

The essential dynamical ingredients leading to the explosive growth stage of the European wind storm “Lothar” of Christmas 1999

G. Rivière (1), P. Arbogast (1), K. Maynard (2), and A. Joly (1)

(1) CNRM-GAME, Météo-France/CNRS, Toulouse, France (gwenda.riviere@meteo.fr), (2) DPrévi/LABO, Météo-France, Toulouse, France

The aim of our study is to identify the key dynamical ingredients leading to the explosive growth stage of the extra-tropical windstorm “Lothar” (24-26 December 1999). The methodology consists in performing different numerical sensitivity experiments using the Météo-France operational model (ARPEGE). Apart from its exceptional strength and the spectacular disasters that were generated along its trajectory, the storm is particularly interesting to study because of its unusual dynamical properties. It is a relatively small-scale extratropical cyclone that travelled across the Atlantic Ocean with moderate amplitude south of the upper-level jet and strongly deepened as it crossed it in its exit region. Note finally that no clear pre-existent upper-level precursor was detected before the explosive growth stage (Wernli et al., 2002).

First of all, the model is shown to reproduce quite well the explosive growth stage of the storm by starting the forecasts 24 hours before the latter stage. Using the potential vorticity inversion algorithm developed by Arbogast et al. (2008), all the numerical experiments consists in modifying the initial conditions of the operational analysis precisely 24 hours before the explosive growth stage and to look at the impact of these modifications. The first set of experiments will check that upper-level high-frequency anomalies have only a moderate impact on the rapid deepening of the surface cyclone. Other experiments are conducted to look at the sensitivity to the strength of the upper-level jet, to the low-level baroclinicity, and finally to the shape, amplitude and location of the low-level cyclone.