







# WP 5 Coordinator Mario Mattia

- NEMESI
- NEar fault observatory in MEssina Stralt













In May 2022, the MEET project (Notice n. 3264 of 28/12/2021 «Strengthening and creation of IR in the context of the National Recovery and Resilience Plan (PNRR)») is approved

WP5 «NEMESI» (NEar fault observatory in Messina StraIt) receives a total funding of 3,500,000 euros

WP5 provides for the implementation of four project actions

As part of WP5, 3 new units of TD staff have been hired (2 technicians and a researcher)

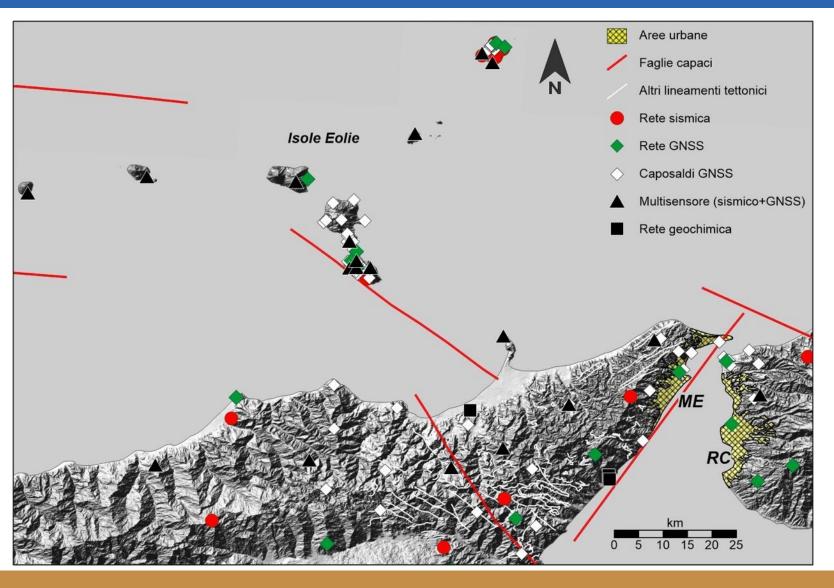
A reconstruction of the INGV Messina office (Viale Regina Margherita - Parco Aldo Moro) is currently underway







The aim of WP05 is the improvement of research and monitoring networks (geophysics, geodetics and geochemical) in Aeolian and Messina Strait area













Resuming, this proposal is founded on four main premises:

- •1. The availability of an INGV office in Messina, under the direct control of the INGV Etnean Observatory section.
- •2. The need to stimulate, in the Strait of Messina area, seismological and geo-environmental research activities, aimed to study seismic and hydrogeological hazards.
- •3. The existence of an important seismic and geodetic monitoring network, built by INGV in the last twenty years
- •4. The availability of an additional dense network of drillings (186), whose property was transferred in 2017 from the former Stretto di Messina S.p.A. to INGV, destined to host piezometers (120 sites in Sicily and 40 in Calabria) and inclinometers (66), but presently not instrumented.
- •The main goal of this WP is creating a research pole in Messina, capable of acquiring, analyzing and distributing data from a vast network of sensors.











