



ISTITUTO NAZIONALE
DI GEOFISICA E VULCANOLOGIA



Italian Sites For Cal/Val Activities For New Thermal Space Missions

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Organisations: Istituto Nazionale Di Geofisica E Vulcanologia, Italy

SBG -TIR Component Key Parameters

Cooperation between ASI and NASA – JPL



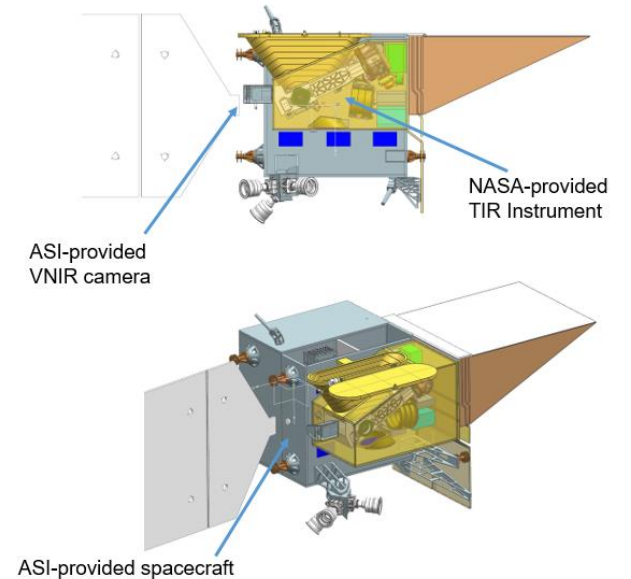
2012 Meeting



2019 Meeting

Key Parameters	SBG-TIR
Number of satellites	1
Combined revisit (days)	≤ 3 (different obs. angles)
Orbit cycle (days)	3
GSD (nadir/edge of scan) (m)	TIR: $\leq 60 / 93$, VNIR: $\leq 30 / 52^*$
FOV (degrees)	± 34.4
Swath (km)	935
Day/Night	Day + Night
LWIR bands (8-12 μm)	6
VNIR/SWIR/MWIR	2/0/2

* Based on angle will be less when combine with mask





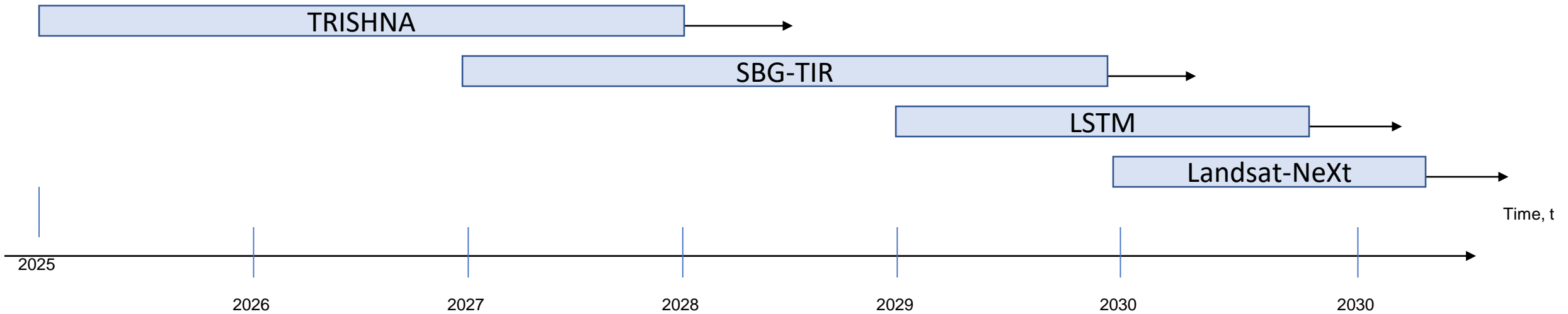
Aim of the Work

Describe Italian sites managed by INGV to support
Cal/Val activities for
TIR MISSIONS



Aim of the Work

These test site that can also be taken into account for other thermal mission:



Common **Vicarious site** for each Satellite mission (TRISHNA; SBG-TIR; LSTM; Landsat-NeXt)

*techniques that use natural or artificial sites on the Earth's surface for the **post-launch** calibration of sensors



Main Site Criteria

Terrain morphology

- Flat and placed at high altitude

Accessibility

- Easiness access of the site

Spatial uniformity

- High spatial uniformity

Spectral features

- The surface properties should be temporally invariant

Weather

- Arid region and minimum cloud probability



Potential Italian Site (Ca/Val)

Multipurpose Site

Stagno Sale 'e Porcus

Thermal Active Sites

Solfatara

Mt.Etna - Piano delle Concazze

Stromboli

Vulcano

Thermal Active Site are constantly monitored by INGV with permanent ground sensor for temperature and gases





Ca/Val Site

Stagno Sale 'e Porcus



Solfatarara



Piano delle Concazze



Stromboli



INGV



Vulcano



INGV



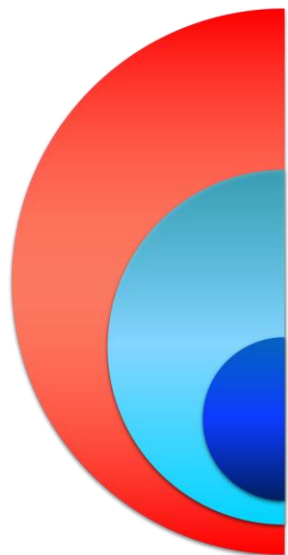
Mt. Etna



INGV



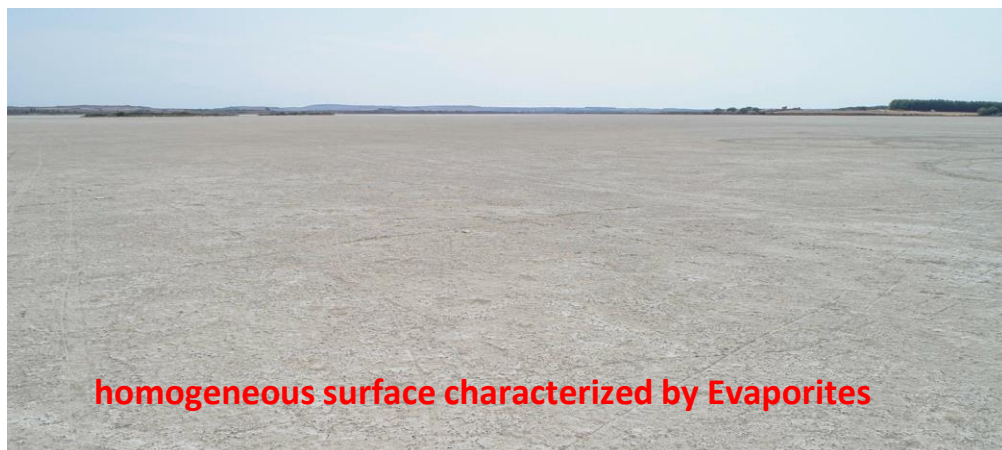
Stagno Sale 'e Porcus



Flat terrain and spatial uniformity

Spectral characterization
Hytes Flight Campaign 2023

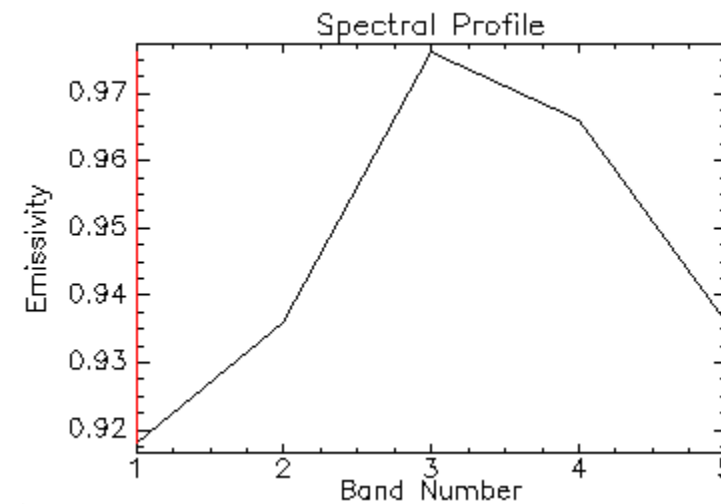
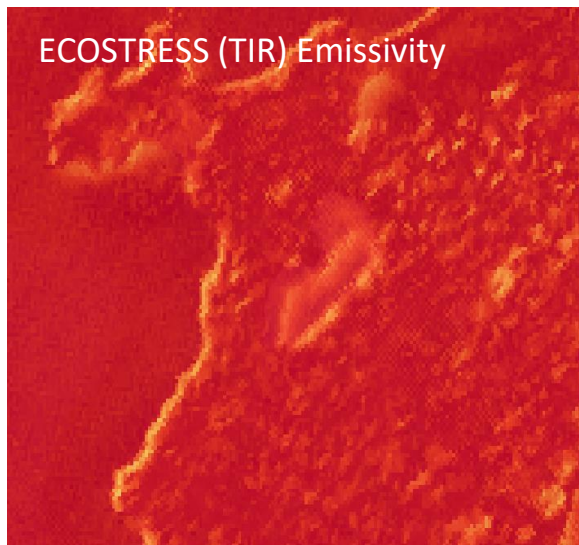
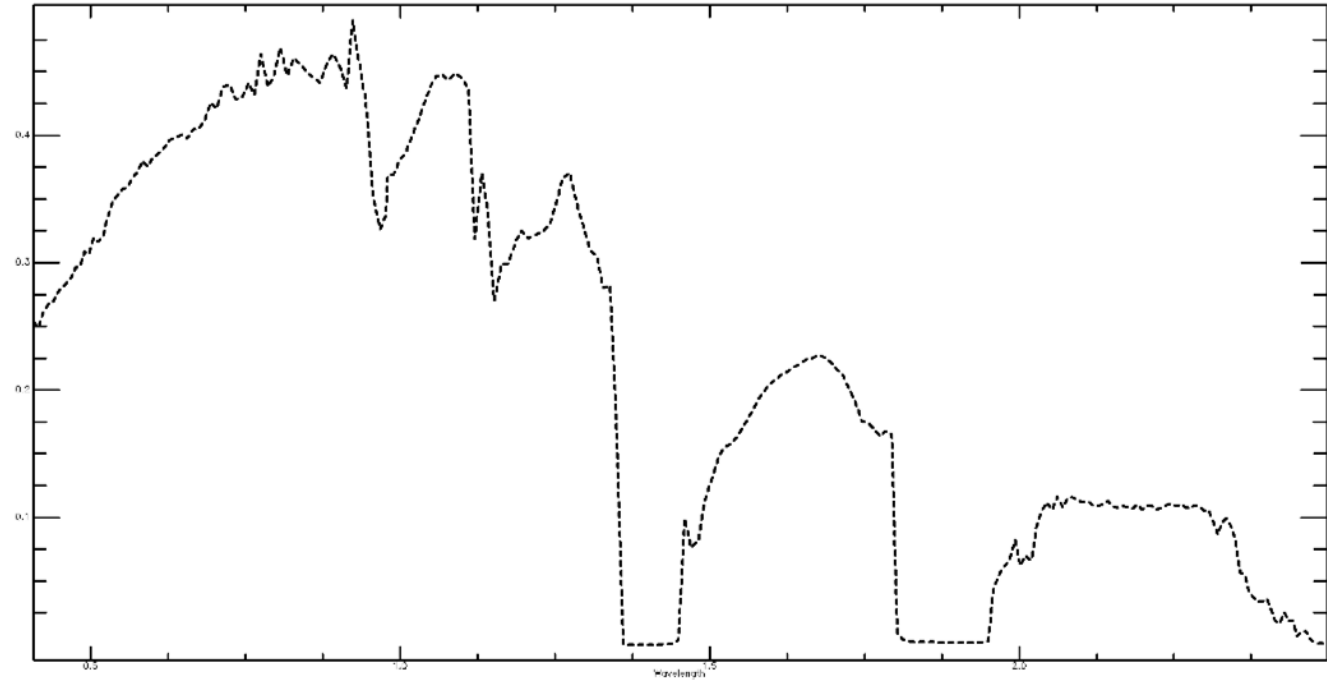
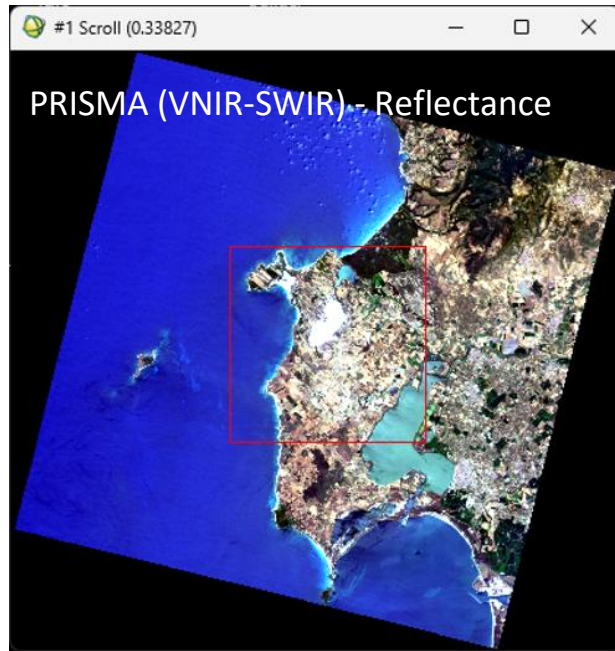
Monitoring and Surveillance
(Mission Advisor Group - ASI for SBG-TIR)



