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Improving flash flood forecasting with distributed hydrological model by parameter optimization

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In China, flash food is usually regarded as flood occured in small and medium sized watersheds with drainage area less than 200 km2, and is mainly induced by heavy rains, and occurs in where hydrological observation is lacked. Flash flood is widely observed in China, and is the flood causing the most casualties nowadays in China. Due to hydrological data scarcity, lumped hydrological model is difficult to be employed for flash flood forecasting which requires lots of observed hydrological data to calibrate model parameters. Physically based distributed hydrological model discrete the terrain of the whole watershed into a number of grid cells at fine resolution, assimilate different terrain data and precipitation to different cells, and derive model parameteris from the terrain properties, thus having the potential to be used in flash flood forecasting and improving flash flood prediction capability. In this study, the Liuxihe Model, a physically based distributed hydrological model mainly proposed for watershed flood forecasting is employed to simulate flash floods in the Ganzhou area in southeast China, and models have been set up in 5 watersheds. Model parameters have been derived from the terrain properties including the DEM, the soil type and land use type, but the result shows that the flood simulation uncertainty is high, which may be caused by parameter uncertainty, and some kind of uncertainty control is needed before the model could be used in real-time flash flood forecastin. Considering currently many Chinese small and medium sized watersheds has set up hydrological observation network, and a few flood events could be collected, it may be used for model parameter optimization. For this reason, an automatic model parameter optimization algorithm using Particle Swam Optimization(PSO) is developed to optimize the model parameters, and it has been found that model parameters optimized even only with one observed flood events could largely reduce the flood simulation uncertainly, thus largely improve the flash flood forecating capability. It also proves that physically based distributed hydrological model needs to optimize model parameter.