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Towards advances in modelling of extreme precipitation by the synergetic use of convection-permitting simulations and state-of-the-art observations

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As a result of global warming, the type, frequency and intensity of extreme events are expected to rise. Changes in some types of extreme events have already been observed, for example, increases in the frequency and intensity of heavy precipitation events. These changes will be more drastic in certain areas of the globe. The Mediterranean region has been identified as a "hot-spot" of the climate change.
The capability to predict such dramatic events is still a great challenge. Despite the significant progress made in terms of climate monitoring as well as weather and extreme event forecasting during recent years, extreme events and the underlying regional mechanisms through which these phenomena develop and persist are not fully understood and model uncertainties remain. With the goal of improving our understanding of the processes shaping these extremes and providing a better model representation, in this study we focus on two components of the water cycle: the soil and the atmospheric moisture. Several studies have shown that soil-atmosphere interactions and atmospheric water vapour evolution are important factors contributing and determining the occurrence and location of heavy precipitation extremes. Uncertainties associated with their model representation contribute to the uncertainty in modelling of heavy precipitation.

In the framework of the HyMeX international program, we explore the sensibility of the western Mediterranean heavy precipitation to soil moisture conditions and atmospheric water vapour evolution. The sensitivity to soil moisture extreme dry and wet initial scenario conditions and soil moisture initialization are examined using high-resolution convection permitting simulations and state of the art soil moisture satellite observations, namely the SMOS disaggregated 1 km product over the Iberian Peninsula. Moreover, the relevance of an accurate representation of atmospheric water vapour distribution and evolution is investigated through assimilation of a state-of-the-art GPS-derived Integrated Water Vapour data set and radiosounding profile information.