homogeneous surface characterized by Evaporites



Stagno Sales Porcus



Stagno Sales Porcus - Validation Activities



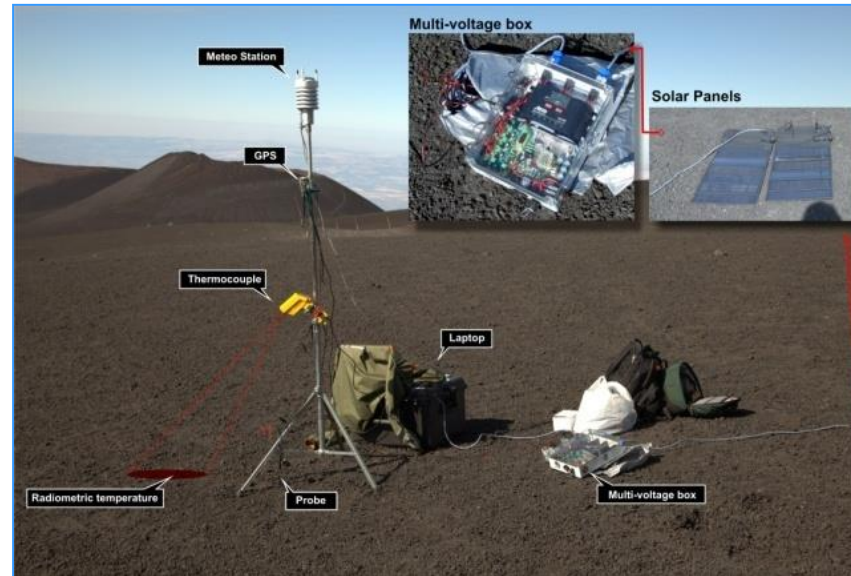
Fieldspec ASD – Spectral Signature



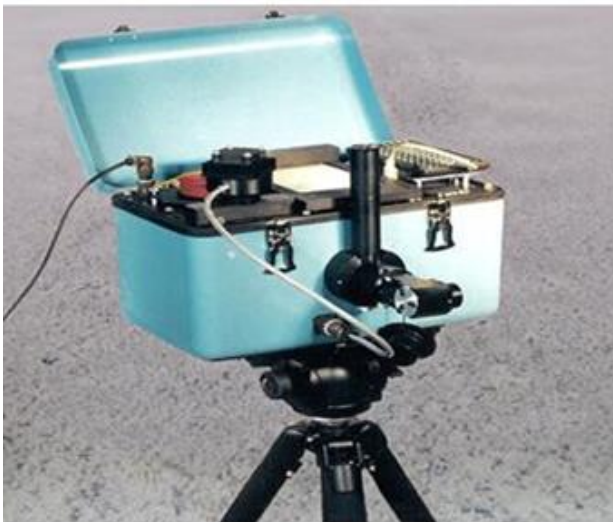
Sun Photometer - AOT



Meteo Station



FTIR - Emissivity



Thermal Camera



Stagno Sale 'e Porcus



INTERNATIONAL REMOTE SENSING SUMMER SCHOOL

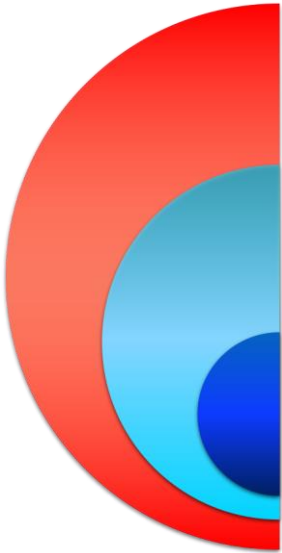
Experiencing Remote Sensing on Sardinia inland site: Advanced summer school on instruments and methodology for a CAL/VAL site for Optical data



17-21 July, 2023

<https://aitonline.org/2023/04/17/international-remote-sensing-summer-school/>

Solfatara - Campi Flegrei caldera



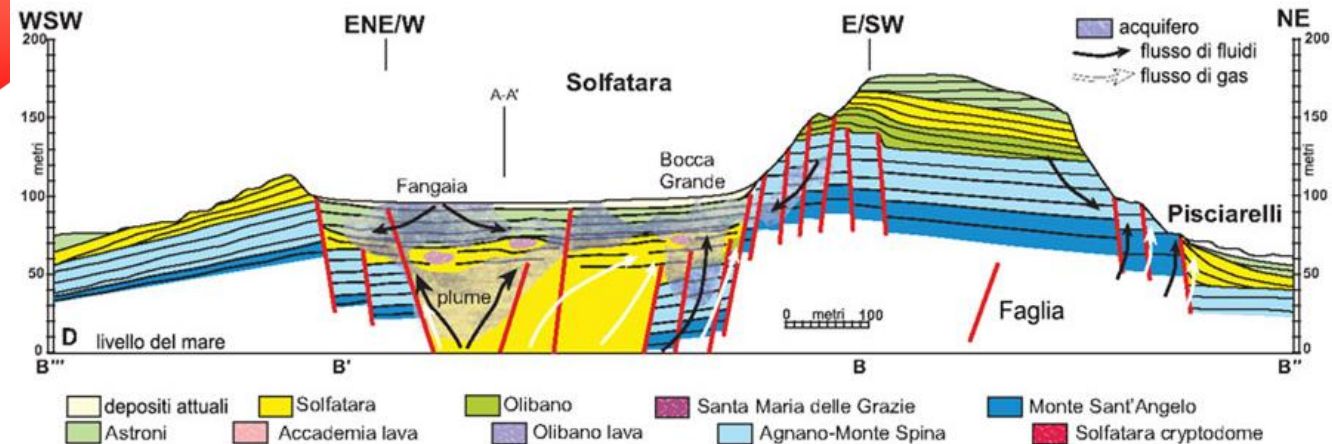
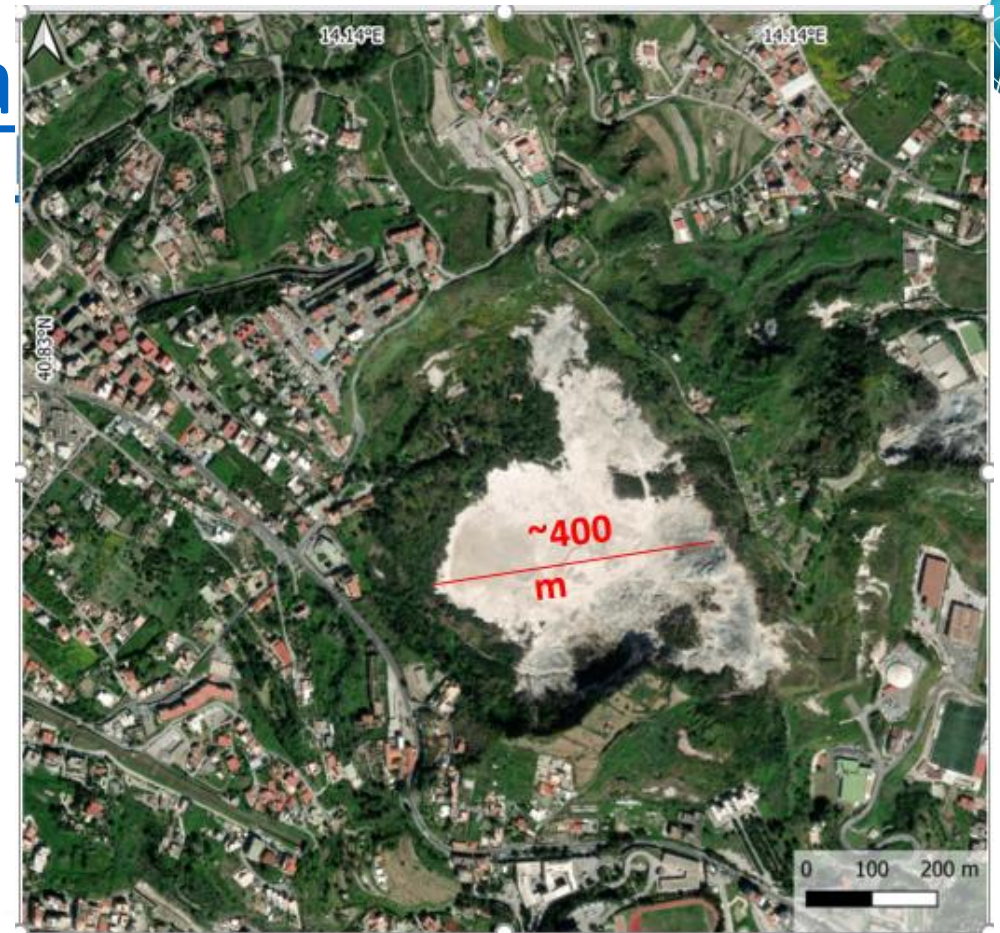
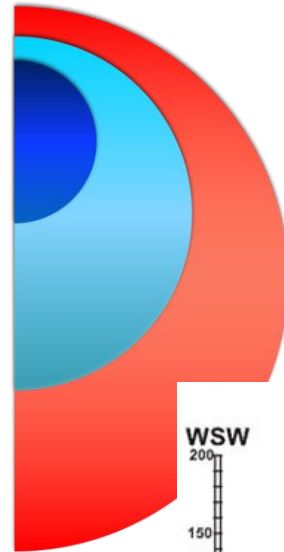
Temperature and Degassing

