Evaluation of runoff predictability based on medium-range weather forecasts for a small mountainous watershed

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We generated medium-range forecasts of runoff for a small (50 km2) mountainous headwater catchment upstream of a reservoir using numerical weather predictions (NWPs) of the past as input to an operational hydrological model. NWP data originating from different sources were tested. For a period of 8.5 years, we computed daily forecasts with a lead time of +120 h based on an empirically downscaled version of the ECMWF's ensemble prediction system. For the last 3.5 years of the test period, we also tried the deterministic COSMO-EU forecast disseminated by the German Weather Service for lead times of up to +72 h. Common measures of skill indicate superiority of the ensemble runoff forecast over single-value forecasts for longer lead times. However, regardless of which NWP data were being used, the probability of event detection (POD) was found to be generally lower than 50%. In many cases, values in the range of 20–30% were obtained. At the same time, the false alarms ratio (FAR) was often found to be considerably high. The observed uncertainties in the hydrological forecasts were shown to originate from both the insufficient quality of precipitation forecasts as well as deficiencies in hydrological modelling and quantitative precipitation estimation. With respect to the anticipatory control of reservoirs in the studied catchment, the value of the tested runoff forecasts appears to be limited. This is due to the unfavourably low POD/FAR ratio in conjunction with a high cost–loss ratio. However, our results indicate that, in many cases, major runoff events related to snow melt can be successfully predicted as early as 4–5 days in advance.