

14th Session of the ICG/IOTWMS-XIV
17-19 November 2024



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Intergovernmental
Oceanographic
Commission

ICG / NEAMTWS

Status of progress

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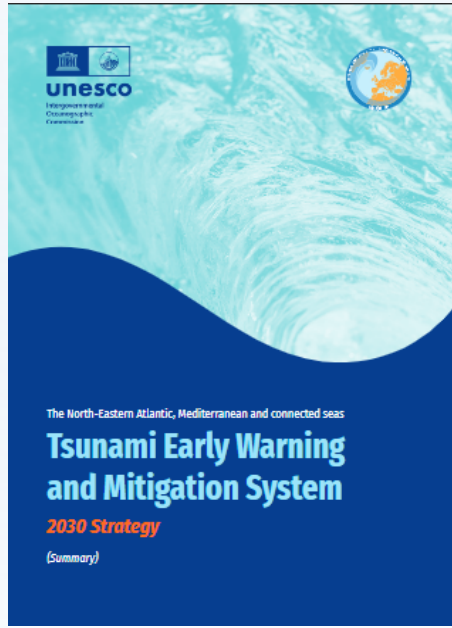
The ICG/NEAMTWS activities/advancements 2023-2024



Several relevant activities and advancements, including:

- ✓ Continued operations (monitoring, warning, meetings, etc.)
- ✓ 6 recognized **Tsunami Ready** communities (and others coming soon)
- ✓ Improved response in the **NEAMWave23** (+ local exercises)
- ✓ Closing of **CoastWave** project (2022-2024), **Phase-2** started July 2024 (DG-ECHO)
- ✓ Other projects on tsunami science and hazard - risk mitigation (+ EPOS, GTM, etc.)
- ✓ **New Task Team on non-seismic tsunami sources** (Stromboli test case + WS)
- ✓ New developments and technologies:
 - New tide gauges in several MS coastal areas (**20 in Marmara Sea, Türkiye**)
 - First cabled **deep-ocean sensors** connected to TSPs
 - Two **DART-like buoys** coming in the Ionian sea (2025) + 1 near Stromboli
 - Probabilistic Tsunami Forecasting - **PTF** implementation

Task team on documentation



NEAM Strategy 2030
(2023)

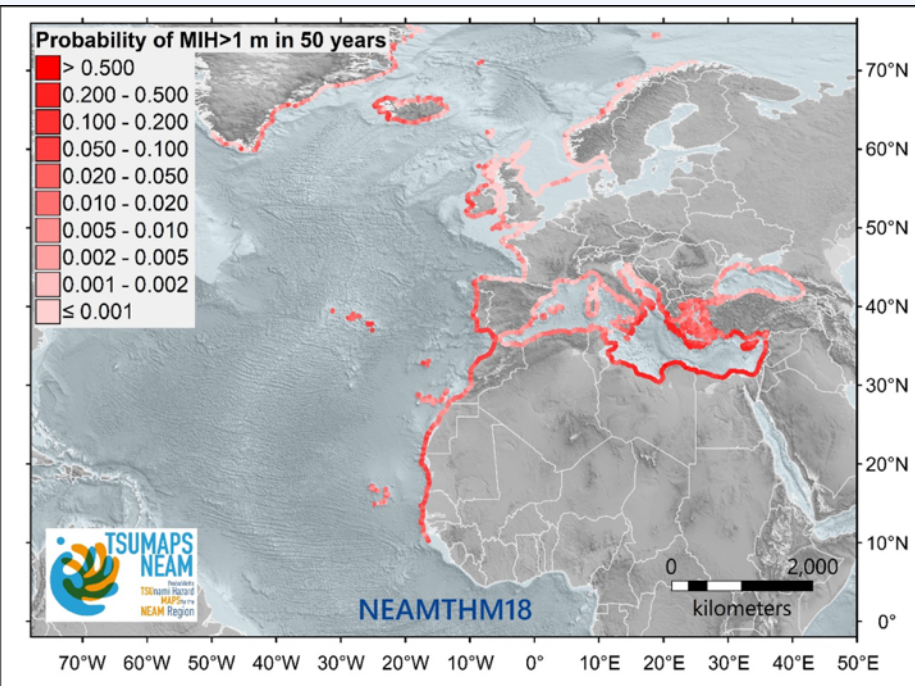
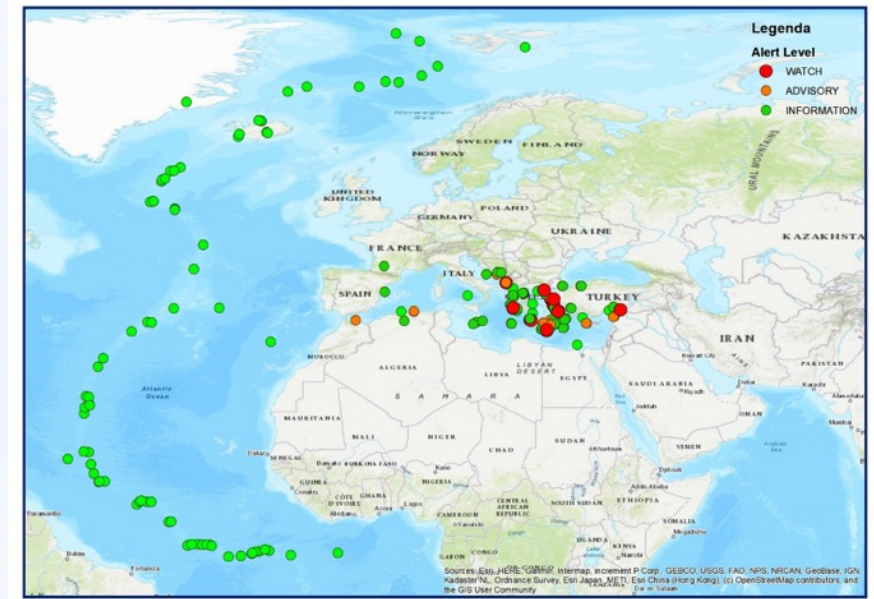
New OUG
(2025)

Drafting of new NEAMTWS Operational Users Guide, taking into account:

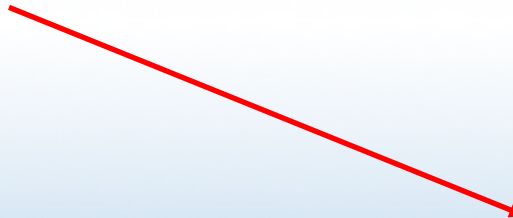
- The NEAM regional particularities for tsunami service provision;
- Lessons-learned from past tsunami events in the NEAM region;
- The need for improved interoperability between the NEAMTWS Tsunami Service Providers;
- The updated Global Service Definition Document, including the recommendation for the adoption of the threat levels by the regional tsunami warning systems.

