



The SISTEMA Project contribution in the implementation of the GEO Geohazards Supersite initiative

Giuseppe Vilardo (1), Agata Sangianantoni (1), Sven Borgstrom (1), Luca D'Auria (1,2), Prospero De Martino, (1), Mario Dolce (1), Roberto Isaia (1), Enrica Marotta (1), Marcello Martini (1), Francesco Obrizzo (1), Rosario Peluso (1), Fabio Sansivero (1), Giovanni Scarpato (1), Valeria Siniscalchi (1), Umberto Tammaro (1), Sabrina Tulino (1), Mario Castellano (1), and Francesca Bianco (1)

(1) Istituto Nazionale di Geofisica e Vulcanologia, Sezione di Napoli - Osservatorio Vesuviano, Napoli, Italy, (2) Instituto Volcanológico de Canarias (INVOLCAN), Puerto de la Cruz, Canary Islands, Spain



The SISTEMA Project

SISTEMA Project has been funded by the PO FESR 2007-2013 action, supported by the Campania Region (Italy).

The project fosters the integrated use of multidisciplinary data in order to improve the understanding of the volcanic processes at Campi Flegrei and Ischia and to progress in science and surveillance of the territory according to the rationale of Supersite GEO initiative to Campi Flegrei, currently identified as Permanent Supersite. The mission of SISTEMA is to upgrade the existing monitoring and surveillance systems through the design, purchase and installation of new instrumentation, equipment, technology and methods addressing the need of delivering, with improved rapidity, scientific information for decision makers and end-users.

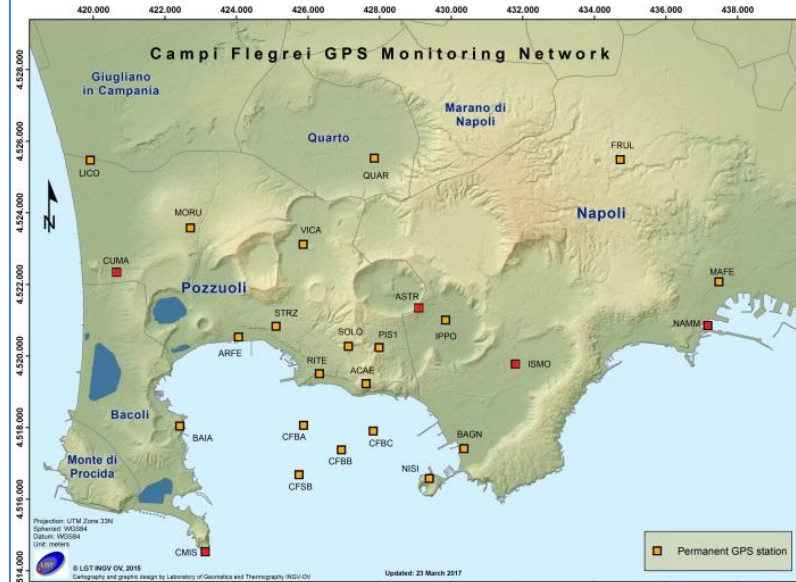
Duplication of the visualization systems at the Campania Region Civil Protection situation room.



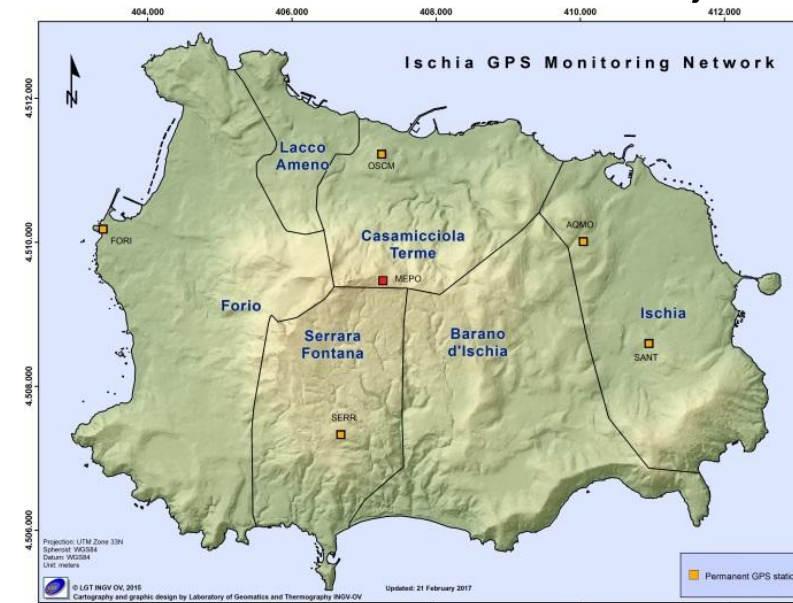
The redundancy of monitoring systems is an important issue to guarantee the full operability during emergencies. The Monitoring Centre of INGV-Osservatorio Vesuviano is currently located within the red zone (potentially at risk of invasion by pyroclastic flows in case of eruption) of Campi Flegrei volcano. For this reason, within the SISTEMA project, we envisioned a backup system which, when needed, could guarantee a shift of the Center in a virtually zero time. This can be achieved by fully duplicating the processing system and the data storage. In case of emergency, it would be required only to switch on the visualization systems in the new Center and transferring the personnel involved in the surveillance activities.

