The 8 November 2011 medicane event: the roles of model physical parameterizations and upper-level dynamical forcing

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A Mediterranean cyclone developed on 8 November 2011 was classified as a tropical storm for the first time by NOAA. This tropical-like cyclone, or medicane, reached its mature state after passing through Majorca Island and then evolved towards the Gulf of Lion region where it dissipated. The event produced heavy rain over Southeast France, parts of Italy and Corsica. It was previously established that the MM5 numerical model, running at moderate horizontal resolutions, is able to simulate the subsynoptic cyclone and the disturbance general trajectory. This study aims to improve our current understanding of key factors involved on medicane development like air-sea interaction and synoptic scale dynamical forcing. To describe the air-sea interaction mechanism operating on this medicane, we test the role of the sea surface latent and sensible heat fluxes on its trajectory and intensity by running simulations switching these factors on and off. Additional numerical experiments with displaced, weakened or strengthened upper-level†potential vorticity (PV)†anomalies serve to analyse the connection between the medicane development and the dynamical forcing at synoptic scale.

Moreover, our regional ensemble prediction systems (EPSs) allow us to expand this study to a probabilistic framework. The ensembles generation method takes advantage of the connection between PV structures and cyclones, and of the different physical parameterization schemes available in the numerical model. Therefore, they are able to provide statistical information regarding the role of the physical parameterizations and the upper-level PV structures on the medicane trajectory and intensity.†

The sensitivity experiments highlight the importance of the air-sea interaction and the synoptic scale dynamical forcing on the medicane development, both in terms of track and intensity. In fact, the tested EPSs are shown to take great advantage of this type of physical and dynamical dependences for a better forecast of medicanes in the short and mid range.