An effective TEWS is operational
(rapid, redundant, improving)

A good group of passionate and prepared scientists



A baseline PTHA is available (NEAMTH18)
and usable for national and local planning



First 6 Tsunami Ready communities (2024)
Others coming soon (scaling-up?)

An infographic titled "Tsunami Ready Implementation in the NEAM REGION" from UNESCO. It lists 11 countries and 15+ communities, with 6 recognized in 2024. The communities shown are: Chipiona, El Jadida, Loulé, Büyükçekmece, Cannes, Marzamemi, Otranto, Marsaxlokk, Israel, Palmi, Minturno, Stromboli, Larnaca, Samos, and Alexandria. Each community is accompanied by a small image showing its coastal area.

Events in the NEAM region in 2017-2024

5 TSPs (France, Greece, Italy, Portugal, Turkey)

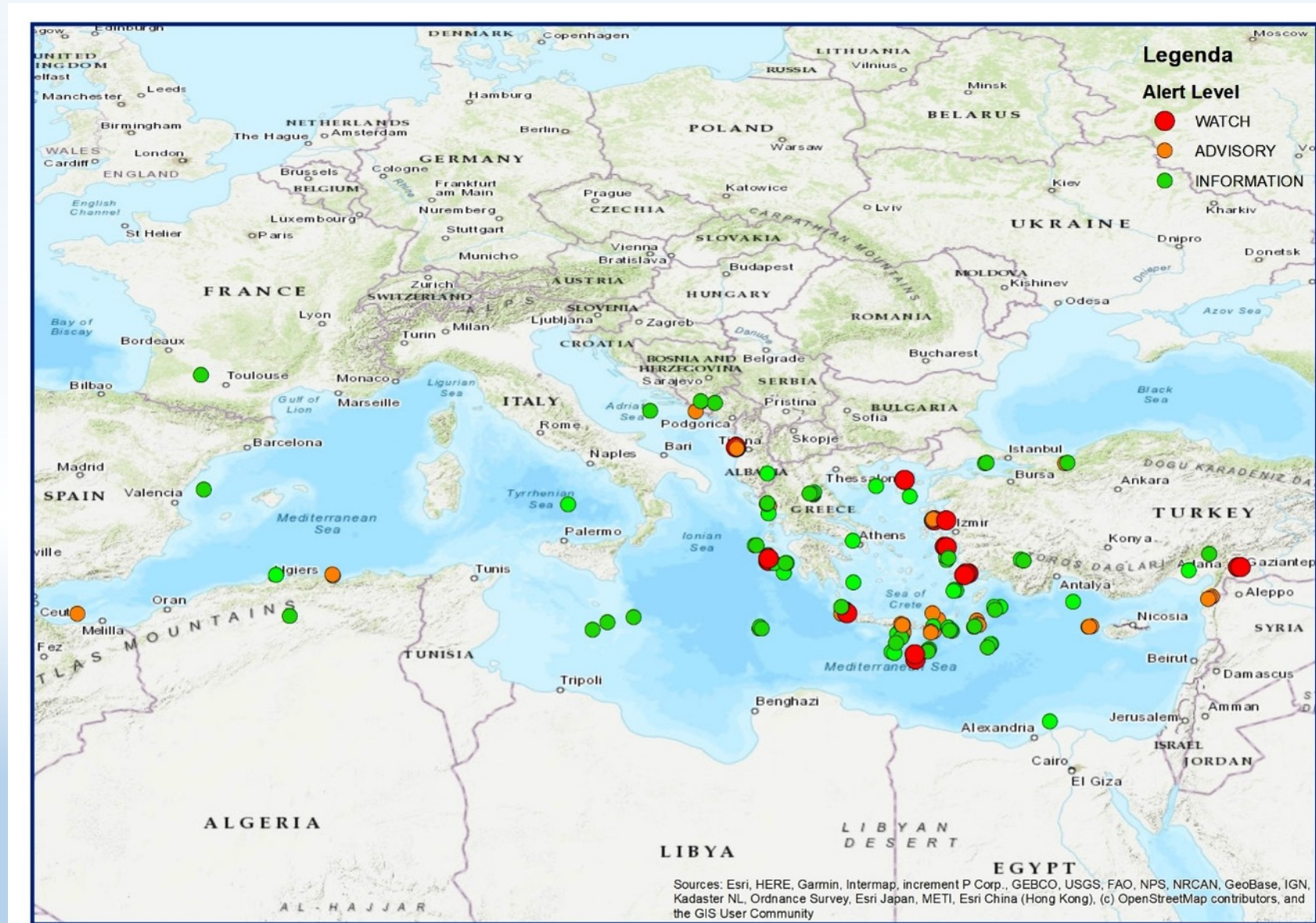
210 Events (activations)

Mag 5.5 to 7.8 (5'-10')

Mostly Information level

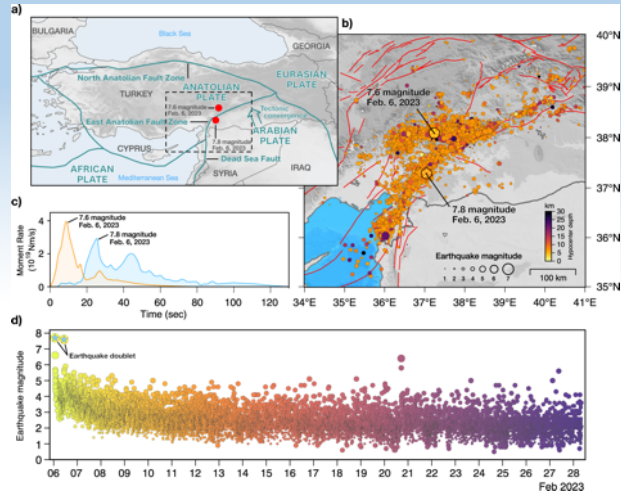
About 20 local **WATCH*** and **ADVISORY** (some of which confirmed)

1 basin-wide **WATCH*** event (Mediterranean) in 2023 (February 6)



A BIG CHALLENGE: PROBABILISTIC TSUNAMI FORECAST

The 2023 February 6 Mw 7.8 earthquake was the first event to have triggered a basin-wide watch level (max) for the Mediterranean Sea.