Mineral Composition

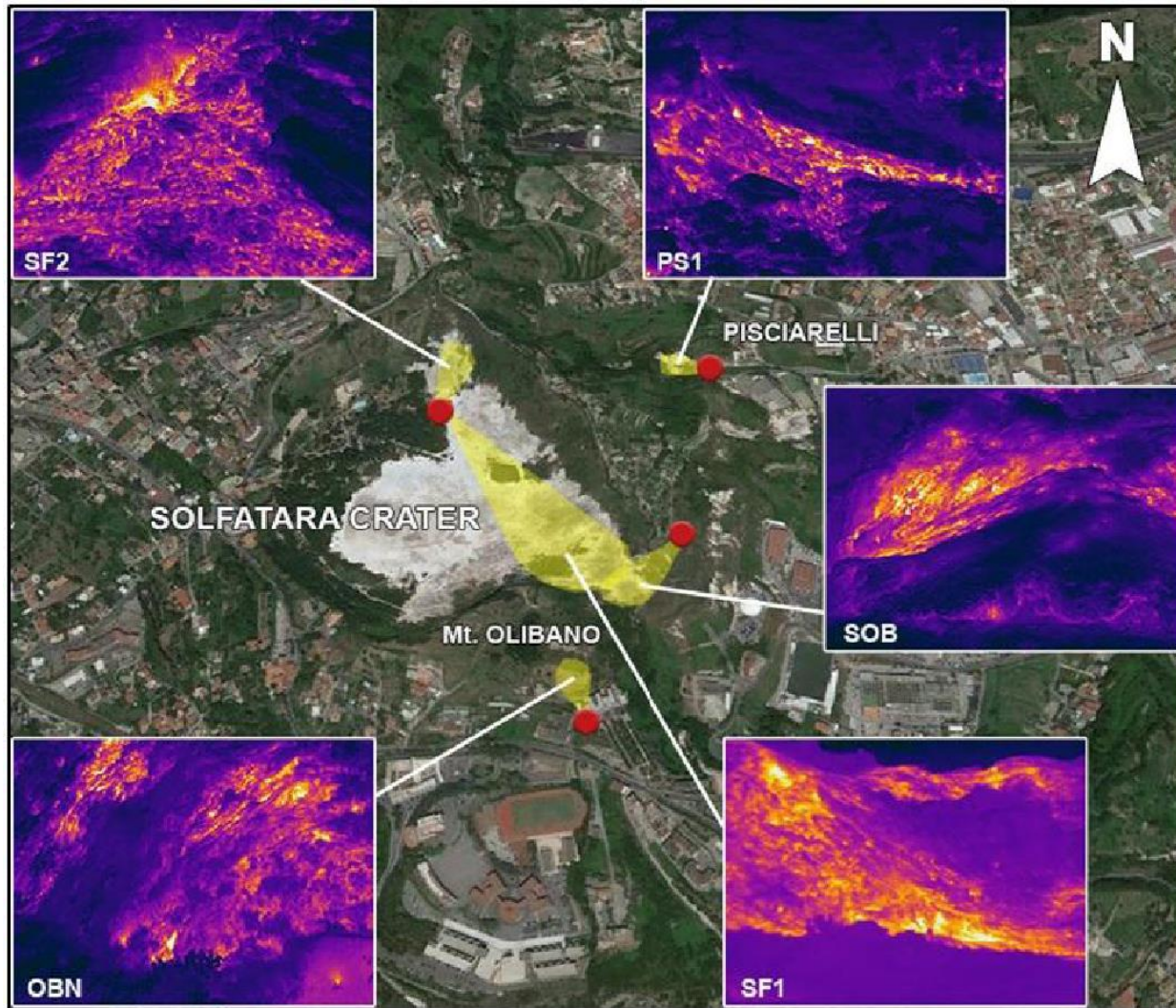
Monitoring and Surveillance

Spatial uniformity

Flat terrain



Solfatara - INGV Permanent Monitoring Network

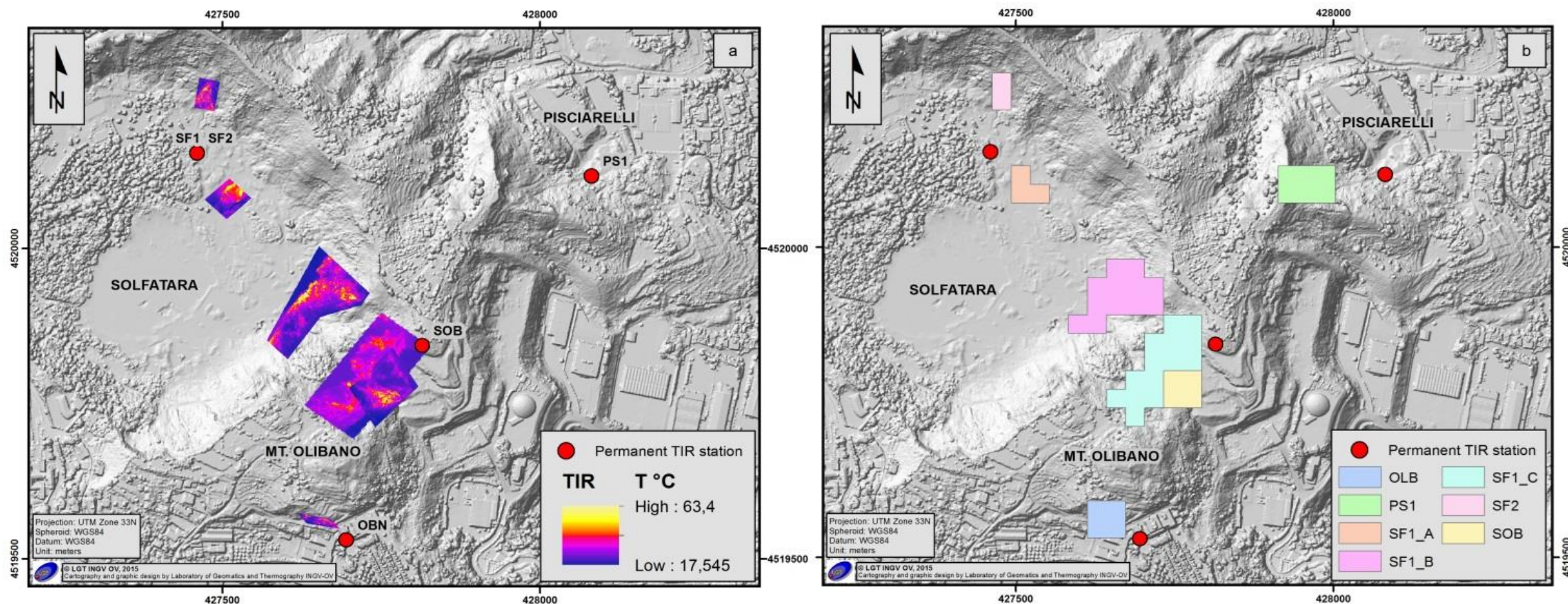


TIRNet - Location (5)

Solfatara - INGV Monitoring Network



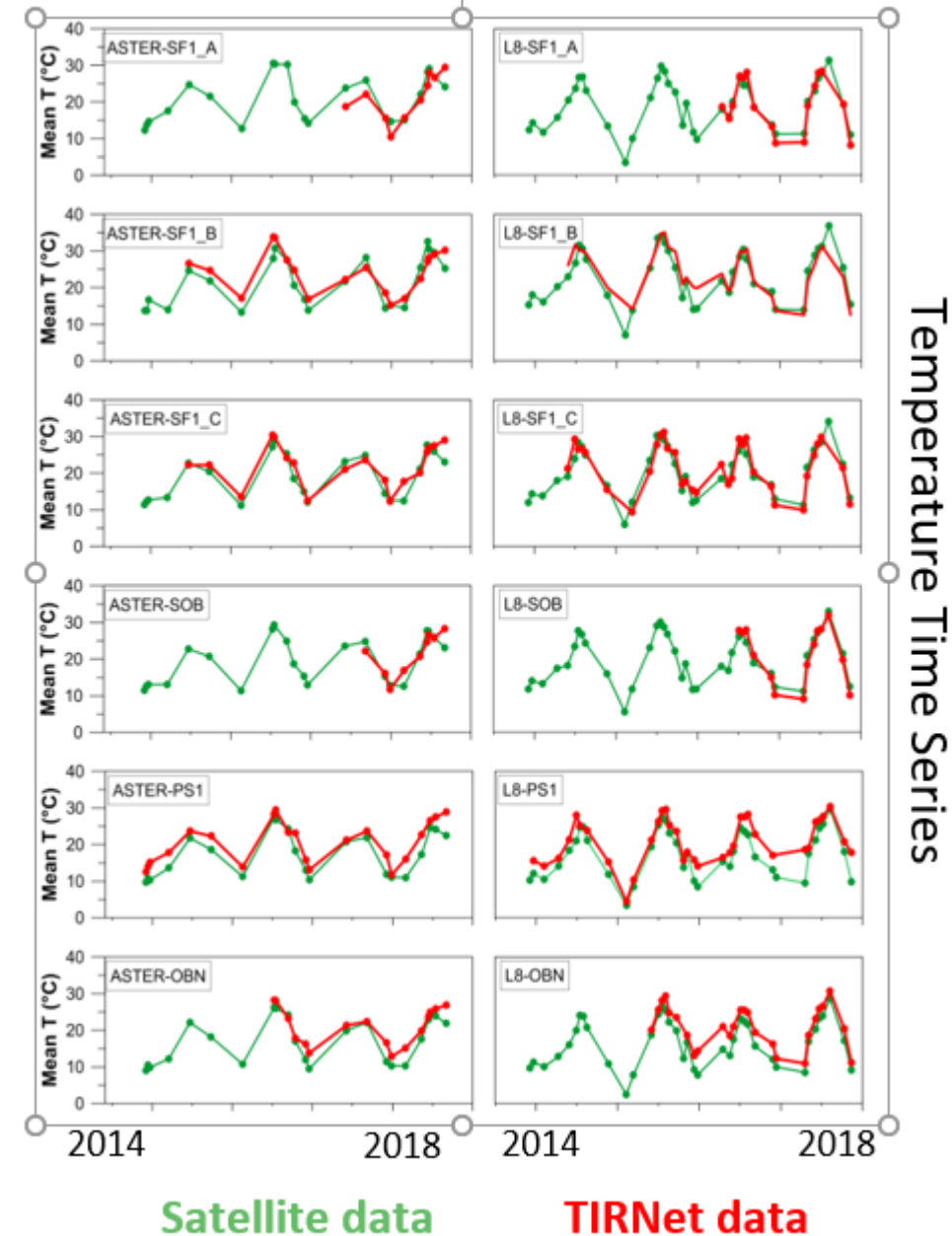
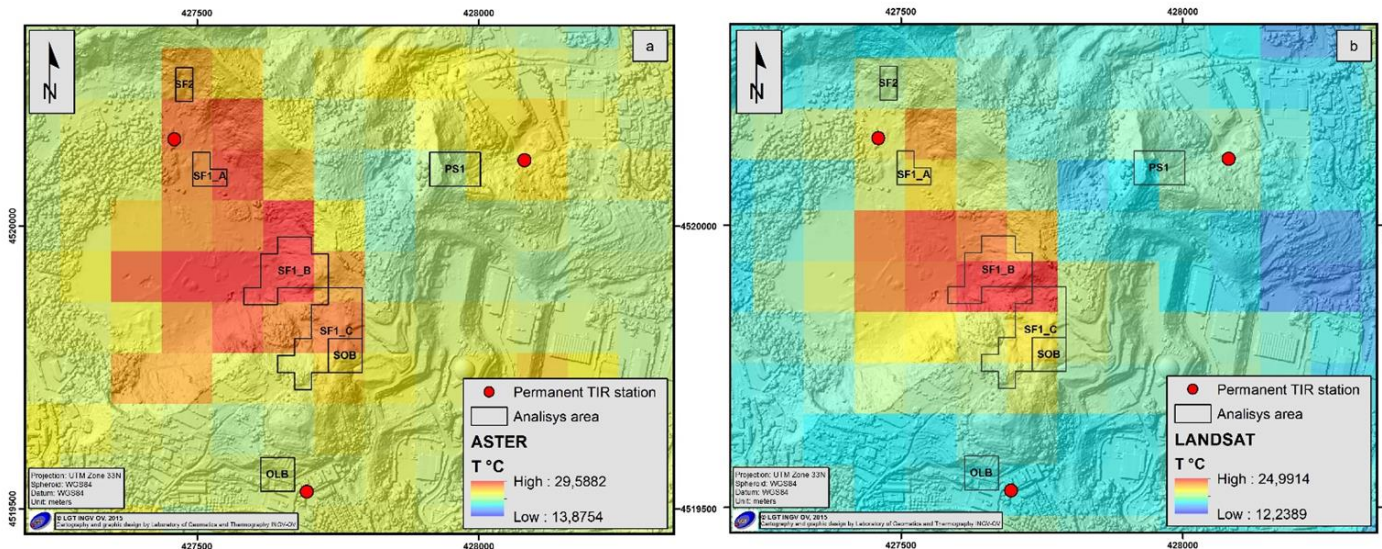
Thermal Images Reprojected



