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A mixing model for operational runoff forecasts

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Advantages of different model types used for operational runoff forecasting can be used by merging two or more model results to an optimised forecast. Depending on the processes described by a model, it produces more or less accurate runoff forecasts during different stages according to the ongoing dominant hydrological process in the catchment. The two stages used in this study are "rising limbs" of flood waves and all other data named "everyday situation". The method of combining model results with time-variant weights for different hydrological stages makes use of each model's strength. It yields an optimised forecast, which has to have a better performance than the best single model result. In a second step and using the fact that flood events often occur during distinct weather situations, this investigation tries to find a connection between the changing performance of the mixing model and different weather types.

The performance of different runoff forecasting models for the Austrian river Gail in dependence of the two different hydrological stages (rising limbs and everyday situation) is investigated. Three different forecasting model results gained from an existing operational forecasting system are then merged using two methods: First, the time-variant merging factors for the two hydrological stages are derived from performance measures (Nash-Sutcliffe efficiency and R^2). Second, a linear regression model for rising limbs combines the forecasts. Distinguishing "rising limbs" and "everyday situation" results in two sets of mixing parameters. The weights describe the advantages of the contributing models during different hydrological stages and lead-times. The resulting optimised forecast fulfils the basic approach to be more accurate than the best single model.

As a second step the mixing model performance with respect to weather types is investigated. The results show that performance measures change with weather types. This behaviour can be explained by the lumped model characteristics, where air masses flow direction and river flow direction influence the model's answer. The results can be used during on-line forecasting for assessing the expected model performance depending on the ongoing weather type.