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Estimating Clear-Sky Land Surface Longwave Radiation Budget from MODIS Data

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Radiative transfer based approaches

Abstract

Surface longwave radiation budget components, including surface upwelling longwave radiation (SULR), surface downwelling longwave radiation (SDLR), and surface net longwave radiation (SNLR), are important parameters in Numerical Weather Prediction (NWP) and hydrological modeling. Today, high resolution NWP and hydrological models (up to 1km) have been widely used in short range forecasting, weather hazards warning, as well as in the next generation operational NWP studies. However, no satellite SLBR products with comparable spatial resolution are available, which limits the accuracy of the high resolution model predictions.

In this study, new statistical models for estimating clear sky SULR, SDLR, and SNLR from the Moderate Resolution Imaging Spectroradiometer (MODIS) data (1km spatial resolution) were developed using more than 1500 high resolution MODIS atmosphere profiles and the Moderate Resolution Transmittance Code Version 4 simulation. Land surface emissivity effect was considered explicitly by incorporating UCSB Emissivity Spectra in the simulation procedures.

Preliminary results show that linear models using MODIS TOA radiances can account for 99% and 98% of variations in SULR and SDLR, with standard errors of 5.2 W/m2 and 12.7 W/m2, respectively. Non-linear (polynomial) model produces better fitting result for SNLR, with correlation coefficient of 74 % and standard error of 7.9 W/m2. The models were evaluated using collated ground measurements.