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PIANO NAZIONALE
DI RIPRESA E RESILIENZA



ISTITUTO NAZIONALE
DI GEOFISICA E VULCANOLOGIA

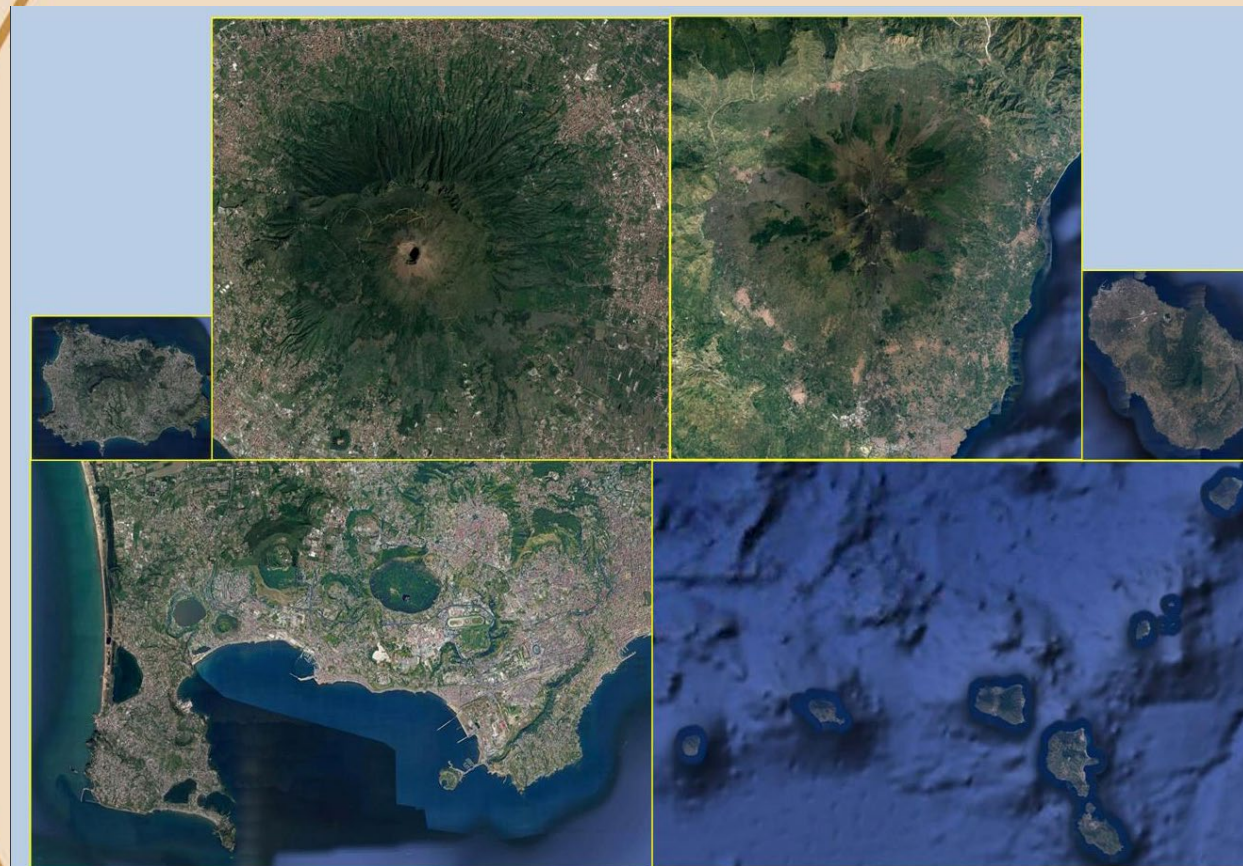
WP2 **SOME** **S**TRENGTHENING **VOLCANIC** **M**ONITORING **N**ETWORKS

Coordinator

Massimo Orazi

Action Leaders

- Sergio Guardato
- Salvatore Alparone
- Sergio Di Prima





WP2 Actions Areas

- **Action 1: Campania Volcanoes (Vesuvius, Campi Flegrei, Ischia)**
OU5 (INGV, Osservatorio Vesuviano) – Ref. S. Guardato
- **Action 2: Etna volcano**
OU4 (INGV, Osservatorio Etneo) – Ref. S. Alparone
- **Action 3: Sicily's volcanic islands (Eolie and Pantelleria)**
OU4 (INGV, Osservatorio Etneo) – Ref. S. Di Prima



WP2 Networks under Strenghtening

Classified by scientific areas:

- **Seismic networks and systems;**
- **Geophysical (and Geodetic) observation networks and systems;**
- **Volcanological, geochemical, multidisciplinary observation networks and systems;**
- **CED, data acquisition systems and Data Storage Centres.**

