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Modeling of Land Surface Flux on the regional climate of the Tibetan Plateau

Weiqiang Ma (1,2), Yaoming Ma (1,2), Zeyong Hu (3,2)

(1) Institute of Tibetan Plateau Research, Chinese Academy of Sciences, Atmospheric Sciences, Beijing, China (wqma@itpcas.ac.cn), (2) CAS Center for Excellence in Tibetan Plateau Earth Sciences, Beijing, 100101, (3) Cold and Arid Regions Environmental and Engineering Research Institute, Chinese Academy of Sciences, Lanzhou, Gansu 730000, China

Land surface heat fluxes over the heterogeneous landscape of the Tibetan Plateau can serve as boundary conditions for modeling the regional climate and the Asian monsoon system. The Weather Research and Forecasting (WRF) atmospheric modeling system has enabled us to model the land surface heat flux through sensitivity experiments that utilize in-situ observation data and the regional land-atmosphere exchanges of water and heat fluxes that are foundational to understanding the water and energy cycles present during the Asian monsoon period. A series of sensitivity experiments based on the WRF model and field observations has been proposed and tested for deriving the land surface heat fluxes (surface net radiation flux, soil heat flux, sensible heat flux and latent heat flux) over a heterogeneous land surface. The sensitivity experiments were simulated over the field area of the Coordinated Enhanced Observing Period Asia-Australia Monsoon Project on the Tibetan Plateau (CEOP-CAMP/Tibet), located on the northern Tibetan Plateau of China. A WRF modeling period from July to August 2007 was selected for the summer monsoon conditions. To validate the modeling results, the ground-measured or calculated variables (e.g., net radiation flux, soil heat flux, sensible heat flux and latent heat flux) were compared to the simulated values. The modeling results show that the derived model land surface heat fluxes are in agreement with the land surface observations over the study area in summer. Therefore, the WRF model sensitivity experiments were successful in simulating the land surface heat fluxes over the study area.
In this study, we designed cases for the WRF model, which lead to the following conclusions:
1) The WRF model successfully simulated the surface heat fluxes over the complex land surface of the Tibetan Plateau, including the diurnal variation. The modeling eigenvalues were similar to the observations.
2) When the initial fields of soil moisture and vegetation coverage were increased to observed values, we achieved the optimal value from the model simulations. Here, the most obvious was the sensible and latent heat fluxes, as the simulation results tended to the observation value.