CGPS - InSAR

SISTEMA project has also enabled the development of the permanent GPS and CRs (Corner Reflectors) networks, the latter supporting SAR Interferometry (InSAR), by helping to improve knowledge of the Campi Flegrei deformation field, both on local and wide scale.



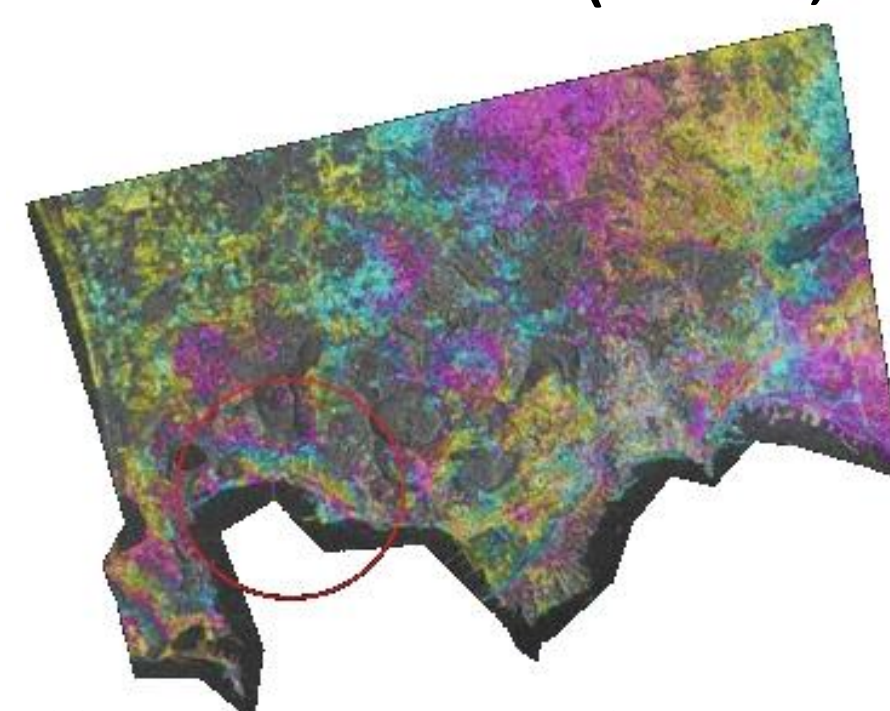
Map of the Campi Flegrei area (left) and Ischia island (right) with new CGPS stations (red squares) implemented by the project SISTEMA.



CGPS sites installed in 2017 with Project SISTEMA to CUMA (left) and MEPO (Ischia) (right).