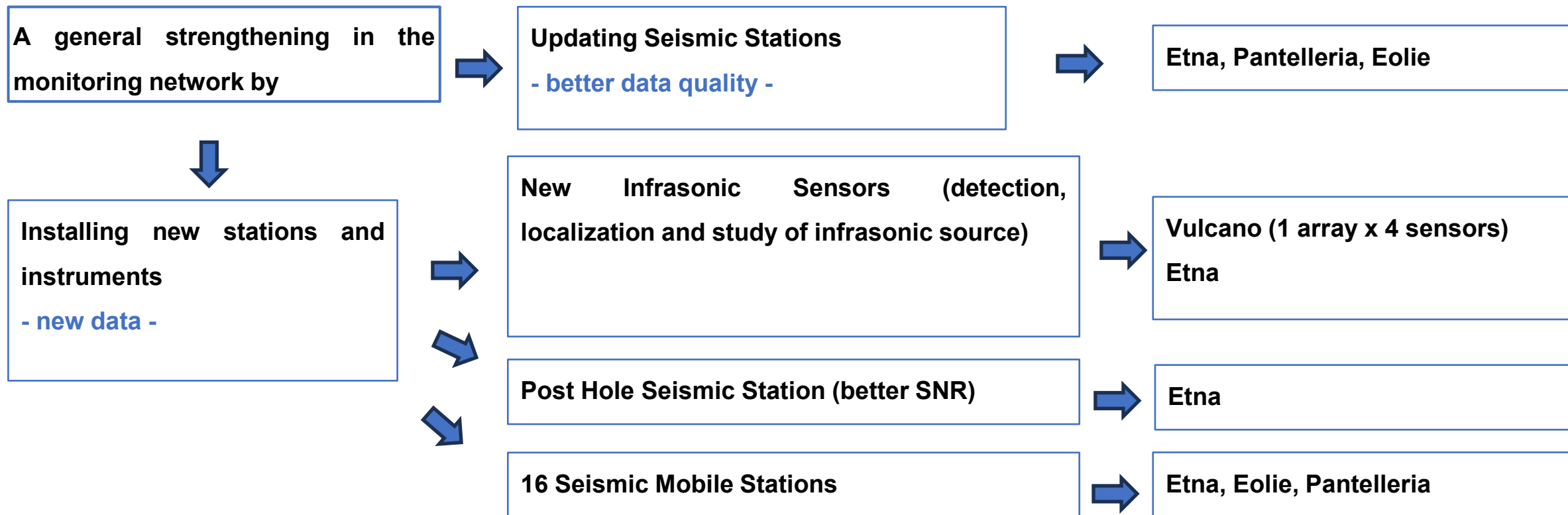
And their

- **Civil infrastructures**



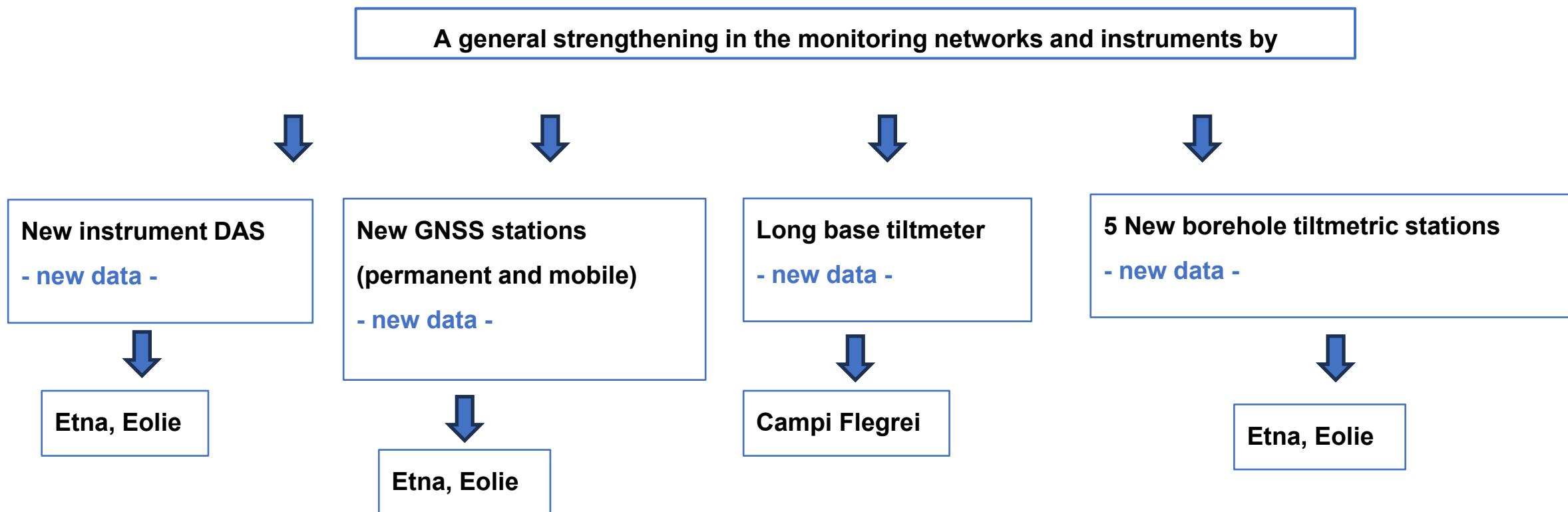
WP2 IR Action Description:

Seismic and infrasonic networks and systems



WP2 IR Action Description:

Geophysical and Geodetic observation networks and systems





WP2 IR Action Description:

Volcanological and multidisciplinary observation networks and systems;

A general strengthening in the monitoring systems and instruments by



New LIDAR
new and better data
Dispersion and sedimentation ashes

Radar Doppler
new data
Volcanic Plums Studies

Observation
remote cameras
new data
Volcanic activity characterization

Long base tiltmeter
new data
caldera dynamic

Gravimeter
better data
Underground mass distribution

Marine Geochemistry
! new data !
Geochemical Monitoring

Marine Observatory
! new data !
Multidisciplinary data



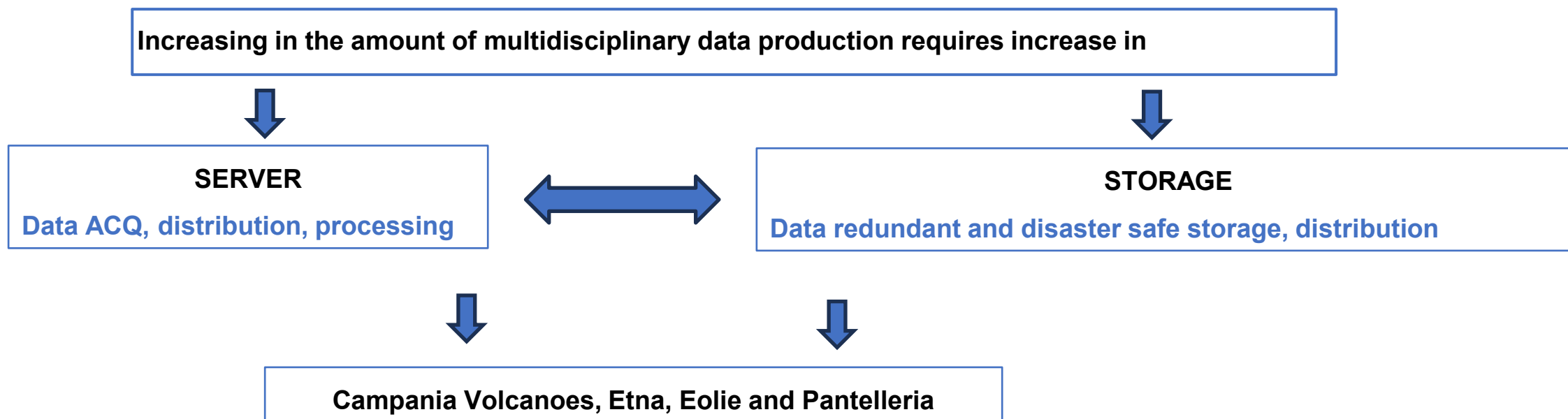
Etna

Etna, Eolie

Campi Flegrei

Campi Flegrei

WP2 IR Action Description: CED and data acquisition systems.



WP2 focus on Campi Flegrei: marine beacon

Seismic Network

Possible new sites...





