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Keynote: Flood forecasting in Bavaria: Organization of the flood information service (HND) and limits of early warning due to model uncertainties discussed on the basis of examples from the 2024 flood event in Swabia

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Flood protection and flood prevention are of fundamental importance for all settlements near bodies of water. Climate change is accelerating extreme precipitation and thus also increasing the importance of flood prevention. A central element of this is flood forecasting, as this is what makes many precautionary measures possible in the first place. In Bavaria, the flood forecasting centers continuously simulate the water balance area-wide and use this as a basis to create discharge forecasts for more than 200 gauging stations. These forecasts form the operational basis for flood risk prevention.

This contribution explains how the flood information service (HND) is organized and carried out in Bavaria. In addition, the uncertainty and quality of the water balance modeling and the resulting discharge forecasts for the 2024 flood event are discussed against the background of the precipitation forecasts.

The floods of May/June 2024, which caused extreme discharges and flooding along the southern tributaries of the Danube in Swabia and Upper Bavaria in particular, were not concentrated on the edge of the Alps, as was the case with previous major floods (1999, 2005, 2013), but downstream to the north. There, smaller streams and lateral tributaries contributed significantly to the catastrophic damage in populated areas. The event also revealed the limits of gauge-based predictions, as some gauges were bypassed by significant portions of the discharge.

Due to meteorological forecasts, a major event was already recognizable some time in advance and a general operational readiness for the HND in Bavaria was communicated on 29.05.2024, two days before the first warning thresholds were reached. However, the later focus on Swabia based on the forecasts first materialized on 30.05. to 31.05.2024. But for a long time even the ensemble forecasts had not depicted the extension to catchment areas further east as a scenario. For this reason, there was also criticism of the forecasts, especially for the Paar (Danube tributary), Glonn and Amper (western Isar catchment area).

Overall, the new ensemble products are very useful for estimating the potential severity of forecast weather conditions and are increasingly being used in the flood information service. However, the early warning of specific catchment areas remains difficult, especially in the case of extreme precipitation, as the location of precipitation is still subject to great uncertainty and a few kilometers offset makes a big practical difference for hazard prevention in small catchment areas. This is shown using the example of the Paar river.

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