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A multi-method analysis of cyclone activity in the Mediterranean Region

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The Mediterranean Basin is a particularly active region in terms of cyclone formation and development. The geographical features of the area, including its location between the mid-latitudes and the sub-tropics, the almost closed sea and the mountain ranges near the coast play an important role determining the dominant meteorological characteristics of the region.

This study revisits monthly climatologies of Mediterranean storms through the analysis of databases obtained from multiple methods for cyclone identification and tracking. Within the context of the IMILAST project, these methodologies were all applied to fields provided by ERA-Int reanalysis, available 6-hourly and at 0.75º x 0.75º spatial resolution. They consist of a set of objective criteria to identify cyclone signatures near the surface, through the search for minima in mean sea level pressure or 1000 hPa geopotential height, or for vorticity maxima at 850 hPa. The tracking is then performed through the analysis of centres identified in consecutive time slots and imposing a set of a priory conditions on the maximum velocity admissible for mid-latitude cyclones.

The distributions of cyclone characteristics obtained from the different databases are analysed focusing on system duration, intensity and velocity. The spatial distributions and density of cyclone centres are also compared among the different storm-track databases, with particular emphasis on the location of the most active regions in terms of cyclogenesis. These are generally well defined in the Mediterranean region, being mostly determined by orographic features mentioned above and land-sea temperature gradients. As such, methodologies tend to agree in the areas that favour cyclone formation, particularly during winter months, while discrepancies among methods tend to be mostly related to number of detections. Finally, we make a critical analysis of some of the options/criteria within each methodology that favour or not the identification and tracking of Mediterranean cyclones, taking into account the period of the year and system type.