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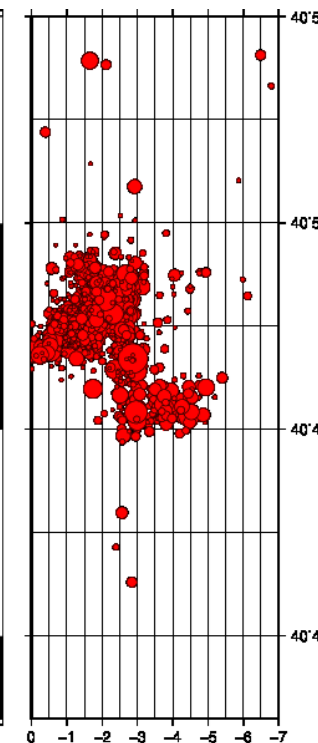
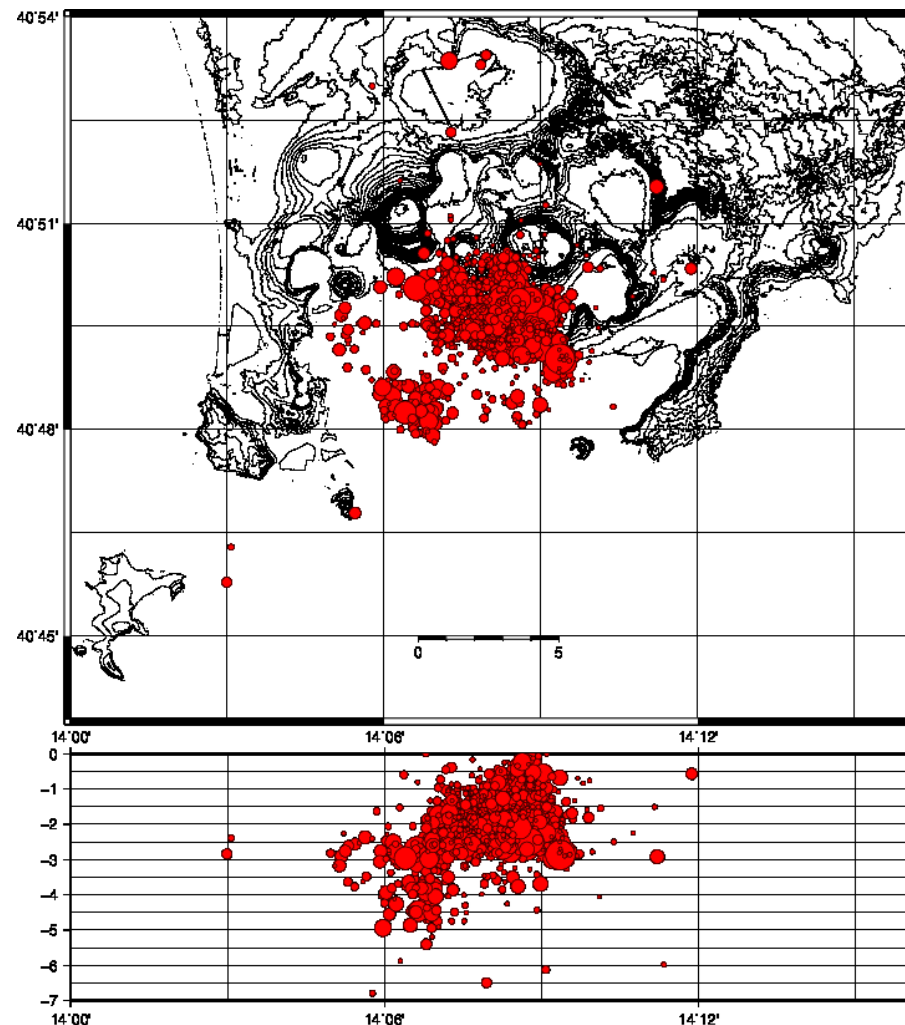
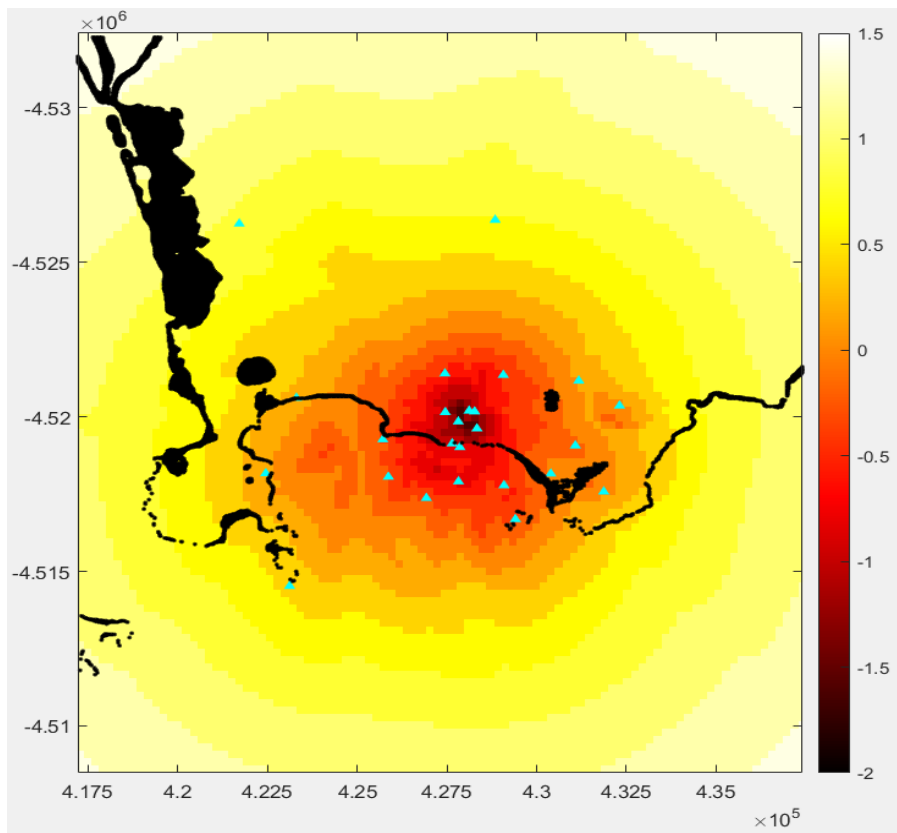
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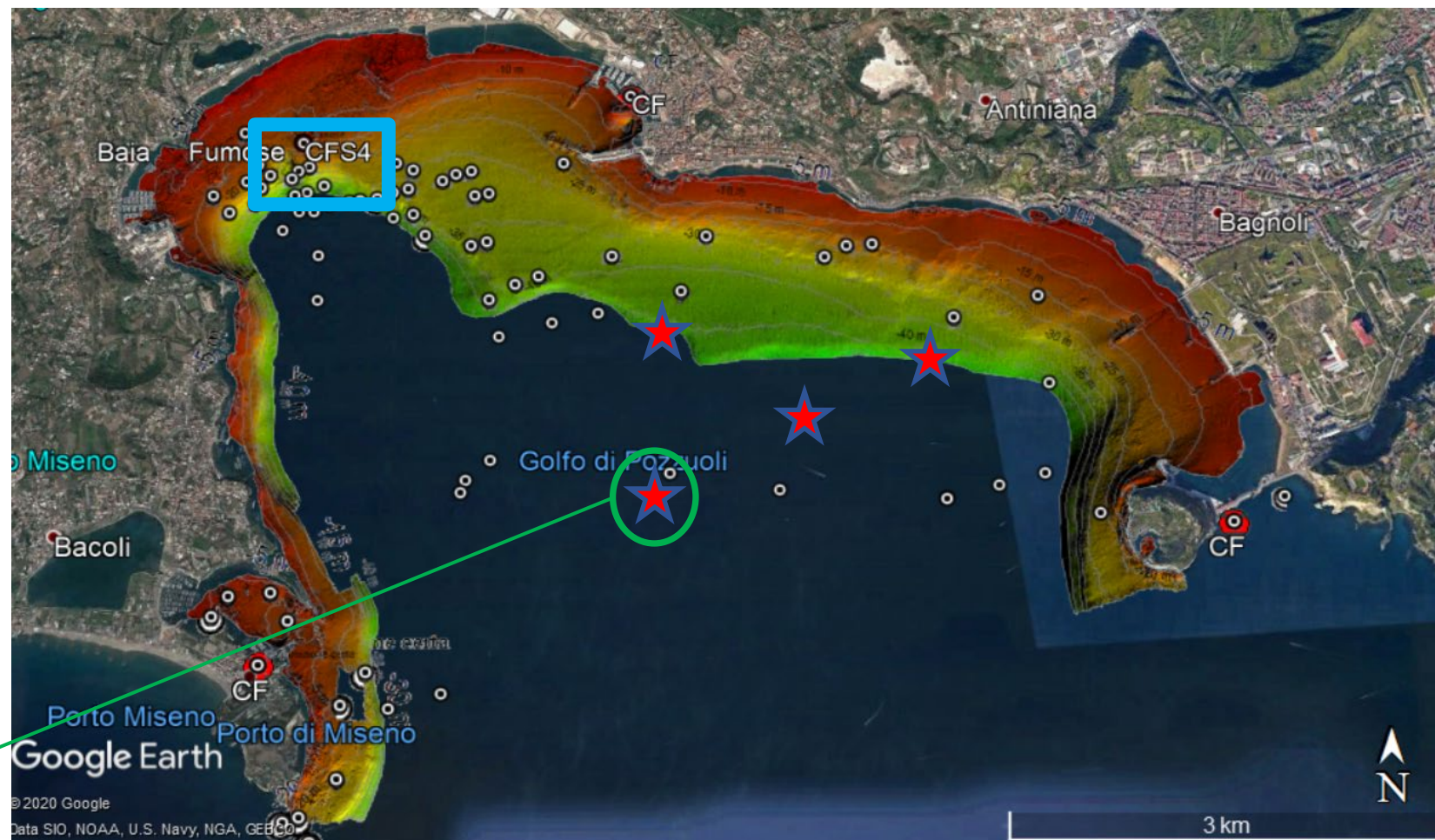
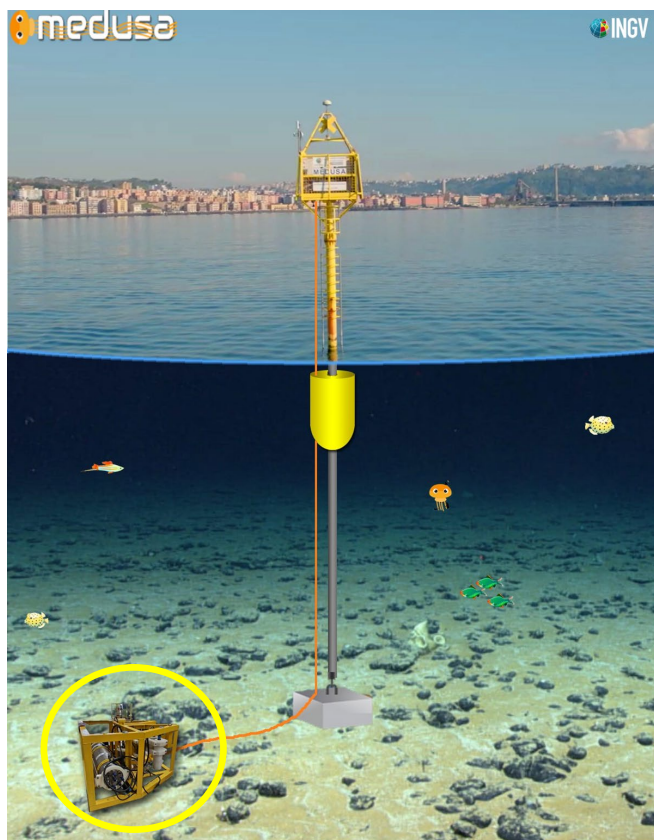
WP2 focus on Campi Flegrei

