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Using field observations and satellite data for the study of energy and water cycle over heterogeneous landscape of the Tibetan Plateau

Yaoming Ma

Chinese Academy of Sciences, Institute of Tibetan Plateau Research, Beijing, China (ymma@itpcas.ac.cn, +86 10 6284-9886)

The Tibetan Plateau, with the most prominent and complicated terrain on the globe and an elevation of more than 4000 m on average above sea leave (msl), is often called the "Third Pole" due to its significance parallel with Antarctica and the Arctic. The exchange of energy and water vapor between land surface and atmosphere over the Tibetan Plateau area play an important role in the Asian monsoon system, which in turn is a major component of both the energy and water cycles of the global climate system. Supported by the Chinese Academy of Sciences and some international organizations, a Third Pole Environment (TPE) Research Platform (TPEP) is now implementing over the Tibetan Plateau and surrounding area. The background of the establishment of the TPEP, the establishing and monitoring plan of long-term scale (5-10 years) of the TPEP will be shown firstly. Then the preliminary observational analysis results, such as the characteristics of land surface heat fluxes,CO_2 flux and evapotranspiration (ET) partitioning (diurnal variation, inter-monthly variation and vertical variation etc), the characteristics of atmospheric and soil variables, the structure of the Atmospheric Boundary Layer (ABL) and the turbulent characteristics have also been shown in this study.
The study on the regional distribution of land surface heat fluxes and ET are of paramount importance over heterogeneous landscape of the Tibetan Plateau. The parameterization methods based on satellite data (AVHRR and MODIS) and Atmospheric Boundary Layer (ABL) observations have been proposed and tested for deriving surface reflectance, surface temperature, net radiation flux, soil heat flux, sensible heat flux, latent heat flux and ET over heterogeneous landscape. As cases study, the methods were applied to the whole Tibetan Plateau area. Four scenes of AVHRR data and four scenes of MODIS data were used in this study. To validate the proposed methods, the ground-measured surface reflectance, surface temperature, net radiation flux, soil heat flux, sensible heat flux and latent heat flux in the TPEP are compared to satellite derived values. The results show that the derived surface variables, land surface heat fluxes and ET over the study area are in good accordance with the land surface status. These parameters show a wide range due to the strong contrast of surface features. And the estimated land surface variables and land surface heat fluxes are in good agreement with ground measurements, and all their absolute percent difference is less than 10% in the validation sites. It is therefore concluded that the proposed methods are successful for the retrieval of land surface variables and land surface heat fluxes over heterogeneous landscape of the Tibetan Plateau area. Further improvement of the methods and its applying field were also discussed.