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On the added-value of high resolution meteorological forcings for continental scale impact modelling

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There is currently an increasing effort to develop operational hydrological forecasting services to serve local water managers and provide information for water resources management and preparedness against extreme events. Evaluations at the local user scale highlight the limitations of these services and foster improvements in the systems the services are based on. One major source of skill of these systems is the meteorological forcings used as input to the impact models. In the prospect of improving the prediction of extreme hydrological events, important efforts are targeted towards improving the skill of weather forecasts via assimilation of earth observations and/or application of high-resolution numerical weather prediction (NWP) models. State of the art pan-European hydrological services (SMHI's WaterInfo) are based on ECMWF weather deterministic forecasts, which are provided at 16 km horizontal resolution. Nevertheless it is expected in principle that NWPs with higher spatial resolution will provide the weather signal to predict better the hydrological events, particularly the spatially localized extremes events. As a result, SMHI has been exploring the high resolution (2.5 km horizontal grid-distance) NWP HARMONIE-AROME (Hirlam Aladin Regional/Meso-scale Operational NWP In Europe) configuration for short-range predictions. In the HARMONIE-AROME configuration, extreme precipitation events are addressed by assimilating surface remote sensing data regarding snow and soil moisture.

Here, we aim to assess the improvements on the performance of the pan-European hydrological forecasting services from using high-resolution NWPs in comparison to the benchmark ECWMF deterministic forecasts. We investigate a number of precipitation events over Europe using the E-HYPE hydrological model, and hence its spatial discretization, and analyze the peak streamflows from ECMWF deterministic and HARMONIE-AROME forecasts. The analysis is focused on 5 and 2 precipitation events over the Southern and Northern European domain respectively, which resulted into flashfloods. We further analyze improvements as a function of catchment type and scale, antecedent conditions and precipitation properties.