

Validation of the V5 MODIS Land-surface Temperature product Worldwide

Zhengming Wan¹, and Zhao-Liang Li^{2,3}

¹ ICESSE, University of California, Santa Barbara, CA 93106, USA

² TRIO/LSIIT/ENSPS, Parc d'Innovation, Bd. Sebastien Brant, BP10413, 67412 Illkirch, France

³ Institute of Geographic Science and Natural Resources Research, Beijing 100101, China

Abstract:

A series of validations have been made for the collection-5 or version-5 (C5 or V5) Terra and Aqua MODIS level-2 Land-Surface Temperature (LST) products with the conventional temperature-based (T-based) and/or radiance-based (R-based) approaches at 32 sites worldwide including lakes, grasslands, croplands, forest, shrubland and urban sites in different continents, snow/ice fields in Antarctica, Arctic and Greenland, bare soil and desert areas in a wide LST range in different seasons and years. The LST errors are within $\pm 2\text{K}$ (within $\pm 1\text{K}$ in most cases) for all the sites but a few sites, most obviously in one bare soil site and two desert sites. For the first time, the R-based approach provided quantitative estimates of larger LST errors: ranging from -2K to -3.4K at a bare soil site west of Salton Sea, California, in cases when LSTs are larger than the air temperature at the surface level by more than 16K and the column water vapor is larger than 1.5cm (Wan and Li, 2008); the LSTs underestimated by larger than 2K in a few cases at the desert site near South of Valley University, Egypt; and ranging from -2K to -5.3K at the desert site near In-salah, Algeria. By analyzing the relationship between the LST error and $d(\text{Tb}31 - \text{Tb}32)$, the difference in brightness temperatures in bands 31 and 32 in the MODIS data minus the difference in the radiative transfer simulation data based on radio sounding data of atmospheric water vapor and temperature profiles, at three desert sites (two in Egypt and one in Algeria) and their surrounding areas, we can attribute the large LST errors to the large errors in surface emissivity values in bands 31 and 32 estimated from land-cover types in desert regions. It is planned to refine the V5 generalized split-window algorithm and the day/night algorithm to keep their good performance in most parts of the Earth's land and to improve their performance in bare soil and desert regions in the reprocessing and new forward processing for the C6 MODIS Land products.

Corresponding author: Zhengming Wan

Zhengming Wan

Mailing address: ICESSE, University of California, Santa Barbara, CA 93106, USA

E-mail: wan@icesse.ucsb.edu

Zhao-Liang Li

Mailing address: TRIO/LSIIT/ENSPS, Parc d'Innovation, Bd. Sebastien Brant, BP10413, 67412 Illkirch, France

Institute of Geographic Science and Natural Resources Research, Beijing 100101, China

E-mail: li@lsitit.u-strasbg.fr