

Key role of snowmelt in high-resolution discharge forecasting during rainfall and snowmelt mixed events

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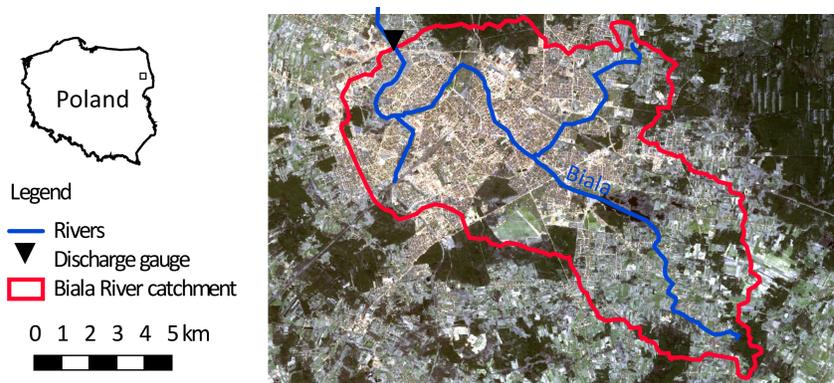
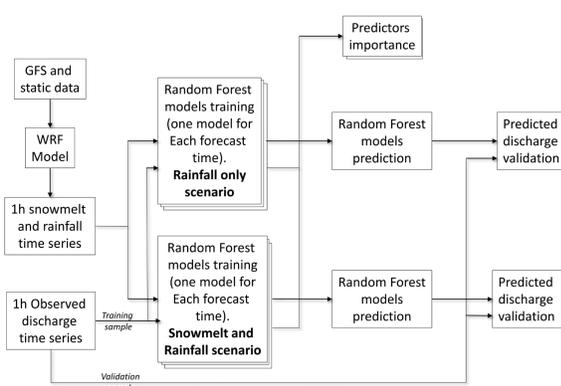
Introduction

The hydrological processes related snowmelt and rainfall mixed events, mostly concerning the rain-on-snow phenomena, were simulated or analyzed recently in a number of studies. Unfortunately, the snowmelt and rainfall mixed events received relatively little attention in high resolution discharge forecasting, especially in study areas where snow processes are tend to be disregarded.

Our aim is to highlight the effect of neglecting snowmelt in high-resolution discharge forecasts in mixed snowmelt and rainfall catchments. We conduct the study in an urbanized catchment where the influence of snow processes on discharge is enforced.

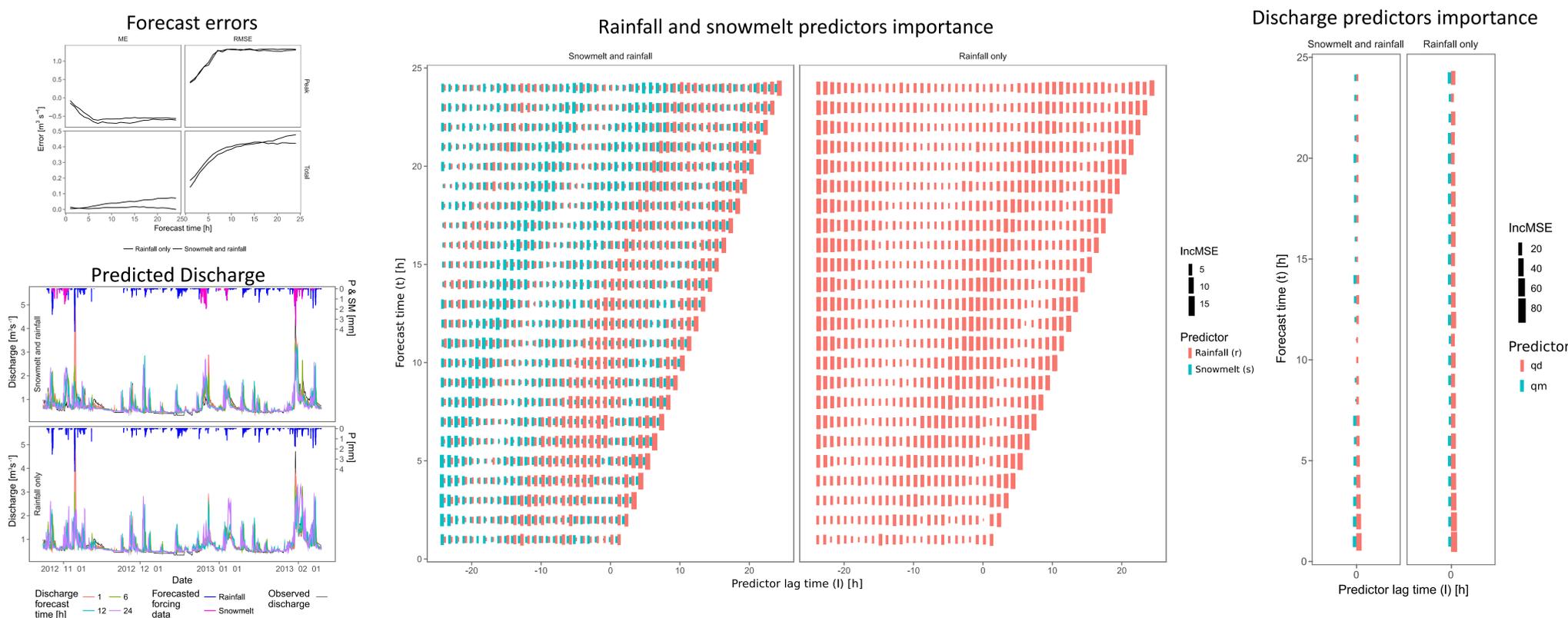
Methods

In this study we use a machine learning algorithm - Random Forest - for 24 h discharge forecasting in 1h resolution in a 105.9 km² urbanized catchment in NE Poland - Biala River. The meteorological data used as the predictors are obtained from Weather Research and Forecasting (WRF) simulations in 1 h temporal and 4 x 4 km spatial resolutions. The Random Forests based discharge forecasting models are set in two scenarios with (1) snowmelt and rainfall and (2) rainfall only predictors in order to depict the effect of snowmelt on the model structure and forecasts.



Results

- Both scenarios (with rainfall only predictors and with snowmelt and rainfall predictors) performed similarly in terms of hydrograph behavior.
- Rainfall only models were more biased and had higher absolute errors than the snowmelt and rainfall models.
- The snowmelt predictors are of comparable importance as the rainfall predictions even though the snowmelt volume is only 20% of the rainfall volume in our study.
- Inclusion of snowmelt prediction changed the pattern of preceding discharge predictors by decreasing their importance with increasing forecast lead time.



Conclusions

The effect of including snowmelt data in discharge forecasts for mixed snowmelt and rainfall environment allows to account for non-linearities and feedbacks such as (1) initial wetting by snowmelt related to air temperature and (2) rain-on-snow phenomena. High importance of preceding discharge predictions in the rainfall only models confirmed that wrongly parameterized model may give predictions with acceptable errors. Whereas, the interpretation of the model structure leads to erroneous conclusions.