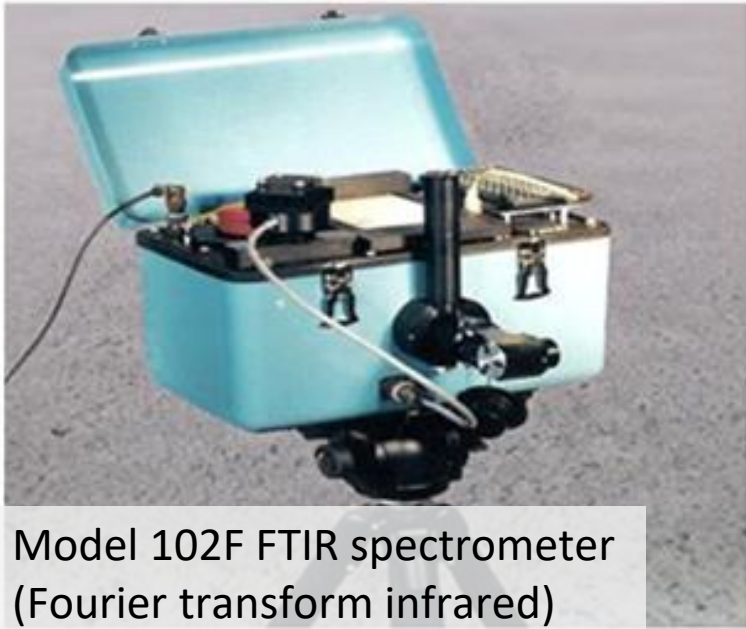
- Draped and georeferenced TIR images of SF1, SF2, OBN and SOB stations. The image of SF1 Station is split into three coherent parts with different focal geometry (SF1_A/B/C);
- Polygons obtained by grouping cells containing data from TIRNet stations

Comparison of Satellite data with ground data

To compare the TIRNet ground data to the **Landsat-8** and **ASTER** satellite images, extra-acquisitions of the **TIRNet** have been programmed to coincide with the time of the satellite passages over the Campi Flegrei area.



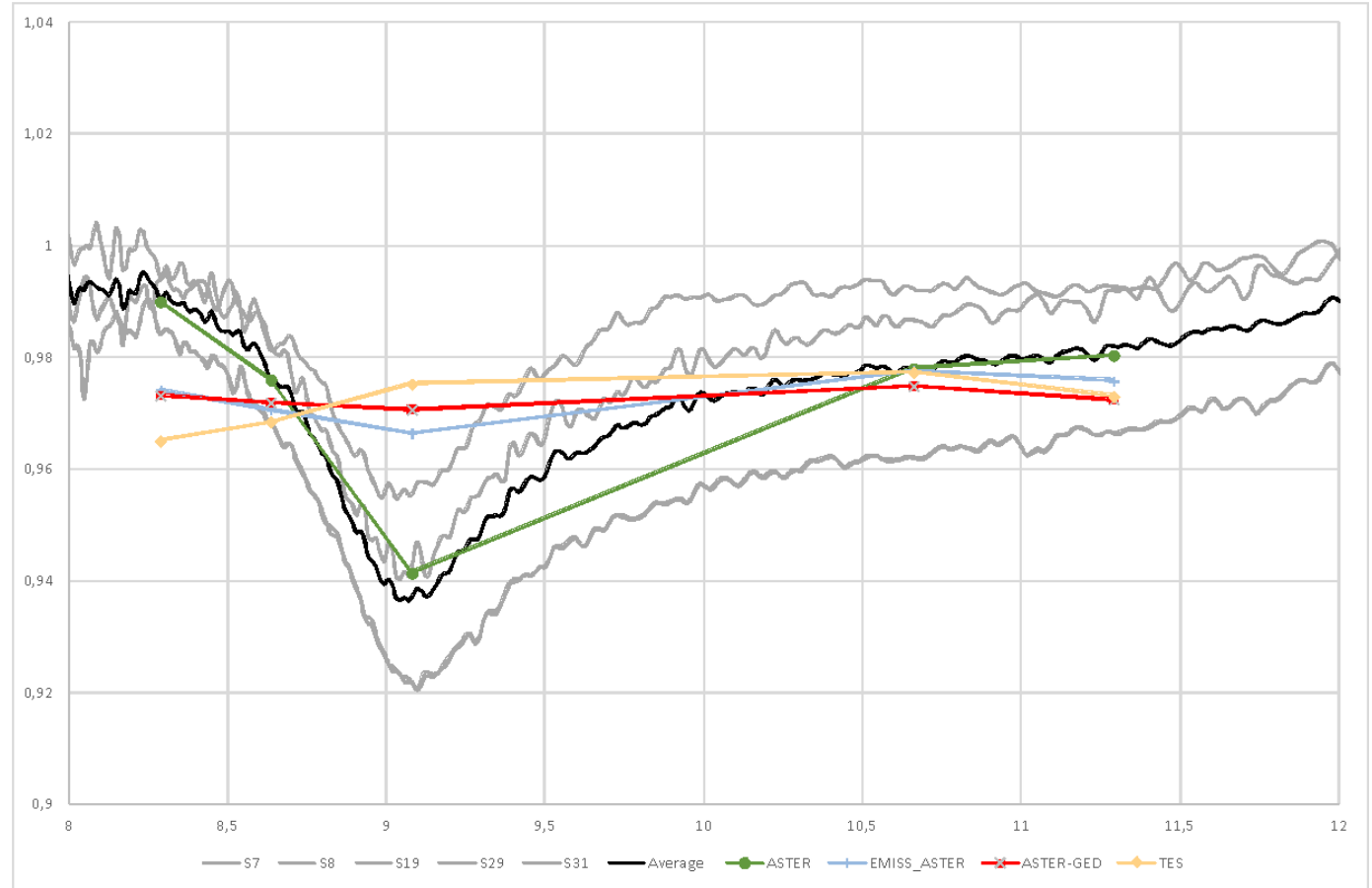
Solfatara - Emissivity comparison



Model 102F FTIR spectrometer
(Fourier transform infrared)

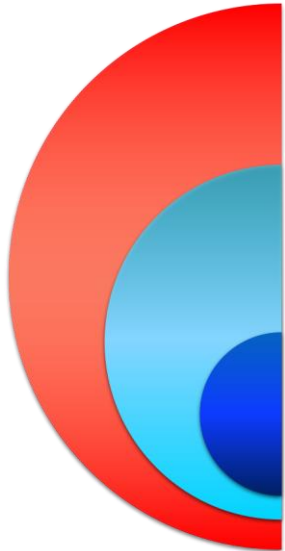
FTIR SPECIFICATIONS

Item	Parameter	Value	Units	Comments
1	Spectral Range	2 - 16	micrometers	Standard IR
2	Spectral Resolution (FWHH)	4	wavenumbers	Standard, 1 sec. scan



S7, S8, S19, S29, S31 and AVERAGE: Measurements collected with FTIR
 Measurements collected with FTIR and convolved on ASTER SRF
 ASTER-GED: emissivity retrieved by the ASTER-GED
 EMISS_ASTER: emissivity retrieved by ASTER 05 data
 Emissivity retrieved using TES algorithm

