

# Forecasting for PCMEGA

## The challenge

PCMEGA relied on two helicopters and a Twin Otter. Each of these aircraft was required to fly on most if not all days, so any limitations imposed by weather could have shortened the time available to collect scientific data. The main requirement was that conditions be suitable for visual flight, which meant that good horizon and surface definition was essential. Although the Twin Otter could be flown in cloud at high altitude for much of the transit from Davis to Mt Cresswell, most of its flying hours were spent in flying near the ice surface to the south of Mt Cresswell. The helicopters required visual flight conditions at all times.

## Why not use instruments?

The surface air pressure and altitude are not known to acceptable accuracy over the ice sheets in Antarctica, so it is impossible to use the aircraft altimeter to maintain a safe altitude at low levels. Low altitude flight over ice requires the ability to detect your height and to be able to maintain the aircraft's flight attitude by eye alone. For these tasks, good horizon and surface definition is essential.

## Horizon definition

Straight and level flight requires that an aircraft be flown at a constant altitude with constant power. In visual flight, the pilot maintains flight altitude by watching the horizon. If the horizon starts to rise, the aircraft has nosed down – not a good idea if the aircraft is close to the ice surface. With clear skies, the blue/white horizon boundary is easy to see, but if cloud extends to the horizon there may be no way to tell where the ice ends and the cloud starts. Rocks on the surface can help, but the area where the Twin Otter had to fly was mostly ice.

## Surface definition

Pilots must be able to see the surface well enough to see its movement relative to the aircraft. Without that movement, it is impossible to tell how close you are. For helicopters, this is especially dangerous, as they must hover before landing. If a helicopter is moving in any direction when it settles onto the ground it can tip over, with disastrous results. In full sunlight, shadows can be cast by surface features, but if it is overcast at any altitude, the light is diffused in all directions, so all the pilot sees is white. In 'whiteout' conditions, it can be difficult to even walk safely, let alone

fly. Even in the absence of cloud, blowing snow can make the surface impossible to see.

## The tools

There are very few weather stations in Antarctica. We received only one visual report from the Prince Charles Mountains, sent by Alan Rooke, the comms operator at Mt Cresswell. While there are a few automatic weather stations around the Amery/Lambert basin, they cannot detect cloud, horizon or surface definition. This meant that we had one visual weather report for an area the size of Tasmania. (Tasmania is not a huge state, but even so, forecasting weather at Devonport is not helped much by observations from Hobart!) Even the reports from Mt Cresswell were at three-hour intervals and the workload imposed on the operator meant that it was often six hours or more before we saw a particular report. Other sources of data were essential, and the best available to us was weather satellites.

Forecasters in Australia can expect a satellite picture of their area every hour, sent by satellites stationed over the equator, but these satellites do not see far enough south to give much information over the Prince Charles Mountains. Instead, we had to use 'Low Earth Orbit' satellites, mostly the American NOAA series of satellites. The images were received in real time at Davis and offered images from



MIKE WOOLRIDGE

*Stephenson screen houses thermometers used for daily weather observations*

both visible and infra-red bands, with acceptable latitude and longitude grids. These gave good coverage during the morning, but in the afternoon there was a gap of about six hours between satellite passes. Fortunately, a Russian satellite, Meteor 3–5, passed overhead during the afternoon for much of the PCMEGA period of operations. While the Russian satellite images could not be gridded satisfactorily, we became familiar with the rock features to the extent that we could detect cloud position given a few identifiable features. The Mawson Escarpment was especially recognisable. If we could not recognise enough surface features to

work out where the cloud was, it was generally too bad to fly anyway!

Finally, we used numerical guidance. Computer models of the atmosphere supplied diagnostic data, from which we tried to forecast the movement of cloud over the next few days.

Essentially, we tried to forecast cloud and surface wind conditions. Although we attempted to forecast snowfall, the cloud cover was the most important issue.

## The people

Two forecasters were on duty at Davis, Martin Crowe and myself, both from the Bureau of Meteorology from the Adelaide and Hobart offices respectively. We commenced duty between 5.15 and 5.45 each day and covered most of the hours until 10 pm. In addition to the PCMEGA forecast, we provided forecasts to each of the stations and to any field parties requesting support.

## The results

We found it difficult to provide an adequate service in the short term. With a six to twelve hour turnaround for information into and out of the Prince Charles Mountains via email, we did not find out about weather deteriorations until too late and most amendments to the forecast would not arrive in time to be of any use. We could not hear the radio traffic to and from the aircraft, so we had no knowledge of what the aircraft were doing or what they were encountering. We attempted to improve the situation by sending small clips of satellite images directly to the comms operator at Mt Cresswell with a brief description of trends, but even these were somewhat delayed.

We found it was more useful to PCMEGA for us to provide a daily forecast in the morning and evening, including an outlook for the next two days. These forecasts and outlooks proved to be the most useful, allowing a degree of planning at Mt Cresswell. Some success was achieved in forecasting the periods of whiteout, with favourable feedback from the people at Mt Cresswell. All in all, the good weather experienced for much of the time during PCMEGA allowed us to provide a forecasting service from Davis that was appreciated by the people who laboured under difficult conditions in the southern Prince Charles Mountains to make PCMEGA a success.

LANCE COWLED, BUREAU OF METEOROLOGY