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MSG-SEVIRI and EOS-MODIS LST Product Validation by Using a Developed Thermal-Infrared Data Acquisition System

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Multidirectional thermal infrared (TIR) measurements are convenient to describe the radiative characteristics of natural surfaces and to obtain accurate Land Surface Temperature (LST). An autonomous system for field angular thermal-infrared (TIR) radiometric data acquisition was developed with the aim of being easily deployed at any traditional meteorological tower station. The device scans land and sky hemispheres at several angular steps to attain remotely sensed land and sky temperatures by means of a single infrared radiometer. Apogee radiometers were selected to be included in the prototype not only by their reduced size and easy functioning but also by their measurement accuracies as proved in calibrations against NIST blackbodies ($\pm$ 0.2 K at 293-303 K). During the 2012 summer, a prototype of the device was deployed at an extensive, homogeneous and flat cultivated-rice area widely used in experimental CAL/VAL campaigns of satellite TIR sensors (39.274°N, $-$0.317°E in WGS-84; 2.5 m above sea level). The measured TIR data were processed to obtain ground-truth LST and compared with the operational LST products provided by two satellite TIR instruments: MODIS on board EOS-Terra and EOS-Aqua platforms and SEVIRI on board of the geostationary MSG. Both the MSG-SEVIRI and the EOS-MODIS LST products were shown to work with uncertainties within those expected, but a general overestimation was observed for the MSG-SEVIRI product (with a median between product and ground LST data of + 0.6 K and a robust standard deviation (RSD) of $\pm$ 1.0K) and a slight underestimation, especially for off-nadir observation angles, was observed for the EOS-MODIS LST product (i.e. a median of -0.10 K and a RSD of $\pm$ 1.2K for all the MODIS-viewing angles, but a median of -0.7 K and a RSD of $\pm$ 1.5 K for angles larger than 40°). Satellite LST product validation will be extended by using data collected by the autonomous and angular system setup at different sites in Eastern Spain. This type of ground observations, and thus the retrieved LST data, can be used to better understand many land–atmosphere interactions, such as the net radiation partitioning into latent and sensible heat fluxes, angular emissive properties of surfaces, or the monitoring of partly cloudy sky TIR emission for the appropriate correction of LST by the sky reflected radiance.