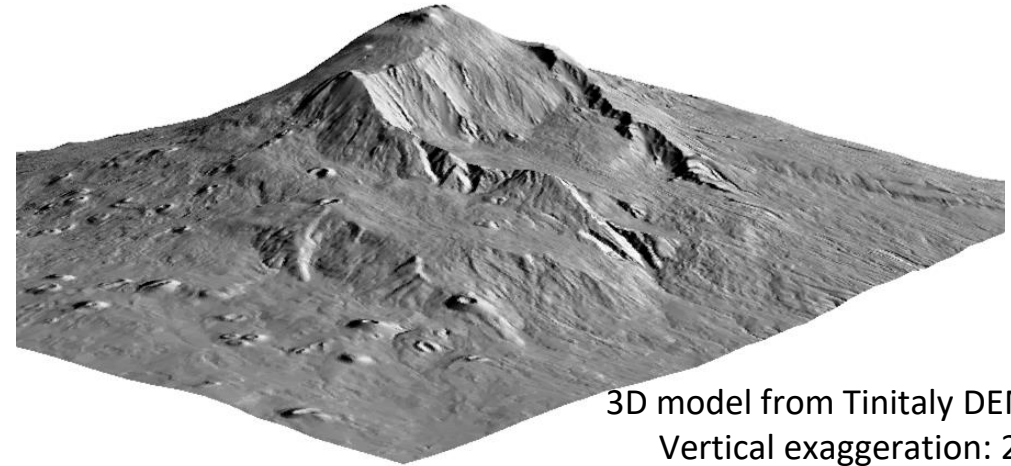
Mt. Etna



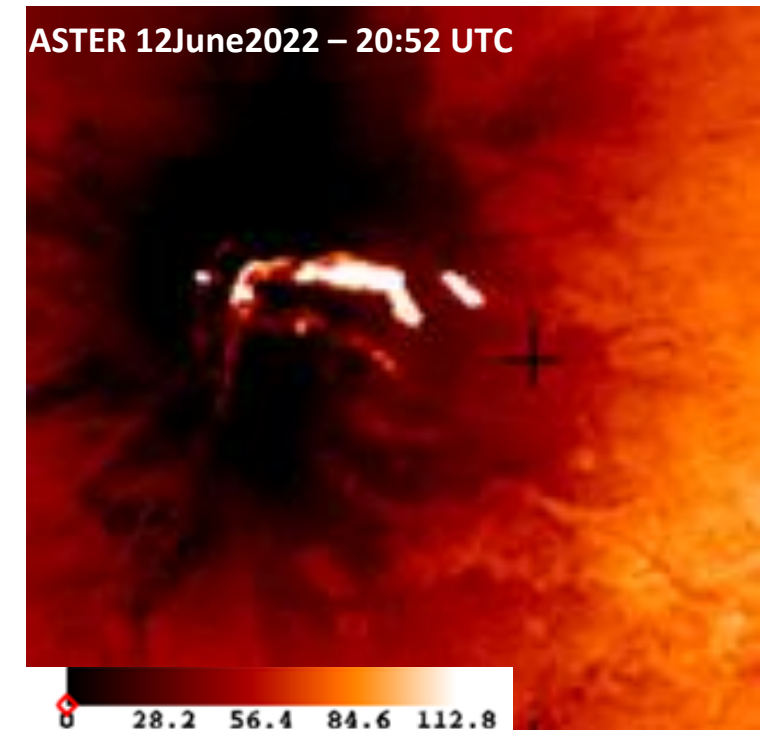
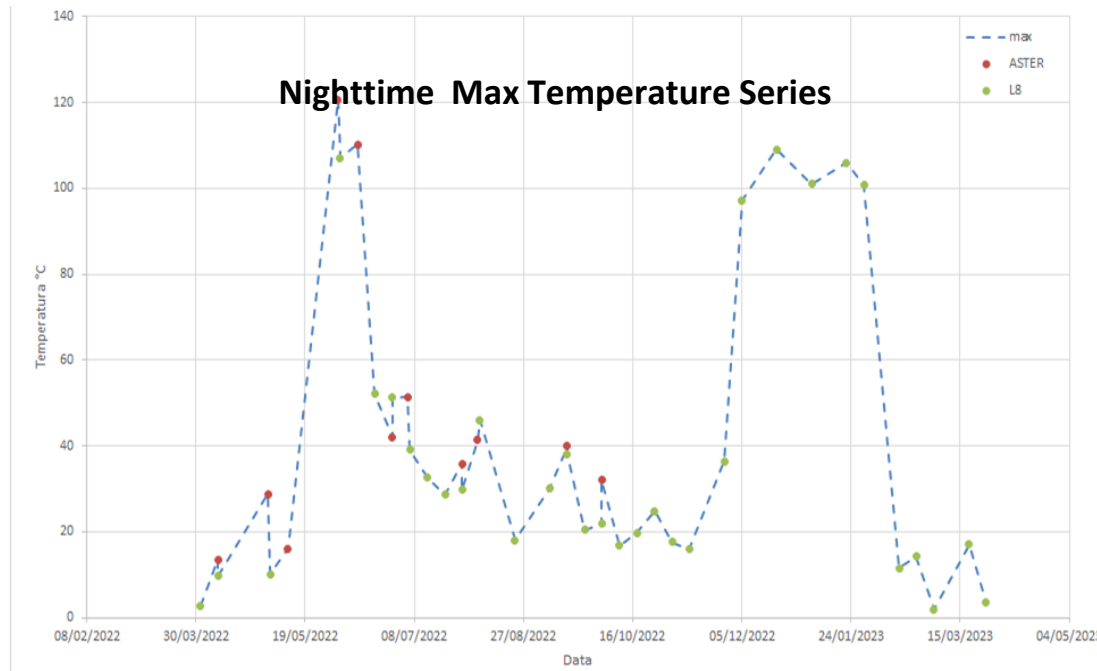
Temperature and Degassing

Mineral Composition

Monitoring and Surveillance

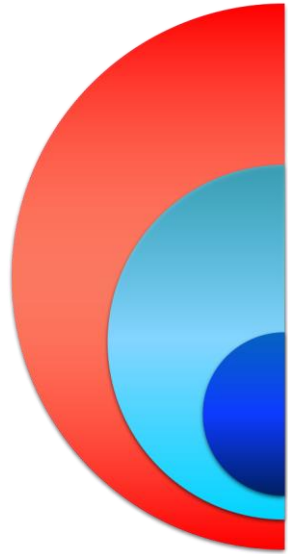


3D model from Tinitaly DEM
Vertical exaggeration: 2x





Mt. Etna - INGV Monitoring Network



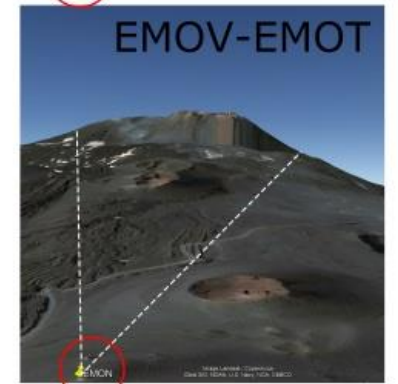
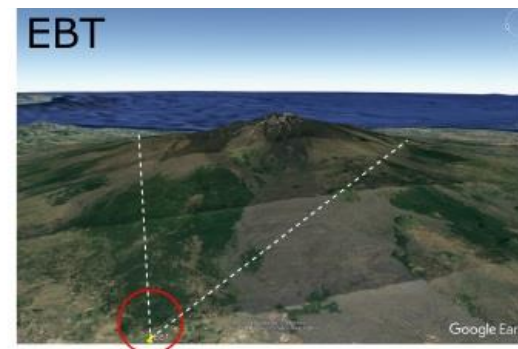
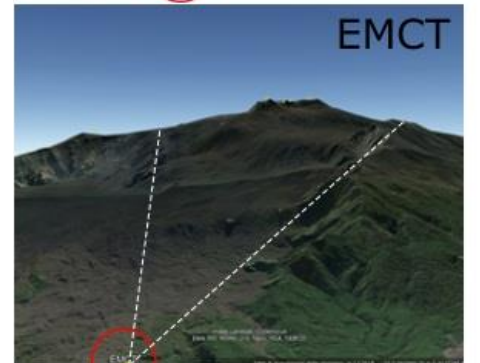
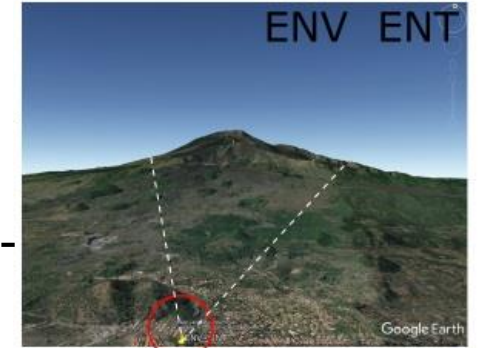
Temperature and Degassing

Mineral Composition

Monitoring and Surveillance



SO2 Flux: UV - Spectroscopy, UV-Scanner, SO₂ camera

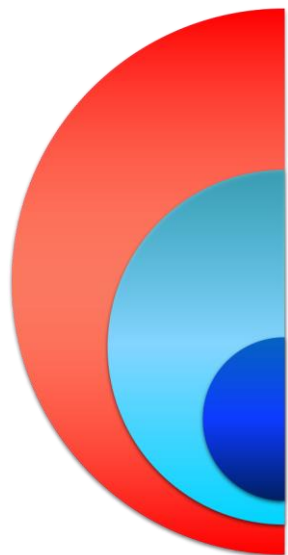


REAL-TIME Acquisition

INGV-OC Catania 14-08-2020 09:21:00:00 EMOV

INGV-OC Catania 14-08-2020 09:30:00:00 EMOT

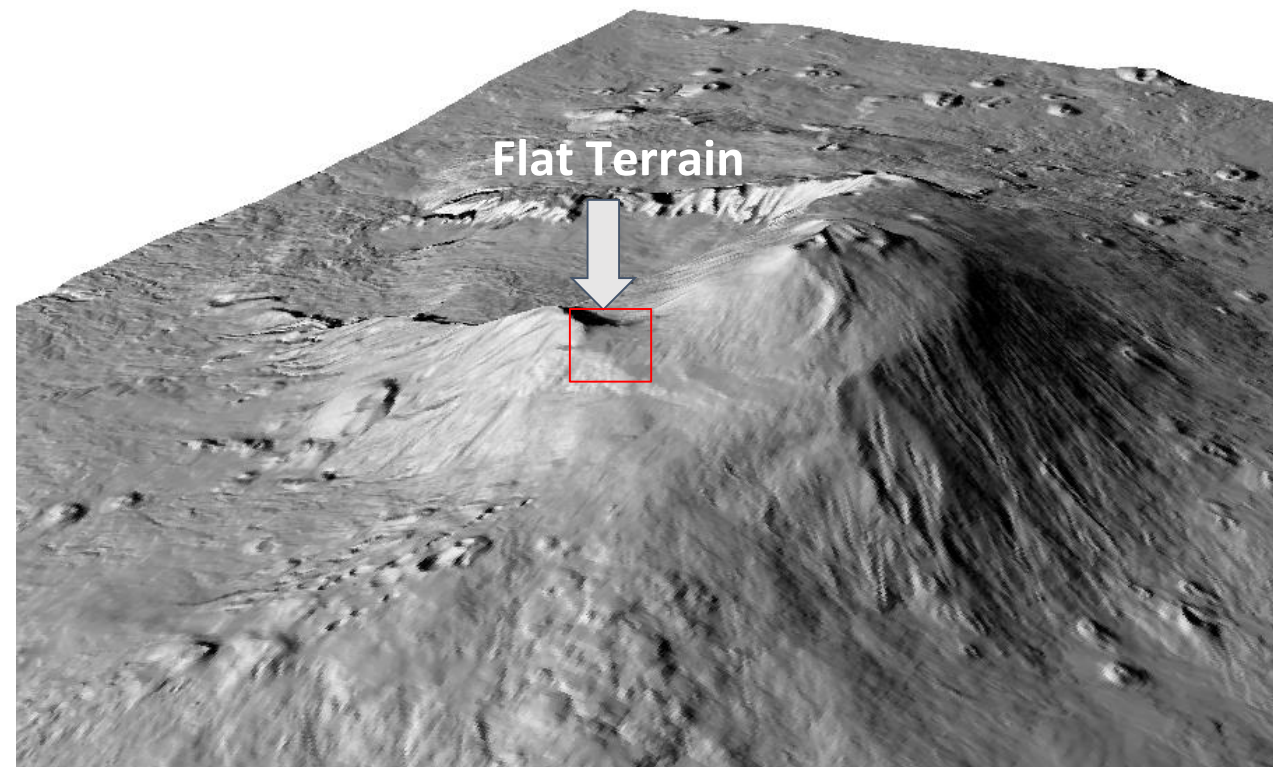
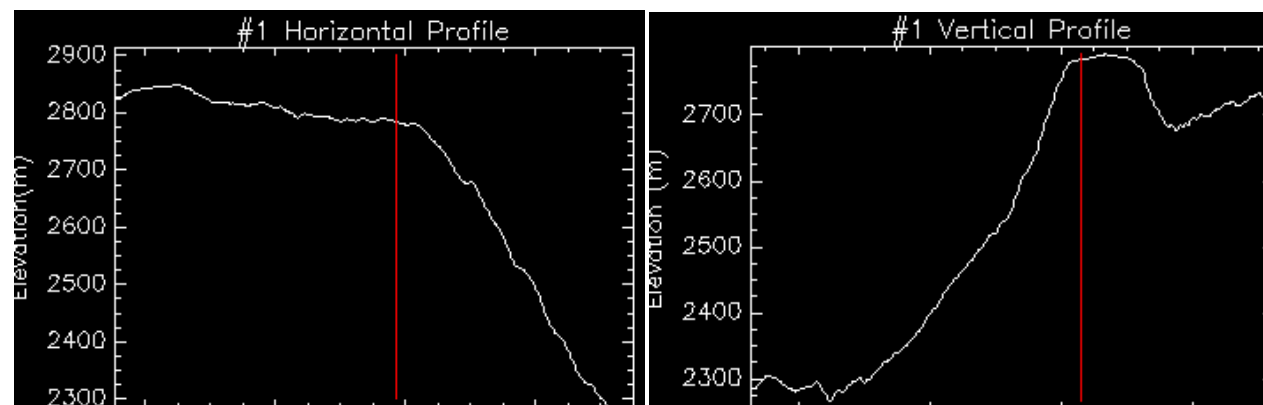
Mt. Etna - Piano delle Concazze - Vicarious site