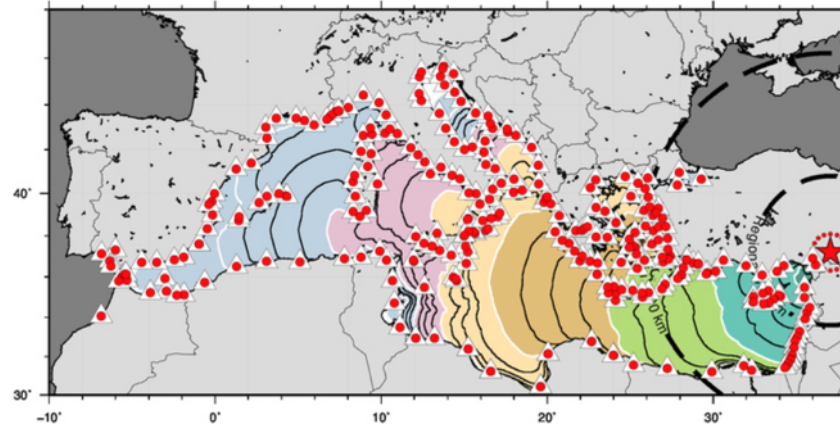
Decision Matrix

Depth	M	Epicenter Location	Tsunami Potential	ALERT LEVEL VS DISTANCE		
				$\Delta eq \leq 100$ km	$100 \text{ km} < \Delta eq \leq 400$ km	$\Delta eq > 400$ km
< 100 km	$5.5 \leq M \leq 6.0$	Offshore or Inland ≤ 100 km	Nil	Information Bulletin		
	$6.0 < M \leq 6.5$	Inland (40 km < Inland ≤ 100 km)	Nil	Information Bulletin		
		Offshore or near the coast (Inland ≤ 40 km)	Potential of weak local tsunami $\Delta eq < 100$ km	LOCAL Tsunami ADVISORY	Information	
	$6.5 < M \leq 7.0$	Offshore or Inland ≤ 100 km	Potential of destructive local tsunami $\Delta eq < 100$ km 400 km	LOCAL Tsunami WATCH	REGIONAL Tsunami ADVISORY	Information
	$7.0 < M \leq 7.5$		Potential of destructive regional tsunami $\Delta eq < 400$ km basin	REGIONAL Tsunami WATCH		BASIN-WIDE Tsunami ADVISORY
$M > 7.5$		Potential of destructive tsunami in the whole basin any Δeq	BASIN-WIDE Tsunami WATCH			
≥ 100 km	$M \geq 5.5$	Offshore or Inland ≤ 100 km	Nil	Information Bulletin		
any	any	Inland > 100 km	Nil	Nil		
				LOCAL	REGIONAL	BASIN-WIDE

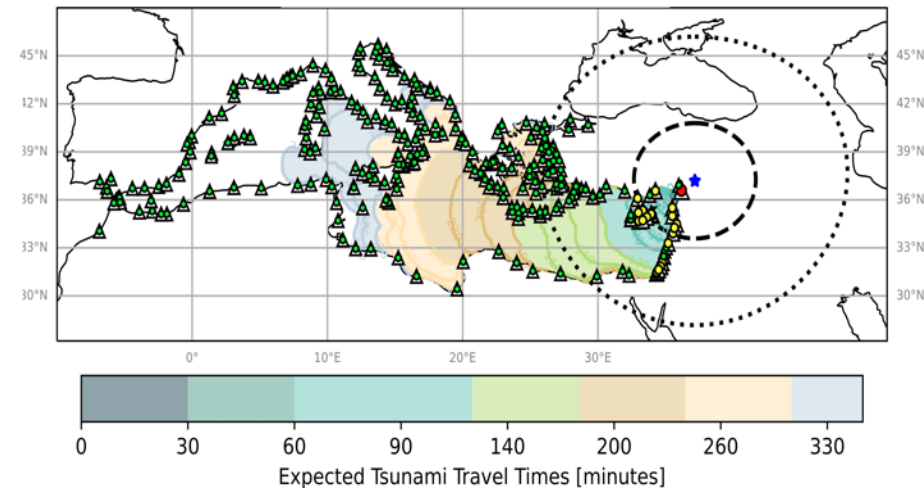
ARTICLE
<https://doi.org/10.1038/s41467-021-25815-w> OPEN
Probabilistic tsunami forecasting for early warning
 J. Selva^{1,2}, S. Lorito², M. Volpe², F. Romano², R. Tonini², P. Perfetti¹, F. Bernardi², M. Taroni², A. Scala³, A. Babeyko⁴, F. Lavholt⁵, S. J. Gibbons⁵, J. Macías⁶, M. J. Castro⁶, J. M. González-Vida⁶, C. Sánchez-Linares⁶, H. B. Bayraktar^{2,3}, R. Basili², F. E. Maesano², M. M. Tiberti², F. Mele², A. Piatanesi² & A. Amato²

- In response to the tsunami warning, trains were stopped in different locations in Southern Italy for several hours, and evacuation of some coastal areas was enforced.
- However, only a relatively small tsunami was recorded by Turkish close-by tide-gauges in the Eastern Mediterranean, with a maximum recorded amplitude of less than 50 cm.

