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What determines the predictability of a Mediterranean cyclone?

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Cyclones provide the majority of water supplies in the Mediterranean and are essential elements of the climate of the region. The most intense of them lead to natural disasters because of their violent winds and extreme rainfall. Identifying systematic errors in the predictability of Mediterranean cyclones is therefore essential to better anticipate and prevent their impact. The aim of this work is to understand what processes determine their predictability.

We investigate the predictability of Mediterranean cyclones in a systematic framework using an ensemble prediction system. First, a reference dataset of 2853 cyclones is obtained by tracking lows in the ERA5 reanalysis, using an algorithm developed for the North Atlantic and adapted for the Mediterranean region. Then we investigate their predictability using IFS ensemble reforecasts in a homogeneous configuration over 22 years (2000-2021). The predictability in the reforecasts is quantified using probabilistic scores on cyclones trajectories and on intensity (mean sea level pressure) and then crossed with explanatory variables such as geographic area, cyclone velocity, season and intensity.

The evolution of location error with lead time shows a two phases growth, until and beyond 72 h, which will be discussed. When crossing the location and intensity errors with the explanatory variables, we can identify the conditions leading to a poorer (respectively better) predictability. In particular the velocity of cyclones appears to play an important role in the predictability of the location, the slower the cyclone the better the predictability, while the season is shown to play a greater role on the predictability of the intensity. These characteristics are also dependant on the sub-region considered and on the intensity of the low itself, the deeper the cyclone, the poorer the predictability in both the location and the intensity.