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Assessment of convection-permitting sub-daily extreme precipitation simulations over Italy

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Convection-permitting climate models have the potential to capture crucial processes in the climate system, presenting an opportunity to significantly enhance climate projections by providing more accurate representations of precipitation extremes. In this work, we conduct an evaluation of the accuracy of sub-daily precipitation extremes obtained from VHR-PRO_IT (Very High-Resolution PROjections for Italy, Raffa et al., 2023) over the Italian peninsula. VHR-PRO_IT is generated through dynamic downscaling of the Italy 8km-CM climate projection at approximately 2.2 km resolution under the IPCC RCP4.5 and RCP8.5 scenarios, employing the Regional Climate Model COSMO-CLM.

Gauged locations are used to assess the accuracy of VHR-PRO_IT in reproducing observed extremes. More specifically, the observed dataset used as ground truth for the comparison is I²-RED (Improved Italian – Rainfall Extreme Dataset; Mazzoglio et al., 2020). For this work, 742 rain gauges covering the entire country with a minimum of 30 years of short-duration (1, 3, 6, 12, 24 h) annual maximum rainfall depths recorded from 1980 to 2022 are used. Conversely, the dataset derived from the VHR-PRO_IT climate projections includes annual maxima from a 30-year time series, connecting the historical period (1981-2005) with 5 years of the RCP8.5 scenario (2006-2010) of the CPM. Return levels are obtained for both dataset by means of a GEV distribution and inform the assessment of the CPM simulations.

Preliminary results outline the quality of the CPM simulations, especially at 24 hours duration, and show the impacts of return period, seasonality, elevation, latitude and proximity to the sea on the CPM model deviations. The results from this work are expected to have implications for both water resources management and adaptation measures.

References

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