Geophysical Research Abstracts
Vol. 18, EGU2016-16484-3, 2016
EGU General Assembly 2016

Innovative approach to retrieve land surface emissivity and land surface temperature in areas of highly dynamic emissivity changes by using thermal infrared data

Sascha Heinemann (1), Javier Muro (2), Andreas Burkart (3), Johannes Schultz (1), Frank Thonfeld (1), and Gunter Menz (1)

(1) Remote Sensing Research Group (RSRG), University of Bonn, Germany, (2) Center for Remote Sensing of Land Surfaces (ZFL), University of Bonn, Germany, (3) Forschungszentrum Jülich (FZJ), IBG-2, Germany

The land surface temperature (LST) is an extremely significant parameter in order to understand the processes of energetic interactions between the Earth's surface and the atmosphere. This knowledge is significant for various environmental research questions, particularly with regard to climate change. The current challenge is to reduce the higher deviations during daytime especially for bare areas with a maximum of 5.7 Kelvin. These temperature differences are time and vegetation cover dependent. This study shows an innovative approach to retrieve land surface emissivity (LSE) and LST by using thermal infrared (TIR) data from satellite sensors, such as SEVIRI and AATSR.

So far there are no methods to derive LSE/LST particularly in areas of highly dynamic emissivity changes. Therefore especially for regions with large surface temperature amplitude in the diurnal cycle such as bare and uneven soil surfaces but also for regions with seasonal changes in vegetation cover including various surface areas such as grassland, mixed forests or agricultural land different methods were investigated to identify the most appropriate one.

The LSE is retrieved by using the day/night Temperature-Independent Spectral Indices (TISI) method, while the Generalised Split-Window (GSW) method is used to retrieve the LST. Nevertheless different GSW algorithms show that equal LSEs lead to large LST differences. For bare surfaces during daytime the difference is about 6 Kelvin. Additionally LSE is also measured using a NDVI-based threshold method (NDVITHM) to distinguish between soil, dense vegetation cover and pixel composed of soil and vegetation. The data used for this analysis were derived from MODIS TIR.

The analysis is implemented with IDL and an intercomparison is performed to determine the most effective methods. To compensate temperature differences between derived and ground truth data appropriate correction terms, by comparing derived LSE/LST data with ground-based measurements, are developed. One way to calibrate LST retrievals is by comparing the canopy leaf temperature of conifers derived from TIR data with the surrounding air temperature (e.g. from synoptic stations).

Prospectively, the derived LSE/LST data become validated with near infrared data obtained from an UAV with a TIR camera (TIRC) onboard, and is also compared with ground-based measurements.

This study aims to generate an appropriate method to eventually obtain a high correlation between LSE/LST, TIRC and ground truth data by integrating developed correction terms.