



Cut-off cyclone formation resulting from merging potential vorticity anomalies

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A case of cut-off cyclone formation or “tropopause cyclogenesis”, which took place over the Southern North Sea on 9 May 1996 (see van Delden and Neggers, 2003), is investigated using the High Resolution Limited Area Model (HIRLAM) together with a technique of adjusting the analysis of the initial state in terms of potential vorticity (Verkley et al., 2005). With a grid distance of approximately 22 km in both horizontal directions, the model has a relatively high horizontal resolution. By inspection of the so-called reference model integration, which represents the most accurate representation of the dynamical evolution in the real atmosphere, it appears that the cut-off cyclone is a result of the merger of two specific potential vorticity anomalies having a horizontal scale of about 1000 km near the tropopause. In the analysis of 8 May these anomalies are located, respectively, over Southern Greenland and over North-Western Scandinavia. The sensitivity of the intensity and position of the cut-off cyclone on 9 May and 10 May to the amplitude of these potential vorticity anomalies on 8 May is investigated by re-running the model with a modified initial state. The modifications consist of either strengthening or weakening one or both potential vorticity anomalies. The results show that position and intensity (in terms of absolute vorticity) of both the cut-off cyclone and the associated blocking anticyclone, which developed to the north of the cut-off cyclone on May 9 and May 10, are sensitive to these changes in the initial state. These numerical experiments are therefore interesting for understanding the development of both a cut-off cyclone as well as the typical blocking anticyclone over Scandinavia.