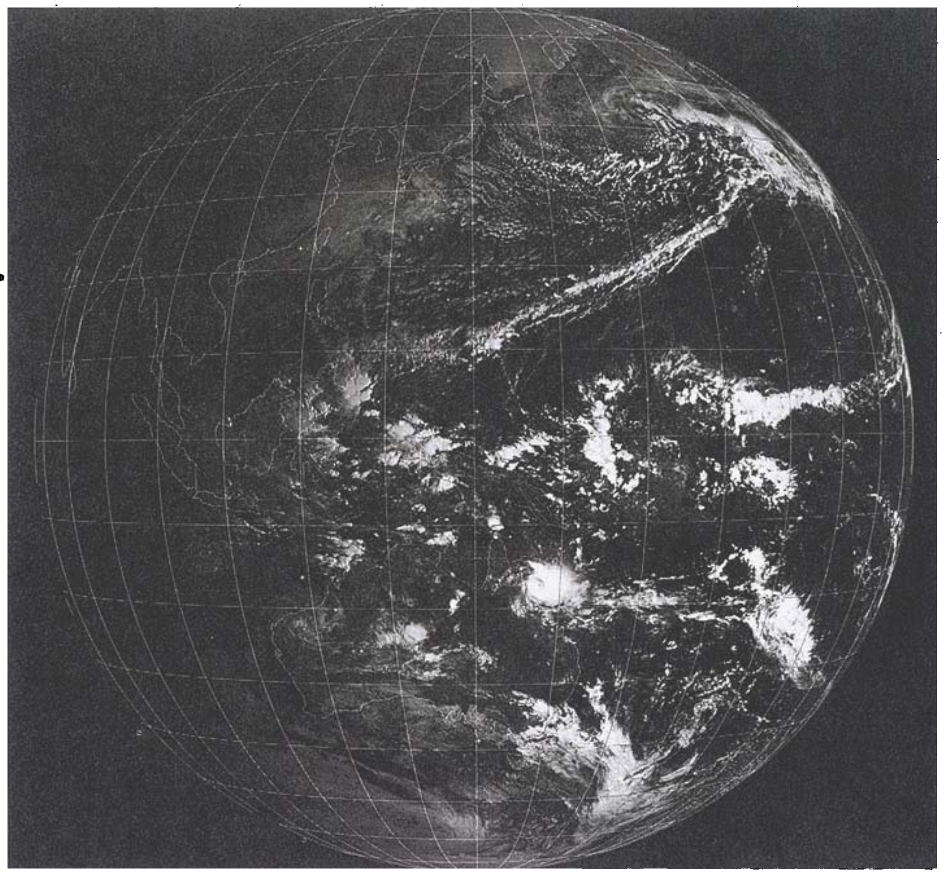
Keeping a weather eye on the world



The half of the world seen by satellite GMS-1.

Weather has fascinated man for thousands of years, and still wields enormous influence over our lives.

In her atmospheric moods, Nature can be almost humanly capricious and mean. A drought is broken by a flood. For weeks a cyclone feints and jinks, threatening tropical homes and livelihoods. A storm is born and within hours has cost millions of dollars in damage.

Clearly we have much to gain from accurate weather forecasts, and meteorologists believe that their predictions will become better and better as they obtain increasingly broader perspectives of the interplay of pressure and temperature or wind and cloud.

From vantage points in space, scientists can watch the weather of the whole world, seeing through the eyes of assistants like GMS-1, a geostationary meteorological satellite hovering 35 800 km above the Pacific Ocean north of New Guinea where the equator intersects longitude 140°E. (See *Ecos* 18 for details of the Global Atmospheric Research Program.)

Financed by Japan and launched from the United States by NASA in July 1977, the satellite provides photographs of the earth by measuring radiation of both visible and infra-red wavelengths and transmitting the information to a control station near Tokyo. Here a computer processes the signals and beams the results back to the satellite for transmission to anybody with a suitable antenna.

In Melbourne the pictures are received by a 5-m parabolic dish on top of the Bureau of Meteorology's head office; a small computer then divides the information into geographical sectors for despatch to the Bureau's regional forecast centres. The photographs of cloud cover accompanying weather forecasts in some Australian newspapers are taken by GMS-1.

The satellite routinely sends signals every 3 hours, and can provide hourly pictures when they are needed urgently, such as when a tropical cyclone is about to hit the coast.

Those keenly poring over the satellite pictures include Mr Takashi Tsuchiya of the Japan Meteorological Agency, who recently spent 1 year on an exchange agreement at the Australian Numerical Meteorology Research Centre, which is jointly sponsored by CSIRO and the Department of Science and Technology.

