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Investigating the predictability of a Mediterranean Tropical-like Cyclone using a non-hydrostatic high-resolution model

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Predicting the evolution of Mediterranean Tropical-like Cyclones (MTLCs) has always been a challenge even within a few hours of verification time, given the inadequacy of Numerical Weather Prediction models to resolve the small spatial scale O(100km) of these systems. In particular, the event of 7-8 November 2014 was poorly predicted by operational Numerical Weather Prediction (NWP) models which failed in reproducing the trajectory of the cyclone. Using a state-of-the-art high-resolution non-hydrostatic model we show that simulations performed in hindcast mode with a resolution of 1 km are able to reproduce the evolution of the MTLC of November 2014. Simulations performed with resolution coarser than 2.5 km fail to represent the evolution of the cyclone while additional nested simulations with ultra-high resolution (300 m) reveal the ability of the model to fully capture the internal structure of the cyclone. Thus, there is a strong convergence towards the observed trajectory of the cyclone with increasing resolution. Finally, a Potential Vorticity (PV) analysis highlights the mutual interaction between a PV streamer and a low-level PV maximum induced by convection. Although the large-scale structure of PV does not change appreciably with the resolution, simulations performed with 1 km resolution show a better representation of local PV maxima induced by deep convection which eventually contribute to a better resolved internal structure.