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# A high resolution modelling study of a severe weather event over the Southern Alps of New Zealand.

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The Southern Alps of New Zealand are about 800km long, 100-200km wide and up to 3.7km high, with many mountain peaks in excess of 2.5km high. They act as a major barrier to the atmospheric flow and so can significantly affect mid-latitude cyclones which regularly results in extremely severe weather events. Simulating and/or forecasting the weather over the Southern Alps therefore presents a severe challenge to numerical models.

In this study we use the Met Office Unified Model (UM) to simulate the severe weather associated with a very active cold front which occurred on 8th January 2004.

This cold front was most notably associated with huge rainfall accumulations along the west coast of the South Island (up to 378mm recorded in 24 hours) and also with damaging surface winds over both the northern end of the Southern Alps (which led to power pylons being blown down) and in the Cook Straits. Satellite observations suggest the former winds were probably associated with rotors beneath trapped lee waves whilst the latter were associated with the channelling effect of the air through the Strait. Less notable, but equally significant, was the flow blocking and associated barrier jet along the south west flank of the Southern Alps which was evident prior to the cold front reaching the Southern Alps.

We have used the UM to simulate this event at high resolution by downscaling a global 24 hour forecast which was run from the appropriate global analysis. The nested limited area versions of the UM have been run at 12km, 4km and 1km resolutions. Both the 12km and 4km simulations qualititatively capture the localised large rainfall maxima, the channelling effect and the barrier jet associated with the flow blocking. The 1km simulation captures these effects and, in addition, captures the strong surface wind signal over the northern end of the Southern Alps and the associated lee wave activity. In general, the 1km simulation is more quantitatively accurate than the 4km simulation and that, in turn, is more quantitatively accurate than the 12km simulation.

This case study therefore suggests that the UM is extremely capable of simulating severe weather phenomena over major orography.