Geophysical Research Abstracts
Vol. 16, EGU2014-645, 2014
EGU General Assembly 2014

Short-Range prediction of a Mediterranean Severe weather event using EnKF: Configuration tests

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The afternoon of 4th October 2007, severe damaging winds and torrential rainfall affected the Island of Mallorca. This storm produced F2-F3 tornadoes in the vicinity of Palma, with one person killed and estimated damages to property exceeding 10 M€Ṡeveral studies have analysed the meteorological context in which this episode unfolded, describing the formation of a train of multiple thunderstorms along a warm front and the evolution of a squall line organized from convective activity initiated offshore Murcia during that morning. Couhet et al. (2011) attributed the correct simulation of the convective system and particularly its organization as a squall line to the correct representation of a convergence line at low-levels over the Alboran Sea during the first hours of the day.

The numerical prediction of mesoscale phenomena which initiates, organizes and evolves over the sea is an extremely demanding challenge of great importance for coastal regions. In this study, we investigate the skill of a mesoscale ensemble data assimilation system to predict the severe phenomena occurred on 4th October 2007. We use an Ensemble Kalman Filter which assimilates conventional (surface, radiosonde and AMDAR) data using the DART implementation from (NCAR). On the one hand, we analyse the potential of the assimilation cycle to advect critical observational data towards decisive data-void areas over the sea. Furthermore, we assess the sensitivity of the ensemble products to the ensemble size, grid resolution, assimilation period and physics diversity in the mesoscale model. In particular, we focus on the effect of these numerical configurations on the representation of the convective activity and the precipitation field, as valuable predictands of high impact weather.

Results show that the 6-h EnKF assimilation period produces initial fields that successfully represent the environment in which initiation occurred and thus the derived numerical predictions render improved evolutions of the squall line. Synthetic maps of severe convective risk reveals the improved predictability of the event using the EnKF as opposed to deterministic or downscaled configurations. Discussion on further improvements to the forecasting systems is provided.