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SUBREGIONAL WORKING GROUP FOR THE NORTH WEST INDIAN OCEAN (NWIO)

Chair Report

Dr. Mohammad Mokhtari

Chair

Ms. Sunanda Manneela,

Vice-Chair

22.07.2024

Subregional Working Group For The North West Indian Ocean (NWIO)

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Terms-of-Reference

1. To evaluate capabilities and ascertain requirements of countries in the northwest Indian Ocean region for providing end-to-end tsunami warning and mitigation services within a multi-hazard framework and within the framework of the ICG/IOTWMS.
2. To promote and facilitate tsunami hazard and risk studies and research in the region.
3. To facilitate cooperation in the establishment and upgrading of seismic, sea level and GNSS stations and networks and communication systems in the region.
4. To facilitate improvement of the education programs on tsunami mitigation in the region.
5. To facilitate capacity building and the sharing of tsunami-related data and information in the region.

Members

- **Chair: Dr. Mohammad Mokhtari (Iran)**
- Vice-Chair : Ms. Sunanda Manneela (India)
- Dr. Dipankar Saikia (India)
- Dr. Behnam Saeidi (Iran)
- Mr. AlYaqdhan Al-Siyabi (Oman)
- Mr. Jaifar Al-Busaidi (Oman)
- Mr. Ameer Hyder (Pakistan)
- Mr. Tariq Ibrahim (Pakistan)
- Major Muhammad Amjad Iqbal (Pakistan)
- Mr. Majed Naser Alshkeili (UAE)
- Mr. Ahmed Awad Alkatheeri (UAE)
- Mr. Mohammed Al-Eryani (Yemen)
- Mr. Ahmed Al-Jabal (Yemen)
- India DMO Representative - tba

Current Group is composed of members representing NTWC & DMO from each of the Member states of India, Iran, Oman, Pakistan, United Arab Emirates, Yemen

Progress on Activities

UNESCAP Project

Strengthening Tsunami Warning in the North West Indian Ocean through Regional Cooperation

Timely delivery of national tsunami warnings to at-risk coastal communities who are prepared to respond effectively (*Tsunami Ready*)

- Phase 1: Hazard & risk assessment and National tsunami warning chain development (India, Iran, Pakistan + Oman and UAE self-funded)
- Phase 2: Inundation and evacuation mapping capacity development
- Phase 3: At-risk coastal community preparedness

Progress on Activities

UNESCAP Project

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Phase 1: Hazard and risk assessment National tsunami warning chain development

Objectives

1. Better understanding of the risk knowledge to inform and underpin warning and mitigation systems in the NWIO to enable appropriate and effective community responses to the tsunami threat.

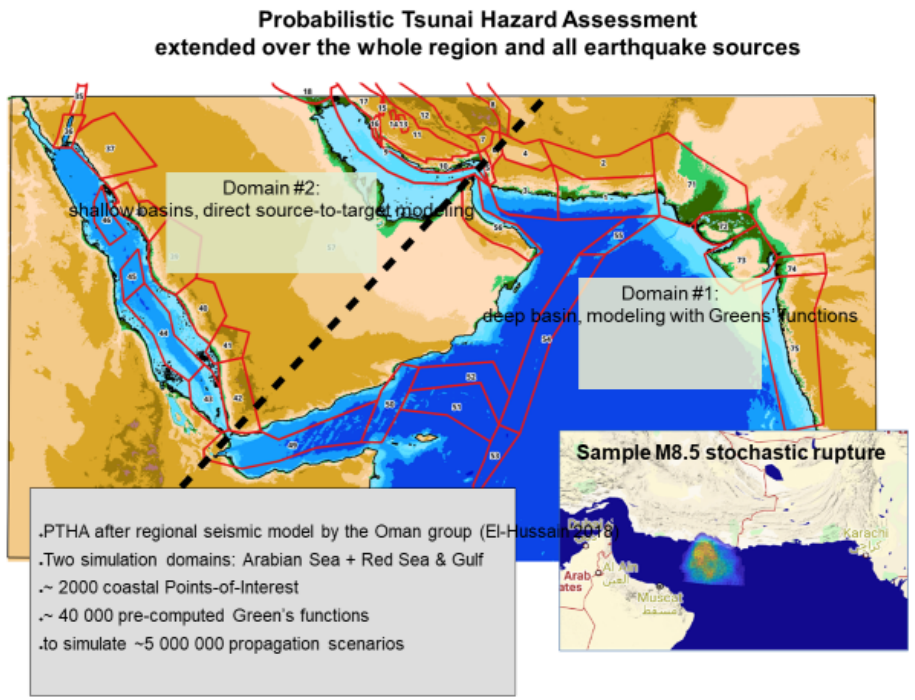
1. ***Expert Team 1*** to jointly develop a seismo-tectonic model for the Makran region to be used for the unified PTHA. The main outcome should be a catalogue of representative tsunamigenic scenarios with recurrence rates. Principles of model construction will be defined (by end of December 2019).

