

## Satellite picture showing evidence of a jet in the low-level winds.

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The U-shaped cloud edge visible to the east of the South Island formed on 24 September in association with a river of strong surface winds on the offshore side of a lee trough, in a situation similar to that documented in Brenstrum (1994) - Case 3. The lee trough is clearly delineated east of the South Island by the 1024 hPa isobar in the mean sea level analysis for 18UTC 23 Sep/06am NZST 24 September.

At the time of this map the Research Vessel *Tangaroa* was reporting a wind of NNE 30 knots in Palliser Bay, although Brothers Island and Kaukau were both only 10 knots NW, Wellington Airport was northerly 5 knots and Cape Campbell was northerly 15 knots. The strong winds at the *Tangaroa* were confirmed by nearby fishing boats and by observers at Beacon Hill, at the mouth of Wellington Harbour, who could see an area of whitecaps to the SE with the aid of binoculars.

On the 24th the NE wind at Christchurch airport only reached 9 knots but had been stronger on previous days, reaching 24 knots on the 21st and 19 knots on the 22nd. At Kaikoura, during this period, the winds were mostly less than 10 knots, sometimes from the NE and sometimes from the SW. It seems likely that the NE winds at Christchurch decreased because the lee trough moved a little to the east taking the zone of strong winds offshore.

Movie loops of the visible pictures on the 24th, 25th, and 26th, clearly show the U shape develop in the back edge of the low cloud, and progressively penetrate further southwards at about 20-25knots during the day-time. During the night its progress was slower, probably because of cloud growth at the cloud edge. Cloud growth into the wind was very evident on the western side of the U shape on the 26th.

Although the cloud edge is eventually more than 500 km south of *Tangaroa's* position when it experienced the strong winds it is still likely to have been caused by a continuous river of strong wind. Brenstrum (1994) showed that these areas of strong wind were sometimes hundreds of kilometres long. They have been shown to be even longer in a further study by Laing and Brenstrum (in press) using scatterometer measurements of surface wind fields taken by the ERS satellite.

The image also shows low cloud in Pegasus Bay just north of Christchurch, which is spilling around the end of Bank's Peninsula in the NE flow. At the time of the image low stratus was being reported at Christchurch airport with a base of only 100 m. Fog had cleared there two hours before, having formed the night before. This was the third day in a row that Christchurch Airport had experienced a long period of fog or low stratus advecting in from the sea.

The fog and low cloud did not return to Christchurch the next evening as the air became slightly drier, probably because of a subtly different trajectory.

The shallow cumulus cloud shown advecting over northern New Zealand in the easterly flow, was bringing light showers to Northland, Auckland and the Coromandel Peninsula.

The clear skies over Wellington in this situation were associated with high temperatures. The maximum temperature of 23 °C recorded at Wellington Airport on the 24th was the highest recorded in September since records began in 1863.

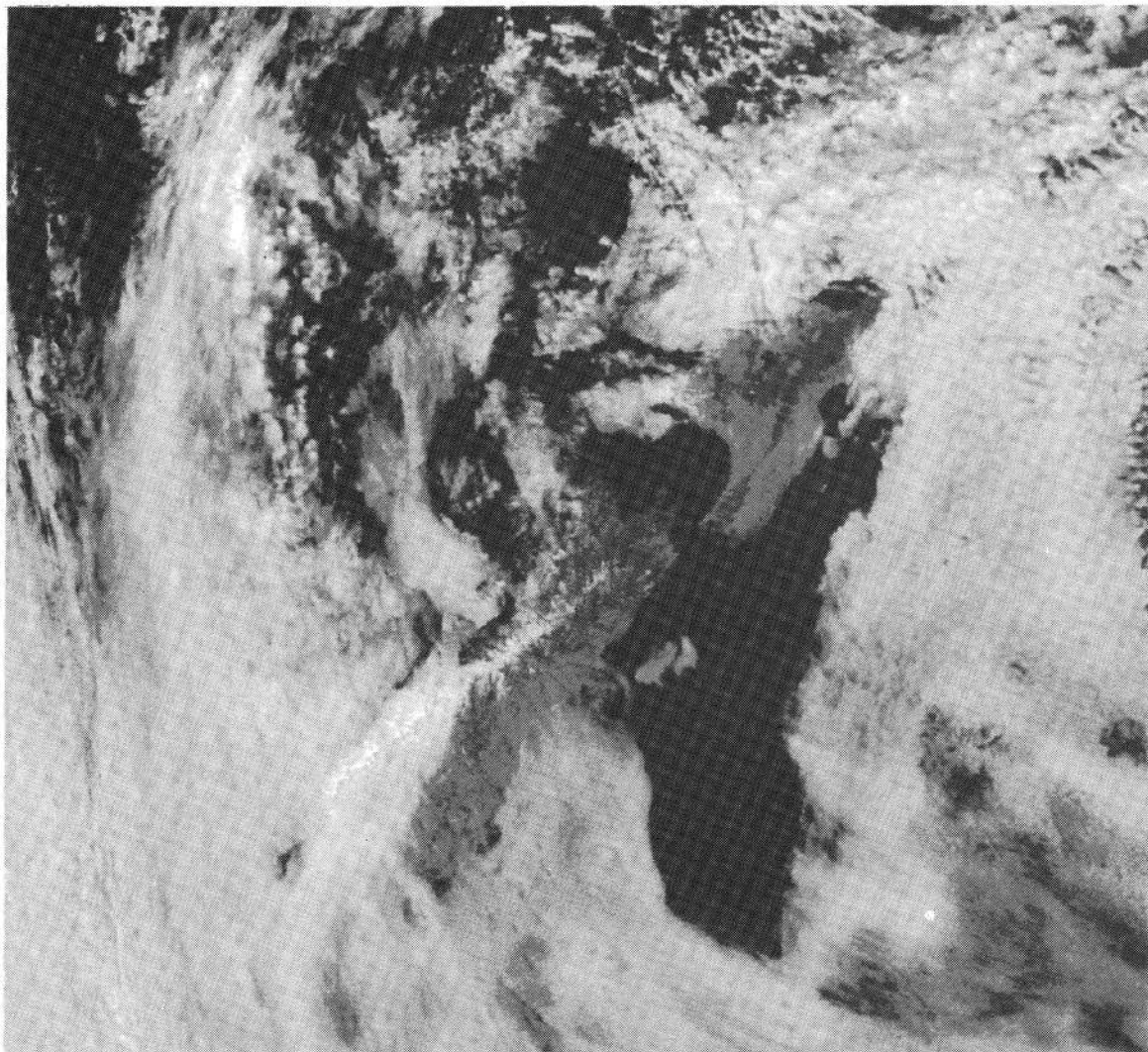
The anticyclone remained slow moving for a number of days contributing to high temperatures in a number of places so that the monthly average temperature for the country as a whole was the second highest