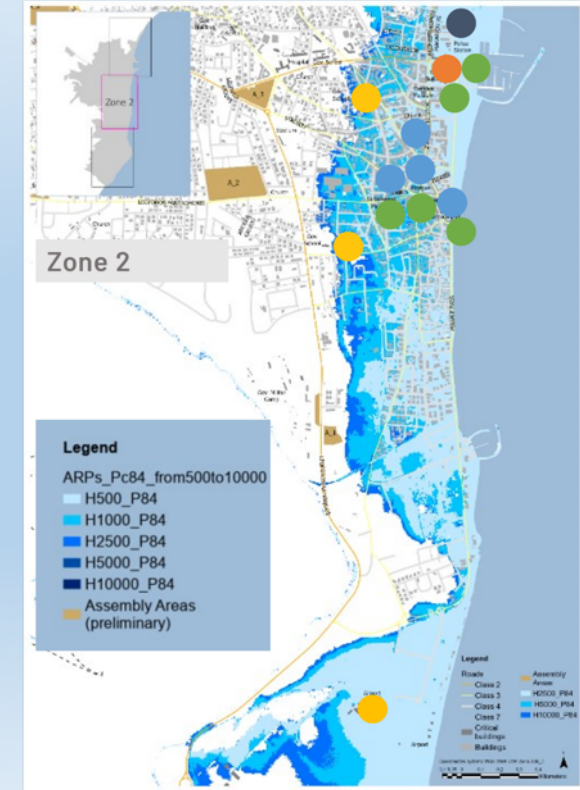
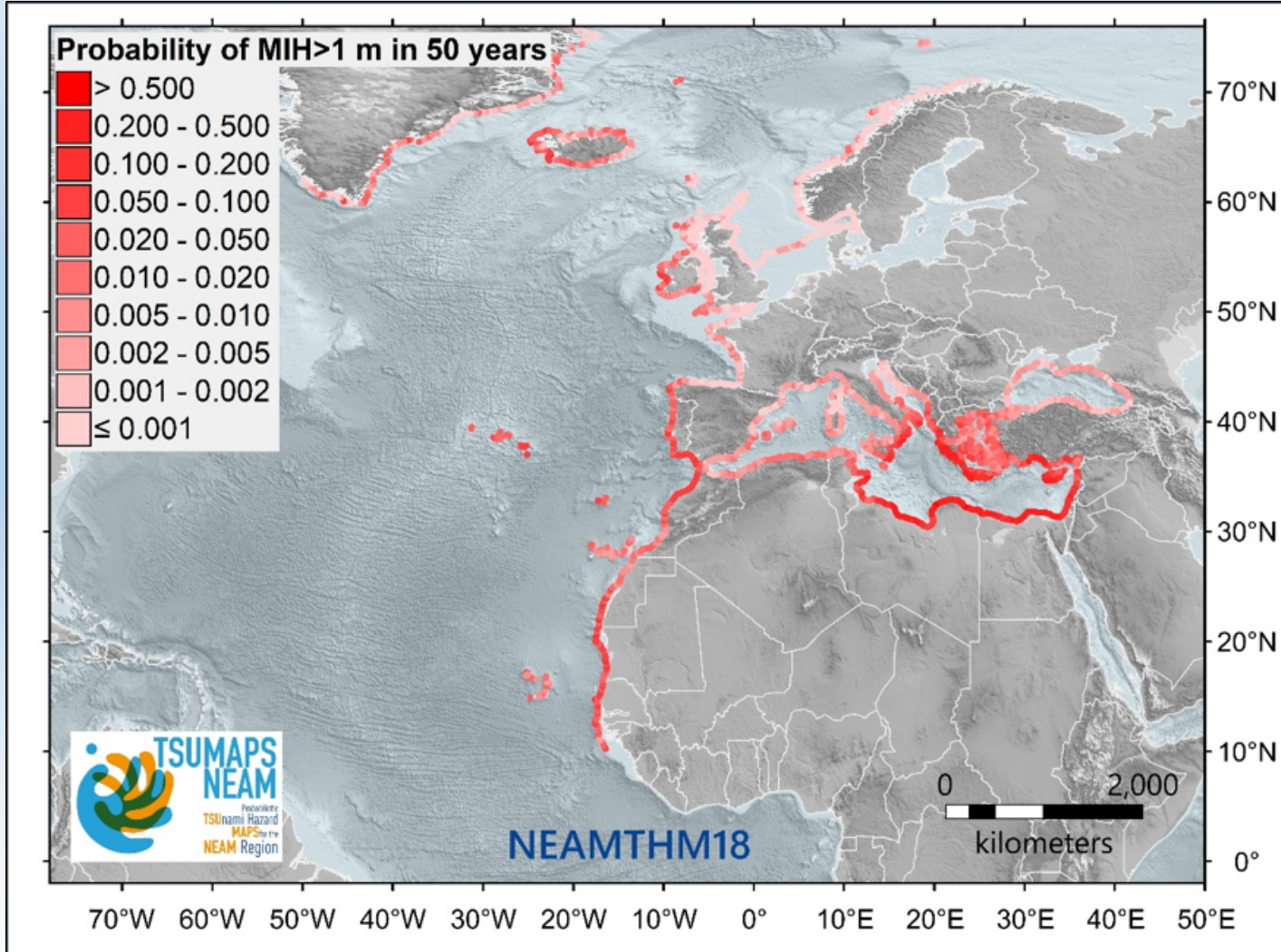
Tsunami Travel Times – Turkey 2023-02-06T01:17:36Z M=7.9