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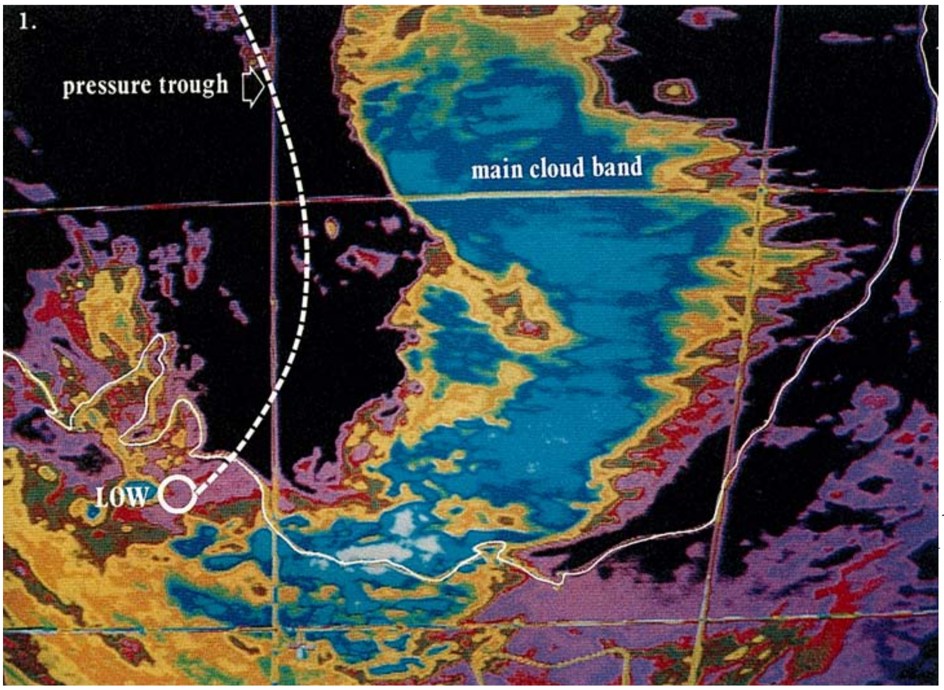
Among other projects, he is analysing the temperature and cloud distributions in Cyclone Kerry, computing wind speeds at different altitudes, and hunting for underlying patterns that may help us predict cyclone behaviour.