2. ***Expert Team 2*** to consider and identify tsunami propagation models, existing and required data sets, amplification factors, etc., to be used for the unified PTHA and future inundation modelling (by end of December 2019).

3. ***Expert Team 3*** to provide guidance on inclusion of tsunamis generated by non-seismic effects such as landslides, mud volcanoes, etc.) and inclusion of Red Sea and Persian Gulf in the proposed PTHA framework, or through other measures to inform risk assessments and decision makers (by end of May 2020).

Progress on Activities

UNESCAP Project

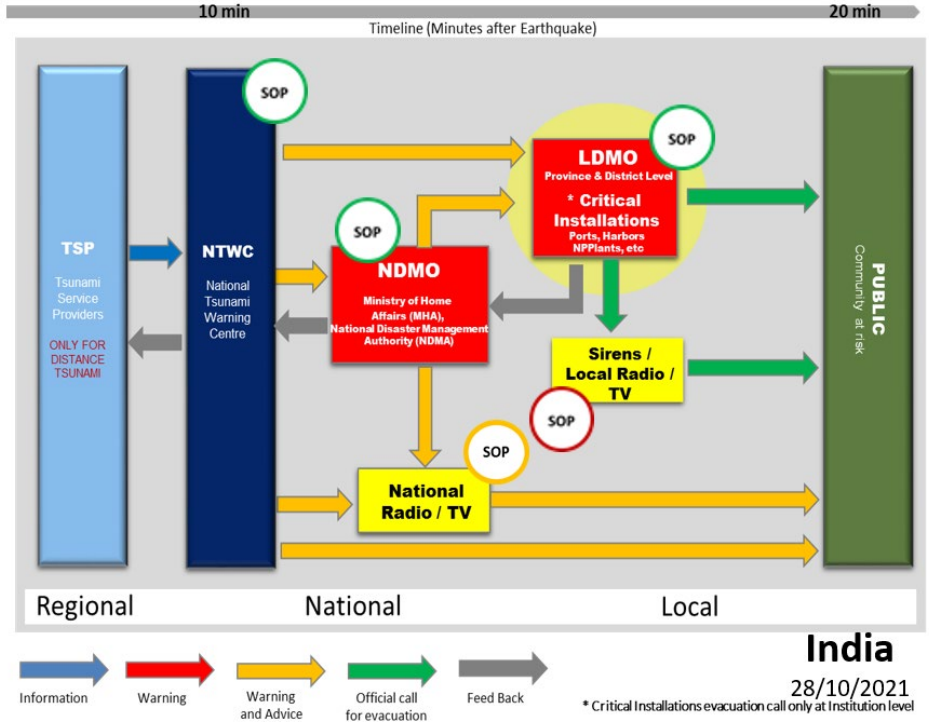


- Meetings of the Makran Probabilistic Tsunami Hazard Assessment (PTHA) in (1) December 2019, (2) May 2020 (3) June 2020 (4) August 2020 & Nov 2021
- Virtual meetings after COVID-19 impact. No break in progress, but slowed down.
- Initial benchmark PTHA model simulations run at INCOIS [India] and INGV [Italy] with guidance from GFZ [Germany], INGV, and the University of Malaga.
- Examining the possibility of the tsunami threat in the neighbouring Persian Gulf, especially Meteotsunami, and the Red Sea.
- PTHA v1.0 is ready (Based on the prestation in Oman, Jan 2025)
- The results will be shared on a common platform and more site specific inundations will be run at nation level. (A project already began for Chabahar and Krachi)
- To consider hazards from non-seismic and complex sources tsunamis (eg submarine landslides, splay faults, meteotsunami,....), A reginal project is under discussion and the first draft is prepared.
- Working towards data exchange through MOUs

Progress on Activities

UNESCAP Project

2. Improvement of warning services at NTWC level and the organization of the national warning chains to assure timely warnings.



