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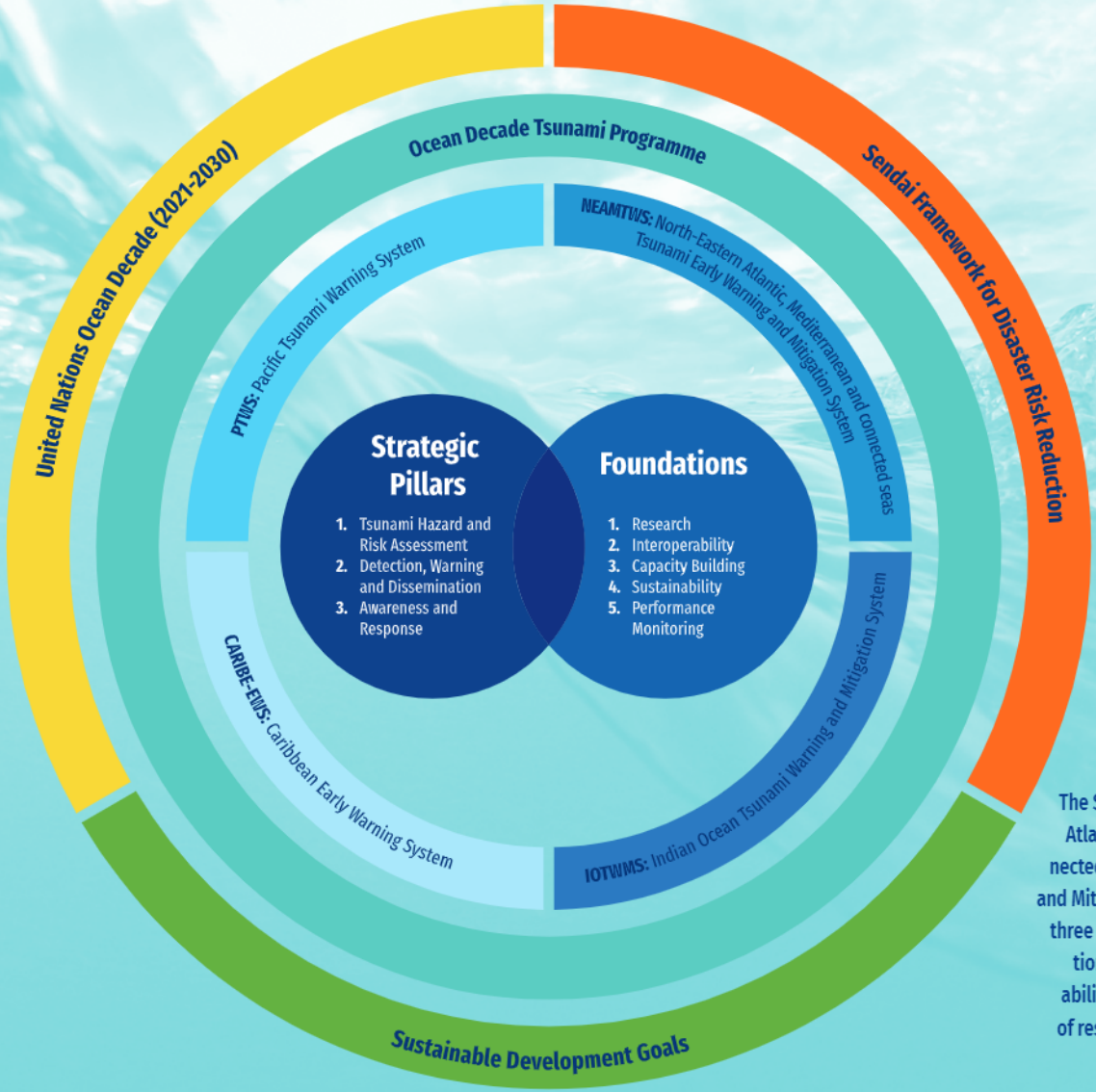
The North-Eastern Atlantic, Mediterranean and connected seas

Tsunami Early Warning and Mitigation System

2030 Strategy

(Summary)

Index



The Strategy of the North-Eastern Atlantic, Mediterranean and connected seas Tsunami Early Warning and Mitigation System is founded on three pillars that require a foundation of interoperability, sustainability and the enabling activities of research, capacity-building and performance monitoring.

Purpose of the Document

This summary document describes the new ICG/NEAMTWS Strategy. It highlights 19 objectives and foundation activities to further advance and strengthen the resilience of coastal communities along the North-Eastern Atlantic, Mediterranean, and connecting seas to tsunamis and other sea-level-related hazards with an effective tsunami warning and mitigation system by 2030.

Following the Indian Ocean tsunami of 26 December 2004, the Intergovernmental Oceanographic Commission of UNESCO was tasked with establishing the Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and connected seas (ICG/NEAMTWS). It was formally established in June 2005 through Resolution XXIII-14 and specifically contributes to Target G of the Sendai Framework for Disaster Risk Reduction (2015-2030) to "substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to people by 2030".

