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Contrasting the large-scale environment of moderate and extreme precipitating systems in the Mediterranean region

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Heavy precipitating events are rather common in the Mediterranean region, with both local effects (orography, local surface fluxes) and large scale dynamics (cyclogenesis, frontal systems) contributing to their occurrence and severity. Because of the several scale interactions and the inherent non-linearity of the atmospheric dynamics, the predictability of such events is limited at best to a couple of days, and indicating the importance of a precise description of the environment in which they develop. Here we present a contrast between the large-scale environment associated with moderate and extreme precipitating systems in the Mediterranean, using 7 years (2001-2007) data from the Advanced Microwave Sounding Unit (AMSU), on board NOAA satellites. Channel 8 of AMSU-A is used to identify upper-level troughs, while combinations of channels 3 to 5 of AMSU-B are used to detect precipitation. A climatology of precipitation shows that rain occurrence is widespread over the Mediterranean except in the eastern part of the basin, where rain events are reduced or short-lived in summer. Convective precipitation presents a seasonal migration being more frequent over land from April to August and over the Mediterranean Sea from September to December. A composite analysis was performed for selected regions where the frequency of intense precipitation is relatively high. Two cases were contrasted: rain without convection and extensive areas of deep convection. The composites show that an upper-level trough is present in both moderate and extreme rainfall, but the trough is narrower and with larger amplitude in the extreme rainfall cases, in all seasons. Also for these (extreme) cases, an eastward propagating wave-train pattern is observed in the upper-level fields. At low-levels, ECMWF Operational sea surface temperature composites show that the Mediterranean is 1 to 2 degrees warmer for extreme rainfall, and low-level winds much stronger and coming from the sea, suggesting that surface fluxes are essential in the development and maintenance of such extreme rainfall events.