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Deutscher Wetterdienst
Wetter und Klima aus einer Hand

Predictability plots as a means to assess meteorological input for hydrological models

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The cooperation between the German flood forecasting centres and the German Weather Service (DWD) is being improved through the IDEA-S4S Co-Design project. Here, precipitation forecasts are evaluated for their accuracy on the scale of catchment areas.

Objective

Examples of retrospective analysis of precipitation for river catchments are presented here. The first one is from devastating flash flood events that took place in 2016 (Figs. 1 and 2). The aim of this analysis was to compare the precipitation forecasts that were available in 2016 with forecasts that are available from current forecasting systems: For this purpose re-forecasts for the 2016 events were run with ICON-RUC and INTENSE which are forecast models developed in the DWD SINFONY project. The second example is a more recent event from summer 2024 (Fig. 4). Here, a shorter precipitation event is considered. Plots like this will be made accessible with an interactive Shiny app (Fig. 3) developed in the Co-Design project. The app may be used by our hydrologic partners on a regular basis.

Simbach 2016

The flood in Simbach, SE Germany, had an estimated return period of 50 to 100 years. The COSMO model that was routinely run in 2016 had a lead time of 27 hours, compared to the ICON-D2 model with 48 hours lead time. Already this difference could have led to better prediction of the event. However, in the shown example, the first forecast close to the observed event occurred only 15 hours before the event. This demonstrated the value of ensemble prediction systems. Those systems have a higher chance of capturing the event, although, in case of extreme events with low probability.

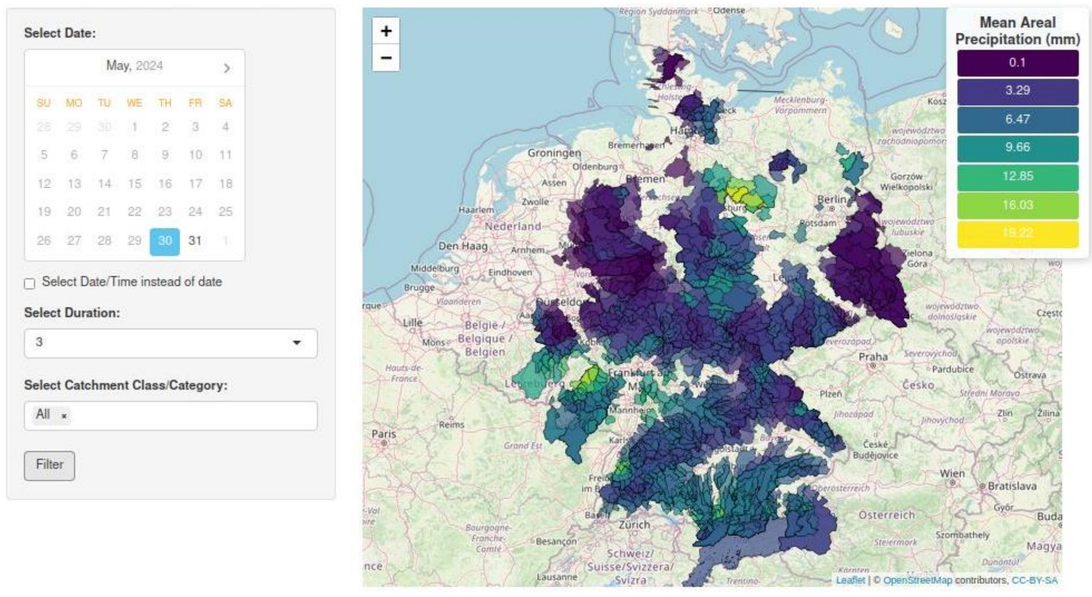

Fig. 3: Observed areal precipitation in the Shiny app: maximum areal precipitation within 3 hours duration in gauge-related catchment areas

Topics for discussion

Meteorological verification typically does not focus on extreme events or on spatial uncertainty, both of which are particularly interesting from a hydrologist's point of view. In addition to a planned systematic approach to meteorological verification for hydrologic interests, the tool presents here allows hydrologists to view forecasts for an observed (extreme) event such as extreme (areal) precipitation or floods in retrospect.