This Strategy states key objectives for a continuously improving North-Eastern Atlantic, Mediterranean and connected seas Tsunami Warning System (NEAMTWS) to meet stakeholder needs during the period (2021–2030). It will contribute to the United Nations Decade of Ocean Science for Sustainable Development (2021-2030), working towards a "safe ocean" where people are protected from ocean hazards. It will capitalise on the Ocean Decade societal benefits to improve monitoring, detection and data-sharing among Member States and partners. In particular, it will contribute to the new United Nations Ocean Decade Tsunami Programme Research and Development Implementation Plan. The Strategy replaces the NEAMTWS Implementation Plan and is supported by the Annual Plans of Action[1] that detail the measurable and time-bound actions planned by the Working Groups and Task Teams of the NEAMTWS Intergovernmental Coordination Group.

NORTH-EASTERN ATLANTIC, MEDITERRANEAN AND CONNECTED SEAS TSUNAMI EARLY WARNING AND MITIGATION SYSTEM

Forty Member States of the IOC border the North-Eastern Atlantic ocean, the Mediterranean and connected seas. The Intergovernmental Coordination Group of NEAMTWS (ICG/NEAMTWS) meets regularly to establish and implement plans in the region. In addition, the ICG forms Task Teams for specific time-bound actions. Tsunami Service Providers (TSPs) are accredited National Tsunami Warning Centres (NTWCs) that issue timely tsunami alert/threat information within the ICG framework to other countries through their NTWCs and Tsunami Warning Focal Points.

The ICG/NEAMTWS reports its activities and recommendations to the Working Group on Tsunamis and Other Hazards Related to Sea-Level Warning and Mitigation Systems (TOWS-WG) and the IOC Governing Bodies on an inter-annual basis. The ICG/NEAMTWS experts participate in TOWS-WG and Task Team activities (Disaster Management and Preparedness, and Tsunami Watch Operations). Activities of NEAM WGs and TTs are conducted in accordance with the recommendations of the IOC-TOWS-WG.

In addition to national and local exercises, ICG/NEAMTWS has organised four regional tsunami exercises (NEAMWave12, NEAMWave14, NEAMWave17, and NEAMWave21). NEAMWave21 took place in March 2021 during the COVID-19 pandemic, allowing Civil Protection Agencies (CPAs) to test their functionality while constrained by other hazards. The ICG/NEAMTWS will assess whether this governance model complies with the strategic plan presented here in particular taking into consideration the experiences and lessons learned since 2016 following the accreditation of TSPs, as well as adapt best practices implemented in other ICGs.

The frequency of tsunamis is low. However, they have a potentially high impact. Regular tsunami exercises are important to maintain a high operational readiness, practice emergency response protocols, and guarantee that crucial communication lines function smoothly.

1. http://www.ioc-tsunami.org/index.php?option=com_oe&task=viewDocumentRecord&docID=28713

A rise in coastal activities and population increase vulnerability and risk. It is estimated that the Low Elevation Coastal Zone (LECZ) (< 10 m height) in the NEAMTWS region is home to about 116 million inhabitants. With 1,403 million international arrivals in 2018, the Mediterranean has become the world's primary tourist destination[2].

REGIONAL CONTEXT

Although the sea basins in the NEAM region are interconnected, bathymetric and topographic obstacles attenuate tsunamis travelling from one sea basin to another. The Gibraltar strait is a natural barrier for tsunamis between the Atlantic Ocean and the Mediterranean Sea. Likewise, the Bosphorus and Dardanelles straits attenuate tsunamis travelling between the Mediterranean and Black seas, the Messina straits divide the Tyrrhenian Sea from the Ionian Sea, and the Gulf of Corinth is separated from the Ionian Sea. This creates a domain partition of tsunami propagation such that the tsunami warning system in the NEAM region has been architecturally conceived with regional tsunami service provision, though with common practices and coordination.

Most tsunamis in the NEAM region are generated by submarine earthquake dislocations (>80%) but can be also caused by submarine and sub-aerial slides, volcanic activity, or some combination of these source mechanisms[3]. Atmospheric disturbances such as sudden air pressure impulses can generate meteorological tsunamis. Currently, NEAMTWS, as with other TWSs, is aimed at detecting seismic sources with direct tsunamigenic potential and does not yet handle non-seismic sources.

Only three volcanic tsunami monitoring and warning systems are in operation globally (one in the NEAM region at Stromboli Island, Italy). Due to the larger number of such sources, implementing a TWS dealing with tsunamigenic landslides, eruptions and meteorological disturbances will require additional research and technological advancement. These sources will be considered progressively in the broader context of the new Ocean Decade Tsunami Programme Research Development and Implementation.

