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Hydrological data assimilation using machine learning

Thursday, 28 November 2019 09:20 (20 minutes)

Data assimilation (DA) allows for updating state variables in a model to represent reality more accurately than the initial (open loop) simulation. In hydrology, DA is often a pre-requisite for forecasting. Neural networks (NN) can learn almost any nonlinear relationship between inputs and outputs. Here, we hypothesize that NN could learn the relationship between the simulated streamflow (from a hydrological model) and the corresponding state variables. Once learned, this relationship can be used to obtain corrected state variables by applying it to observed rather than simulated streamflow. Based on this, we propose a novel, ensemble-based, DA approach. To verify the above mentioned hypothesis, we used an international testbed comprising of four contrasted watersheds. We applied the new DA method to the lumped hydrological model GR4J, which has two state variables. Within this framework, we compared two types of NN, namely Extreme Learning Machines (ELM) and Multilayer Perceptrons (MLP). Using well-known metrics such as the CRPS, we compared the assimilated streamflow series with the open loop streamflow series and with the observed streamflow. We show that NN are effective for DA, with a noticeable improvement over the open loop simulation for all watersheds.

Which session would you like to present in?

1. Novel hydrological data sources and assimilation techniques

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