PTF Alert Level Map



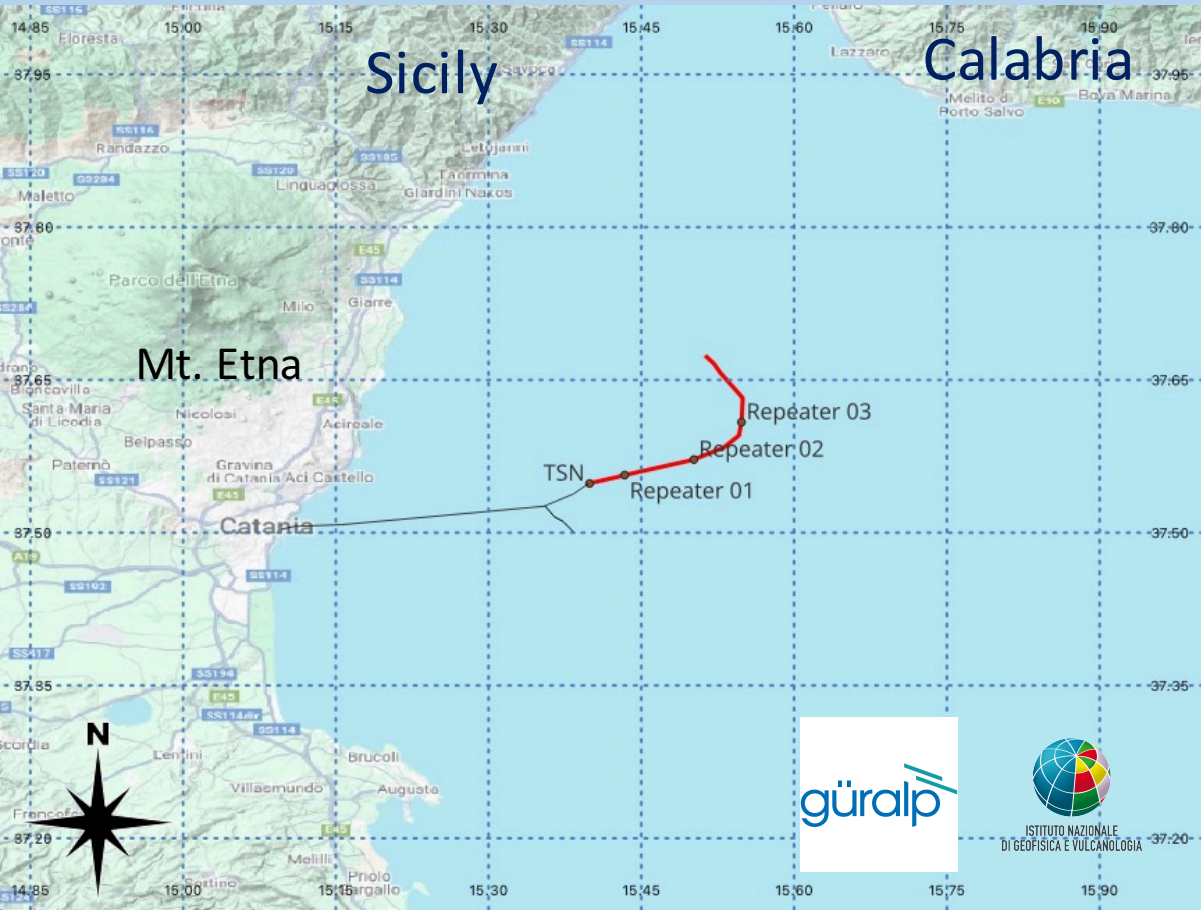
S-PTHA assessment at various scales (global to local)



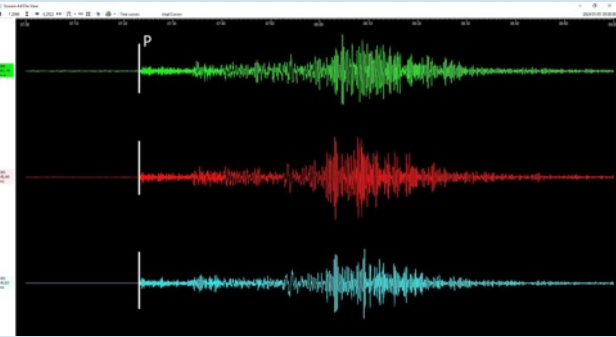
In some countries (e.g. Italy) the TSUMAPS-NEAM S-PTHA were used to define the inundation zones.

Other approaches at regional / local scale are being adopted (e.g. France, Larnaca/Cyprus)

WESTERN IONIAN SEA INFRASTRUCTURE Deployed December 2023

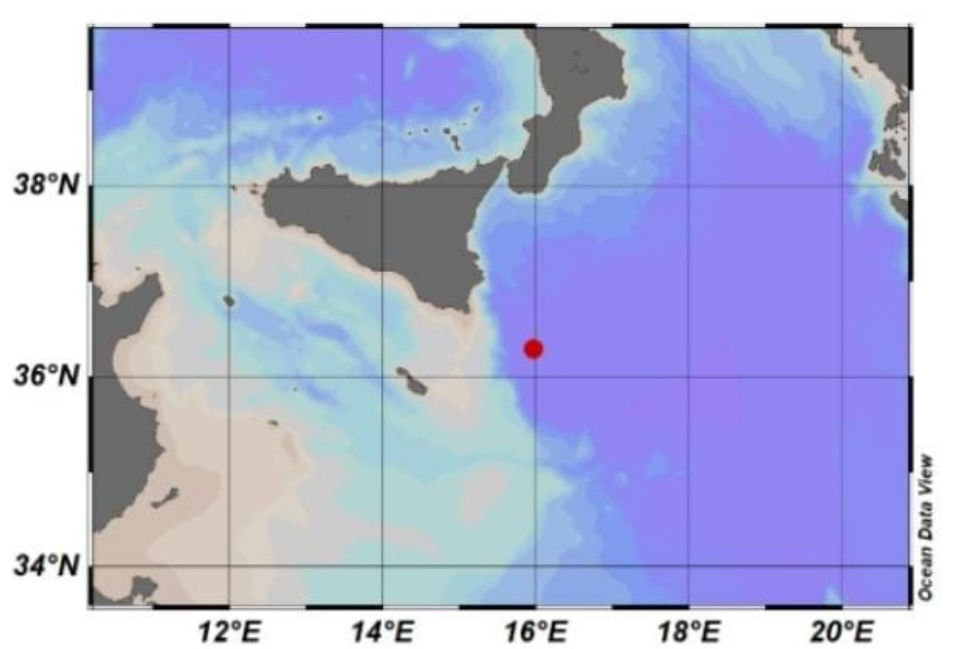


Courtesy of G. Marinaro (INGV)