Awareness and response to threats requires Member States to commit to improved and expanded national tsunami warning capability and regional collaboration. The aim is an interoperable network of regional NTWCs and TSPs. This Strategy provides the framework for international coordination and collaboration of Member States through the ICG/NEAMTWS.

The Strategy responds to the demands of society for a safe ocean where people are safeguarded from ocean risks and supports the United Nations Decade of Ocean Science for sustainable development.

2. UNWTO, 2019. 3. Data available at Maramai, A., Graziani, L., Brizuela, B. (2019). Euro-Mediterranean Tsunami Catalogue (EMTC), version 2.0. Istituto Nazionale di Geofisica e Vulcanologia (INGV) https://doi.org/10.13127/tsunami/emtc.2.0 Maramai, A., Graziani, L., Brizuela, B., 2021. Italian Tsunami Effects Database (ITED): The First Database of Tsunami Effects Observed Along the Italian Coasts. Front. Earth Sci., 18 March 2021 DOI: https://doi.org/10.3389/feart.2021.596044

The Mediterranean is more seismically active than the Atlantic and has complex tectonic variations. Moreover, the variable characteristics of oceans and seas across the region lead to very complex propagation of tsunami waves. Critically, the design and further advancement of NEAMTWS must recognise that for much of the region, time for warnings is very short.

Strategic Pillar 1

Tsunami Hazard and Risk Assessment

OBJECTIVES

Hazard and risk assessment for coastal hazards are key elements of any tsunami warning system and are made mainly from documentation of historical events and impacts, geological and geophysical knowledge of the sources and their dynamics, and tsunami generation, propagation and inundation modelling for expected scenarios.

A key issue is the relationship between the earthquake source parameters (mainly epicentre, focal depth and magnitude or seismic moment) and the expected tsunami size. This knowledge provided the basis for the Tsunami Warning System (TWS) decision matrices currently used to evaluate the threat of the potential tsunami and to respond quickly.

Other data sets required for a proper analysis of hazard are the tectonic setting of the region, including long-term deformation patterns of the plates, the distribution of the major active seismic faults, and the historical seismicity in the coastal zones and offshore. It is also essential to have updated batrymetry in the open sea and in the coastal zone, especially in the shallow-water zone with depths less than 100 m up to the coastline, where tsunami interaction with sea-bottom becomes quite complex and non-linear wave behaviour may prevail. In addition, topographic data at the coast such as digital terrain or elevation models are required.

Continuously updated seismic catalogues are available for most countries and on a regional and a global basis. Tsunami catalogues need to be refined and updated when new information becomes available. Wave and run-up heights are available only since the sea level network was developed for the NEAMTWS, while in most cases observations and qualitative descriptions allow for tsunami intensity estimations. Work has been done in the region to extend the record of historic and prehistoric tsunamis through the study of tsunami sediment deposits or signatures, but more research is needed in this field. Analysis of vulnerability and risk requires data on a number of parameters such as coastal geomorphology, soil conditions and exposure, infrastructures, port facilities, tourist resorts, industrial plants, as well as population demographics and land-use designations. The results of such assessments serve as a basis for decision support mechanisms and to identify and implement appropriate mitigation and preparedness measures to reduce the risk for coastal communities.

1

Implementation of probabilistic methodologies in tsunami hazard and risk assessment

Probabilistic Tsunami Hazard Assessment (PTHA) for long-term planning, integrating all potential tsunami sources and effects, allowing to run any possible scenario through disaggregation of probability distributions.

2

Member States to develop specific tsunami hazard and risk assessments for vulnerable national sub-regions

Specific deterministic studies, possibly derived from PTHA models, for improved tsunami hazard and risk assessment at sub-regional / local level.