Network sensitivity (1km depth, location 4 stations)



Seismicity
 $M_d \geq 0.5$
2000-27/09/2023

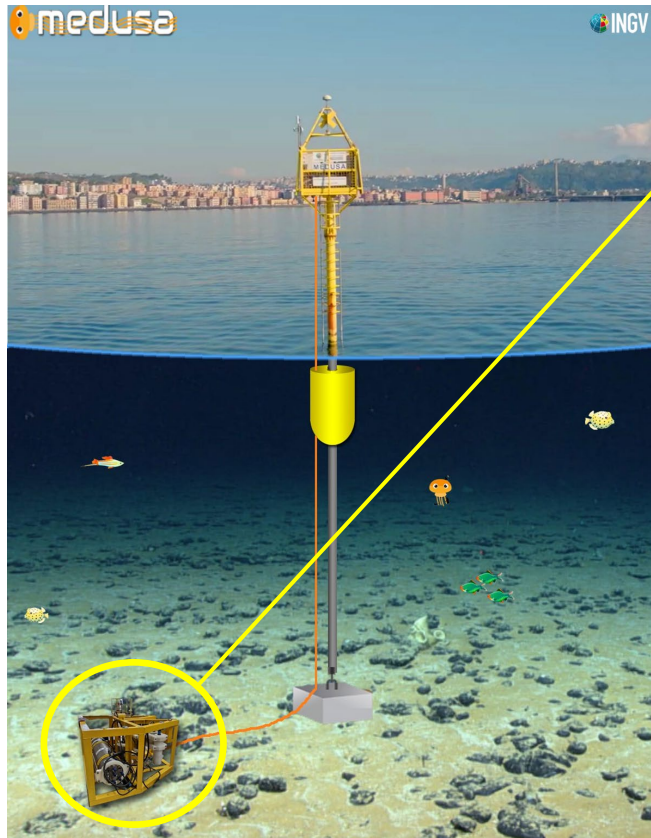
WP2 focus on Campi Flegrei: marine beacon



New Marine Beacon



WP2 focus on Campi Flegrei: marine observatory



Marine Observatory

Equipped with:

- **Seismic OBS sensor**
- **Accelerometric sensor**
- **Absolute pressure gauge**
- **Idrophone**
- **3D correntometer**
- **Water temperature sensor**
- **Heading system**

And subaerial (top of buoyancy structure)