• WEST COAST, EASTERN HONSHU, JAPAN

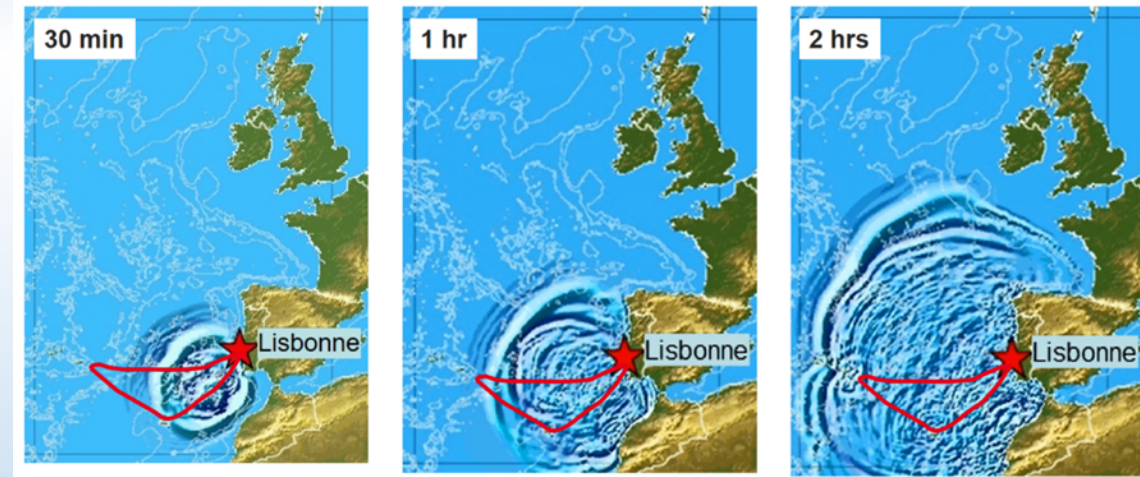
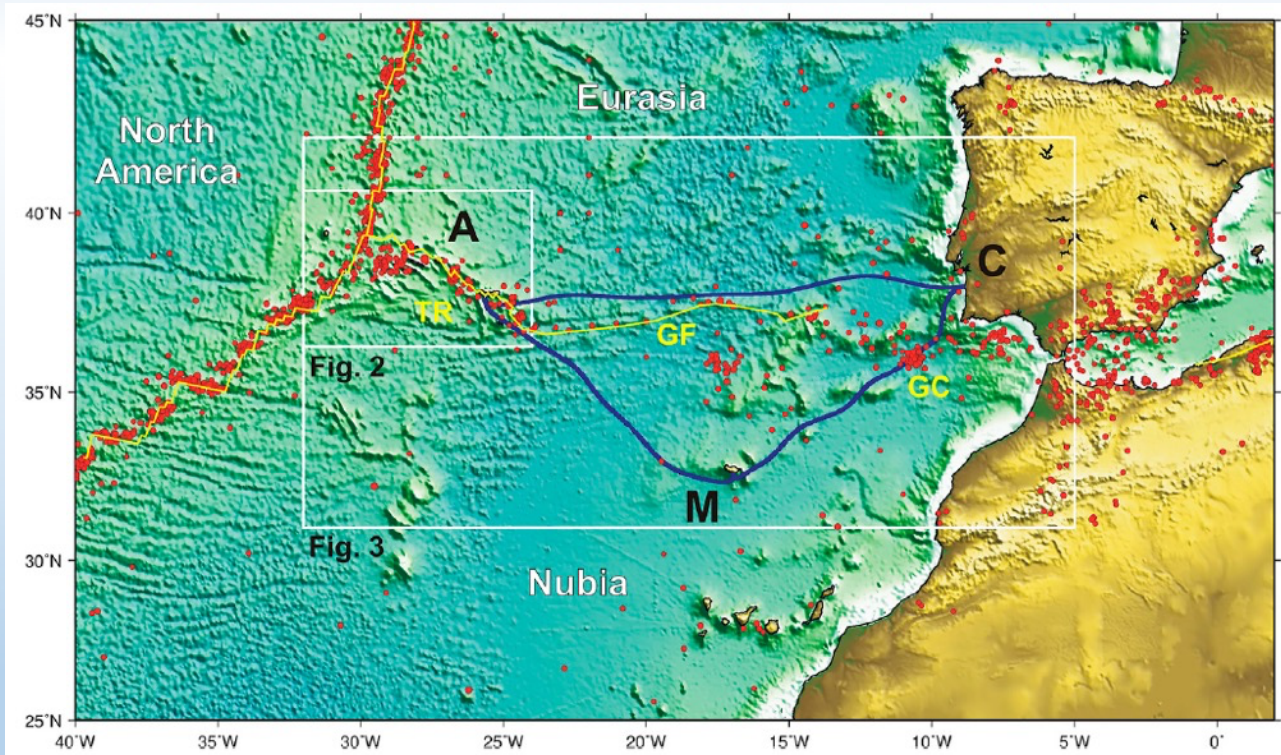
• 01/01/2024 07:10 M_{wpd} 7.4



INFN Km3NeT Observatory @ 3,500 m depth
Trillium 120s + hydrophone + P-T sensor (RBR)
Cabled with fiber optic to land (100km)

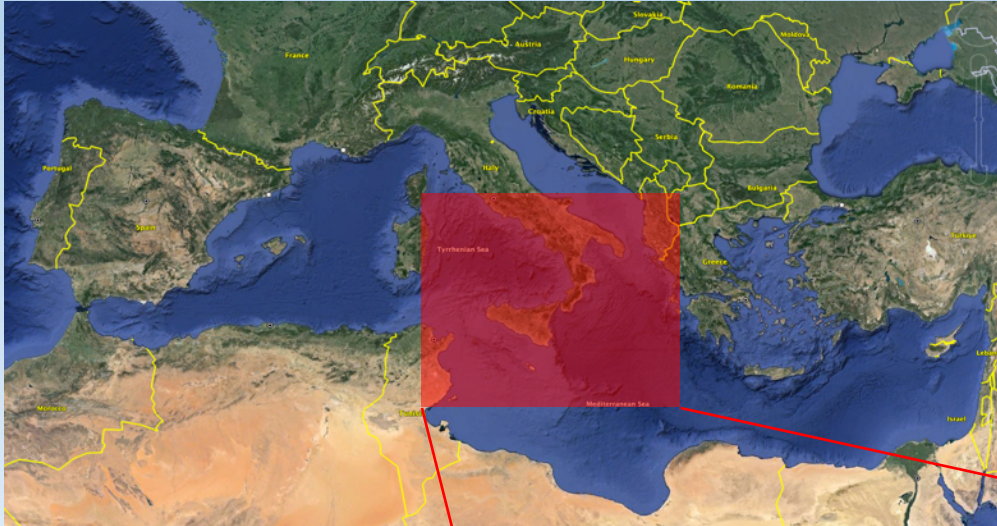
ONGOING ACTIVITIES: SMART CABLES

- New Submarine Cable Ring connecting Portugal Mainland-Azores-Madeira
- Opportunity for a SMART system (SMART CAM) supported by Portugal
- Operational in 2025-2026

