

Annual variations in the surface radiation budget and soil water and heat content in the Upper Yellow River area

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Measurements taken between July 2006 to May 2007 at the Maqu station in the Upper Yellow River area were used to study the surface radiation budget and soil water and heat content in this area. These data revealed distinct seasonal variations in downward shortwave radiation, downward longwave radiation, upward longwave radiation and net radiation, with larger values in the summer than in winter because of solar altitudinal angle. The upward shortwave radiation factor is not obvious because of albedo (or snow). Surface albedo in the summer was lower than in the winter and was directly associated with soil moisture and solar altitudinal angle. The annual averaged albedo was 0.26. Soil heat flux, soil temperature and soil water content changed substantially with time and depth. The soil temperature gradient was positive from August to February and was related to the surface net radiation and the heat condition of the soil itself. There was a negative correlation between soil temperature gradient and net radiation, and the correlation coefficient achieved a significance level of 0.01. Because of frozen state of the soil, the maximum soil thermal conductivity value was $1.21 \text{ W m}^{-1}\text{C}^{-1}$ in January 2007. In May 2007, soil thermal conductivity was $0.23 \text{ W m}^{-1}\text{C}^{-1}$, which is the lowest value measured in the study, likely due to the fact that the soil was drier than in other months. The soil thermal conductivity values for the four seasons were 0.27, 0.38, 0.55 and $0.83 \text{ W m}^{-1}\text{C}^{-1}$, respectively.