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The genesis of the 7 November 2014 tropical-like cyclone: Numerical Sensitivity Study

The Mediterranean basin is known to be a prone region to cyclogenesis due mainly to its location, geographical configuration and relative warm Sea. Mediterranean cyclones can be ranged from pure tropical to pure baroclinic systems and they occasionally produce hazardous weather, generating high impacts on exposed and vulnerable humans and property assets. In recent years, a relatively rare type of Mediterranean cyclones has got the attention of the atmospheric scientific community. These cyclones are relatively small in size and associated to strong winds and usually heavy precipitations. These Mediterranean systems share morphological characteristics with Hurricanes such as a warm core, axisymmetry and cloud-free eye, and have been consequently named Mediterranean Hurricanes. In the last years, the name of Medicane as acronym of Mediterranean hurricane, has gained importance in the scientific community. Detection and forecast of Medicanes are a difficult task and many efforts have been dedicated to identify them.

During 7 November 2014, a mid-levels synoptic trough was extending across the western Mediterranean, reaching as far south as southern Algeria. Cyclonic conditions were present at low levels over the western Mediterranean since 4 November, but on 7 November a small intense cyclone formed in the South Central Mediterranean Sea and moved northeasterly towards southern Sicily, affecting Pantelleria, Lampedusa and Malta Islands. The small rapidly-rotating system dissipated as it crossed the Catanian coast (eastern Sicily), in the first hours of 8 November.

The main scope of this study is to provide an understanding of the physical mechanisms involved in the cyclogenesis of 7 November 2014 event, with a special focus on a diagnostics of the extratropical and tropical characteristics based on satellite, gridded analysis and high-resolution numerical simulations.

A set of high-resolution (horizontal 2.5 km grid space) sensitivity experiments through factor separation (Latent heat release, surface fluxes, …) and PV-Inversion techniques have been applied to this case study. Results show the key role of the upper-level dynamics (i.e., Potential Vorticity) and the synergisms in the genesis and posterior development of the 7 November 2014 intense small-scale cyclone. The fact that diabatic heating does not contribute as a key factor is a feature of a no-pure tropical circular system, ergo it is not a pure medicane. Finally, cyclone transitions between different state phases are also depicted using Hart's diagrams showing the formation of axisymmetric deep warm-core cyclone (Medicane).