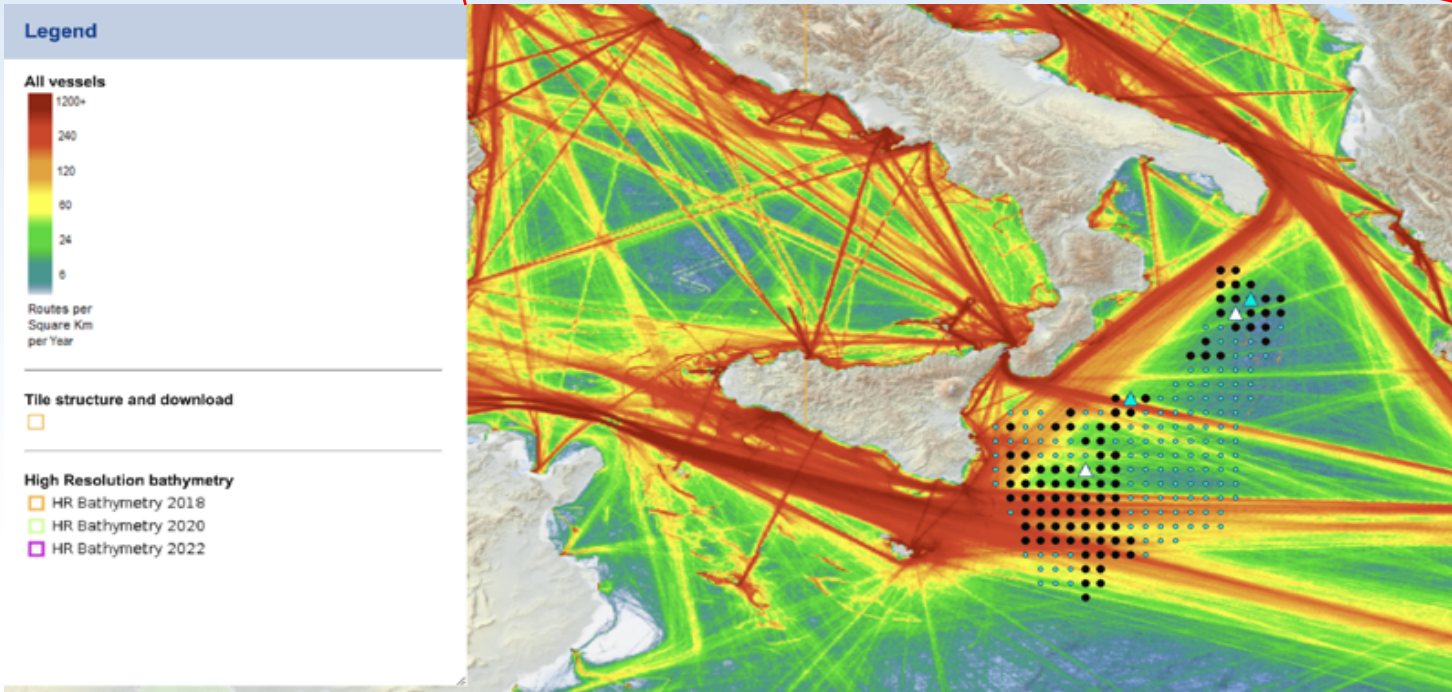


Timeline of 1755-like tsunami propagation in NE Atlantic

ONGOING ACTIVITIES: TSUNAMI BUOYS



- 2 tsunami buoys will be installed in the Ionian sea by 2025
- Location and technical requirements decided based on possible tsunami sources and ship traffic



Funding (~2.8 M€) by the Italian Ministry of Research through the European contribution Next Generation EU - NRRP (National Recovery and Resilience Plan) "MEET", coord. by INGV

ONGOING ACTIVITIES: **NON-SEISMIC TSUNAMI SOURCES**

The ICG/NEAMTWS at the February 2024 session DECIDED to establish a new

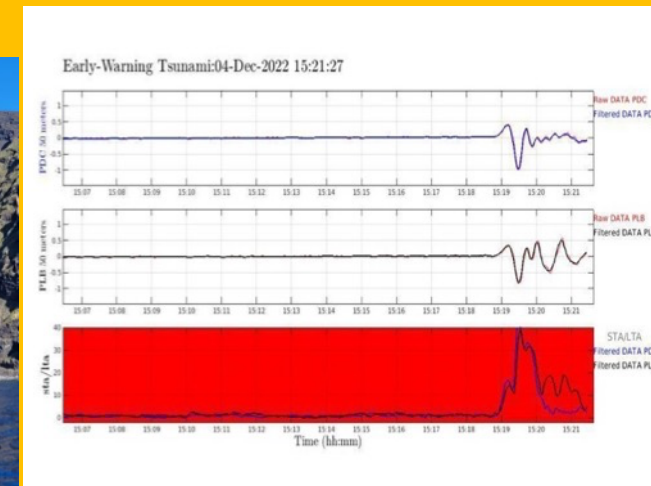
Task Team on Non-Seismic Tsunami

Among other issues, this TT will be important to foster the integration of local TWS specifically conceived for non-seismic tsunami with the NEAM system effective for seismic tsunami