1			REVISION				
1 Acquisition of instrumentation	Sub-action	D eliverable	Cost	105.1	105.2	105.3	105.4
1   Civil infrastructures-seismic network   192,720 €   18,720 €   18,720 €   14,000 €   2   Running costs-individuation of sites-GNSS   3,000 €   3,000 €   3,000 €   1,000 €   1,000 €   2,000	1	Running costs-seismic network	14.000€				14.000€
Total seismic network   192,720 €   100,000 €   0 €   78.720 €   14.000 €   2   3.000 €   3.0	1	Acquisition of instrumentation	100.000€	100.000€			
2 Running costs-individuation of sites-GNSS   3,000 €   3,000 €   10,000 €	1	Civil infrastructures-seismic network	78.720€			78.720 €	
2 Running costs-installation of remote sites-oNSS   10,000 €   24,000 €   24,000 €   24,000 €   24	1	Total seismic network	192.720 €	100.000 €	0 €	78.720 €	14.000 €
2 Acquisition of SNSS receivers and accessories 2 Acquisition of software for dataprocessing-SNS 3 Hiring of temporary personnel-SNSS 3 Running costs-Evaluation SdM SpA network and individuation 10,000 € 10,00	2	Running costs-Individuation of sites-GNSS	3.000€				3.000€
2 Acquisition of software for dataprocessing-GNSS	2	Running costs-Installation of remote sites-GNSS	10.000€				10.000€
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3   Running costs-Evaluation SdM SpA network and individuation   10.000 €   10.000 €   3   Running costs-installation hydrogeological memory   4.000 €   4.000 €   100.000 €   3   Acquisition advanced hydrogeological monitoring station   150.000 €   150.000 €   3   3   Acquisition multiparametric downhole hydrogeological stat   150.000 €   150.000 €   3   3   3   3   3   3   3   3   3			A CHARLES OF THE PARTY OF THE P				
3   Running costs-installation hydrogeological network   4,000 €   100,000 €   100,000 €   3   Acquisition advanced hydrogeological monitoring station   100,000 €   150,000 €   3   Civil infrastructures- Housing of hydrogeological monitoring   30,000 €   133,520 €   133,520 €   3   3   Civil infrastructures- Housing of hydrogeological network   407,520 €   113,520 €   3   3   Civil infrastructures- Housing of hydrogeological network   407,520 €   113,520 €   3   3   Civil infrastructures- Intellation of tilt stations   35,500 €   4   Acquisition of the tilt network hardware   76,000 €   76,000 €   76,000 €   35,500 €   4   Civil infrastructures-installation of tilt stations   35,500 €   99,760 €   99,760 €   35,500 €   8   Running Costs-Tilt   7   70 tal Tilt   7   70 tal Tilt   7   70 tal Tilt   7   70 tal Tilt   7   7   7   7   7   7   7   7   7				233.760 €	0 €	27.220 €	13.000 €
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1 Data Center hardware 750.000 € 750.000 € 1 Hiring of temporary personnel -Data Center 0 € 0 € 1 € 750.000 € 1 8.0	1	Running costs-Data Center	60.000€				60.000€
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1       Running costs-TELECOM       18.000 €       18.000 €       18.000         1       Civil infrastructures-Adaption of the ING∨ Messina facilities       20.000 €       20.000 €       160.000 €         1       Aquistion of telecommunication hardware, software and higher than the properties of	1	Hiring of temporary personnel -Data Center	0 €	0 €			
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1       Development of FAIR platforms for data diffusion       52.000 €       52.000 €         1       Hiring of temporary personnel       99.760 €       99.760 €         1       Total TELECOM       349.760 €       119.760 €       0 €       212.000 €       18.000		· · · · · · · · · · · · · · · · · · ·		20.000€			
1       Hiring of temporary personnel       99.760 €       99.760 €       99.760 €       199.760 €       0 €       212.000 €       18.000	0.00	por 1					
1 Total TELECOM 349.760 € 119.760 € 0 € 212.000 € 18.000						52.000€	
3.500.000 € 1.521.560 € 256.000 € 1.483.440 € 239.000	1	Total TELECOM					18.000 €
			3.500.000 €	1.521.560 €	256.000 €	1.483.440 €	239.000€









<u>5.1 Technological implementation of instrumental networks (A.L. Paolo Madonia)</u>: This activity will be aimed at the consolidation and implementation of a dense network of sensors able to quantify the seismicity and micro-seismicity of the Strait area, to evaluate the deformation rate associated to the main faults and to evaluate the effects of the rainfall/runoff regime on hillslope stability and recharge of groundwater bodies exploited for human usages.

- Sub-actions comprehend the following products:
- 1) The extension of the present seismic network (13 sites) with new 5 seismic-accelerometric stations.
- 2) The extension of the present GNSS network (20 sites) with 4 new stations, acquiring high frequency and meteorological data that will be processed in real time at the master station of the Messina INGV office.
- 3) A new hydrogeological network, to be built after an accurate inspection of the boreholes of the S.P.A. Stretto di Messina S.p.A. network, consisting of 10 sites plus one master station.
- 4) A new high precision tiltmeters network, consisting of 4 stations installed in 40 m deep holes, providing high-precision signals (resolution 5 nanoradians) close to Peloritani Mts. main faults.
- 5) A mobile laboratory facility for inspection and maintenance of overground and borehole monitoring networks, execution of downhole hydrogeological and geophysical surveys and in situ non-destructive tests on geomaterials.
- 6) Two laboratories hosted by the Messina INGV office, supporting the monitoring networks: a geophysical lab, for the characterization of soils and shallow crustal structures, and a second one devoted to the analysis and modeling of geodetic, geotechnical and remote sensing data











5.2 Development of Urban Seismic Observatories and seismic-accelerometric networks in industrial areas with high risk of major accidents (A.L. Domenico Patanè): The main objective of this action is to create rapid response monitoring networks in north-east Sicily and south Calabria, based on the most recent micro-electronic (low-cost and low energy consumption devices), and computing technologies (Artificial Intelligence, Machine Learning, Internet of Things, etc.). The Urban Seismic Observatories, similar to those already operational in the city of Catania (PON EWAS), will be implemented in the metropolitan areas of Messina and Reggio Calabria and in the industrial area of Milazzo, few km W of Messina.

