Frontal identification in digital analyses

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We report on our plans and progress to develop a sophisticated, objective frontal identification and tracking algorithm able to be applied to reanalyses or model output. This problem has attracted only modest amounts of attention over recent decades. However, there have been significant landmarks in its development, and among these may be mentioned the works of Renard and Clarke (1965), Huber-Pock and Kress (1989), Huth (1991), Hewson (1998), McCann and Whistler (2001) and Kašpar (2003). The scheme we are developing is designed to make optimum use of information on the three dimensional structure of the thermal, moisture and dynamic fields. A particular focus of our work is on frontal systems in the Southern Hemisphere.

The approach to the automatic identification of fronts depends considerably on the spatial resolution available. SeaWinds-on-QuikSCAT scatterometer surface winds provides resolution of 25 km, and Patoux et al. (2005) have shown this data is capable of providing extraordinary detail for fronts over the Southern Ocean. One limitation of using such data is that only the surface manifestation of frontal systems can be explored, and use can only be made of the dynamical (*viz* the wind) structures at that level. Our aim is to use numerous variables in three dimensions, and hence part of our work is devoted to exploring frontal structures in high resolution models. We are making use of the output of the Australian 'ALAPS' model (Adams, 2004). Figure 1 shows a very preliminary version of the frontal identification scheme applied to the surface wind field of an arbitrarily chosen (29/12/2000 at 500 UTC) 6-hour forecast of the ALAPS model run at 0.375^o lat-long. resolution. Use is now being made of the wind and other variables in the model throughout the troposphere.

In concert with the 'identification' phase are also developing software which will provide the 'optimum' method for tracking fronts. The first approach will be a generalization of the robust scheme we have already developed for cyclone centres (Simmonds and Keay, 2000; Simmonds et al., 2003).

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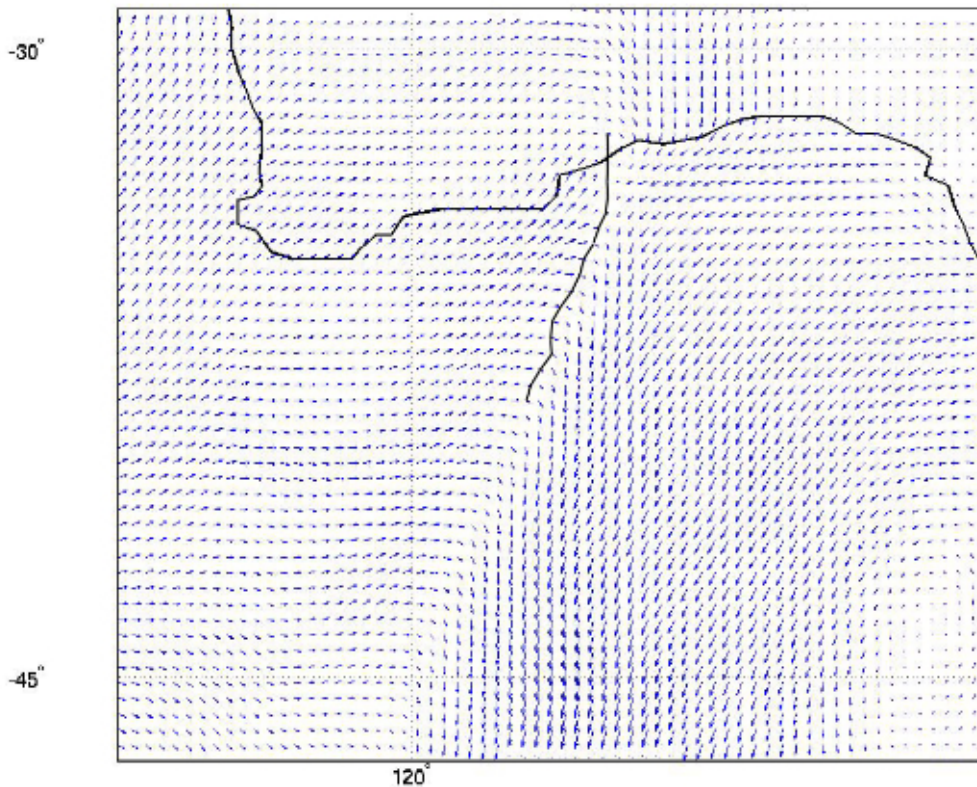
Figure 1: An example of a very preliminary version of the frontal identification scheme applied to the surface wind field of an arbitrarily chosen (29/12/2000 at 500 UTC) 6-hour forecast of the ALAPS model (Adams, 2004) run at 0.375^o lat-long. resolution.