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Aerosols effects on hydroclimatic extremes over Europe using online coupled chemistry-climate model

Javier Medina Moya, Laura Palacios-Peña, José María López-Romero, Juan Pedro Móntavez, Pedro Jiménez Guerrero, and Raquel Lorente-Plazas

Universidad de Murcia, Facultad de Química, Dpt. of Physics, Spain (javier.medina@um.es)

Atmospheric aerosols affect Earth's radiative budget by aerosol-radiation (ARI) and aerosol-clouds interactions (ACI) and are considered as one the most uncertain forcing agent by IPCC AR5. How these aerosol-radiation-cloud interactions affect to precipitation is still poorly understood and, this lack of understanding becomes more crucial when extreme events are analyzed. To gain insight in these aerosol feedbacks, on-line chemistry-atmospheric models are widely used, but due to its computational cost few of these research focus on the climatology.
Here, two regional climate simulations covering a 20-year period (1991-2010) provided by the Spanish REPAIR and ACEX projects are analyzed. The only difference between both simulations is that one of them takes into account anthropogenic, natural and biogenic emissions, and also aerosols effects (ARI and ACI) conducted by the Weather Research and Forecast (WRF) coupled with Chemistry (WRF-Chem). The dynamical downscaling is performed to ERA-20C reanalysis over Euro-CORDEX compliant domain with 50 km spatial resolution. The simulations are evaluated by comparing with the observational database E-OBS. Several climate indeces, defined by the European Climate Assessment (ECA) are inspected to better characterize the role of the aerosol on extreme events. Results show a decrease for the precipitation, both convective and non-convective, when aerosols effects are included. Overall, the inclusion of aerosol effects decreases both the intensity and the frequency of extreme precipitation. However, the differences in the precipitation due to aerosols interactions are lower than those introduced by changes in physical parameterization, such as, microphysics and cumulus schemes.

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