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A High-Resolution Ensemble Data Assimilation System (EnKF): Impact of RS-AMVs observations over complex orography and large data-avoid regions in the Western Mediterranean.

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The Western Mediterranean is frequently affected by high-impact weather events, such as tornadoes, medicanes (Mediterranean Hurricanes), heavy precipitation rainfalls, hailstorms, gust winds or flashfloods, that produce loss of life and property for an invaluable amount. Most of these extreme weather events are characterized to be initiated and developed over large data-avoid regions, such as maritime bodies, where the state of the atmosphere is poorly known due to the lack of in-situ observations. Numerical predictability of this kind of events remains a key challenge, mainly due to errors in the initial conditions, lack of accuracy modelling micro-scale physic processes and the chaotic behavior inherent to current numerical weather prediction models.

In order to address that problem, a high-resolution (4-km) ensemble-based data assimilation technique, known as Ensemble Kalman Filter (HREnKF) is employed. The novelty of this data assimilation system in comparison with other data assimilation scheme, such as the variational data assimilation (e.g., 3D-Var, OI, 4D-Var) is that EnKF uses its own ensemble of forecasts to estimate flow-dependent background error covariance, instead of using static or climatological background error covariances.

In this study is assessed the impact of assimilating both in-situ conventional observations (i.e. buoys, aircrafts, METAR or rawinsondes) and satellite derived observations, such as Rapid-Scan Atmospheric Motion Vectors (RS-AMVs), with the main objective of improving the predictability of a MEDIterranean hurriCANE (MEDICANE) that took place on 7 November 2014 over the Sicilian channel, affecting the Islands of Lampedusa, Pantelleria and Malta. Gust wind values exceeding 42 m s-1 and a pressure drop above 20 hPa in 6 h were registered in Malta.

We discuss the performance of the EnKF system producing new analyses through statistical scores (RMSI, spread, BIAS sawtooth plots and consistency ratio plots). Then, we quantitatively verify the quality of the forecast using statistical verification methods. We discuss not only on the forecasts products but also in terms of the relevant physical mechanisms involved in this event.