#### The products are:

- 1) Implementation of a strong-motion monitoring system in densely urbanized areas, by means of a dense network (35 stations) of low cost seismic-accelerometric sensors.
- 2) Extension of the INGV-OE seismic laboratory (L.E.D.A., Laboratory of Earthquake engineering and Dynamic Analysis), at the University of Enna KORE, devoted to calibration, dynamic tests and diagnosys of seismic instruments. Acquisition of a laser vibrometer for primary low frequency calibration and of a vertical shaker to be added to the existing system; accreditation of calibration and calibration measures in accordance with ISO 17025.









<u>5.3 Enhancement of the Messina INGV office - Data Acquisition Center (A.L. Marcello D'Agostino)</u>: The recent availability of new INGV offices at Messina, in the building located in Viale Regina Margherita 87, Parco Aldo Moro, aims to create a driving force for research activities on the geodynamics of the Strait and southern Calabria area. For this reason, the choice of hosting a Data Acquisition Center at the INGV offices must be considered strategic for the pursuit of the aforementioned purposes.

#### The products are:

- 1) Creation of a Data Processing Center, supporting acquisition, storing and processing of data from the monitoring networks, supporting intensive server workloads such as Artificial Intelligence, Deep Learning and High Performance Computing.
- 2) Creation of a Cloud Computing infrastructure for virtual machines, bare metal and containers, able to control and distribute pools of computing, storage and network resources, made available by the Data Center for all monitoring and research needs.











<u>5.4 Enhancement of the Messina INGV office - Development of systems for acquisition, analysis, archiving and automatic distribution of data (A.L. Massimo Rossi)</u>: The main function is to offer a telecommunication infrastructure to all remote monitoring and research stations, both permanent and periodically used. Its specific aim is the connection to the EPOS platforms for data distribution. The INGV office in Messina, will be equipped with all the necessary technologies to ensure effective and secure data transmission, bot wired and wireless, connected to INGV data transmission backbones and external facilities.

#### The products are:

- 1) Adaption of the internal systems of the Messina INGV building to current standards for interconnecting workstations, laboratories and the high-speed data center in both wired and wireless mode.
- 2) High-speed CED Internet connection, based on cloud technologies, private-public and processing and archiving "on-demand" protocols and systems, continuously optimizing computing resources.
- 3) Development of a geographic network based on a mixed radio/terrestrial/satellite system for the acquisition of data from the monitoring network and the mobile lab described at Action 1-e).
- 4) Implementation of adequate security and data protection systems (firewall, backup, cloud storage) to prevent external attacks and hacking.











#### WP5 Action 1 – Status of administrative procedures for instrumentation acquisition

## Allotments of European tender notices

- 5.1.1 Seismic network concluded
- 5.1.2 GNSS network concluded
- 5.1.3 Hydrogeological network concluded
- 5.1.4 Tilt network on the go

#### Local ("Sezioni" INGV) procedures

- 5.1.3 Advanced hydrogeological monitoring station on the go, very close to be concluded
- 5.1.5 Downhole mobile lab to be launched
- 5.1.6 Multidisciplinary lab to be launched





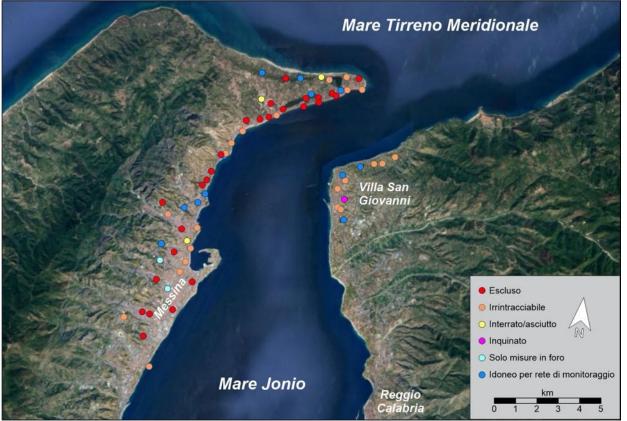






#### WP5 Action 1 – Activities

Evaluation of the Stretto di Messina SpA piezometric network



### Individuation of stakeholders for hydrogeological data (collaboration started)

- 1) Autorità di Bacino della Sicilia (regional quantitative monitoring network of underground aquifers)
- 2) Azienda Meridionale Acque Messina (quantitative monitoring of drinking water underground sources for the urban area of Messina)
- 3) Città Metropolitana di Messina (environmental management of the Nature Reserve "Laguna di Capo Peloro e Laghi di Ganzirri")













