Land surface temperature retrieval for Himawari-8 Advanced Himawari Imager (AHI) data

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Land surface temperature (LST) is the radiative skin temperature of land surfaces, which plays vital roles in Earth surface energy balance and various land surface processes at local and global scales. It has been newly endorsed as an essential climate variable (ECV) by the Global Climate Observing System (GCOS) in 2016, recognizing its importance to characterize climate change and corresponding impacts. Products derived from satellite data has provided the unique opportunity to monitor LST dynamics at various spatial (e.g., regional and global) and temporal (e.g., daily, monthly) scales. However, current LST products still cannot meet requirements for climate studies proposed by GCOS (i.e., high accuracy and precision at 3-hour and 1-km). Fortunately, with rapid increasing interests and developing technologies, new satellite sensors have been launched into space for monitoring LST together with other ECVs. In 2015, Japanese Meteorological Agency (JMA) has launched geostationary satellite Himawari 8 with Advance Himawari Imager (AHI) to replace its predecessor MTSAT-2 for numerical weather prediction and environmental monitoring. Because of its frequent scanning mode (10 minute), improved spatial resolution and sensor characteristics, AHI data has provided the unique opportunity to monitor LST dynamics over the rapid changing Asia/Oceania regions. In this study, we develop the emissivity explicit split window algorithm to retrieve LST using AHI split window channels (11.2μm and 12.4 μm). The emissivity data used in the retrieval are dynamic values corresponding to surface vegetation and snow dynamics. Based on ground station measurements in China and Australia, retrieved AHI LST has shown promising accuracy and precision. However, the retrieval performance have notable dependence on solar zenith angle and land surface types. Daytime LST retrieval over sparse vegetated areas (e.g., woodland and shrubland) has notable overestimation especially in summer time. Cross comparing with operational polar-orbiting satellite LST products, AHI has shown good consistency with MODIS and VIIRS LST despite different sensor characteristics and viewing geometry. This algorithm is originally developed for GOES-R Advance Baseline Imager (ABI) data. Since AHI and ABI share almost the same sensor characteristics, this study presents the feasibility and effectiveness of the algorithm on AHI data. In the future, by combining AHI LST with LST products derived from Meteosat SEVIRI data and upcoming GOES-R ABI data, the LST community could ultimately provide essential product to promptly monitor land surface thermal anomalies at regional and global scales.