of Halley Bay.

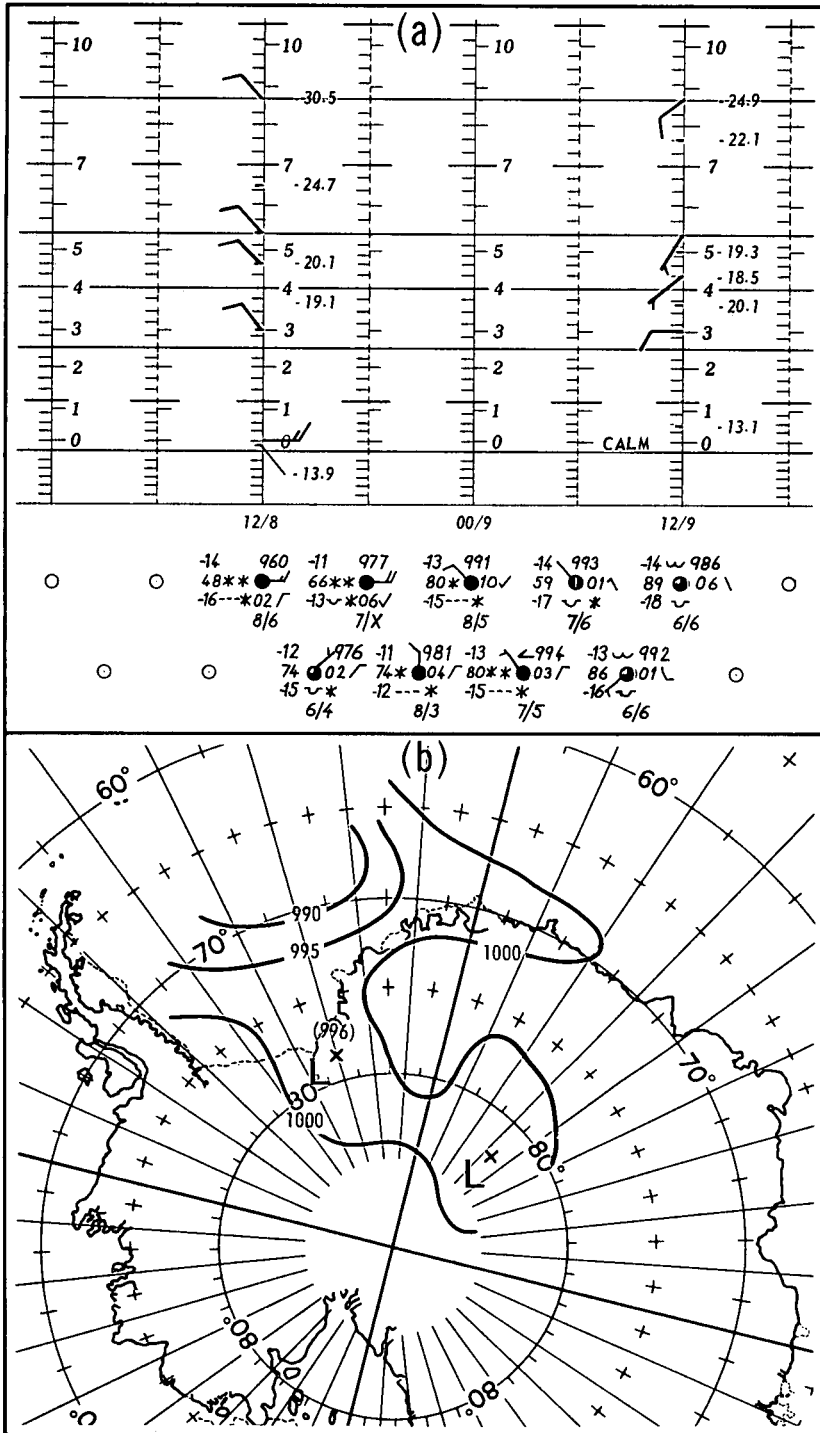


Fig 8.3 (a) Time section of surface and upper air (to 700mb) observations, at Halley Bay between, 12 GMT/8 and 12 GMT/9 November 1969.

(b) Portion of the MSL isobaric analysis for 00 GMT 9 November 1969.