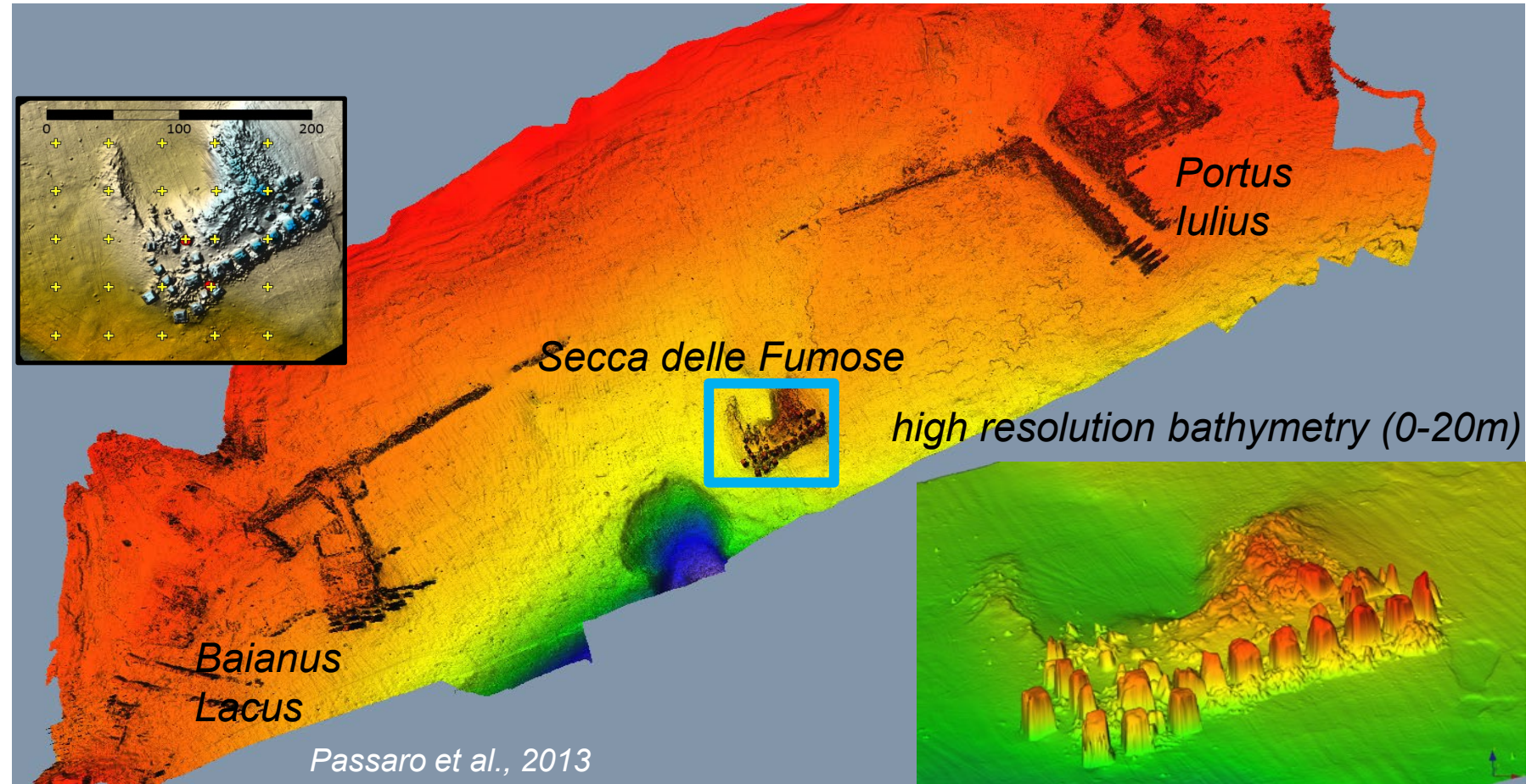
- **GNSS receiver**



WP2 focus on Campi Flegrei: Marine Geochemistry

Research objective

Monitoring of seafloor hydrothermal fluid emissions and estimation of degassing process





WP2 focus on Campi Flegrei: Marine Geochemistry

First Studies

Seawater Multiparametric vertical profiles:

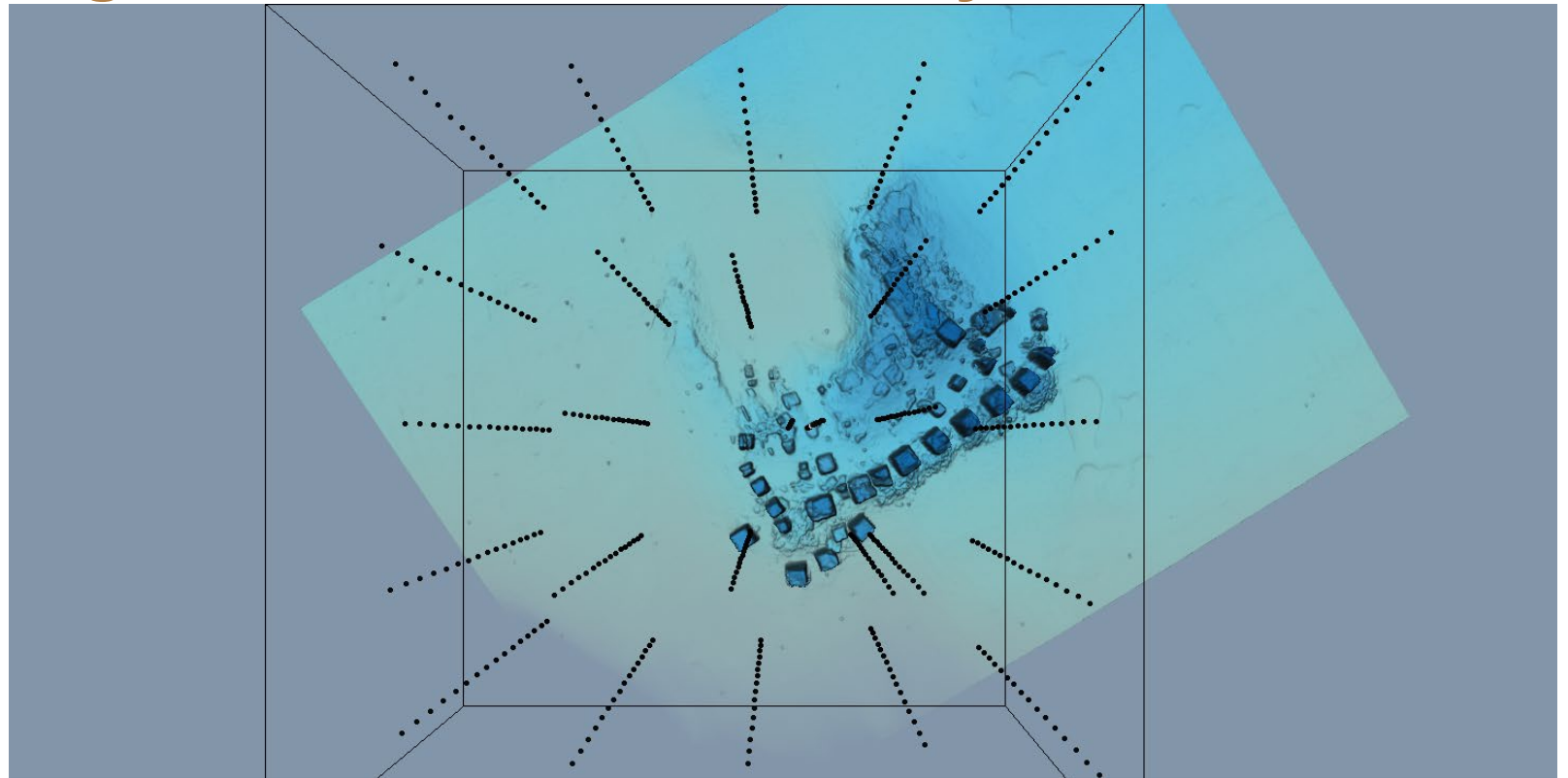
area: ~ 200x200 m;

