Geophysical Research Abstracts
Vol. 21, EGU2019-2827, 2019
EGU General Assembly 2019

Stacking of probabilistic predictions for improving hydrological forecasts

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Probabilistic streamflow forecasting by postprocessing the outputs of hydrological models is commonly performed using regression models. The relevant applications are mostly based on quantile regression. Ensemble learning of regression (statistical learning) algorithms can improve their generalization ability when applied properly. Here we propose stacking (a special case of ensemble learning) of quantile regression and quantile regression forests. Stacking is performed by weighting the base-learners, while optimal weights are estimated by minimizing the interval score. The ensemble learner is benchmarked against the base-learners in a large-scale study conducted at daily timescale. This study examines over 500 basins in the contiguous US. The results indicate that in terms of interval score the ensemble learner improves over quantile regression and quantile regression forests by 10% and 5% respectively in one-step ahead forecasting.