TEWS for Stromboli volcano, Italy

1.5m tsunami of Dec. 4, 2022



Tsunami Ready: International, National, Local Engagements

City Mayors and Governor



Cannes, France



Büyükçekmece, Istanbul, Turkey



Alexandria, Egypt



Chipiona, Spain



Samos, Greece



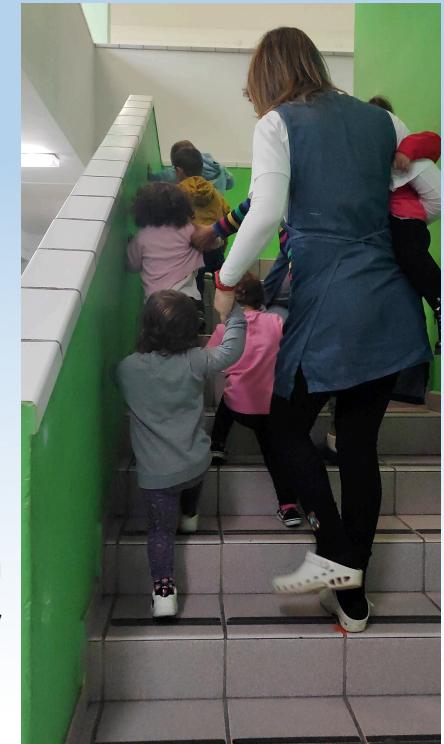
Minturno, Italy

NEAMWave23 / WTAD

15 Tsunami Exercises Organised

- ✓ Regional NEAMWave23 conducted on 6-7 November 2023
- ✓ For the first time, NEAMWave 23 exercises was also conducted at the local communities in several MS, many of them within the countries participating in the CoastWAVE project

School evacuation in Chipiona, Spain, 6 November 2023



Vertical evacuation
in a nursery in
Minturno, Italy
7 November 2023

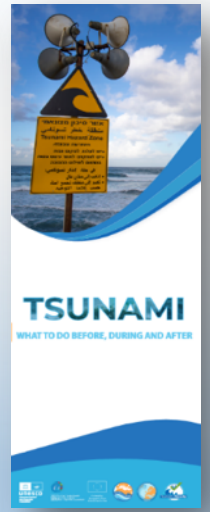
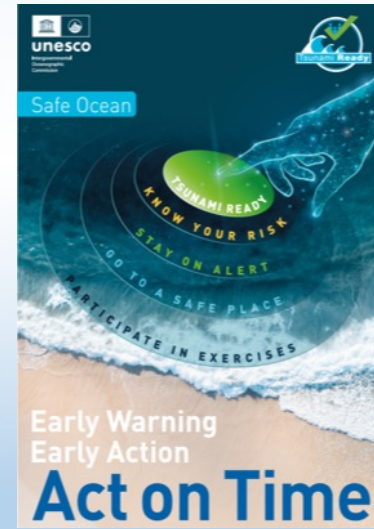
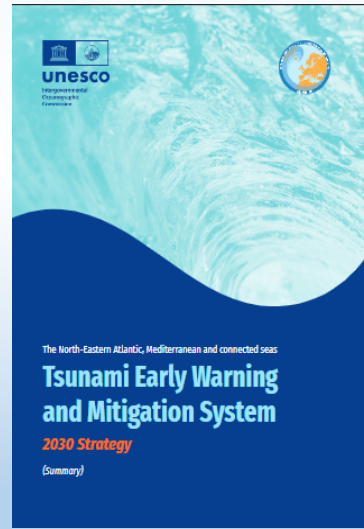
Communication and Outreach

28 Articles Produced and Published
+ others on TSPs websites



9 Brochures/Leaflets and Posters

- NEAMTWS 2030 Strategy Brochure
- NEAMWave Exercise – Information Brief
- NEAMWave23 Exercise – Information leaflet
- Tsunami Fact Sheet Brochure
- Tsunami What to do Brochure.
- Tsunami Ready Recognition Programme Brochure
- Tsunami Ready Poster
- Coastal Hazard Ready Poster
- ICG/NEAMTWS Poster update



Communication and Outreach

➤ 10 Videos Produced and Published

- 2 Stromboli Volcano - Tsunami Warning System documentary, 3 min, 10 min versions) (To be launched in Feb 2024)
- Tsunami Exercise in Chipiona, Spain, Dec 2023
- 2 Tsunami Risk in Malta (documentary, 3 min, 10 min versions), 5 Nov 2023
- Supporting Children Prepare, 5 Nov 2023
- Commemorating the Aegean Sea event, October 2023.
- Tsunami Evacuation Workshop in Cyprus, Sep 2023.
- CoastWAVE Project Standard Operating Procedures (SOPs) Workshop, Ispra, Italy.
- Tsunami Exercise, Istanbul during WTAD 2022

➤ + others on TSPs websites

Including a 4.3+ million views on the 2020 SAMOS tsunami:
<https://www.youtube.com/watch?v=YM6hha4n5W4&t=5s>

➤ [Story Maps: Traveling through Mediterranean tsunamis](https://storymaps.arcgis.com/stories/32091c82e42a4d30a2f24b1e7b5955b6)



A new “virtual” tsunami pool (Genova, Oct.2024)



Current and future projects in NEAM ICG

- DG-ECHO '**CoastWAVE**' project in Cyprus, Egypt, Greece, Malta Morocco, Spain, and Türkiye on “Strengthening the Resilience of Coastal Communities in NEAM region...” (Phase 1) ended in 2024;
- **CoastWAVE Phase 2** approved and starting in July 2024 “Scaling up....”;
- New phase of COST Action **AGITHAR** - (Accelerating Global Science in Tsunami Hazard and Risk Analysis) to establish the **Global Tsunami Model (GTM)** organization;
- Formal recognition of the **TSUNAMI Thematic Core Service (TCS)** within **EPOS** The European Plate Observing System (EPOS General Assembly in Dec. 2023);
- Some other projects funded by EU contributing to the advancement of Tsunami science, including both R&D (**DT-GEO**) and warning-oriented (EPOS, **GeoInquire**)
- DG-ECHO project **NEAM-COMMITMENT** (coord. NOA, Greece) with other MS and relevant stakeholders for hazard mapping and scaling-up TR



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THANK YOU



The Stromboli MULE
carrying new warning
sirens around the volcano
(Dec. 2023)