Geophysical Research Abstracts
Vol. 15, EGU2013-12518-1, 2013
EGU General Assembly 2013

Temporal analysis of emissivity values in urban areas from airborne hyperspectral thermal sensors

Michele Lazzarini (1), Zina Mitraka (2), Michael Berger (2), and Hosni Ghedira (1)

(1) Research Center for Renewable Energy Mapping and Assessment, Masdar Institute,United Arab Emirates (mlazzarini@masdar.ac.ae), (2) European Space Agency, Via Galileo Galilei, 00044 Frascati, Italy

Land Surface Temperature (LST) is one of the key parameters in the physics of land surface processes on regional and global scales, combining the results of surface – atmosphere interactions related to energy fluxes such as sensible and latent heat, and also of hydrological cycle. Accurate LST mapping has the potential to support applications in various areas and especially when referring to the urban environment, as for example the urban heat island monitoring. Spatiotemporal distributions of LST are estimated with the use of satellite remote sensing sensors. To accurately estimate LST, measured radiance should be corrected for spectral emissivity.
Emissivity provides a measure of the inherent efficiency of the surface to convert heat energy into radiant energy. Surface emissivity varies largely in space and time due to the strong heterogeneity of land surface characteristics, such as the topography, the vegetation cover and the soil and its physical properties. The emissivity dependence on the surface physical condition emerges the study of temporal effects on emissivity. It is important to quantify the temporal variations of emissivity and their extend and the effect on the estimation of LST.
The present work aims at contributing to a better understanding of the temporal variation of emissivity in urban environments. Thermal data acquired with the Airborne Hyperspectral Scanner (AHS) over Madrid, Spain and Athens, Greece during two ESA Campaigns (namely Desirex and Thermopolis) was used. A total of 30 and 28 images were acquired respectively for each city, covering a time period of six summer days, both day and night. Emissivity and LST were also estimated in the framework of the campaigns for seven spectral AHS bands between 7.5 – 12.0 μm using the Temperature Emissivity Separation Algorithm. Field emissivity and LST measurements are also available from the campaign.
A statistical analysis was performed to assess the variations of emissivity in time, to identify the behavior of the different surface types found in urban environments and to quantify the differences arising between day and night. Representative areas corresponding to different surface types were selected for the analysis by considering homogenous areas to avoid mixed pixels. Some temporal variations of emissivity values were observed in all cases and they were also depending on the surface type and the specific thermal bands.