

The role of Mediterranean cyclones for producing large-scale precipitation extremes

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Extreme precipitation events are often associated with the passage of cyclones in the Mediterranean region. Particularly, large scale (LS) high-impact extremes, both on the spatial as well as temporal scales, are of societal importance for their association with a high risk for extended flooding and severe damage. Yet, the majority of current studies analyze local extremes as observed at single stations, or at a grid point, over a short time duration. Thus, key aspects regarding large-scale extremes remain unresolved: (i) where and when do LS precipitation extremes occur? (ii) what are the common precursors and dynamics of LS precipitation extremes?

We study these questions by an objective identification of spatio-temporal large scale precipitation extremes using ERA-Interim data for 1979-2012, a statistical analysis of the events, and with investigation of dynamical processes that occur during the evolution of selected events, using both ERA-Interim data and mesoscale model (COSMO) simulations.

We find that LS precipitation extremes are associated with Mediterranean or Atlantic cyclones, and preceded by different upper level jet structures in the different regions and seasons, namely, (1) an upper-level trough and strong jet on its western flank, followed by cyclogenesis (mainly in the western Mediterranean, in autumn), and/or (2) merging of the polar with the subtropical jet over northeastern Africa (in the eastern Mediterranean, in winter).