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Predictability of Medicanes in the ECMWF ensemble forecast system

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Medicanes are intense tropical-like cyclones that occasionally strike the Mediterranean region. These storms constitute a major threat due to strong winds, intense precipitation and flooding. While the full spectrum of processes associated with Medicanes can only be reproduced using high-resolution, convection-permitting model simulations, the use of ensemble prediction systems (EPS) allows a deeper investigation of the uncertainty of forecasts and their dependency on lead time. This approach is valuable in that it sheds light on the interdependent factors influencing Medicane predictability at various spatial and temporal scales.

The predictability of several Medicane cases is analyzed in this contribution using ECMWF ensemble forecast and operational analysis data. An object-oriented technique is employed to detect and characterize the best-matching storm-like feature in each member of each forecast run. Several metrics, including cyclone phase space parameters, are employed to analyze the uncertainty of forecasts and examine to what extent the EPS can reproduce Medicanes. The predictability of large-scale processes such as Rossby waves and upper-level precursor troughs is also investigated to characterize their influence on storm occurrence and features.

Results show a general underestimation of both storm intensity and the magnitude of typical Medicane features such as strong pressure gradients close to the storm center and an upper-level warm core. However, there is large variability between individual cases, with some storms better forecast than others at all lead times. A leap in forecast accuracy is found between 3 and 5 days lead time for most storms, marking a limit in mesoscale predictability due to the propagation of errors down the spatial and temporal scale. In most cases, large-scale processes appear to be instrumental in determining storm occurrence: EPS members having larger errors in e.g. trough depth and position or Rossby wave breaking tend to represent storm occurrence and features less accurately.