depth range: 8 – 16 m

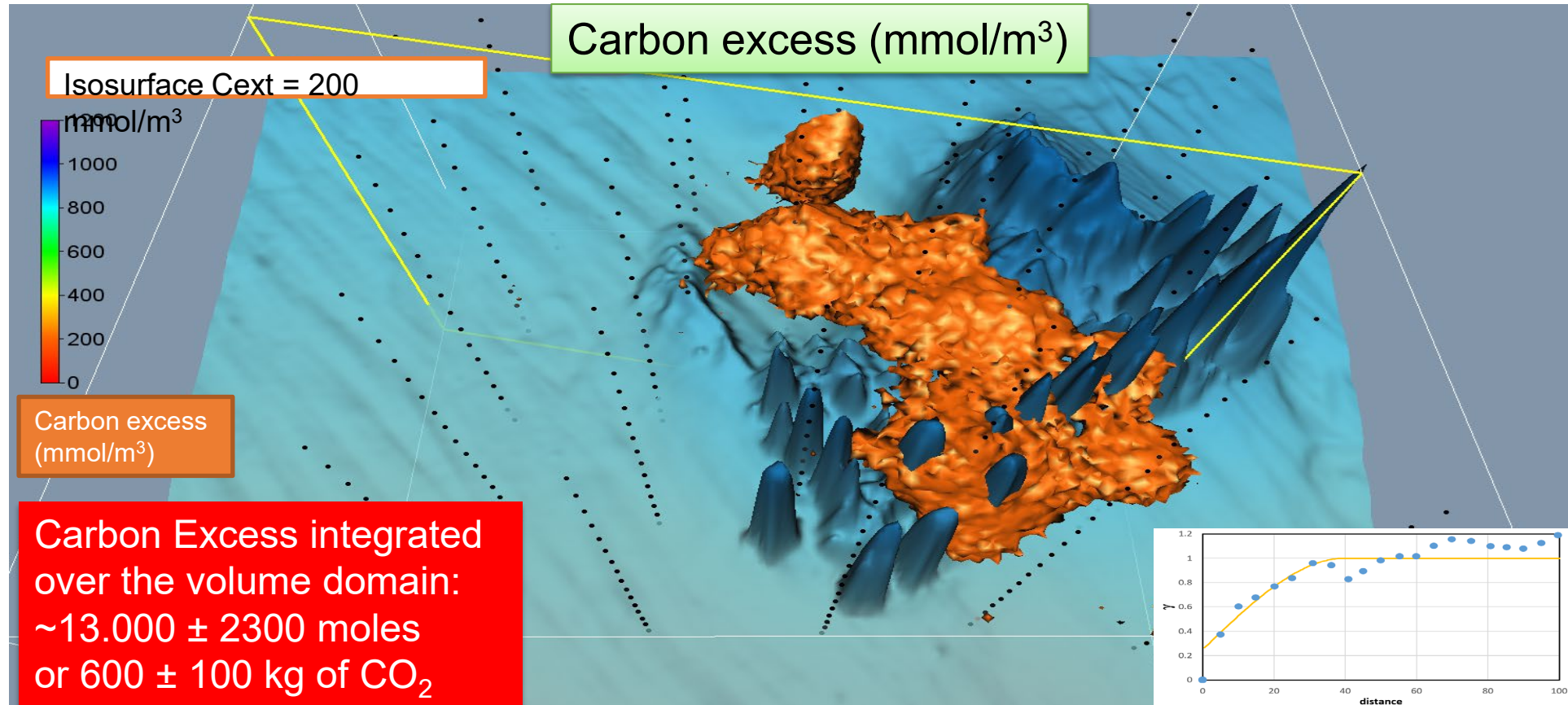
measured parameters:

- temperature
- depth
- pH
- Eh
- salinity
- dissolved oxygen
- pCO₂ potentiometric
- pCO₂ NDIR

- Direction and intensity of Sea currents

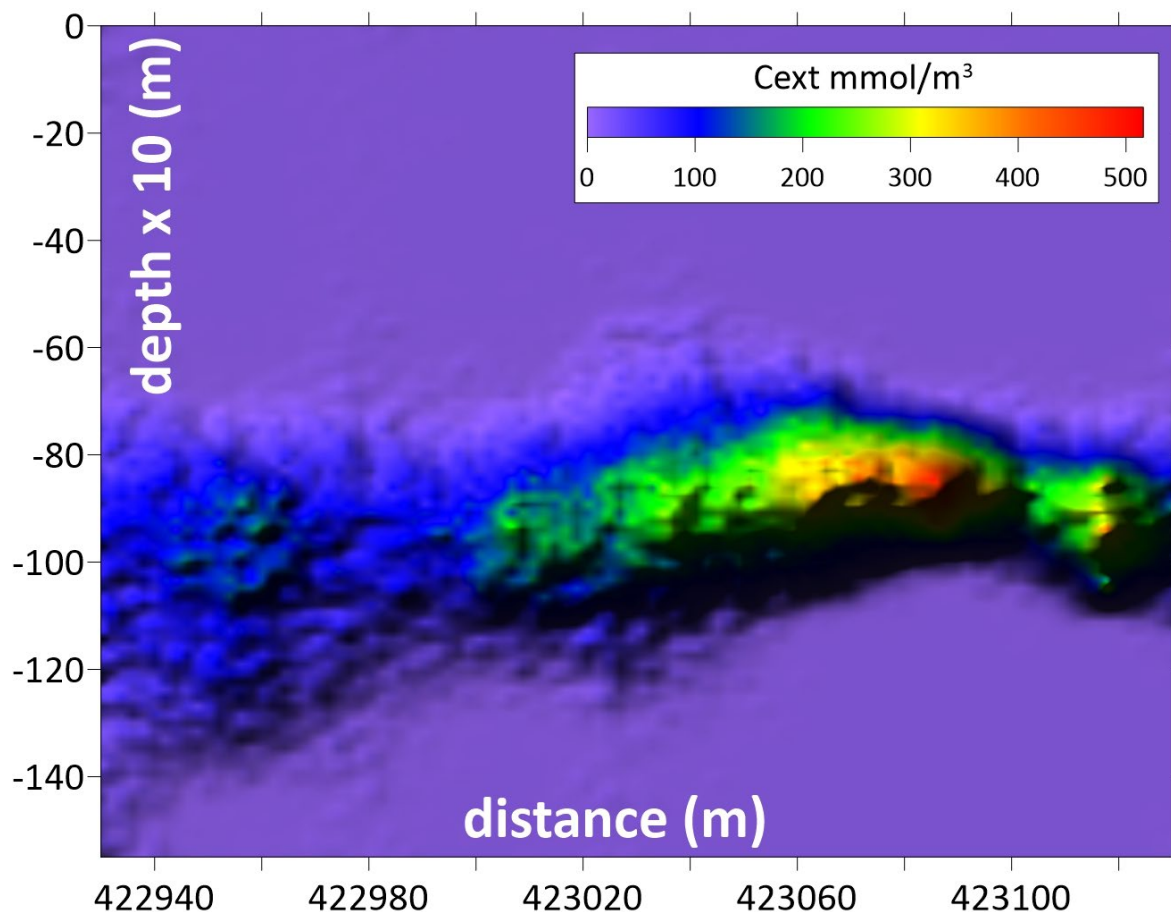


Multiparametric Probe: Idronaut 303;
pCO₂ NDIR sensor: ProOceanus miniCO₂ ;
Currentmeter: Nortek aquadopp