- Key stakeholders involved in the national tsunami warning chains brought together to enhance ownership, communication and coordination across national and local levels
- Series of virtual National Consultative Meetings with India, Iran, Oman, and Pakistan
- National tsunami warning chains developed, tested and refined for each country
- Evolution of national tsunami warning chains at different stages between the countries
- Standard Operating Procedures (SOPs) completed or in development for NTWCs, DMOs, and Broadcast Media
- Pilot communities identified and Local Disaster Management Organizations and other stakeholders engaged
- Several Workshops and Webinars: February 2020, November 2020, June 2021, September 2021, twice in October 2021
- COVID-19 guidelines provided to all IOTWMS Member States in 2020

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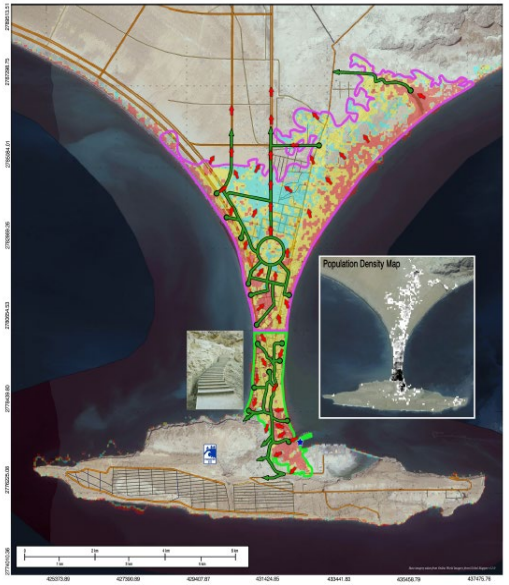
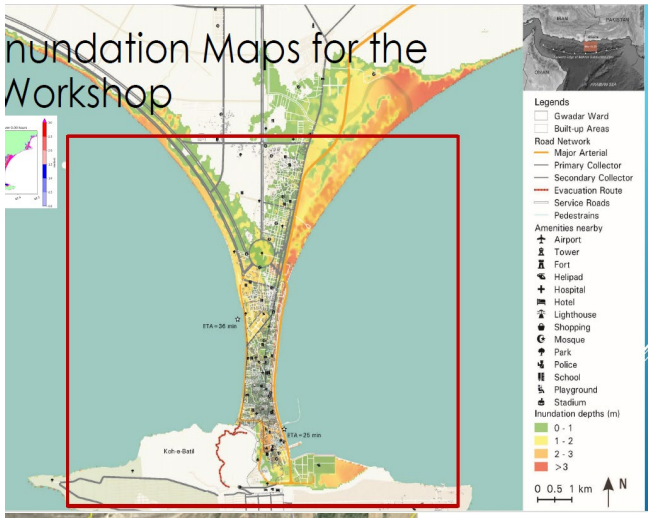
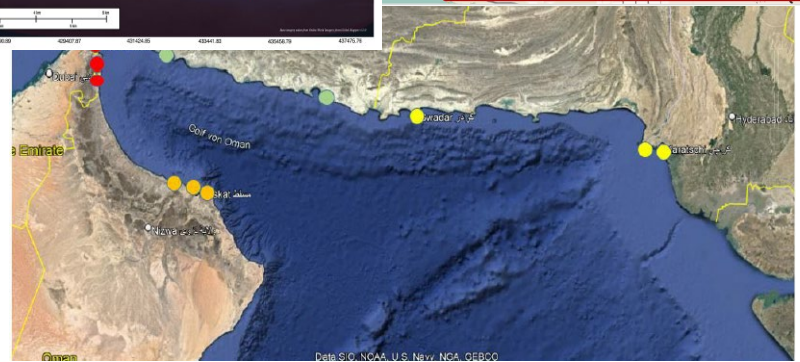
Inundation Mapping and Evacuation Maps Workshop

Evacuation map of Gwadar for a hypothetical tsunami from extreme rupture along the Makran Subduction Zone







- Two workshops were conducted for the five Member States in Oman, April 21-25, 2024
- Phases 1, 2a and 2b of the project and related initiatives were briefed along with the UN Ocean Decade Tsunami Programme and the UNESCO-IOC Tsunami Ready Recognition Programme (TRRP)
- Discussed principal concepts and approaches for tsunami inundation mapping and evacuation planning
- Review of existing tsunami inundation maps
- Training in tsunami evacuation mapping using existing global approaches, standards, methodologies, and best practices outlined in Phase 2b
- The framework is defined for next steps
- Tsunami evacuation plan (TEP) to be developed by each Member State and conduct a mockdrill by August

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West Makran Paleo-tsunami Investigation

Objectives

- Investigate the relationship between great earthquakes and associated tsunamis in Makran Subdcution Zone, duration of the tsunami recurrence, probability of it happening in populated places, identification of the most affected places, extent of the potential damage, time needed for tsunami hazard alert, probability of major earthquakes occurrence, leading to the reduction of humanitarian and property damage.
- Develop a building stone for further analysis to support the identification of the most probable tsunami occurrence from geological point of view, including identification of the major locations that have been affected by past (paleo) tsunami.
- The first workshop was held virtually on October 29, 2021
- The first site visit and trenching is conducted in 2023 and the results are now being analyzed, which will be presented later today.
- During workshop of the first meeting after trenching a proposal to make the paleotsunami compulsory was discussed.