#### WP5 Action 2 - Urban Seismic Observatory (Messina-Reggio Calabria)

#### Acquisition of Instrumentation \* (480 k€)

48 Smart Seismic stations

48 Q-MEMS accelerometers with very high sensitivity and ultra-low noise characteristics

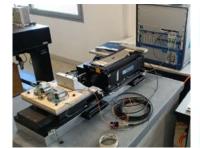
\* The contract notice for the acquisition of the above apparatus has started.

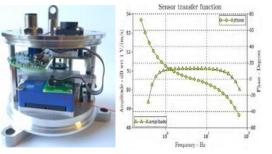
#### **Civil Infrastructures accomodation (50 k€)**

Running costs (9 k€)

Expansion of the INGV Shaker-table for the primary calibration of sensors (120 k€) □ 2024

















#### WP5 Action 3 – INGV Messina Data Center

#### **Computing Resources**

**256** Core 4th Generation Processors

**2TB** DDR5 ECC Registered Memory

8x **GPU** NVIDIA L4 ADA 24GB

8x 32Gbit HBA FC/NVMe-oF

16x **25Gbit** Ethernet RoCEv2

#### **Network Resources**

**25Gbit** Switches RDMA over Converged Ethernet

#### **Storage Resources**

**150TB** SSD NVMe PCIe Storage for

Virtualization

**20TB** SSD SAS 12Gbit Storage for

FlashPool

500TB SAS-NL 12Gbit Storage for Data













#### **WP5 Action – INGV Telecommunication systems**



Line-of-sight availability of WLAN link between INGV office of Messina and Dinnammare antenna for a direct connection to INGV WLAN network for data transmission from Eolie-Messina-Etna-Catania areas













#### WP5 Action 3 and 4 – INGV Messina Data Center

#### Data Center Hardware and telecommunication infrastructure (750 k€)

- 300k€ transferred to CINECA for HPC infrastructure
- Waiting for the start of the European tender for the remaining servers and telecommunication devices

#### Civil infrastructure - Accomodation and facilities Data Center Room (25 k€)

purchase procedure started

Running costs – Data Center (60 k€)



