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PV approach for the analysis of the 9-12th November 2001 western Mediterranean cyclone

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The Mediterranean basin is one of the most cyclogenetic zones in the world. Some of the cyclones attain very high intensity, such as the 9-12th November 2001 event in the western Mediterranean which produced strong winds (sustained values of 30 m/s) and heavy rains (200 mm in 24h in the Balearic Islands), resulting in 700 victims in Algiers and 4 in the Balearic Islands. This cyclone was the result of a rapid baroclinic development in the frontal zone established between a cold air intrusion from the European continent and the characteristic warm air over the African plateau. Presumably, the diabatic contribution by the latent heat release around the cloudy system was also an important ingredient of the cyclogenesis process. In this work, a PV Inversion Technique combined with MM5 numerical simulations is used to highlight the role of the above main mechanisms: PV signatures associated with the upper level trough, upper level jet-streak, warm thermal anomaly over Africa, diabatically-induced PV over the Mediterranean and other dynamical features are first identified. A balance flow is found for each of these PV signatures, and then an ensemble of 37 perturbed simulations is constructed by changing the intensity of the PV anomalies in the initial conditions. Some statistical parameters are defined to objectively summarize the perturbations of the initial conditions and the forecast sensitivity to these perturbations. The results show an important role on the cyclone depth and trajectory of the upper level trough, the surface warm thermal anomaly, the diabatic PV, and a ridge-anticyclone system located over the Atlantic. It is also found that the magnitude of the effects on the forecast is not generally scaled with the magnitude of the perturbation introduced in the initial PV. On the other hand, the examined forecast fields (rainfall, sea level pressure, 500 hPA geopotential height and temperature, and isentropic PV on the 330 K surface) do not exhibit an uniform sensitivity response among the different perturbed experiments.