Geophysical Research Abstracts
Vol. 15, EGU2013-7368, 2013
EGU General Assembly 2013

Uncertainties in estimating Normalized Difference Temperature Index from TOA radiances

jian peng (1,2), yuanbo liu (3), and alexander loew (1)

(1) Max-Planck-Institute for Meteorology, KlimaCampus, 20146 Hamburg, Germany, (2) International Max Planck Research School on Earth System Modelling, 20146 Hamburg, Germany, (3) State Key Laboratory of Lake Science and Environment, Nanjing Institute of Geography and Limnology, Chinese Academy of Sciences, Nanjing 210008, China

The widely used surface temperature/vegetation index (T_s/NDVI) triangle method provides an effective way to estimate surface turbulent energy fluxes and soil moisture. This type of method mainly relies on the Normalized Difference Temperature Index (NDTI), which is usually calculated from land surface temperature (LST). However, retrieval of LST from remote sensing data requires atmospheric correction procedures, which are often difficult and troublesome. Our study investigates the feasibility of determining NDTI using top of the atmosphere (TOA) radiances, instead of satellite-derived LST. A thorough assessment of the uncertainties in NDTI estimates for different atmospheric and surface conditions is performed. It is shown that NDTI can be estimated from TOA radiances with an accuracy of 90% if the spatial variabilities of atmospheric parameters (water vapor, effective atmospheric temperature) and surface emissivity are below 10%, 4 K and 0.05, respectively. A test study is performed using Moderate Resolution Imaging Spectroradiometer (MODIS) data over a heterogeneous area of the Poyang Lake basin of China for six consecutive image acquisitions. When the spatial variations of the surface emissivity, effective atmospheric temperature and water vapor are respectively less than 0.01, 1 K and 0.2 g cm^{-2}, the TOA radiance-calculated NDTI value and LST-determined NDTI value are quite close with root mean square deviation (RMSD) values and biases varying from 0.033 to 0.051 and from -0.004 to 0.014. The high coefficient of determination (R^2) values, ranging from 0.904 to 0.939, indicated that the use of TOA radiances appears to be adequate for calculating NDTI in these studies. Overall, the proposed algorithm requires less a prior information on the atmospheric state while providing NDTI estimates at a similar level of accuracy than obtained using atmospherically corrected LST data products. It therefore provides a useful alternative for determining NDTI from satellite data.