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Heavy precipitation episodes in the Western Mediterranean : Use of a semi-Lagrangian advection model for the fine-scale description of upper-level troughs

N. Gauthier (1), C. Claud (1), B. M. Funatsu (2), J.-P. Chaboureau (2), S. Argence (2), D. Lambert (2), E. Richard (3), A. Hauchecorne (4), P. Arbogast (4), and K. Maynard (1)

(1) Laboratoire de Météorologie Dynamique, CNRS/IPSL, Palaiseau, France, (2) Laboratoire d'Aérologie, Université de Toulouse, and CNRS, Toulouse, France, (3) Laboratoire Atmospheres, Milieux et Observations Spatiales, CNRS/IPSL, Verrières le Buisson, France, (4) Météo France Dprevi/Labo, Toulouse, France

Heavy precipitation events over the Mediterranean Sea are generally associated with upper-level troughs. The mesoscale structures of such troughs are however not well reproduced by the atmospheric analyses due to inappropriate spatial resolution. We propose here to use a semi-Lagrangian advection model called MIMOSA (Modélisation Isentrope du transport Méso-échelle de l'Ozone Stratosphérique par Advection) initially developed to describe stratospheric filaments, to calculate fine-scale Potential Vorticity (PV) fields on isentropic surfaces near the tropopause.

After a description of MIMOSA, we will focus on the model-generated PV fields for several high impact weather cases that occurred over the Western Mediterreanean Sea. We will demonstrate the ability of MIMOSA to resolve fine scale structures of upper-level troughs considering the Algiers' flash flood, which occurred on November 2001, and then a heavy precipitation event over southeast France on the 5-6 September 2005. Finally, with a PV inversion method, we will show the impact of the fine scales PV structures as depicted by MIMOSA to improve the numerical simulation of a « hurricane » that hit Italy in September 2006, both in terms of surface pressure and precipitation forecasts.