3

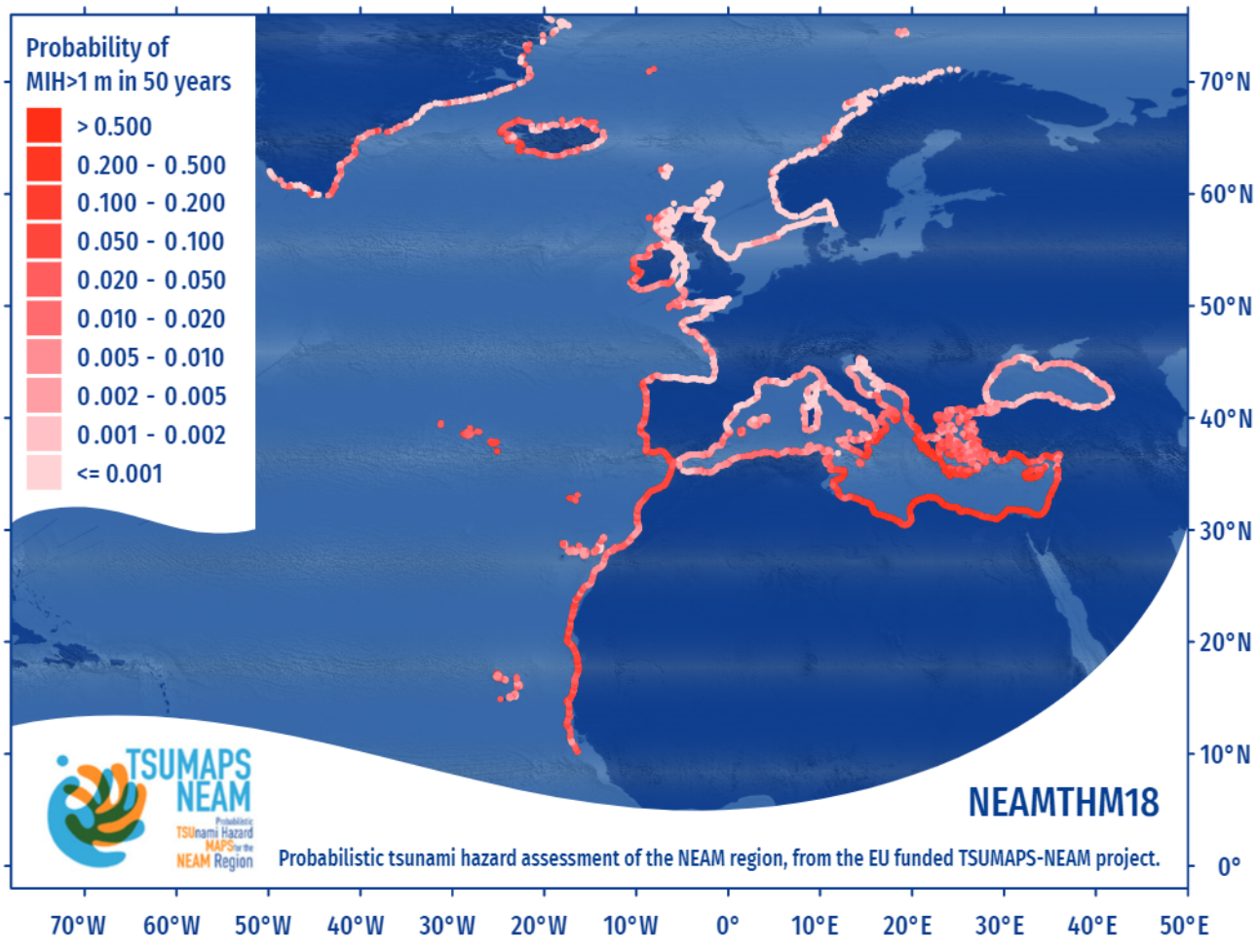
Develop regional hazard assessment for landslide-generated tsunamis

Hazard assessment for landslide-induced tsunamis, including deterministic and probabilistic approaches depending on the degree of knowledge of potential sources, for either submarine or sub-aerial phenomena.

4

Multi-source tsunami hazard assessment

Hazard assessment of tsunamis induced by different sources (earthquakes, landslides, volcanic activity, meteorological events, etc.) possibly adopting probabilistic approach using common tsunami intensity metrics (e.g., run-up or maximum inundation height) and exposure time.



Probabilistic tsunami hazard assessment of the NEAM region, from the EU funded TSUMAPS-NEAM project.

Strategic Pillar 2

Detection, Warning and Dissemination

OBJECTIVES

Detection involves the implementation and development of, for example, seismic and sea-level observing systems for rapid assessment and verification of the threat. Warning involves the forecasting of wave propagation and potential impacts of tsunamis and conveying that information in interoperable message formats. Dissemination involves the timely and accurate distribution of threat and warning information from and between Tsunami Service Providers and National Tsunami Warning Centres, and from NTWCs to civil protection authorities and the community.

Effective tsunami warning depends on rapid detection and assessment of a potentially tsunamigenic event after verification that a tsunami has been generated, forecasting of wave propagation and the threatened areas, and dissemination of the information to the "last mile," enabling communities to respond quickly and effectively.

Seismic Network

All TSPs utilise automatic monitoring systems to assess earthquake parameters as they occur and when certain criteria are met, they alert analysts who then assess, verify or revise the event. For large earthquakes this usually happens within a few minutes of the initial rupture. In the NEAM region, the adoption of fully automatic solutions for earthquake location and magnitude is encouraged due to the short travel times to many near-source coasts. Nonetheless, well-trained personnel at the TSPs' monitoring rooms are needed for evaluation and decision analysis of the automatic solutions and improving effective interactions with CPAs.

