IRS2012-543
International Radiation Symposium 2012
Dahlem Cube, Berlin, Germany, 06 – 10 August 2012

Correcting Surface Solar Radiation Modeled by two Data Assimilation Systems for Micrometeorological Research

L. Zhao and X. Lee
School of Forestry and Environmental Studies, Yale University, New Haven, CT, United States

Abstract: Solar radiation at Earth's surface is an important driver of micrometeorological and ecological processes. Because this variable is not among the measurements made at standard surface weather stations, models of various complexity are used to estimate its temporal and spatial distributions. Atmospheric reanalysis is one such class of models. In reanalysis model systems, solar radiation at the surface is calculated with radiative transfer models (RTM). The objective of this study is to evaluate the accuracy of the solar radiation products produced by NARR (North American Regional Reanalysis) and GEOS-5 DAS (Version 5 of the Goddard Earth Observing System Data Assimilation System) against the FLUXNET measurements in North America. We found that both assimilation systems systematically overestimated the surface solar radiation flux on the daily, monthly and annual scales. The errors were large under cloudy skies and small under clear skies. The average bias ratio was +19.6% in NARR and +11.3% in GEOS-5 respectively. The inaccurate description of sky clearness in the RTM appeared to be the primary factor that resulted in the overestimation. An algorithm was proposed to correct the model errors. Results show that the algorithm can remove the systematic bias errors for both FLUXNET calibration sites (sites used to establish the algorithm) and independent validation sites. The average bias ratio was reduced to +1.5% in NARR and +0.4% in GEOS-5 after correction.

Key words: incoming solar radiation, clearness index, global energy budget, atmospheric absorption