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Surface Energy Budget Characteristics and Surface Energy Imbalance over Chinese Loess Plateau

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Abstract

Field observation of land-surface processes is a fundamental approach to quantitatively measure mass and energy exchanges between the land surface and the atmosphere. Chinese Loess Plateau, a unique landscape in the world, is known as a transitional zone both in terms of climate and ecosystem. Land-surface process measurement helps to better understand the aridity trend and the ecosystem change over Chinese Loess Plateau. Based on data collected at the Semi-Arid Climate and Environment Observatory of Lanzhou University (SACOL) from June 2008 to June 2010, we analyzed the characteristics of land surface radiation and energy budget in summer, as well as the surface energy imbalance issues over Chinese Loess Plateau. Main results are concluded as follows:

(1)By studying impacts of different weather conditions on micrometeorological characteristics, the clouds and the precipitation contribute disturbances by about 25[U+FF05] to each component of energy balance. Weakening impact of clouds and precipitation on surface energy budget is much stronger than that in desert and Gobi region. Furthermore, it shows that the mean climatic characteristics in summer relatively close to those of cloudy days.

(2)To investigate the land surface energy imbalance over the Loess Plateau, we estimated the heat storage associated with change of air temperature and humidity as well as the energy stored in plants due to the photosynthesis, which determines the vertical water transport and soil temperature at the shadow soil layers. The peaks of averaged diurnal variation of energy storages by air and plant photosynthesis reach 1.5 and 2.0 W m-2 respectively. In addition, the peak of diurnal variation of mean heat flux transferred by vertical water movement can reach nearly 8.0 W m-2. The closure of energy balance is improved from 88.1% to 89.6% by adding the three additional energy terms mentioned above to the energy balance equation. We found that the special climate background and vegetation coverage over Chinese Loess Plateau essentially lead to the significant differences of energy storages between this region and other climatic districts.