WP2 focus on Campi Flegrei: Marine Geochemistry



Energy and Fluid

Slice section volume	107113 mmol CO ₂ /m
cut volume >70 mmol CO ₂	90950 mmol CO ₂ /m
Average current velocity	0.05 m/sec
CO ₂ flux	4548 CO ₂ /sec 4.548 mol CO ₂ /sec
~90 L/sec hydrothermal liq.	~17 ton CO ₂ /day
Enthalpy kj/molCO ₂	14569 66.251.83 9Watt

~ 66 ± 12 MW



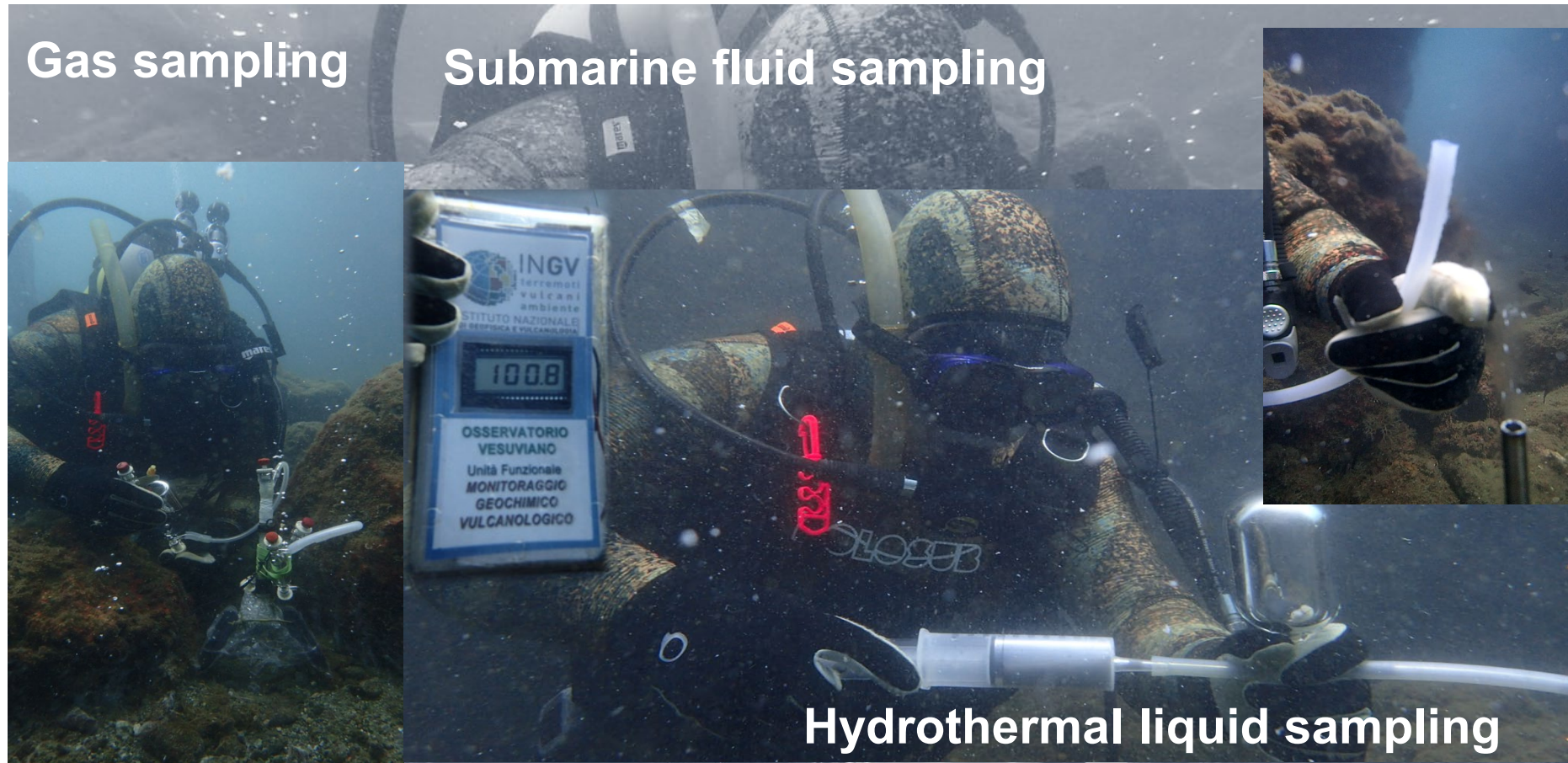
WP2 focus on Campi Flegrei: Marine Geochemistry

Readiness Scuba Staff OV

- Licenced OSS
- Quite full equipped

Today able to

- deploy and move systems and instrument down to 30m depth
- maintain systems and sensors underwater
- sample gas underwater





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WP2 focus on Campi Flegrei: Marine Geochemistry

We want to deploy in the Secca Fumose Area a multinode submarine acquisition system with integrated acoustic modem in order to measure:

- water PCO₂
- water temperature
- 3D current velocity
- underfloor temperature

All those data will be sent in near real time toward INGV, Osservatorio Vesuviano Data Center !

