



Spectral Emissivity of eruptive products using laboratory based FTIR and Thermal Remote Sensing analysis of same area targets

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As less than 10% of the ~1500 active subaerial volcanoes around the world are monitored with appropriate quality, frequency and timeliness, a combination of passive and active remote sensing (RS) are accepted to be a technological solution for bridging critical gaps in volcanic hazard assessment and risk mitigation. We note that the exceptionally large literature available on optical remote sensing of very-high temperature volcanic features lacks detailed spectral emissivity information. Spectral emissivity - defined as the efficiency with which a surface radiates its thermal energy - is seldom measured and mostly assumed or estimated but it's an extremely important variable because of its close relationship with Land Surface Temperature (LST) values.

To fill this gap in knowledge, we designed a multi-stage experiment to measure spectral emissivity of rock samples collected in a grid, scaled to the spatial resolution of High-Resolution multispectral payloads – in particular, Landsat 8's TIRS and OLI – from which spectral emissivity can be derived using their thermal channels.

The experiment is aimed at clarifying the lateral spatial heterogeneity of the spectral emissivity of volcanic targets at the scale of a satellite image/pixel and the capacity for reproducing it from spaceborne observations. After a preparatory step to validate the method, >50 samples were collected according to the above criteria on Mount Etna, Italy in 2017. The suite of lava flow samples (1999 to 2017) were investigated using laboratory based Fourier Transform Infra-Red (FTIR) spectroscopy at 8 to 14.5 μm wavelength range and low-to-moderate temperatures (323 K to 353 K).

To develop a general method of spectral emissivity valuation, the initial investigation presented here assesses the correlation of laboratory measured data with (i) petrological composition and sample properties and (ii) high resolution RS data of the same target.