The seismic monitoring network used by TSPs in each regional warning system is primarily based on national networks complemented by various real-time networks operated by agencies such as IRIS Global Seismographic Network (GSN), Comprehensive Nuclear Test Ban Treaty Organization (CTBTO), the German Research Centre for Geosciences (GFZ) Geofon Extended Virtual Network, the National Institute of Geophysics and Volcanology (INGV, Italy) MedNet, and stations from other national and regional networks. The distribution of existing stations that meet the requirements of NEAMTWS for data quality and real-time transmission capability is strongly non-homogeneous. The most crucial gap exists in the northern African countries, either due to a lack of stations or data free sharing policies.

Rapid determination of focal parameters (mainly location, focal depth and magnitude), essential for any TWS, depends upon real-time, high-quality, broad-band seismic waveform data and computational algorithms. Strong motion sensors, and Global Navigation Satellite System (GNSS) stations, are needed for areas close to the tsunamigenic sources, i.e. within <10 minute tsunami travel time, to improve detection capability of the TWS, including rapid finite fault solutions. Moreover, earthquake detection should be improved by future deployment of Ocean Bottom Seismometers (OBS) or seafloor platforms with multi-parameter acquisition capabilities.

1

Increase the density of the detection system and its sustainability

Reinforcing international co-operation to promote effective data-exchange policies and to extend the detection capability of the TWS through the installation of new stations and equipping harbours with tide gauges as safety instruments.

2

Install multi-hazard observations composed of co-located tide-gauge /accelerometer / GNSS sensors

Encourage multi-hazard observations, including GNSS observations co-located with tide-gauges for near-real time corrections, strong motion and broad-band data for better understanding of the source properties.

3

Plan and implement an "Inter-Operability Tool (IOT)"

Improving inter-operability among Tsunami Service Providers to gain efficiency through data exchange, comparison of solutions, and integration of near real-time tsunami modelling capability in the decision support systems of the TSP operation services.

4

Develop and implement additional monitoring tools

Implementation of new monitoring techniques and data sources: real-time GNSS on the coasts, deep sea observations and SMART cables; Tsunami Ionospheric Disturbances will also be tested.

5

Implement Probabilistic Tsunami Forecasting

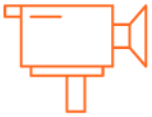
Probabilistic Tsunami Forecasting, as an alternative to Decision Matrices, will be implemented after validation and optimization, as it provides a better assessment in real-time while quantifying the uncertainty associated with the forecast.

6

Adapt threat levels

Evaluate replacing alert level terms with threat level terms; adaptation of the appropriate threat level terminology in English and its adaptation to other national languages.

7



Explore additional sources of tsunami observations

Exploring the possibility of using and reporting amateur or surveillance video observations of the tsunami waves during the NEAMTWS warning process.

Sea-level networks

Real time sea-level data are required to confirm whether a tsunami has been generated by an earthquake or to cancel alerts if no tsunami is observed. Such observations are typically recorded by tide gauges in harbours and pressure sensors on the sea floor. Tide-gauge stations are operated in the NEAM region by a number of national agencies and research institutions.

In the NEAM region, tsunami travel times are within minutes and the time between the tsunami arrival at the sea-level gauges and its impact on the coasts is very little. Currently, the use of pressure gauges on the sea floor is only experimental within NEAMTWS.

The sea-level stations analysed by TSPs in the NEAM region operate in real-time, often with high frequency sampling rates (less than one sample per minute). TOWS-WG recommends a data sampling rate of 1 s to be able to record near-field tsunami waves of all origins. Sampling rates larger than 5 minutes are not useful for tsunami monitoring and detection. Denser networks are required in the areas that are close to the tsunamigenic zones. Several countries are making efforts to upgrade their national sea level networks, usually as part of a multi-purpose/multi-hazard system approach. This is especially the case for countries on the Atlantic coast of Europe, where data are normally available for inclusion in the system. In the Mediterranean, uniform coverage and reliable data availability are less, particularly in the North African countries. Many existing stations require upgrading to tsunami requirements. Recent tsunamis have shown that sea-level information is not dense enough even in the areas where potentially tsunamigenic earthquakes occur more frequently.

Offshore buoys in the open ocean are useful for recording tsunamis because the tsunami signals are not affected by amplification and other interactions that take place in coastal areas. They can intercept the tsunami along its propagation path to distant coasts and their records can be used, in conjunction with modelling tools, for forecasting purposes. In complex areas with many islands, such as the Aegean Sea, the use of offshore buoys may not be effective. Therefore, an increase in the number of tide gauges in the islands is needed.

A densified Global Sea Level Observing System (GLOSS) network may make relevant contributions to the TWS sea-level monitoring systems, and collaboration with offshore observation networks for operational oceanography, such as the regional components of Global Ocean Observing System (GOOS) in the Euro-Mediterranean region, could also be valuable. Acceptable instrumentation standards and suggested analysis procedures are based on the Tsunami Global Service Definition Document (IOC Technical Series, 130)[4].