High Elevation and Flat Terrain

Spatial Uniformity

Monitoring and Surveillance





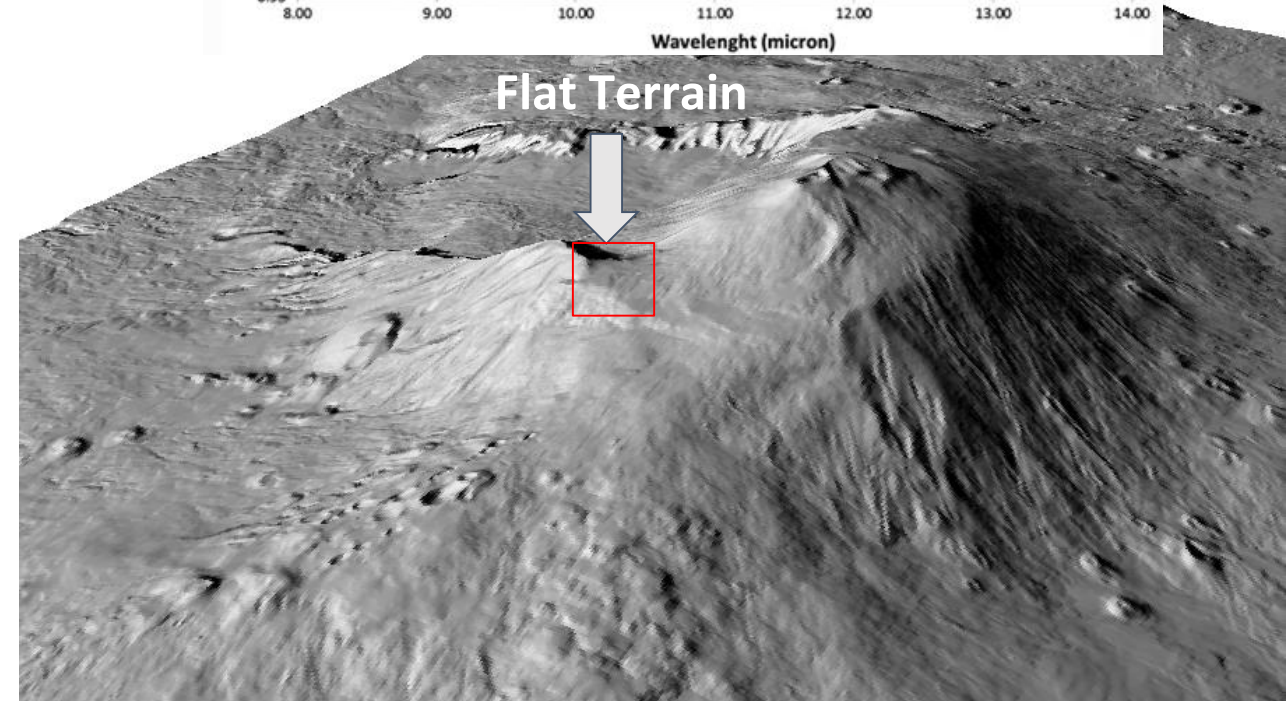
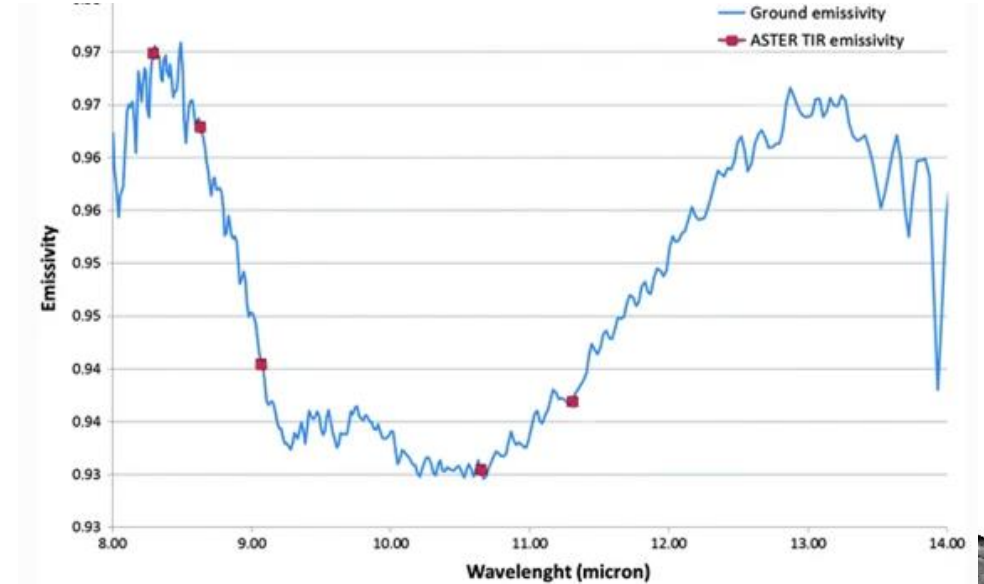
Mt. Etna - Piano delle Concazze - Vicarious site



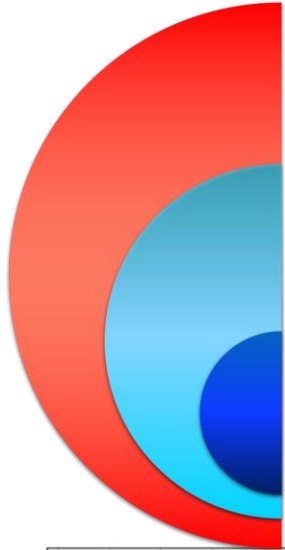
High Elevation and Flat Terrain

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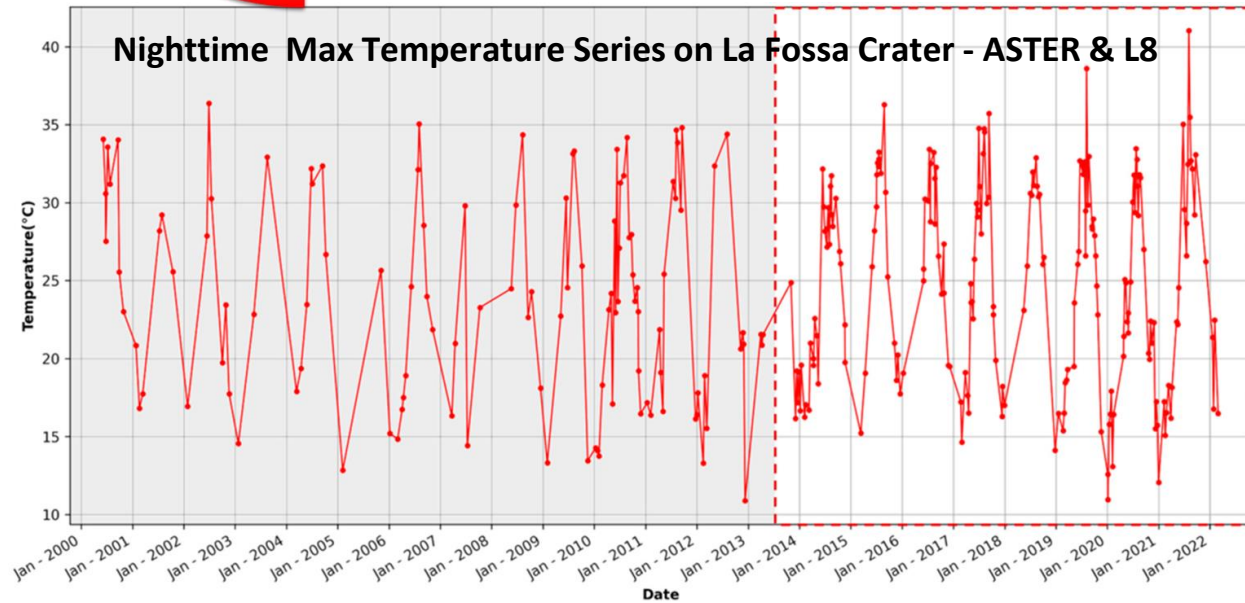
Vulcano



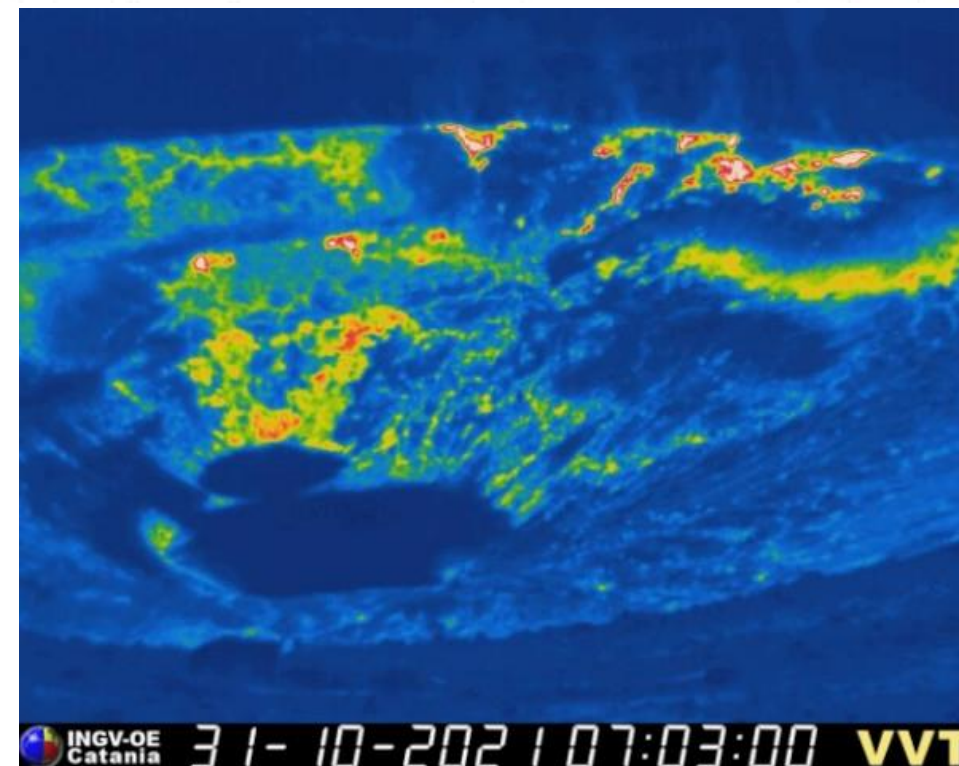
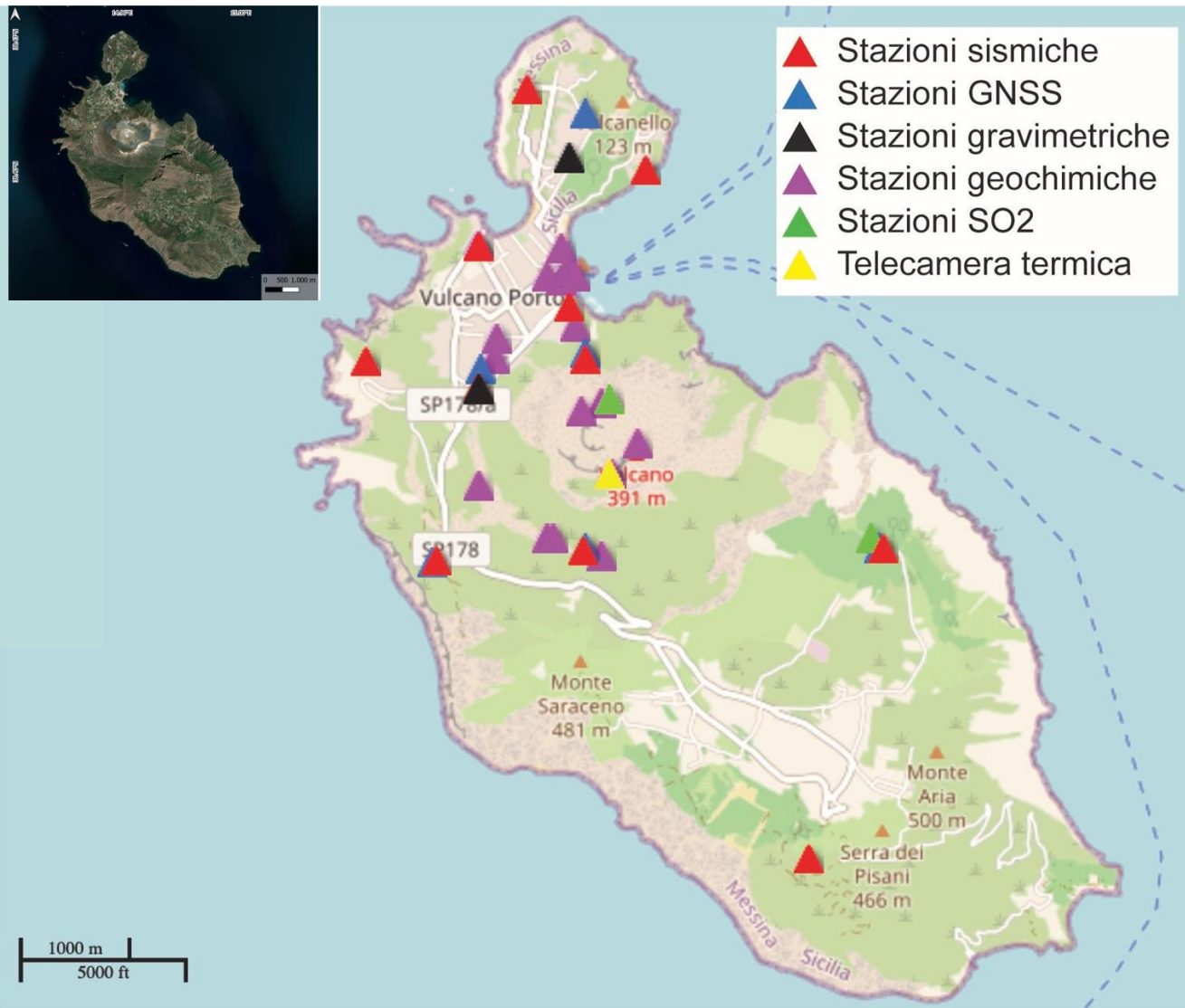
Temperature and Degassing

