CNRM, UMR 3589

SEMINAIRE CNRM

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DIAGNOSTIC AND PROGNOSTIC IMPLICATIONS OF POTENTIAL VORTICITY IN CYCLONE DYNAMICS : 100 CASE STUDIES OF MEDITERRANEAN CYCLONES AND… ONE CYCLONE CASE IN THE TROPICS

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Abstract:
This is a two part story that uses potential vorticity (PV) theory to articulate two works: (i) an already published work on the understanding of Mediterranean cyclone dynamics and (ii) very recent unpublished efforts to understand the sensitivity of intensity and track of tropical cyclone Usagi (2013) to different physical (parametrized) processes.

The first part of the talk is somewhat larger. It introduces concepts and tools that we have used. It also presents our approach that applies online PV budget diagnostics and piecewise PV inversion to WRF model simulations. This was done for the mature stage of 100 intense Mediterranean cyclones to quantify the relative contributions of different processes to cyclone development. Our study delivered, for the first time, a comprehensive insight into the variety of cyclonic systems that develop in the Mediterranean from the perspective of cyclone dynamics. Finally, we focus on 10 medicane cases (i.e. tropical-like cyclones). In contrast to their tropical counterparts – but in accordance with most intense Mediterranean cyclones – most medicanes are shown to develop under the influence of both baroclinic and diabatic processes.

The second part is smaller than the first one. It uses similar online diagnostics as in the first part to identify PV objects in 3D which are composed by high neighboring grid points of high PV values, solely produced by physical parametrisations. Given the invertibility trait of PV, these 3D objects are describing the atmospherc state that is "directly produced" by physical parametrisations. Therefore these grid points are affecting the forecasted atmospheric state with model uncertainties inherent to physical parametrisations and are mostly suspicious for consequent growth of model errors. Our first application has been done for TC Usagi (2013) where we've seen that our method and traditional SPPT are both producing comparable spreads in cyclone tracks and mean sea level pressure evolution in cyclone centre.

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