Urban runoff forecasting with ensemble weather predictions

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Title: Urban runoff forecasting with ensemble weather predictions

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Summary:

This research shows how ensemble weather forecasts can be used to generate urban runoff forecasts up to 53 hours into the future. The results highlight systematic differences between ensemble members that needs to be accounted for when these forecasts are used in practice.

Abstract:

Numerical Weather Predictions (NWP) can help extend the lead time of urban runoff forecasts. The use of these forecasts within integrated stormwater management is, however, still rare. Uncertainty in NWP is generally provided in the form of ensemble forecasts, which sample the uncertainty related to various aspects of the weather model. In this study, weather forecasts from the Danish Meteorological Institute's (DMI) HIRLAM-S05 NWP Ensemble are used. DMI's ensemble consists of 25 individual forecasts that are produced by pairing five different model structures with five ways of generating initial conditions. Ensemble forecasts are generated every six hours with a spatio-temporal resolution of 5x5 km^2 and 1 hr. The case area is the northern part of the Damhusåen catchment in Copenhagen, Denmark, and data is available from June 2014 to July 2016. The weather forecasts are used to force a conceptual urban runoff model based on Nash cascades, yielding flow forecasts up to 53 hours into the future. The flow forecasts are compared with observed flow at the outlet of the local sewer system. Comparison is only made when the observed flow is above the normal daily dry weather variations, i.e. when stormwater is present.

One figure is attached to this abstract. It shows the Mean Absolute Error (MAE) for each ensemble member as a function of the forecast horizon. Each member's MAE is indicated by a thin line in both the upper and lower part of the figure. The difference between the two parts are the coloring of each line. In the upper part, each member is colored depending on the weather model's structure while the lower part colors each member depending on its approach to setting up initial conditions. The thick lines are the average of each color's error. It is seen that two of the model structures systematically produce larger errors than the others while there is no apparent pattern in the initial condition plot. This suggests that the choice of model structure has a larger effect on forecast skill than the initial conditions. A slight decrease in forecast skill is seen for all ensemble members as the forecast horizon increases. Future research will focus on how the systematic differences in the

ensemble can be accounted for when these types of forecasts are used for integrated stormwater management.

Comments:
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