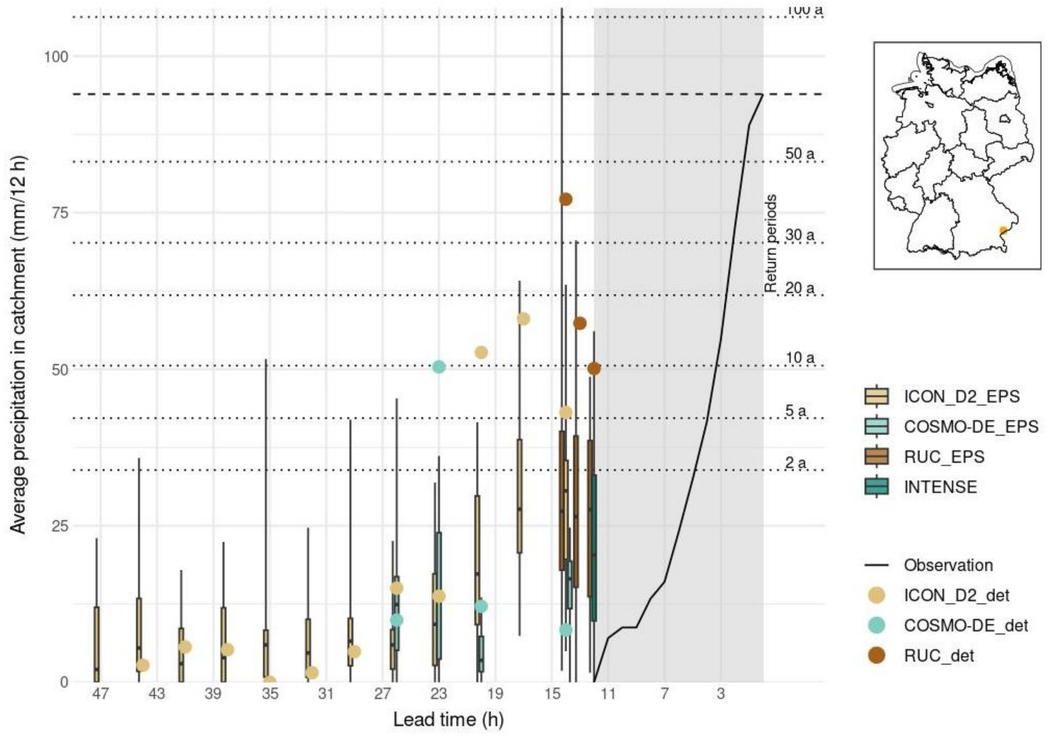

Fig. 1: Predictability plot for Simbach, 1 June 2016, 14 UTC, duration: 12 hours

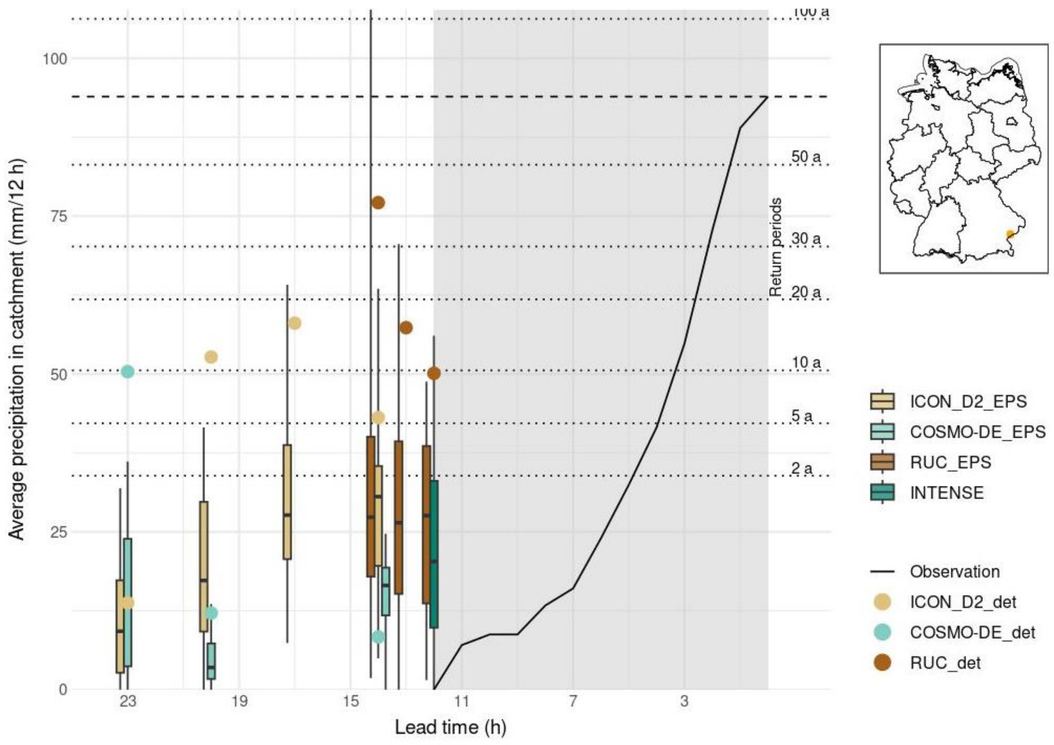

Fig. 2: Predictability plot for Simbach 1 June 2016, 14 UTC, duration: 12 hours (zoomed in)

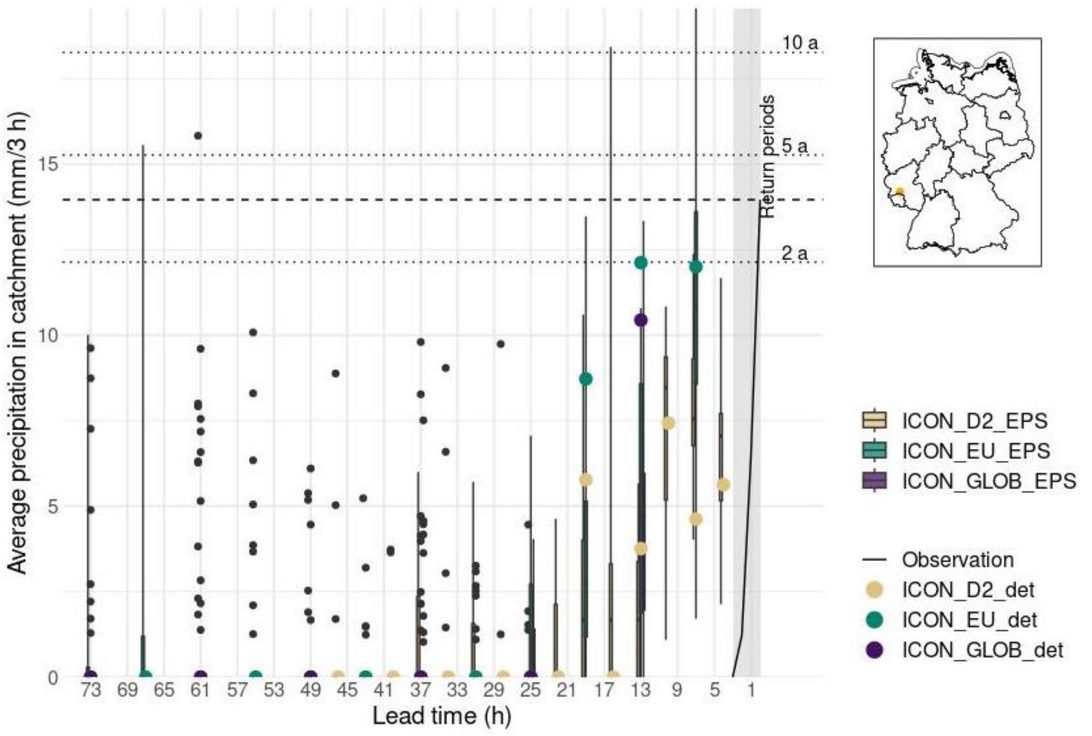

Fig. 4: Predictability plot for a catchment area in W Germany, 30 May 2024, 01 UTC, duration: 3 hours

While predictability plots provide a useful means to assess meteorological forecasts as hydrologist, a systematic and objective verification requires understanding of hydrologic demands. To collect these demands we need feedback from our hydrology partners. Topics for discussion include:

- Time-related uncertainty: What is the impact of events taking place earlier or later than forecast? How critical is this kind of uncertainty?
- Variation of precipitation rate within an event: If this is critical, should be include it into meteorological verification?
- Any verification outcome that could directly help with using meteorological forecasts for hydrological purposes.

Research and Development, Data Assimilation and Verification
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