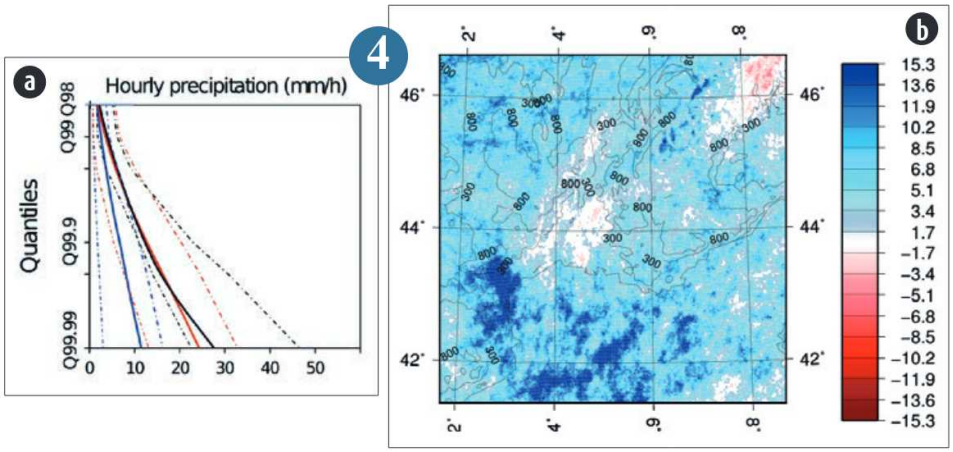
Mediterranean events and climate change: contribution of CNRM-AROME

South East France is often affected by intense rainfall episodes called "Mediterranean episodes" generating flash floods causing major material damage and sometimes loss of life. For these reasons, studies on the evolution of these Mediterranean episodes in a context of global warming are of major importance for our society.

Until now, the climate change projection simulations used for this type of study in South East France have been carried out using Regional Climate Models (RCMs) with parameterized convection and a horizontal resolution not exceeding 12.5km. With the recent increase in computing capabilities, it is now possible to perform very high resolution (2-3km) climate simulations with Explicit Deep Convection Regional Climate Models such as CNRM-AROME.

The use of the AROME model in climate mode has shown a high added value in the representation of extreme precipitation compared to the ALADIN RCM with parameterized deep convection (Fumière et al. 2019). This added value is significant on the representation of daily extreme precipitation, but also and especially on hourly extremes where the intensity of precipitation in convective systems is better represented (see Figure a).

The first climate projections with CNRM-AROME over 30-year periods were made following the IPCC's greenhouse gas emission scenario RCP8.5. By 2100, projections show a decrease in average autumn precipitation and an increase in extreme daily and hourly precipitation in south-eastern France. Note that this intensification is more pronounced in Roussillon (see Figure b).



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(a) Cumulative Density Function (CDF) of hourly precipitation over the Cevennes in south-eastern France. The black curve represents Comephore observations, the blue curve represents precipitation simulated by ALADIN and the red curve represents precipitation simulated by the CNRM-AROME model. The discontinuous curves represent the 90% confidence interval of each data series. (b) Map of differences in the quantiles 99.9 of hourly precipitation over South East France between the historical (1976-2005) and future (2071-2100) periods according to the IPCC's RCP 8.5 greenhouse gas scenario. The differences in percentages are represented by degree of warming.