Infrared Land Surface Emissivity Diurnal Variation from SEVIRI using GOES-R Algorithm

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Infrared (IR) land surface emissivity (LSE) with a high temporal and a spatial resolution is very important for deriving other products using IR radiance measurements as well as assimilating IR radiances in numerical weather prediction (NWP) models over land. However, no study has addressed the infrared (IR) land surface emissivity (LSE) temporal variations within a relatively short period of time, specially the diurnal variations. Commonly used emissivity databases almost always assume emissivity does not change within a month. However, laboratory measurements have shown that emissivity increases by 1.7% to 16% when soil moisture content becomes higher, especially in sandy soils in the 8.2–9.2 micron range. And a clearly defined diurnal pattern (wave) of decreasing surface soil moisture during the day and recovery (or increased soil moisture) at night was observed. Therefore, it is expected that LSE has a diurnal wave-pattern variation with small values during daytime and larger values during nighttime. The GOES-R ABI land surface emissivity (LSE) algorithm is applied to SEVIRI radiance measurements over the Sahara Desert during August 2006. Preliminary results show that 8.7 micron emissivity has a significant diurnal wave-pattern variation, with maximum values during nighttime and minimum values during daytime. 10.8 micron emissivity also shows a similar diurnal variation, but with a less profound amplitude as 8.7 micron. 12 micron emissivity has an even less profound diurnal variation, and an opposite pattern as 8.7 and 10.8 micron. Evidence swill be provided to demonstrate that the retrieved diurnal wave-pattern variations of 8.7 micron is from the SEVIRI radiance measurements, not an artifact from the retrieval algorithm. To indirectly evaluate the retrieved LSE, the retrieved land surface temperature (LST) is compared with the in-situ LST measurements at the Rust Mijn Ziel (RMZ) farm in Namibia, one of four permanent Land Surface Analysis (LSA) Satellite Applications Facility (SAF) LST validation stations, for August 2009. The results will be presented.