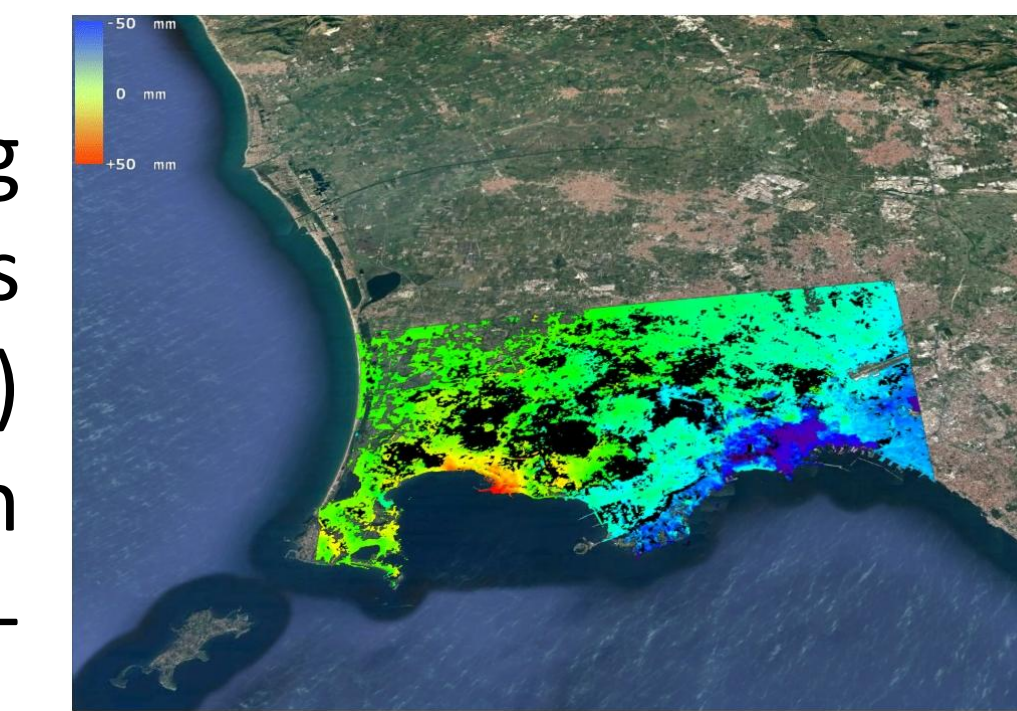


In 2016, 4 stations have been installed (CMIS, NAMM, ISMO, ASTR), while in early 2017, two new stations have been installed (MEPO, CUMA).



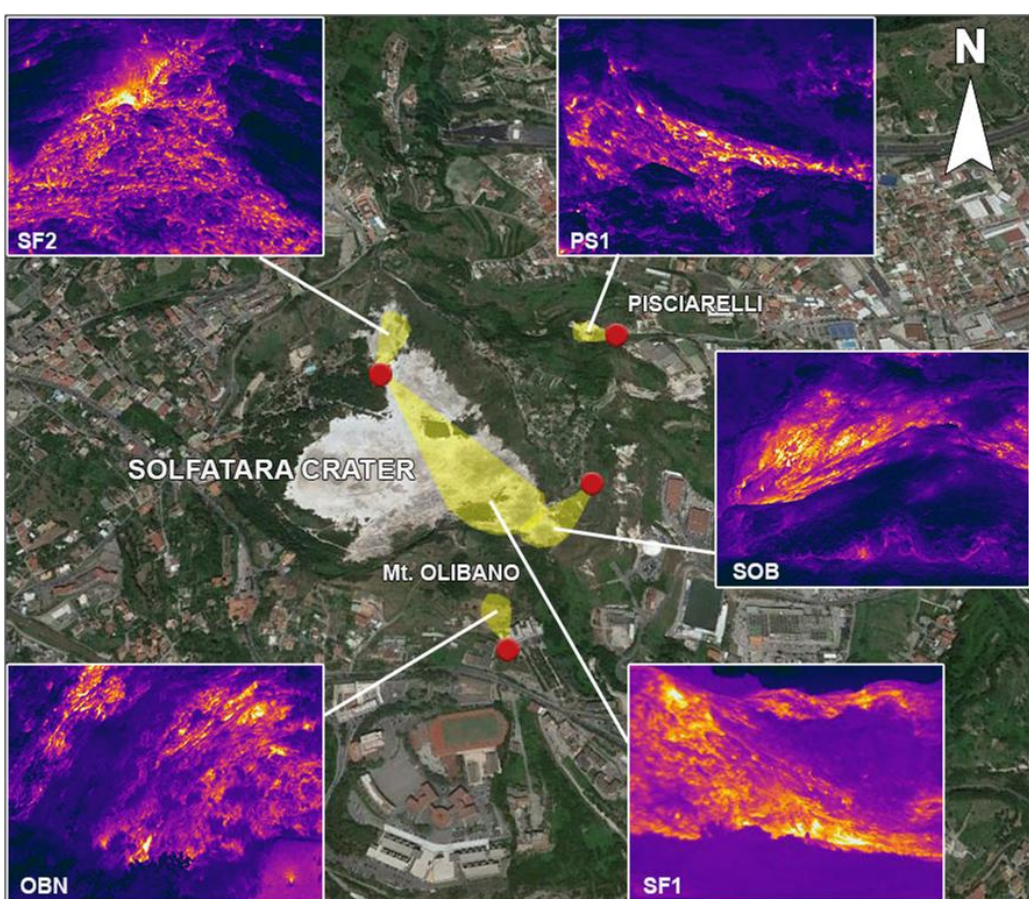
Differential interferogram (Strip Map; ascending orbit). In the red circle the investigated area is shown.