The EU Joint Research Centre (JRC) has developed the Inexpensive Device for Sea Level Measurement (IDSL), a low-cost mareograph system to measure sea level in real time. Over 36 IDSLs have been installed in the NEAM region and were used to supplement and fill gaps in the regional sea level detection network. In 2019, JRC ended its support for the installed IDSLs and new stations are provided only under certain circumstances, such as "Last Mile" initiative. A long-term sustainability plan for IDSL is therefore needed and this is being explored and supported by the IOC Directorate-General for European Civil Protection and Humanitarian Aid Operations CaostWAVE project which started in September 2021.

Dissemination

Effective dissemination requires agreements among stakeholder organisations as well as Standard Operating Procedures (SOPs) for activation of the process. Organisational tsunami SOPs can be utilised to ensure transmission of warnings from the Tsunami Warning Focal Point (TWFP) to critical response agencies and vulnerable coastal communities.

Regular SOP training need to be organised to develop protocols that define: (i) the roles and responsibilities of each organization; (ii) paths of communication between organizations; and (iii) the hierarchy of decision makers for evacuations or other mitigating actions. The CoastWAVE project is currently addressing these needs in seven pilot communities in NEAM region.

Reliable communication technology is also an essential component of any tsunami warning system. This includes the acquisition of data from seismic and sea level networks, the dissemination of alerts from TSPs, and the internal communications chains within each country. Given that tsunamis are relatively rare, it is important to maintain the system in the state of readiness between events and this requires regular testing of all sequences in the chain.

4. Intergovernmental Oceanographic Commission technical series, 130, Tsunami Watch Operations, 2016. https://unesdoc.unesco.org/ark:/48223/pf0000246931?locale=en

