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Predictability of the atmospheric conditions leading to extreme weather events in the Western Mediterranean Region in comparison with the seasonal mean conditions

Samiro Khodayar and Norbert Kalthoff
Institute for Meteorology and Climate Research, Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany

Among all severe convective weather situations, fall season heavy rainfall represents the most threatening phenomenon in the western Mediterranean region. Devastating flash floods occur every year somewhere in eastern Spain, southern France, Italy, or North Africa, being responsible for a great proportion of the fatalities, property losses, and destruction of infrastructure caused by natural hazards. Investigations in the area have shown that most of the heavy rainfall events in this region can be attributed to mesoscale convective systems.
The main goal of this investigation is to understand and identify the atmospheric conditions that favor the initiation and development of such systems. Insight of the involved processes and conditions will improve their predictability and help preventing some of the fatal consequences related with the occurrence of these weather phenomena. The HyMeX (Hydrological cycle in the Mediterranean eXperiment) provides a unique framework to investigate this issue.
Making use of high-resolution seasonal simulations with the COSMO-CLM model the mean atmospheric conditions of the fall season, September, October and November, are investigated in different western Mediterranean regions such as eastern Spain, Southern France, northern Africa and Italy. The precipitation distribution, its daily cycle, and probability distribution function are evaluated to ascertain the similarities and differences between the regions of interest, as well as the spatial distribution of extreme events. Additionally, the regional differences of the boundary layer and mid-tropospheric conditions, atmospheric stability and inhibition, and low-level triggering are presented.
Selected high impact weather HyMeX episodes' are analyzed with special focus on the atmospheric pre-conditions leading to the extreme weather situations. These pre-conditions are then compared to the mean seasonal conditions to identify and point out possible anomalies in the atmospheric conditions which could favor the initiation and intensification of extreme precipitation weather events.