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Realtime monitoring of urban flooding by ensemble Kalman filters

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Urban drainage models have been used in many cities for analysis, prediction, and control related to urban flooding. Many sources of uncertainties exist in these models comprising model parameters, meteorological forcings, and surface conditions. Thus, it is necessary to calibrate models before using them in reality. A common choice in calibration is to fit the model outputs with observations through many cases. This strategy is known as the offline mode in calibration and works on the stationary assumption of model parameters. If parameters vary in time, this method usually yields the climatological range of the parameters, which are not necessarily optimal in specific cases. In this study, instead of the offline model we follow the online mode in estimating model parameters by using an ensemble Kalman filter (EnKF). Furthermore, we estimate not only model parameters but also model states simultaneously utilizing the EnKF. Note that originally, EnKF is a data assimilation technique that is based on sampling in estimating any system states given observations, and later is used for the purpose of parameter estimation. The combination of EnKF and an urban drainage model is expected to lead to a real-time monitoring system for urban flooding similar to reanalysis systems in numerical weather prediction.