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Past climate variability study of Heavy Precipitation Events in the north-western Mediterranean using the Convection-Permitting Regional Climate Model CNRM-AROME41

Cécile Caillaud (1), Samuel Somot (1), Antoinette Alias (1), Quentin Fumière (1), Aurélien Ribes (1), and Isabelle Bernard-Bouissières (2)

(1) CNRM UMR 3589, Météo-France/CNRS, Toulouse, France (cecile.caillaud@meteo.fr), (2) DIROP/PI, Météo-France, Toulouse, France

Occurring in the western Mediterranean during an extended fall season, Heavy Precipitation Events (HPEs) are characterized by significant precipitation rates (above 200mm/day or locally 100mm/3h) and quasi-stationary systems, leading to devastating flash-flooding and floods. Up to now, climate models with too coarse resolution and deep convection parametrization failed to represent accurately the meteorological key processes, such as Mesoscale Convective Systems (MCS) often associated with precipitation extremes in the Mediterranean area. With the recent computer power increase, the regional climate model community starts implementing Convection-Permitting Regional Climate Models (CP-RCM) with promising results (Prein et al. 2015, Berthou et al. 2018, Fumière et al. in rev).
The purpose of our study is to evaluate and characterize the past variability of HPEs simulated by the CP-RCM CNRM-AROME41.
Therefore, we run a long and continuous past climate simulation of CNRM-AROME41 over the last 35 years driven by ERAInterim (80km) using an ALADIN-Climate-12.5km-Med CORDEX simulation as an intermediate step. The domain (common CORDEX-FPS-Convection domain, 1300km*1500km, centred on the Alps) allows a good representation of the north-western part of the Mediterranean basin.
In a first step, comparing to high resolution gridded observational datasets, we evaluate the ability of the model to reproduce the fall precipitation statistics at daily and hourly time scale. We also quantify the added value compared to the driving model.
In a second step, we focus on past French Mediterranean HPEs. Defining the events the same way as Ribes et al. (2018), we wonder if CNRM-AROME41 is able to reproduce the past HPEs over the period 1982-2016 using an event-based approach (interannual variability, frequency, intensity, spatial coverage).
Finally, we apply convective cell tracking method in order to capture the main characteristics of MCS simulated by the model.