



## **Surface temperature multiscale monitoring by thermal infrared satellite and ground images at Campi Flegrei volcanic area (Italy)**

Teresa Caputo (1), Eliana Bellucci Sessa (1), Malvina Silvestri (2), Maria Fabrizia Buongiorno (2), Massimo Musacchio (2), David Pieri (3), Fabio Sansivero (1), and Giuseppe Vilardo (1)

(1) INGV, Osservatorio Vesuviano - Naples, Italy (teresa.caputo@ingv.it), (2) INGV, Centro Nazionale Terremoti -Roma, Italy, (3) Jet Propulsion Laboratory of the California Institute of Technology, Pasadena, CA, USA

The Campi Flegrei volcanic area (Italy) is part of the Neapolitan volcanic district, a high volcanic risk area where population and human activities are exposed. It is monitored by INGV multi-platform surveillance networks systems. In this work we performed a comparison of the surface temperature in volcanic areas between satellite imagery in the Thermal Infrared (TIR) bandwidth and infrared thermal scenes acquired by ground cameras network (TIRNet). TIRS on LANDSAT and ASTER on NASA-TERRA provide thermal IR channels to monitor the evolution of the surface temperatures on Campi Flegrei area. The spatial resolution of the TIR LANDSAT8 data is 100 m and ASTER resolution is 90 m. Temporal resolution is 16 days for both satellites. TIRNet network has been developed by INGV-Osservatorio Vesuviano for long-term volcanic surveillance of Campi Flegrei caldera through the acquisition of thermal infrared images. The system is currently composed of 5 permanent stations equipped with FLIR A645SC cameras using a 640x480 resolution IR sensor. Acquisitions and data transmission are managed remotely through technology specially developed at INGV laboratories in Naples. To improve the systematic use of satellite data in the monitoring procedures of Volcanic Observatories, a suitable integration and validation strategy is needed, also considering that current satellite missions do not provide TIR data with optimal characteristics to observe small thermal anomalies that may indicate changes in the volcanic activity. The presented procedure has been applied to the analysis of Solfatara Crater and is based on 2 different steps: 1) two parallel processing chains to produce ground temperature data both from satellite and ground cameras; 2) data integration and comparison. The ground cameras images generally acquire scenes of portion of the crater slopes characterized by significant thermal anomalies due to fumarole fields. In order to compare the satellite and ground cameras scenes, it has been necessary to take into account the observation geometries. All thermal images of the TIRNet have been georeferenced to the UTM WGS84 system, a regular grid of 30x30 meters has been created to select polygonal areas corresponding only to the cells containing the georeferenced TIR images acquired by different TIRnet stations. The surface temperature images retrieved by ASTER and LANDSAT data, have been georeferenced and resampled in cells of 30x30 with a careful control in maintaining the original cell values. The results show a good correspondence between trends of surface ground temperatures and satellite temperatures. This allow to calibrate the surface temperatures of the satellite imagery and to extend the area of analysis of thermal anomalies in the Campi Flegrei caldera. The effectiveness of this methodology allow to integrate the temperature data acquired by TIRNet with the satellite temperature data acquired before the installation of TIRNet ground network.