A skill assessment of the European Flood Awareness System notifications

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The European Flood Awareness System (EFAS) of the Copernicus Emergency Management Service is an operational forecasting system whose aim is to raise awareness about floods in European transnational rivers. It produces probabilistic, medium-range discharge forecasts twice a day by running the open-source hydrological model LISFLOOD with four different meteorological forcings, two deterministic forecasts from the DWD (German Weather Service) and the ECMWF (European Centre for Medium Range Weather Forecasts), respectively, and two probabilistic forecasts from ECMWF and the Cosmo Consortium (COSMO-LEPS). Based on these forecasts, flood notifications are issued to the EFAS partners if a set of criteria is met: contributing area larger than 2000 km², lead time from 48 to 240 h, at least one deterministic model exceeds the discharge threshold (5-year return period), and at least one probabilistic model predicts 30% exceedance probability of that discharge threshold for three or more consecutive forecasts.

However, the operational EFAS is being regularly updated, so the configuration of EFAS has changed since the time these notification criteria were defined. For instance, the temporal resolution has increased from daily to 6-hourly, and the spatial resolution is planned to improve from 5km to approximately 1.5 km (1 arcminute).

This study aims at assessing the skill of the notification criteria above presented with the current system setup, and to derive a new set of criteria that optimizes the notification skill. We will focus on three research questions: (i) how can we combine the different models (deterministic and probabilistic) into a grand ensemble and what probability threshold optimizes skill? (ii) Is the persistence criterion (i.e. 3 consecutive forecasts need to provide persistent predictions of high flood risk) adding to the skill both at shorter and larger lead times? (iii) Can we reduce the contributing area threshold without compromising skill?

The study will make use of reanalysis, driven by meteorological observations, and forecast data at over 2300 stations across Europe for a time span from October 2020, which was the release time of the last major change in the EFAS setup, until present. By comparing the reanalysis data with the simulated discharge threshold, a total of 1327 “observed” flood events have been identified in the 2 years from October 2020 to October 2022. The “notified” events will be computed by comparing the forecast data against the notification criteria; we will compute skill metrics (f1, Hanssen-Kuipers) at each daily lead time for different combinations of meteorological forcing and notification criteria in order to find the procedure that maximizes the skill of EFAS notifications and to assess the above research questions.

The outcome of this study will be applied to the EFAS operational system, directly impacting the preparedness of the relevant authorities in future flood events.