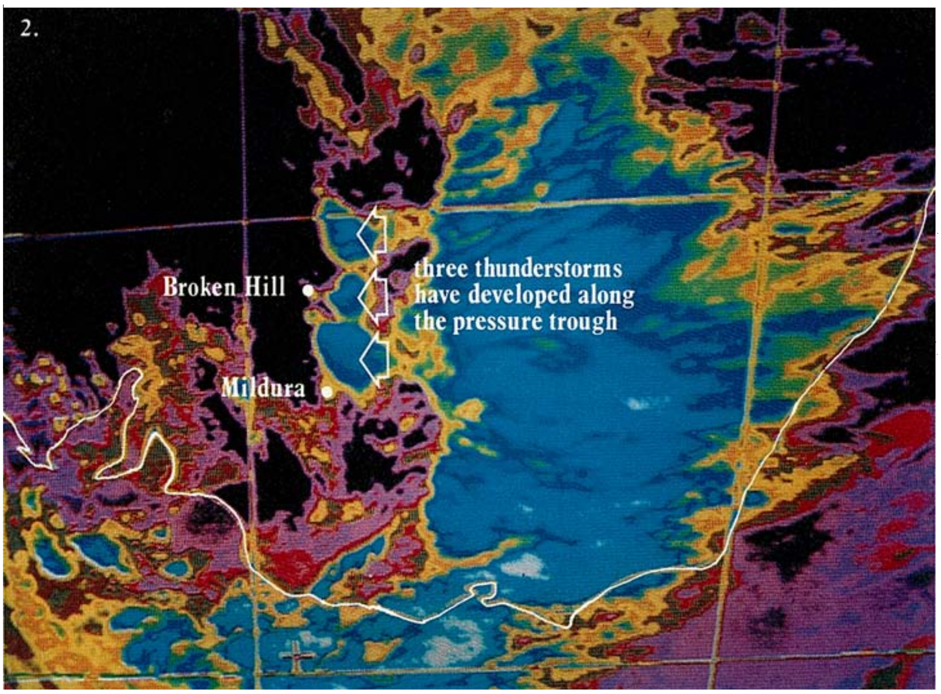
A storm is born

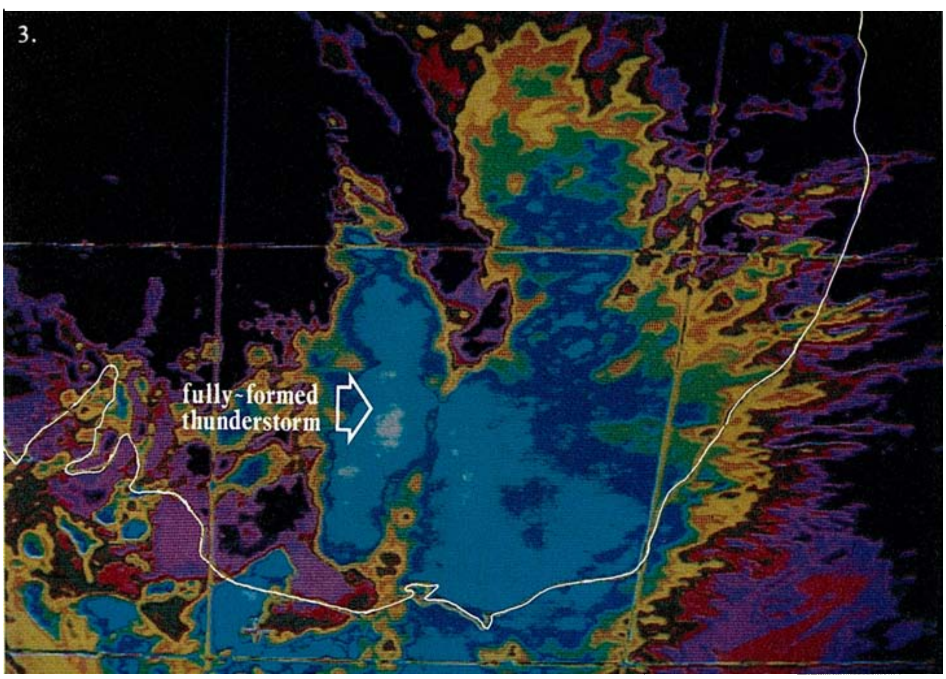
On September 26, 1978, Mildura and Broken Hill were lashed by a swiftly developing storm. Wind, rain, and hail did considerable damage, some of which could have been prevented if local people had known such violent weather was imminent. Cars, caravans, and parked aircraft, in particular, could have been protected.

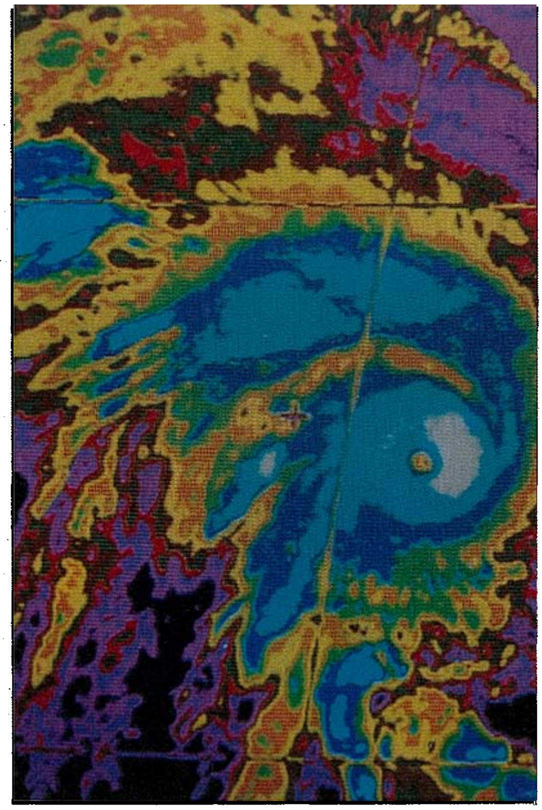
The three colour images opposite, obtained at 3-hour intervals, show the rapid growth of the storm. The first picture shows a large cloud band over inland south-eastern Australia, and the germ of a thunderstorm near Broken Hill. Within 3 hours, three storms had formed along the pressure trough, and by the time of the third picture these had merged into one thunderstorm complex.

The intervals between images are at present too long to allow scientists to predict just where and how hard a storm like this may strike. A new series of satellites planned for the second half of the 1980s will give almost continuous monitoring of the earth's cloud cover. It should then be possible to detect embryonic storms and issue warnings an hour or two before any serious damage can be done. A communications satellite will perhaps be used to relay such warnings to the public.









Cyclone Kerry

The colour picture above shows Cyclone Kerry on February 18, 1979, and was compiled from infra-red radiation reaching the satellite. Each colour represents a temperature range, from black (more than 14°C) through reds, dark green, brown, yellows, light green, and blues, to white (below −72°C).

The coldest cloud tops appear as a white region to the west of the eye of the cyclone, and the blue spiral arms represent bands of air being drawn into the storm's centre.

Kerry developed in the second week of February and reached hurricane strength on the 15th as it crossed the Solomon Islands, where it caused loss of life and widespread destruction.

Following an erratic path, the cyclone threatened the Queensland coast for 3 weeks, grazing the mainland near Bowen on March 1 and bringing floods, violent winds, and high seas that cost the communities between Cairns and Gladstone millions of dollars.

From the analysis of successive satellite images, meteorologists can calculate the flows of air into and out of a cyclone, and in particular the asymmetries of rotation that play an important part in the cyclone's development and behaviour. By studying many cyclones, scientists hope to learn how better to predict their movements.