With regard to the InSAR activities (COSMO-SkyMed data processing, StripMap data, ascending orbits), a differential interferogram (left) and the related deformation map (right), are shown as an example. For the analyzed period (21.12.2015-21.06.2016), pointing out a Line Of Sight (LOS) deformation of about 4 cm on the coast-line, the displacement is in a good agreement with continuous GPS measurements, recording an height variation of about 5 cm in the same time-span at RITE GPS station, located in the maximum deformation area.



Deformation map (21.12.2015-21.06.2016).

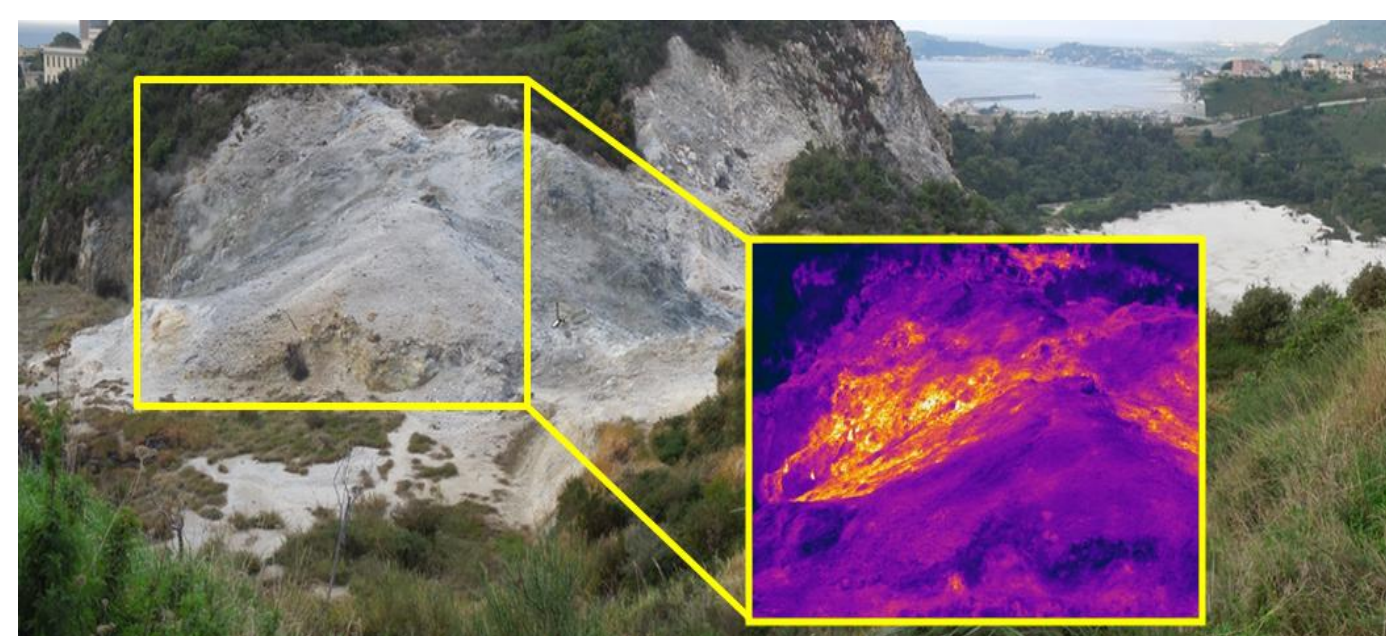
Ground based thermal camera



In order to enhance the heat flux measurements from ground based thermal camera observations, the permanent thermal infrared imagery monitoring network operating at Campi Flegrei has also been improved.

