Geophysical Research Abstracts
Vol. 17, EGU2015-3851-3, 2015
EGU General Assembly 2015

Spectral characterization of surface emissivities in the thermal infrared

Raquel Niclòs (1), Maria Mira (2), Enric Valor (1), Diego Caselles (1), Vicente García-Santos (1), Vicente Caselles (1), and Juan M. Sánchez (3)

(1) Department of Earth Physics and Thermodynamics. University of Valencia. 46100 Burjassot, Spain., (2) Grumets Research Group. Dep. Geography. Universitat Autònoma de Barcelona. 08193 Bellaterra, Catalonia, Spain., (3) Applied Physics Department. University of Castilla-La Mancha. 13400 Almadén-Ciudad Real, Spain

Thermal infrared (TIR) remote sensing trends to hyperspectral sensors on board satellites in the last decades, e.g., the current EOS-MODIS and EOS-ASTER and future missions like HyspIRI, ECOSTRESS, THIRSTY and MISTIGRI. This study aims to characterize spectrally the emissive properties of several surfaces, mostly soils. A spectrometer ranging from 2 to 16 μm, D&P Model 102, has been used to measure samples with singular spectral features, e.g. a sandy soil rich in gypsum sampled in White Sands (New Mexico, USA), salt samples, powdered quartz, and powdered calcite. These samples were chosen for their role in the assessment of thermal emissivity of soils, e.g., the calcite and quartz contents are key variables for modeling TIR emissivities of bare soils, along with soil moisture and organic matter. Additionally, the existence of large areas in the world with abundance of these materials, some of them used for calibration/validation activities of satellite sensors and products, makes the chosen samples interesting. White Sands is the world's largest gypsum dune field encompassing 400 km̂2; the salt samples characterize the Salar of Uyuni (Bolivia), the largest salt flat in the world (up to 10,000 km̂2), as well as the Jordanian and Israeli salt evaporation ponds at the south end of the Dead Sea, or the evaporation lagoons in Aigües-Mortes (France); and quartz is omnipresent in most of the arid regions of the world such as the Algodones Dunes or Kelso Dunes (California, USA), with areas around 700 km̂2 and 120 km̂2, respectively.

Measurements of target leaving radiance, hemispherical radiance reflected by a diffuse reflectance panel, and the radiance from a black body at different temperatures were taken to obtain thermal spectra with the D&P spectrometer.

The good consistency observed between our measurements and laboratory spectra of similar samples (ASTER and MODIS spectral libraries) indicated the validity of the measurement protocol. Further, our study showed the high precision achieved by in situ spectra of real covers (instead of laboratory measurements over microscopic portions of samples). Several spectral features were observed: 1) the high spectral contrast of gypsum in the TIR, which emissivity decreases from 0.98 up to 0.70 around 8.6 μm, 2) the broad absorption band of salt in the infrared (low emissivity at wavelengths lower than 16.7 μm), 3) the weak absorption feature of the quartz Reststrahlen bands (low emissivity between 7.7 and 9.7 μm, and near 12.6 μm), and 4) the absorption features near 11.4 μm and 14.0 μm characteristics of calcite.