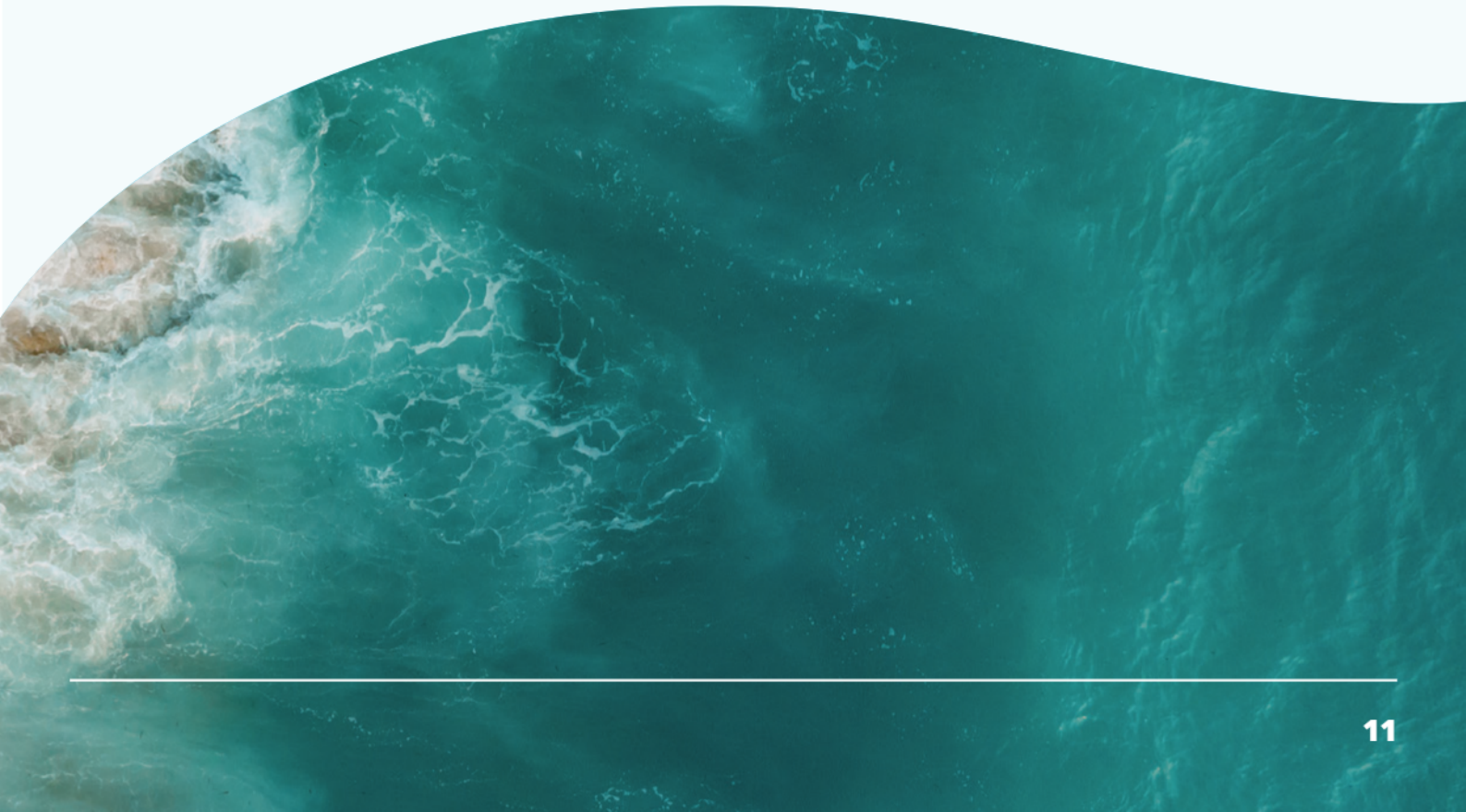
Strategic Pillar 3

Awareness and Response

OBJECTIVES

The impact of tsunamis and other sea-level related hazards in the NEAM region can be substantially mitigated with timely warnings to the population by the TWS and if coastal communities receive appropriate preparation and education to respond with or without an official warning. Due to the many active faults and short tsunami travel times in the Mediterranean and the Black Sea, there is a real possibility that a tsunami will impact before the population can be properly alerted. Advisory schemes, mitigation and adaptation measures tailored to the local communities and sustained public awareness are essential components of an end-to-end tsunami warning and mitigation system. To be effective, community awareness must be developed through simple and culturally sensitive programmes. It is emphasised each Member State is responsible for the implementation of responses. The system should recognise the diversity and complex basin characteristics of the region and accept that flexibility is required to accommodate the circumstances and requirements of individual countries.

It is especially crucial to educate people about natural tsunami warning indicators. An all-encompassing tsunami warning and mitigation system must include community-specific advisory programmes, efficient adaptation and mitigation strategies, and ongoing public awareness and education campaigns.



1

Understanding perceptions of coastal hazards and risks

Analyze tsunami risk perception in the NEAM region, in order to better design and implement educational and preparedness activities.

2

Strengthen public and local authority awareness of tsunami and associated hazards and how to prepare to respond

Increasing awareness of local authorities to be able to develop appropriate response plans; of citizens to know what to do immediately after a warning, and after a strong earthquake or unusual sea-level changes.

3

Develop tsunami-related curriculum programmes for all levels of education

Tsunami Service Providers and National Tsunami Warning Centers as a source of career development to Member States to plan for, respond to and recover from tsunamis by providing material and guidelines.

4

Develop and deliver suitable and sustainable capacity-building programmes to facilitate effective and efficient response and coordination

Providing specialised training opportunities to specific stakeholders to sustain knowledge of emerging methods and new technologies. Creation of a training and capacity-building centre for the NEAM region.

5

Develop and maintain the NEAMTIC tsunami information website

An informative and frequently updated NEAM Tsunami Information Centre website as a tool for learning, sharing, and making didactic material avaliable to different stakeholders, with the support of Member States able to provide frequent updates.

6

Establish rapid and effective evacuation mechanisms given the risk assessment guidance and data

Tsunami Emergency Response Plans (ERP) must be easily available to citizens, from the national to the local level of coastal areas, including evacuation zone maps and route plans established by every Member States.

7

Develop and conduct regular exercises to test early warning systems and evacuation mechanisms

Organization of periodic drills involving all levels of the alerting chain, including local authorities and citizens with the involvement of broadcast and social media, in addition to general NEAMWave exercises.

8

Roll out the "Tsunami Ready" initiative in coastal communities

Implementation of IOC-UNESCO Tsunami Ready Recognition Programme (TRRP) across the NEAM region in partnership with other international organisations, first tested and applied to some pioneering local coastal communities in each country.

5. https://unesdoc.unesco.org/ark:/48223/pf0000183253
6. https://unesdoc.unesco.org/ark:/48223/pf0000381353

Several tools, Guides and products are available to support the implementation of tsunami awareness and preparedness, including an IOC guideline for enhancing awareness and mitigation of tsunami, storm surge and other sea-level related hazards and risks in Integrated Coastal Area Management (ICAM; Manuals & Guides 50)[5], a Standard Guideline for the Tsunami Ready Recognition Programme (Manuals & Guides 74)[6], etc.

These tools highlight principles of good practice for early warning, for emergency preparedness and response, or for mitigation and adaptation, so that response arrangements are credible, sustainable and appropriate to the risk. Member States should plan and conduct exercises on a regular basis to test early warning systems and emergency evacuation, focusing also on improvement of SOPs on how to handle diverging TSP warning messages and understand the inherent uncertainty. Additionally, to ensure that governments, non-governmental organizations (NGOs), private sector and community representatives are able to provide the required response, sustainable capacity building programmes should be developed and delivered.

Emergency Response Plans should include full evacuation zone maps and route plans, which must be easily accessible to the citizens. The information must be able to reach every segment of the population, via multiple communication media such as TV, radio, newspapers, web, and social media.

Foundation

This NEAMTWS 2030 Strategy is based on a foundation of interoperability and sustainability, together with essential research and capacity-building activities.