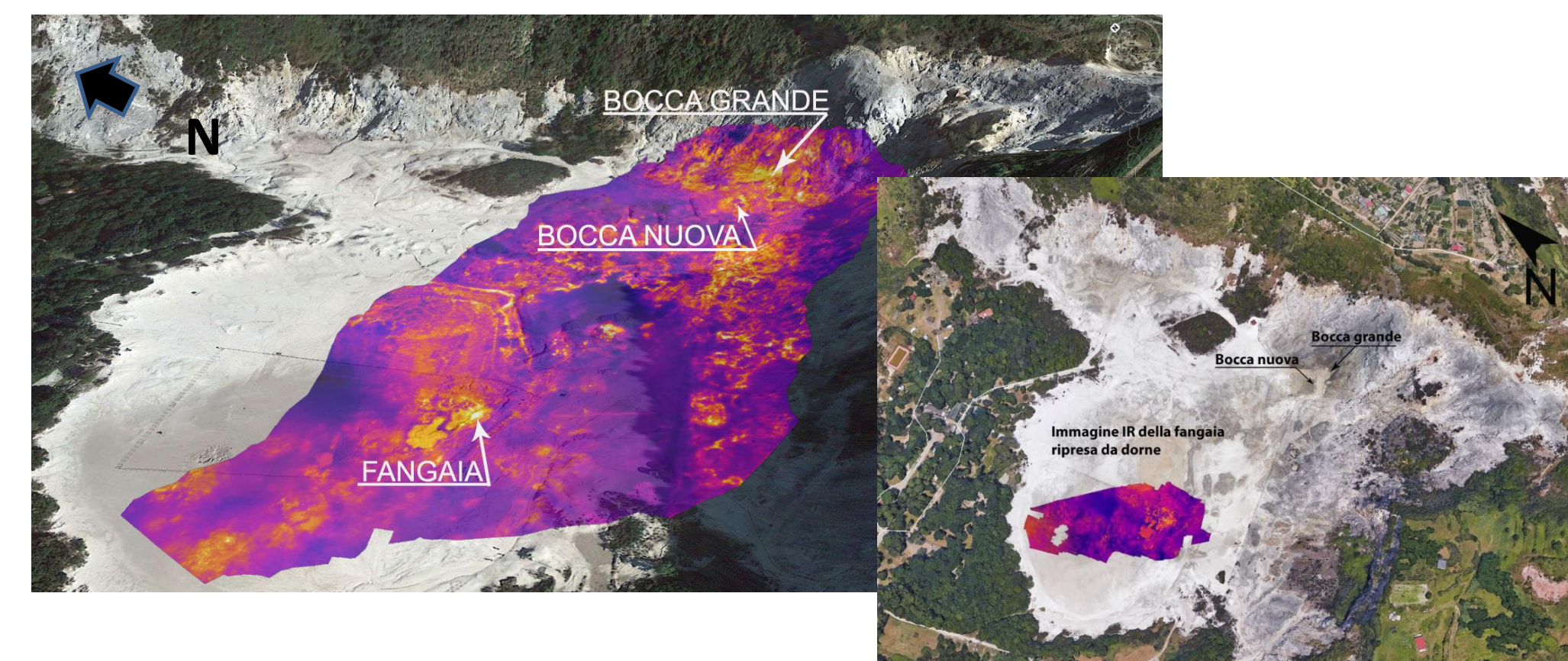
Location of the TIRNet permanent stations (red dots) and the investigated regions (yellow areas) with the IR frames at Campi Flegrei. SF1 = Solfatara Station 1; SF2 = Solfatara Station 2; SOB = Solfatara OB Station; OBN = Olibano Station; PS1 = Pisciarelli Station.

Target area of the Solfatara OB Monitoring Station installed on June 22, 2016.



Drone-born thermal images

A method based on drone-borne IR cameras has been developed in order to measure the time variations of heat flux. This will boost the definition of the activity state of a volcano allowing a better assessment of the related hazard and risk mitigation through the design and installation of two drones equipped with thermal and visible cameras.



Thermal mapping (left) at Solfatara by using infrared images acquired with drone (right).



Conclusions

The impact of SISTEMA project is measured through the implementation of its services, the continued and further engagement of different stakeholders and the delivery of crucial communication for decision makers and end-users. The research promoted by its multidisciplinary data can have a crucial impact on the advancement of the Emergency Plans, contributing to a safe and sustainable society and economic development, geo-hazards assessment and a sustainable management of geo-resources.