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

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1 Introduction

From 18th to 12th of November 2001, one of the most severe episodes on the western Mediterranean basin in last decades was developed. Heavy rainfall (200 mm/24h) and strong wind (over 38 m/s) produced 300 deaths in Algeria, 4 victims in Balearic Islands and heavy damages (1 billion trees fell down in Balearic Islands). A sensitive study on the changes in the initial conditions through the use of the PV inversion technique is presented. MM5 primitive equations, nonhydrostatic model is used to perform the simulations related to each modified initial condition. Each modification will be done with different PV anomalies related with different thermodynamical aspects of the flow. Statistical numbers are used to summarize the results in an objective way.

2 Case description

Strong baroclinic environment was present on the early stages of the episode (Nov. 18th 2001 at 00 UTC, top left). Warm advection from the North African region and cold advection from European controll were centered over the West Mediterranean basin. A weak cycloone was developed to the South of the Atlas mountains. A significant upper-level trough enhanced the deepening process of the cycloone and drew the cycloone to the Mediterranean basin (top right). The deepened mature stage of the cycloone (300 hPa) occurred when the cycloone reached the Mediterranean Sea (Nov. 19th at 00 UTC), meanwhile the strongest wind speed and heaviest rainfall were developed (bottom left). On the following days the cycloone moved to the Canary Island and dissipated (bottom right).

Figure 1: Synoptic overview

3 Conclusions

- Complete description of an intense episode in terms of PV and dynamical behavior of the PV anomalies.
- Intense effect of the PV upper level features through the strong interactions between upper- level and surface cycloones.
- Significant deepening effect of the intense cold advection over the Mediterranean Sea.
- Surface thermal anomaly can be treated as a PV anomaly.
- Strong impact of baroclinic process on the initial stages of the cycloone.
- Atlantic high pressure area played a significant role on the translation speed of the cycloone and determination of the pressure gradient.
- Significant role of the coldly inverted PV in the onset of deepening the cycloone.
- High sensitivity by different PV anomalies on different variables.

Figure 2: PV evolution

Figure 3: PV anomalies definition

Figure 4: Different modified initial conditions

Figure 5: Significant results

Figure 6: Statistics

[Images and diagrams related to the aforementioned points are shown here, illustrating the PV approach for the analysis of the 9-12th November 2001 western Mediterranean cyclone.]