Mineral Composition

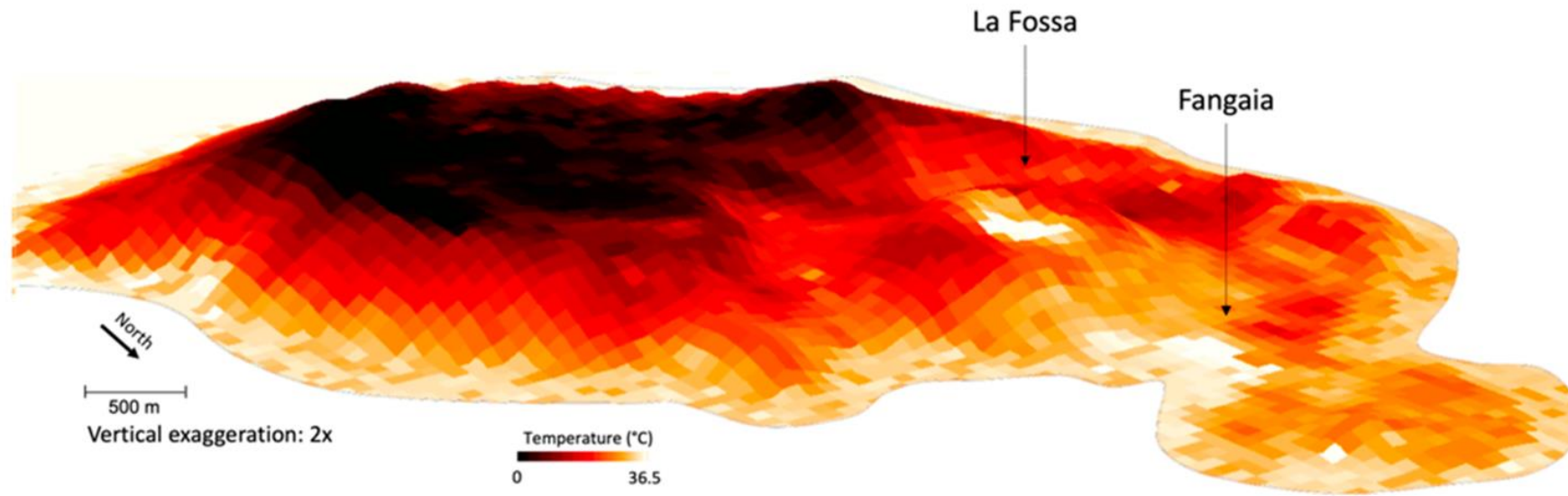
Monitoring and Surveillance



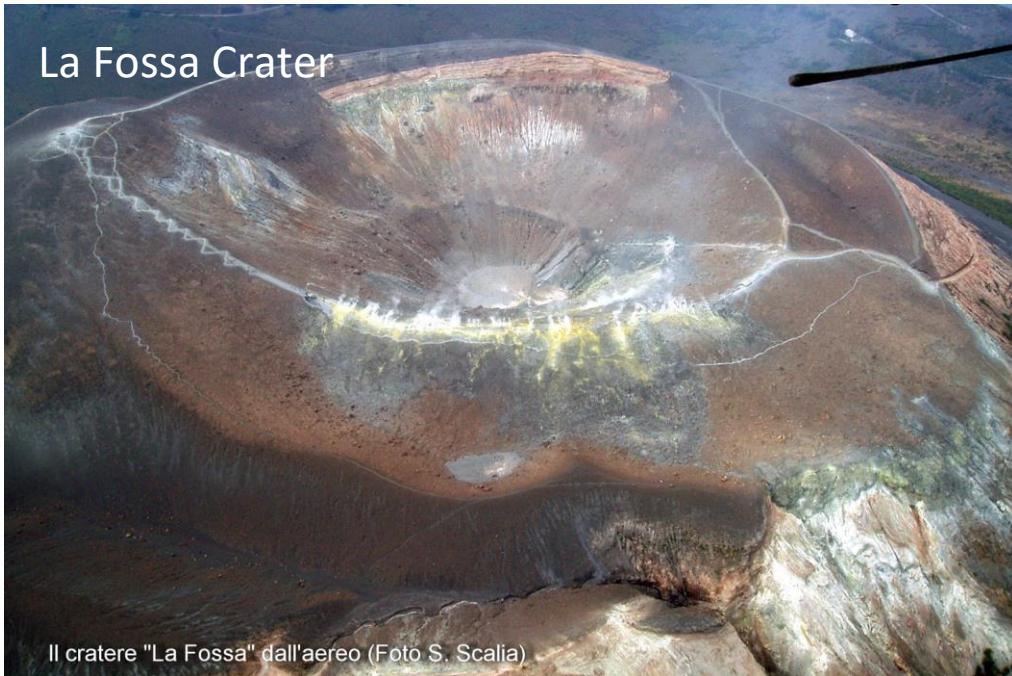
Vulcano - INGV Monitoring Network



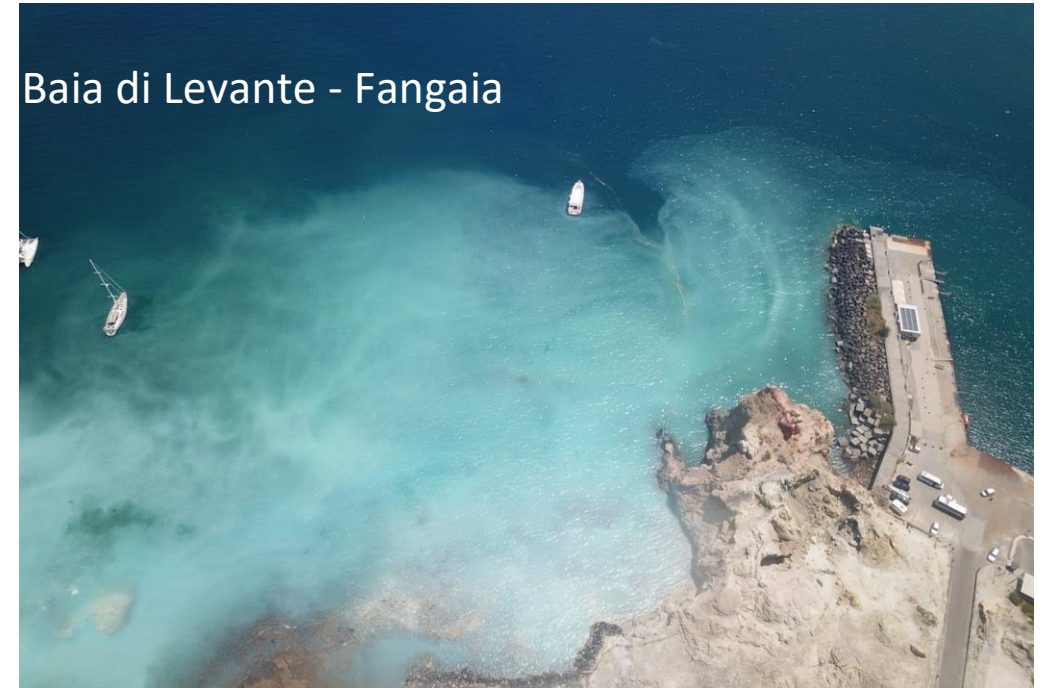
Vulcano - Main Thermal Areas



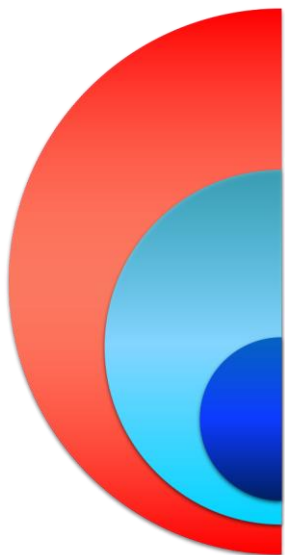
La Fossa Crater



Baia di Levante - Fangaia



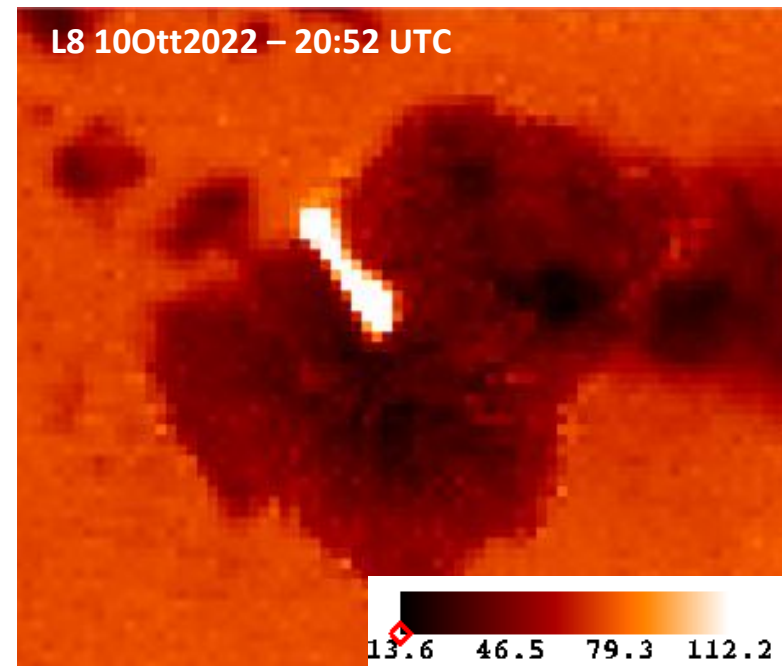
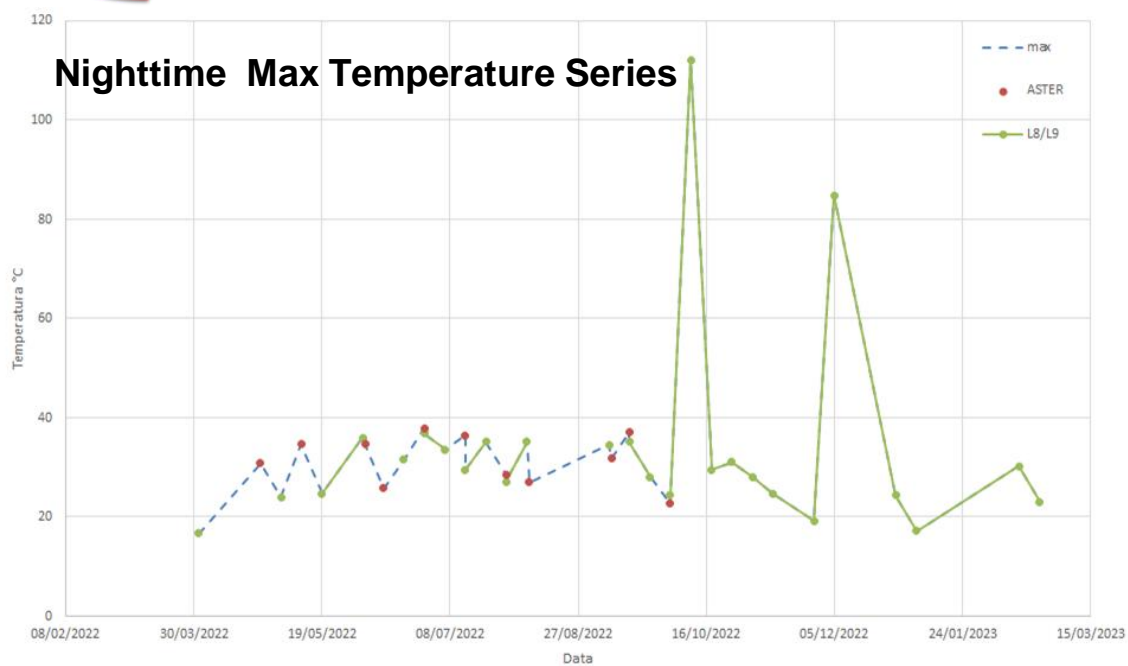
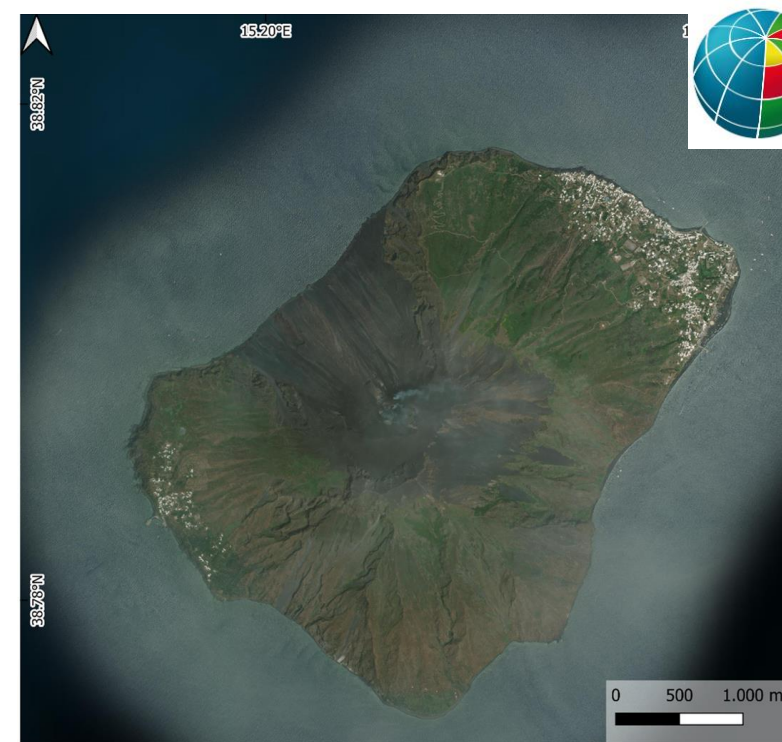
Stromboli



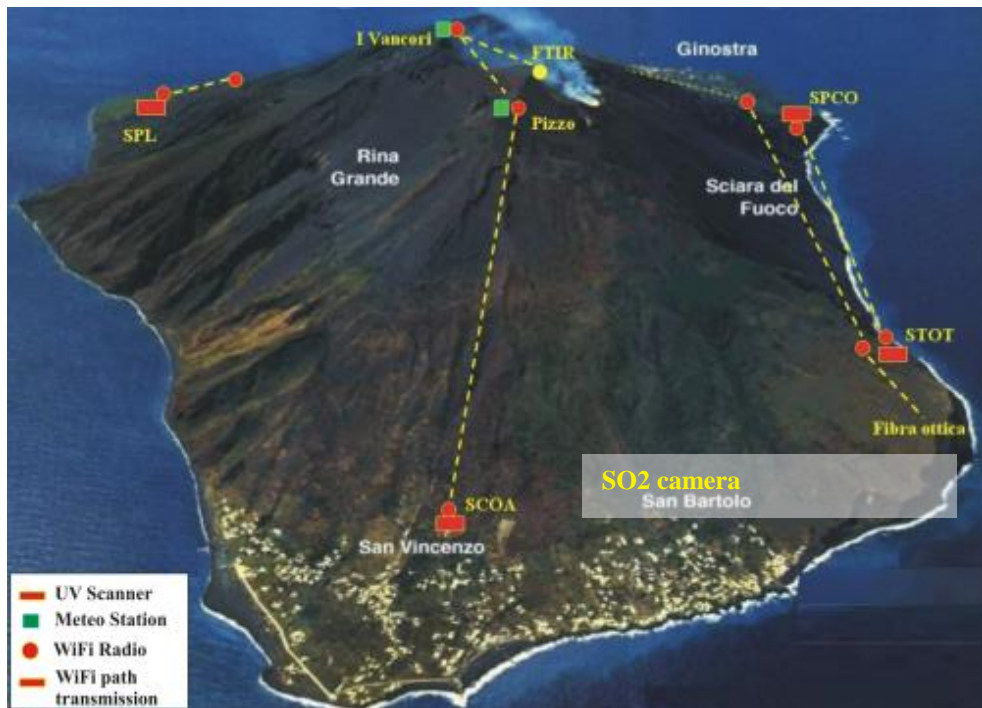
Temperature and Degassing

Mineral Composition

Monitoring and Surveillance

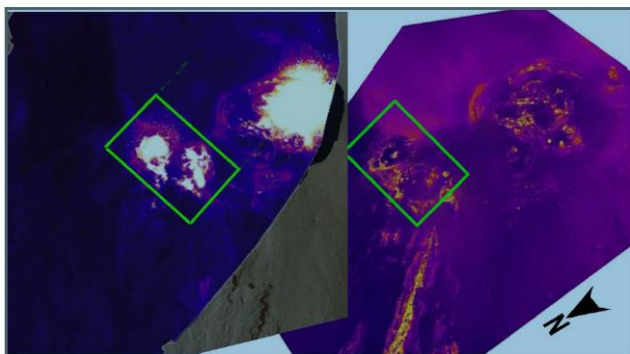


Stromboli - Monitoring



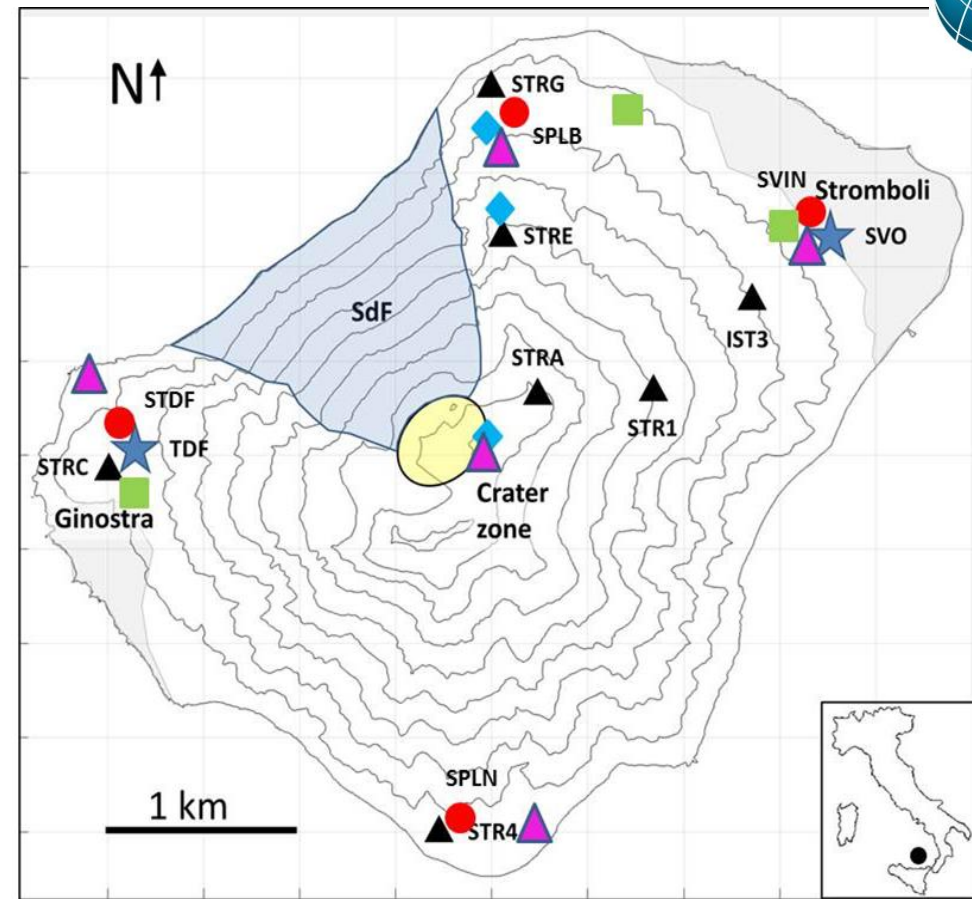
settembre 2022

ottobre 2022



settembre 2022

ottobre 2022



- Tiltimeters
- GPS Stations
- ▲ Seismic Station
- ◆ Videocam
- ★ Strain meters
- ▲ Geochemical Stations

REMARKS AND FUTURE WORK

- The volcanic CAL/VAL areas are permanently equipped and are already used as natural laboratories
- For SBG mission INGV is building spectral libraries in VIS-SWIR, MIR and TIR range both in the multipurpose site and volcanic sites.
- The first CAL/VAL summer school for optical satellites has been organized for July 2023 and we plan to do regular events for students and young researchers.
- The volcanic sites will be also used to test TIR missions products for geology and geophysical applications
- We would like to equip the Sales Porcus dry lake with permanent instruments in order to use it as vicarious test site in Italy for calibration of VIS-SWIR and TIR instruments.



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Thank you for your attention

