Development of an 11-year (2000-2010) land surface energy balance dataset for mainland China

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In the absence of high resolution estimates of the components of surface energy balance for China, we developed an algorithm based on the surface energy balance system (SEBS) to generate a dataset of land-surface energy and water fluxes on a monthly time scale from 2001 to 2010 at a 0.1 × 0.1 degree spatial resolution by using multi-satellite and meteorological forcing data. A remote-sensing-based method was developed to estimate canopy height, which was used to calculate roughness length and flux dynamics. The land-surface flux dataset was validated against "ground-truth" observations from 11 flux tower stations in China. The estimated fluxes correlate well with the stations' measurements for different vegetation types and climatic conditions (average bias = 15.3 Wm^{-2}, RMSE = 26.4 Wm^{-2}). The quality of the data product was also assessed against the GLDAS dataset. The results show that our method is efficient for producing a high-resolution dataset of surface energy flux for the Chinese landmass from satellite data. The validation results demonstrate that more accurate downward long-wave radiation datasets are needed to be able to accurately estimate turbulent fluxes and evapotranspiration when using the surface energy balance model. Trend analysis of land-surface radiation and energy exchange fluxes revealed that the Tibetan Plateau has undergone relatively stronger climatic change than other parts of China during the last 10 years. The capability of the dataset to provide spatial and temporal information on water-cycle and land–atmosphere interactions for the Chinese landmass is examined. The product is free to download for studies of the water cycle and environmental change in China.

Key words: Surface energy balance, turbulent flux, parameterization, flux network