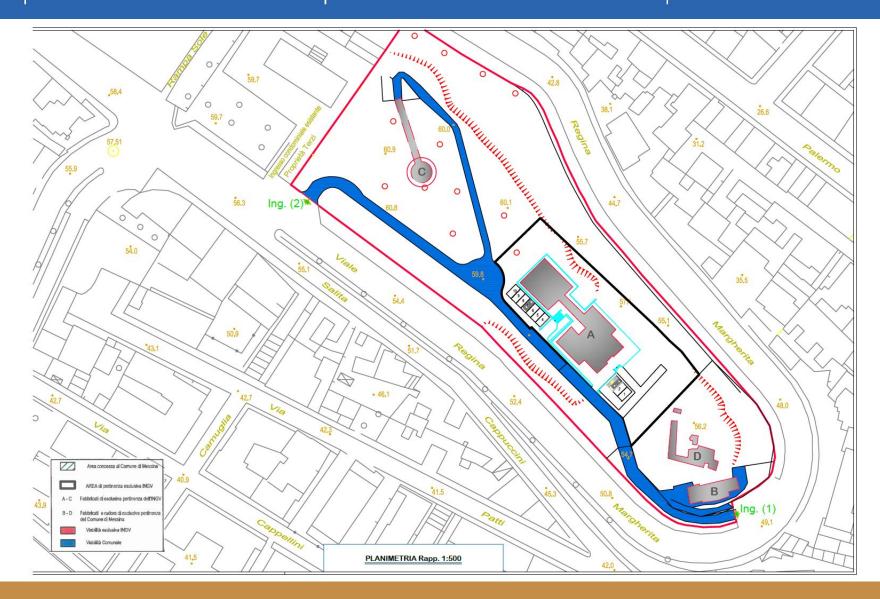








#### Planimetria Parco Aldo Moro







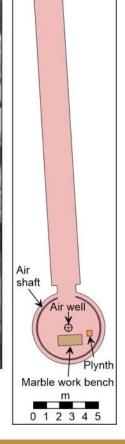






#### WP5: Topographic survey of the INGV Messina headquarter geophysical





























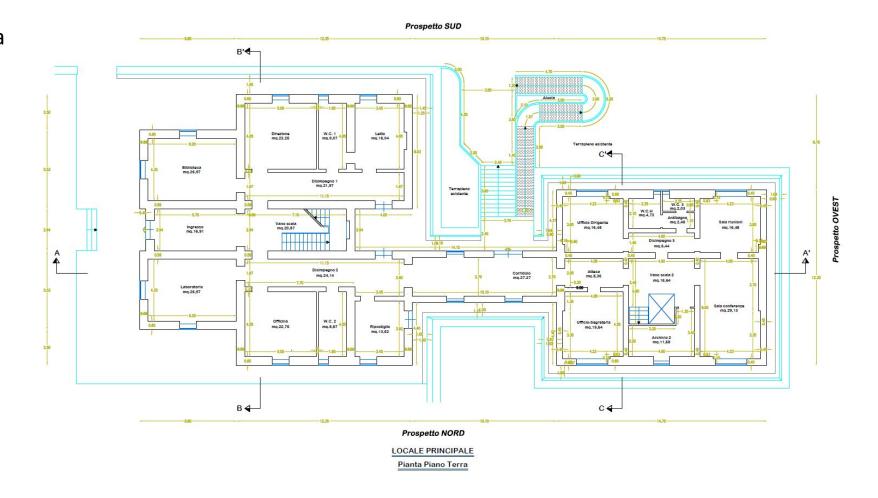








Sede di Messina INGV – Piano Terra





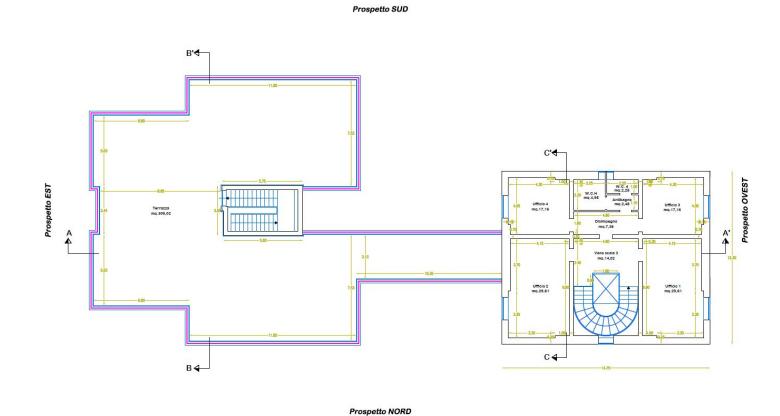








#### Sede di Messina INGV – Piano primo



LOCALE PRINCIPALE
Pianta Piano Primo

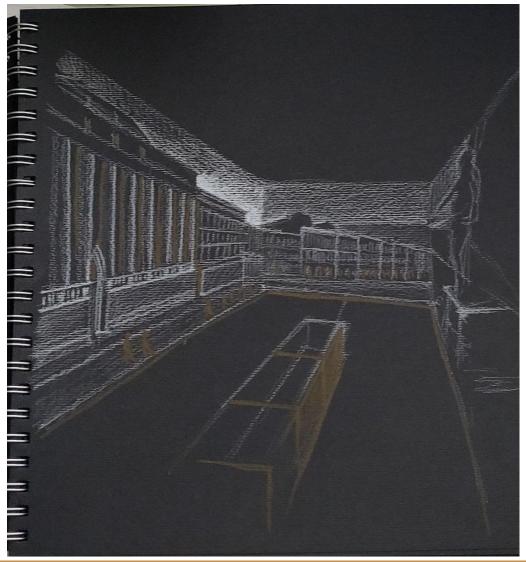










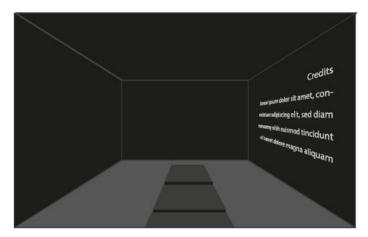




Sulle pareti, appaiono adesso le immagini di Messina distrutta, animate e arricchite da elementi grafici e testi.

Audio da decidere.

Durata: 180-240 secondi



Al termine, sulle ultime immagini di Messina post-terremoto, se possibile inserire qualche immagine odierna e poi presentare i credits.

Audio da decidere.

Durata: 30-40 secondi











#### Acquisizione immagini dell'archivio del giornale «L'Ora» di Palermo relative al terremoto del 1908































## Grazie per l'attenzione!