Interoperability

NEAMTWS requires three kinds of interoperability:

- First, national tsunami warning and mitigation systems must be interoperable among NEAMTWS Member States and the Tsunami Service Providers to ensure full and open access to tsunami-relevant observational data, analysis, advisory and warning information, operational techniques and technologies, and best practices. More effective national tsunami warning and mitigation systems will result.

- Second, NEAMTWS must be interoperable with other ICGs in the context of the TOWS-WG framework. Again, improvements in effectiveness and efficiency will result for Member States, both individually and collectively. For enhancing such interoperability, IOC created the TOWS-WG to coordinate activities of the ICGs and of relevant organizations dealing with other ocean hazards.

- Third, the TWS must be interoperable with other ocean hazards warning and mitigation systems to use and share data, analyses, awareness and preparedness, and other common elements of such systems. Synergies will increase the effectiveness of national tsunami warning and mitigation systems, regional warning centre operations, and drive down the costs of operating and maintaining ocean hazard and mitigation systems.

Sustainability

A robust and effective TWS requires adequate funding that can evolve to meet new needs and incorporate new technologies. Member States will need to commit to investing in national tsunami warning and mitigation systems and to contribute, in whatever way possible, to the operation of the TWS.

Implementing this Strategy will require additional investment from within and outside the NEAMTWS Member States with a separate funding and sustainability strategy. With new and strengthened partnerships and participation of more countries, driven by the United Nations Decade of Ocean Science for Sustainable Development (2021-2030) and the Ocean Decade Tsunami Programme Research and Development Implementation Plan, we envision this fully effective and sustainable NEAMTWS contributing to a safer ocean and coast by 2030. To this end, long-term sustainability strategies should be developed within the European Strategy Forum on Research Infrastructures (ESFRI) framework, and integrated with those of the main related research infrastructures such as the European Plate Observing System (EPOS) - European Research Infrastructure Consortium (ERIC) and European Multidisciplinary Seafloor and water column Observatory (EMSO)-ERIC.

Research

Each of the three pillars requires on-going research and development to advance all elements of the TWS. These include: Investigations of the tsunami phenomena, including tsunamis caused by landslides, volcanoes, and other sources; new developments

in tsunami detection, tsunameter technology, innovative GPS applications and communications technology, cable-based sensors, new threat-based forecast systems and development of probabilistic tsunami forecast; and innovative approaches to community preparedness. This research and development need to be monitored, evaluated, and publicised to Member States. Linking with the most important thematic scientific networks, such as the Joint Tsunami Commission of the International Union of Geodesy and Geophysics (IUGG) and the Global Tsunami Model (GTM), should be encouraged.

Building capacity

An effective tsunami warning and mitigation system requires ongoing capacity-building and training to support all three strategic pillars. All Member States must be able to assess their tsunami hazard and vulnerability and develop ways to mitigate the risk, warn their population quickly, and carry out awareness and preparedness activities to create an ability to respond in all sections of society.

Building national human resource capacities that can develop and lead these activities in each country is essential. Substantial experience, knowledge, and best practice have been accumulated over the years by Member States and should be shared widely through training courses and national, cross-sector and inter-regional workshops which are excellent ways to build these skill sets and support networking between countries during a real event.

This NEAMTWS Strategy is supported by Annual Plans of Action of the Working Groups and Task Teams of ICG/NEAMTWS that detail the measurable and time-bound actions planned to develop the TWS. The Task Team on Operations guides the interoperability of the system, as documented in the Operational Users Guide[7].

Performance Monitoring

The concept of performance monitoring and reporting is an approved element of the IOC Intergovernmental Coordination Groups for Tsunami Early Warning and Mitigation activities since 2015, when it was requested that all ICGs report to the IOC Governing Bodies on their performance against targets of the Sendai Framework for Disaster Risk Reduction (2015–2030).

In particular, ICG/NEAMTWS will develop and implement Key Performance Indictors (KPIs) similar to other ICGs based on the three key pillars, and also implement the TOWS–WG XIV recommendation to include international cooperation on its KPIs. The improvement and finalization of this draft Performance Monitoring Framework should be ensured in the early stages of this strategic plan.

7. http://www.ioc-tsunami.org/images/stories/NEAMTWS/NEAMTWS-IOUG-version%202%200%20final.pdf

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The ICG/NEAMTWS 2030 Strategy was prepared by the Task Team on Documentation co-chairs: Alessandro Amato and Brian McConnell.

Editorial Team : Denis Chang Seng, Alejandro Aldana, Nikos Kalligeris, Jamel Abdallah, Maria Camila León Duque, and Derya Vennin.

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Contributions from: Maria Ana Baptista, Fernando Carrilho, Denis Chang Seng, Marinos Charalampakis, Mauricio Gonzales, Nikos Kalligeris, Ocal Necmioglu, Areti Plessa, Marzia Santini, and François Schindelé.

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