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Combining Landsat-7 ETM data with field observations for regional land surface heat fluxes over heterogeneous landscape of the Tibetan Plateau

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The Tibetan Plateau is often called the "Third Pole" of the earth due to its significance parallel with Antarctica and the Arctic. As a unique geological and geographical unit, the Tibetan Plateau dramatically impacts the world's environment and especially controls climatic and environmental changes in China, Asia or even in the Northern Hemisphere. The Tibetan Plateau, therefore, provides a field laboratory for studying global climate change. Due to its heterogeneous topographic characteristics, the plateau surface absorbs a large amount of solar radiation energy, and undergoes dramatic seasonal changes of surface heat and water fluxes. The lack of quantitative understanding of interactions between the land surface and atmosphere makes it difficult to understand the complete energy and water cycles over the Tibetan Plateau and their effects on global climate change with numerical models. The study on the regional distribution of land surface heat fluxes is of paramount importance for the study of interactions between the land surface and atmosphere over heterogeneous landscape of the Tibetan Plateau. How can we determine the regional heat fluxes over heterogeneous landscape of the Tibetan Plateau? Remote sensing from satellites offers the possibility to derive regional distribution of land surface heat fluxes over heterogeneous land surfaces.

In this study, a parameterization method based on Landsat-7 ETM data and field observations has been proposed and tested for deriving surface reflectance, surface temperature, NDVI, MSAVI, vegetation coverage, LAI, net radiation flux, soil heat flux, sensible heat flux and latent heat flux over heterogeneous landscape. As a cases study,

the methodology was applied to the experimental area of the CAMP/Tibet (CEOP (Coordinated Enhanced Observing Period) Asia-Australia Monsoon Project (CAMP) on the Tibetan Plateau), which located at the central Tibetan Plateau. Five scenes of Landsat-7 ETM data were used in this study. To validate the proposed methodology, the ground-measured surface reflectance, surface temperature, net radiation flux, soil heat flux, sensible heat flux and latent heat flux are compared to Landsat-7 ETM derived values. The results show that the derived surface variables and land surface heat fluxes in five different months 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 methodology is successful for the retrieval of land surface variables and land surface heat fluxes using the Landsat-7 ETM data and filed observations over the study area.