

GMS Visible Picture 23 UTC 6 October 1996

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This photo shows a front lying from the Tasman Sea across Fiordland to a low over Foveaux Strait. Ahead of the front, lee wave clouds can be seen over Canterbury. These form frequently east of the main ranges in strong northwest airstreams, and have on occasion been observed as far downstream as the Chatham Islands. The spacing between the wave crests, and hence the lines of cloud, increases with wind speed and decreases with stability.

Severe turbulence and downdrafts are associated with lee waves. At the time this picture was taken a Singapore Airlines Boeing 747-400 hit severe clear-air turbulence at an altitude of 2440 metres when it was 15 minutes from landing at Christchurch International Airport. A leading edge flap on one wing was badly damaged and eleven cabin crew had to be taken to hospital with injuries including a broken wrist and arm.¹

Cirrus clouds can be seen over Northland. Although very high and cold these appear grey as they are very thin. The angle of the cirrus striations is perpendicular to the front and testifies to the strength of the upper ridge, and hence the strength of the northwest flow between the front and the surface ridge.

Heavy rain commenced at Hokitika two hours before the photo and continued for another six hours with just under 40 mm recorded during the 8 hours. During this time the wind at Hokitika was northnortheast. The rain became light when the wind shifted northerly, then northnorthwest, before the front went through. This is consistent with the existence of a low level barrier jet blowing parallel to the Alps ahead of the front, as described by Wratt et al. (1996). When the barrier jet is operating, air upstream rises over it, causing heavy rain to occur right on the coast of Hokitika. Once the barrier jet breaks down, the uplift of the northwest airstream shifts inland taking the heavier rain with it, and significant spillover occurs east of the main divide.

A small line of cloud is also visible lying parallel to the coast just west of East Cape. This appears to be associated with a river of wind blowing around the end of the Raukumara Mountains as described in Brenstrum (1994). The wind at Hicks Bay, just west of East Cape, was westerly 21 knots gusting 29 knots at the time of the photo. Forecasters use the gust speed as a round guide to the speed likely over the sea in these situations, so a speed of around 30 knots would represent a significant increase over the speed to be expected from the isobar spacing east of Auckland which would be more like 15 knots.

REFERENCES

- Brenstrum, E.M., 1994: Coastal wind patterns revealed by hourly reports from a ship at sea. *Weather and Climate*, **14**, 16-23.
- Wratt, D. et al., 1996: The New Zealand Southern Alps Experiment. *Bulletin of the American Meteorological Society*, vol. **77**, 683-692.

¹ One of the MetService forecasters was aboard a Qantas Boeing 767 from Brisbane that attempted to land at Wellington Airport but was diverted to Christchurch Airport because of turbulence. Returning from Christchurch to Wellington in the evening it was caught in a downdraft and rapidly lost height. Cabin crew were thrown in the air and over the seats but did not hit the roof of the cabin. Severe turbulence was again encountered on approach to Wellington and occasioned a brief period of screaming on the part of a number of passengers, followed by the traditional applause once the plane had landed.

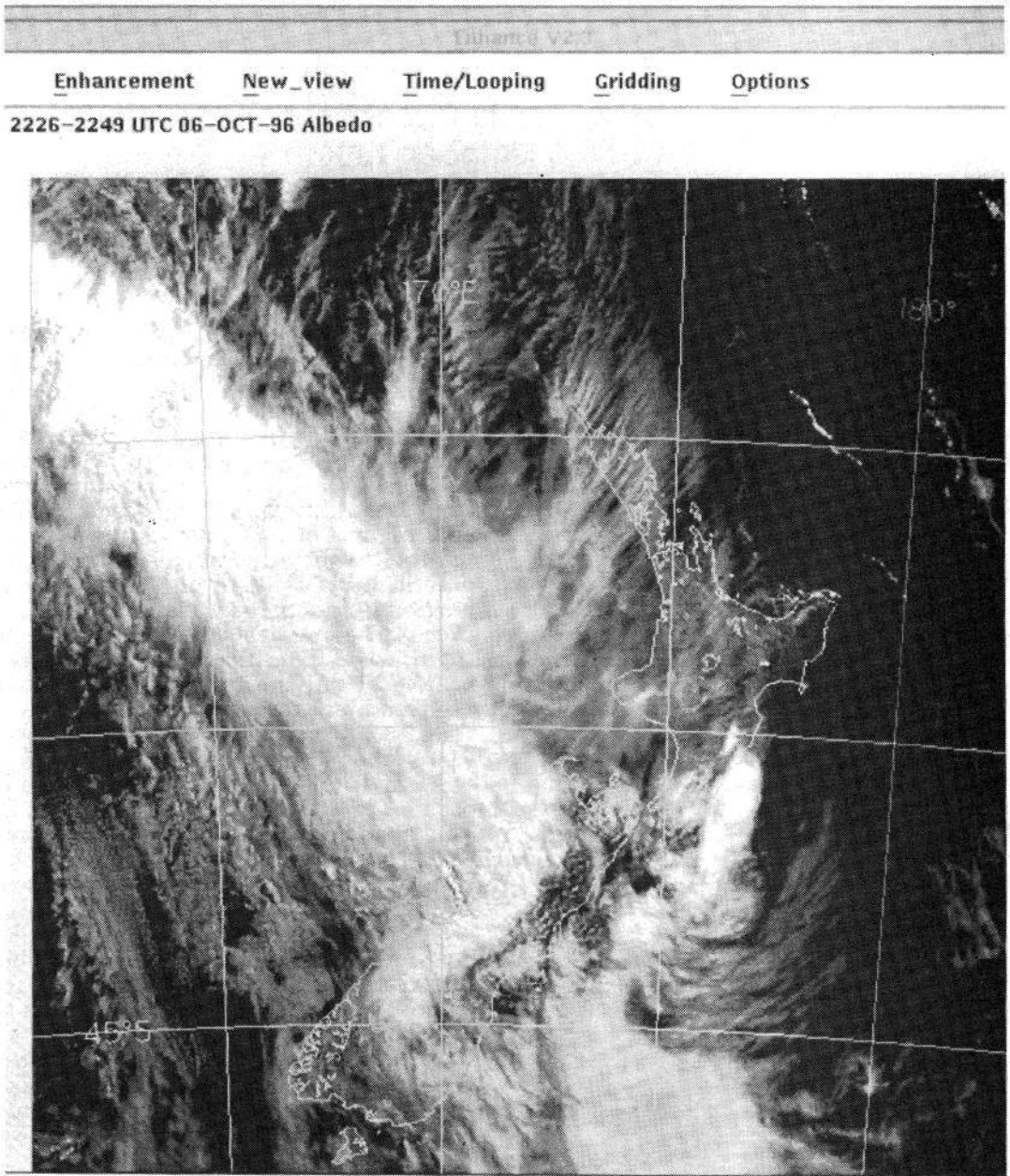


Figure 1 : Satellite Picture Associated with Severe Turbulence.