recorded. The only warmer September was in 1988 during the strongest La Niña episode of recent times.

Coming after plentiful winter rains in many areas, the warm temperatures lead to rapid growth of vegetation. In the Waikato this caused diary farmers trouble with bloat affecting some cattle.

## REFERENCES

- Brenstrum, E.M., 1994: Coastal wind patterns revealed by hourly reports from a ship at sea. *Weather and Climate*, **14**, 16-23.
- Laing, A.K. and Brenstrum, E.M., Surface Jets in Winds over New Zealand. *Weather and Forecasting*, in press.



*Figure 1: GMS Visible Picture Midday 25 September, 1996*

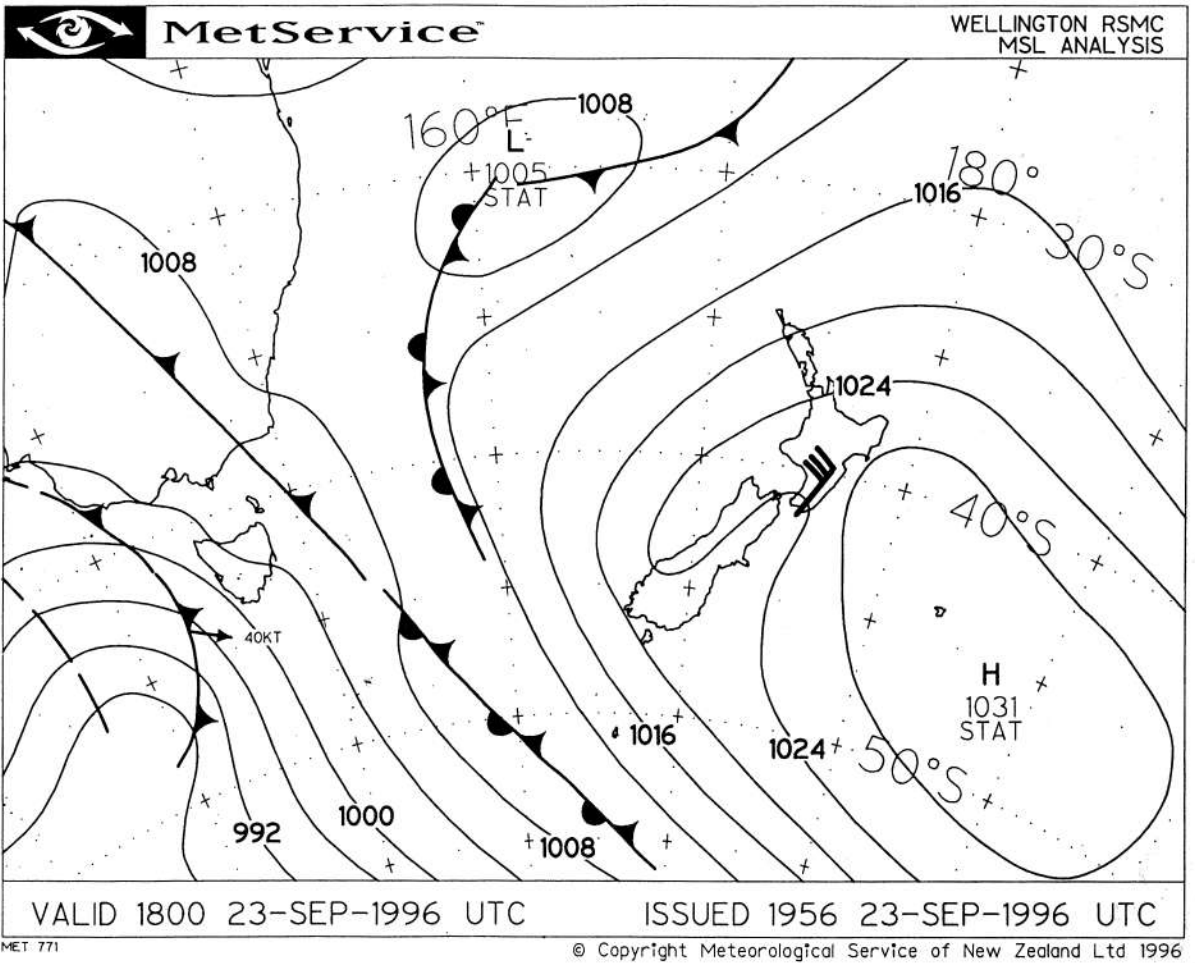


Figure 2: Sea level analysis, 0600 hours, 24 September 1996. The 30 knot observation is from Tangaroa.