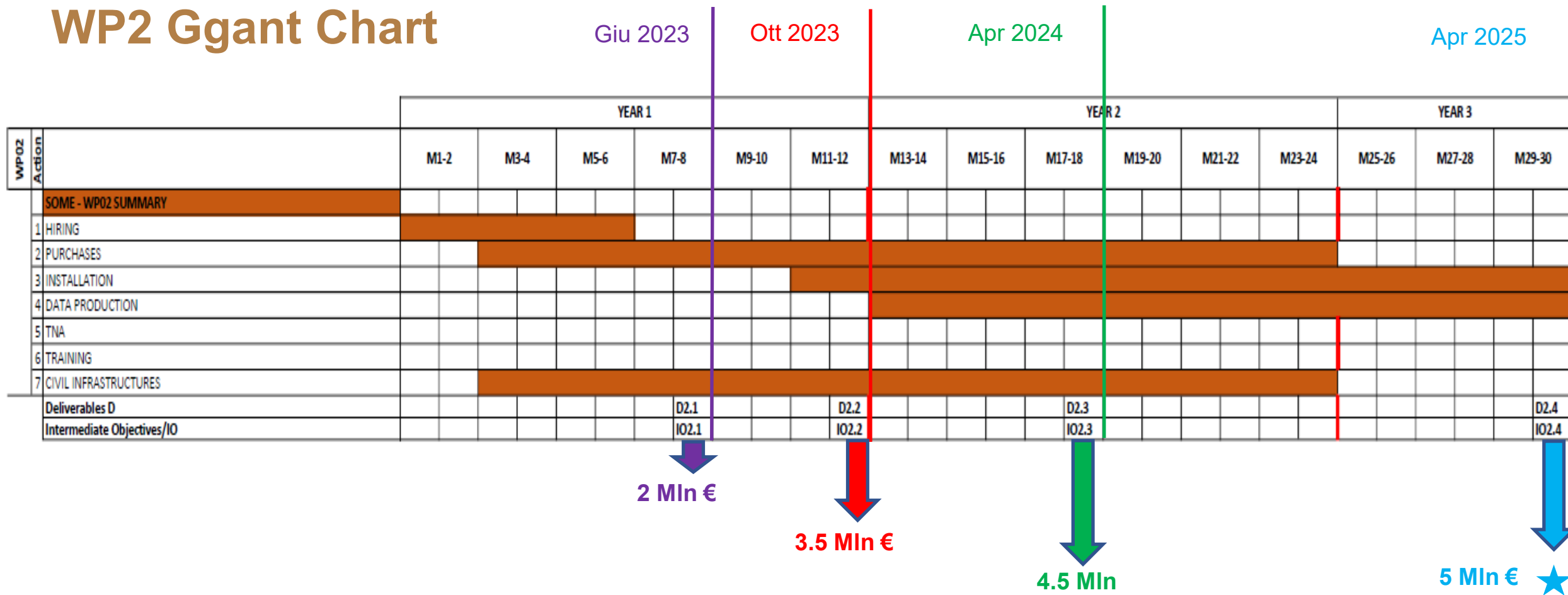


WP2 Budgets

ACTION	FT Personnel	Scientific Instr. (VAT incl.)	Civil Infrastr. (VAT incl.)	Indirect costs (VAT Incl.)	TOTALS
Campania	€ 279.700,93	€ 1.361.570,72	€ 93.457,94	€ 121.431,07	€ 1.856.160,66
Etna	€ 279.700,93	€ 1.747.520,41	€ 186.915,88	€ 154.989,62	€ 2.369.126,84
Eolie + Pant.	€ 93.233,64	€ 542.011,68	€ 88.785,05	€ 50.682,13	€ 774.712,50
TOTALS	€ 652,635,50	€ 3.651.102,81	€ 369.158,87	€ 327.102,82	€ 5.000.000,00



WP2 Ggant Chart





WP2 Item 1 Hiring Fixed Term Personnel

- Campania Volcanoes (Vesuvius, Campi Flegrei, Ischia)**
 3 CTER for a total of 72PM
 (3 electronic technician)

→

2 CTER selected
 - (One will switch to Permanent Term contract...)
 - One never signed employment contract

€93.233,64
- Action 2: Etna volcano**
 3 CTER for a total of 72PM
 (2 electronic technician+ 1 Computer technician)

→

2 CTER selected
 2 electr. tech

€186.467,28
- Action 3: Sicily's volcanic islands (Eolie and Pantelleria)**
 1 CTER for a total of 24PM
 (1 electronic technician)

→

1 CTER selected
 1 electr. tech

€93.233,64



WP2 Item 2 Purchases

Action 1: Campania Volcanoes

Purchases WP2	Activity	Net Cost	Preliminary Procedures	Starting	Award	Shipped	Installed	Committed Budget (no VAT)
Action 1 Campania Volcanoes								
Long Base Tiltmeter	2.1	€ 52.091,31	Commercial Import Evaluation	No	No	No	No	€ 0,00
GNSS Atmosphere sensors	2.1	€ 61.283,90	Quote ready	No	No	No	No	€ 0,00
Gravimeter	2.1	€ 130.228,32	Completed	Yes	Yes	No	No	€ 138.920,00
Seafloor Geochemistry	2.1	€ 141.718,97	Documentation complete	No	No	No	No	€ 0,00
Underwater Observatory	2.1	€ 424.391,03	Documentation complete	No	No	No	No	€ 0,00
CED servers	2.1	€ 99.586,36	Completed	Yes	Yes	No	No	€ 106.367,36
Storage	2.1	€ 206.833,18	Completed	Yes	No	No	No	€ 200.000,00
							TOTAL	€ 445.287,36



WP2 Item 2 Purchases

Action 2: Etna volcano

Purchases WP2	Activity	Net Cost	Preliminary Procedures	Starting	Award	Shipped	Installed	Committed Budget (no VAT)
Action 2 Etna Volcano								
Mobile Lidar and photometer	2.2	€ 76.604,87	Completed	Waiting to start	No	No	No	€ 0,00
Multi-sensor observation infrastructure	2.2	€ 38.302,44	Information requested	Almost ready	No	No	No	€ 0,00
Network Cameras	2.2	€ 53.623,41	Completed	In progress AC/waiting	No	No	No	€ 0,00
Radar doppler	2.2	€ 76.604,87	Completed	Waiting to start	No	No	No	€ 0,00
FTIR_Solar_network	2.2	€ 114.907,29	Documentation under revision	No	No	No	No	€ 0,00
Upgrade of seismic and infrasonic monitoring	2.2	€ 321.740,47	Completed	Yes	Yes	No	No	€ 314.573,77
DAS instrument for strain measurement from a fibre optic cable	2.2	€ 168.530,75	Completed	Yes	Yes	No	No	€ 217.712,00
Mobile GNSS network	2.2	€ 76.604,87	Waiting for documentation	No	No	No	No	€ 0,00
Upgrade of the tilt permanent network	2.2	€ 38.302,44	Completed	Yes	No	No	No	€ 40.983,61
Upgrade of the GNSS permanent network	2.2	€ 76.604,87	Completed	Yes	Yes	Yes	Partially?	€ 58.202,61
CED servers	2.2	€ 291.098,50	Completed	Yes/In progress AC/waiting	Yes (part.)	No	No	€ 30.179,04
Hardware	2.2	€ 99.605,05	Completed	In progress AC/waiting	No	No	No	€ 0,00
							TOTAL	€ 661.651,03



WP2 Item 2 Purchases

Action 3: Sicily's volcanic islands (Eolie and Pantelleria)

Purchases WP2	Activity	Net Cost	Preliminary Procedures	Starting	Award	Shipped	Installed	Committed Budget (no VAT)
Action 3 Eolie and Pantelleria Volcanoes		€ 0,00						
Network Cameras	2.3	€ 65.114,14	Completed	In progress AC/waiting	No	No	No	€ 0,00
Upgrade of seismic and infrasonic monitoring	2.3	€ 214.493,64	Completed	Yes	Yes	No	No	€ 217.426,23
Upgrade of the tilt permanent network	2.3	€ 61.283,90	Completed	Yes	No	No	No	€ 65.573,77
Installation of a upgraded existing instrument	2.3	€ 49.793,17	Information requested	-	-	-	-	€ 0,00
Upgrade of the GNSS permanent network	2.3	€ 53.623,41	Completed	Yes	Yes	Yes	Partially?	€ 38.801,74
							TOTAL	€ 321.801,74



WP2 Progress status (committed budget)

Action 1 Campania Volcanoes	€ 445.287,36
Action 2 Etna Volcano	€ 661.651,03
Action 3 Eolie and Pantelleria Volcanoes	€ 321.801,74
Instruments Total	€ 1.428.740,13
Instruments Total VAT incl.	€ 1.743.062,96
Hiring Personnel	€ 372.934,56
TOTAL Committed Budget	€ 2.115.997,52
Expected Committed Budget Value	€ 3.500.000,00
Execution level(%)	60



WP2 Critical aspects

- **personnel recruitment difficult**
- **INGV people quite full busy in other institutional activities with difficult to respect dead line of scheduled activities**
- **time to be spent in order to evaluate the DNSH requirements**
- **civil infrastructures requires complex technical and administrative activities than expected before**