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Application of a developed land surface model to improve meteorological model surface layer forecasts

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Land surface processes and their modeling play a key role in the atmospheric models. However, the traditional land surface model (LSM) only calculates runoff with the simplified water balance (SWB) method, which often performs a land surface runoff and runoff-yield distribution simulation with poor response.

In this paper, to better represent the runoff mechanism and land surface water redistribution, the curve of repletion of storage and flow concentration module are introduced into land surface hydrological model in mesoscale meteorological model. The curve of repletion of storage can take the change of runoff-yield within the grid area for the better simulation of runoff into consideration. The poor runoff and soil moisture simulation can be improved with water redistribution in two-dimensional level by flow concentration modeling. Muskingum-Cunge method is applied for flow concentration.

The region, located in 31˚–35˚N, 112˚–121˚E. in China, is taken as the test region. The incorporation of the developed land surface model into mesoscale meteorological model is used to study two heavy rainfall events in the 2009 and 2010 flood seasons in test region. Results demonstrates that the meteorological elements in the surface layer are influenced in most extent by land surface water cycle process, such as soil moisture, evaporation, soil temperature, and cloud structure and heat distribution. The developed land surface hydrological model can represent land surface water cycle and runoff production process reasonably and perform better in runoff simulation than the traditional land surface model (LSM). The incorporated meteorological-hydrological feedback model surface layer forecasts including precipitation were improved in quantity and distribution. It has a good application prospect

Key words: Land surface model, the curve of repletion of storage, Muskingum-Cunge, Mesoscale Meteorological model, China

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