Uncertainty quantification in operational algorithms to retrieve land surface temperature from Himawari-8/AHI data

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Land surface temperature (LST) is a key parameter of land–atmosphere interaction on various scales. Therefore, the LST has potential applications in environmental studies, such as the surface energy balances and vegetation monitoring. Himawari-8, a new generation of Japanese geostationary satellite, began the observation from July 2015. The Advanced Himawari Imager (AHI) onboard Himawari-8 features high spatial (about 2 km) and temporal resolution (10 min), and three thermal infrared bands (band 13, 14, and 15 centered at 10.4, 11.2, and 12.4 μm, respectively). The observation area of Himawari-8 has many islands, complex terrains, and megacities, causing a large spatial variation in LST. Therefore, it is important to compare the performance of the different LST algorithms and evaluate the reliabilities of the LSTs in various land covers and atmospheric environments.
In this study, we compared the sensitivities to their input data between three different LST retrieval algorithms; a nonlinear split-window algorithm proposed by Sobrino and Raissouni (2000) (*NSW_sob*), a NSW proposed by Wan (2014) (*NSW_wan*), and a nonlinear three-band algorithm developed by Yamamoto et al. (2018) (*NTB_yam*). In addition, the LST algorithm, which was selected as the most accurate of the three, was validated in various land covers and seasons by *in-situ* LST. The sensitivity analysis of the LST algorithms were performed using the data simulated by the MODTRAN6 radiative transfer code. Inputs of MODTRAN6 were atmospheric profiles of SeeBor (7204 profiles), surface emissivities from ASTER spectral library (70 types), response functions of AHI three thermal infrared bands, and satellite zenith angle ranging 0–70 °. The *in-situ* LST were estimated from the upward longwave radiation data provided by AsiaFlux and OzFlux.
The sensitivity analysis showed that the *NTB_yam* has the highest robustness to the uncertainties of input data and highest accuracies under hot, humid, and high view-zenith angle situations. Regarding validation, we are waiting for the results of the analysis.

Keywords: Himawari-8, Land surface temperature

