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Reduction Continuous Rank Probability Score for Hydrological Ensemble Prediction System

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Ensemble Prediction System (EPS), calculated operationally by the weather services for various lead-times, are increasingly used as input to hydrological models to extend warning times from short- to medium and even long-range. Although the general skill of EPS has been demonstrated to increase continuously over the past decades, it remains comparatively low for precipitation, one of the driving forces of hydrological processes. Due to the non-linear integrating nature of river runoff and the complexities of catchment runoff processes, one cannot assume that the skill of the hydrological forecasts is necessarily similar to the skill of the meteorological predictions. Furthermore, due to the integrating nature of discharge, which accumulates effects from upstream catchment and slow-responding groundwater processes, commonly applied skill scores in meteorology may not be fully adapted to describe the skill of probabilistic discharge predictions. For example, while for hydrological applications it may be interesting to compare the forecast skill between upstream and downstream stations, meteorological applications focus more on climatologically relevant regions.

In this paper, a range of widely used probabilistic skill scores for assessing reliability, spread-skill, sharpness and bias are calculated for a 12 months case study in the Danube river basin. The Continuous Rank Probability Score (CRPS) is demonstrated to have deficiencies when comparing skill of discharge forecast for different hydrological stations. Therefore, we propose a modified CRPS that allows this comparison and is therefore particularly useful for hydrological applications.