Geophysical Research Abstracts,
Vol. 10, EGU2008-A-10377, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-10377
EGU General Assembly 2008

Estimation of Instantaneous Shortwave Radiation for all Sky Conditions Using MODIS

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Shortwave radiation is an essential component of net radiation balance. Significant progress has been made for the estimation of shortwave radiation and its components (incoming and outgoing) for clear sky conditions using remote sensing data. Estimation accuracy for cloudy days remain elusive because passive satellites, such as MODIS, cannot observe the surface of the earth during cloudy conditions. We propose a methodology to estimate shortwave net radiation by using only MODIS based-remote sensing information to produce instantaneous spatial shortwave radiation maps. We will use remotely sensed cloud fraction and cloud top temperature to develop a pixel-by-pixel estimation of fluxes. We build on our previously developed and tested algorithm for estimation of shortwave radiation for clear skies. Shortwave radiation for cloudy days is estimated by using a combination of linear regression models which relate cloud fraction to empirical parameters. The model has been validated using ground based observations. A methodology recommended by the Food and Agriculture Organization to calculate shortwave radiation has been tested at several ground sites over the South Great Plains in the United States. MODIS cloud data (MOD06_L2) is extensively used to extract cloud cover information. Primary results, based on RMSE and bias, indicate that the proposed methodology can provide reliable estimates of shortwave radiation for cloudy and clear sky conditions. We plan to extend our methodology to develop distributed estimates of net radiation for all sky conditions.