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West Makran Paleo-tsunami Investigation

STUDYING TSUNAMI SEDIMENT

Remote Sensing

Satellite and aerial images can provide a bird'seye view of the effects of a tsunami over a large area, and can help identify areas where tsunami sediment is likely to be found. This can be particularly useful in areas that are difficult to access.

1

Sampling Techniques

2

Techniques to collect and analyze tsunami sediment, including coring, sieving, and chemical analysis. These methods can provide information about the sediment's composition, age, and location.

Micropaleontology

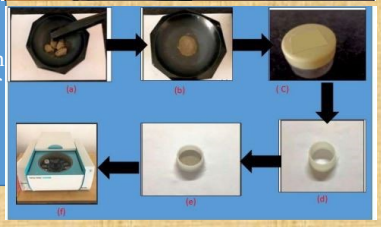
By examining microfossils in tsunami sediment, scientists can learn more about the timing and magnitude of past tsunamis, and can even identify tsunamis from thousands of years ago. This can be particularly useful in areas where there are no written records of tsunamis.

3

Geochemical Analysis

4

By analyzing the chemical composition of tsunami sediment, scientists can learn more about the source of the sediment, and can track the movement of water and debris during the tsunami. This can provide insights into the nature of the tsunami, and can help with hazard assessment.



Dating Method (OSL)

5

To obtain Chronological Event

Progress on Activities

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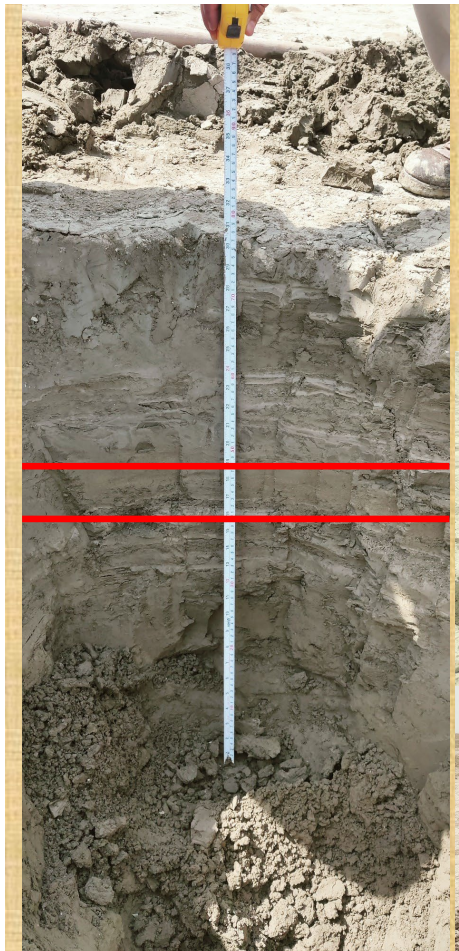
West Makran Paleo-tsunami Investigation



SITE 1 GABRIK

- Depth of trench- 80 cm
- Sand layer from top 28 cm and thickness 7cm
- Collected 2 OSL samples
- 10 samples for Geochemical

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West Makran Paleo-tsunami Investigation

Progress on Activities

Status of Action Items from Intersessional Steering Group November 2024

Sl No.	Actions & Recommendations	Status
1	Requests the ICG/IOTWMS to encourage all Member States to work on their tsunami warning chain to minimize the number of steps (between the NTWC and the Public) in the warning chain, and with clear authorization of responsibilities amongst the NTWCs, NDMOs, LDMOs, and Public.	As part of UNESCAP Project Warning Chains of all MSZ member states were refined and SOPs are being prepared
2	NWIO-WG member states are urged to exchange real-time data with the TSPs. It is also strongly suggested to go toward the multi-lateral.	Currently bi-lateral agreements between member states is in progress
3	The reaction to non-seismic and complex tsunami source events needs to be considered more seriously and in addition, they need to be incorporated into tsunami early warning systems including community evacuation and emergency plans.	'The non-seismic events need to be further studied to incorporate them in TEWS
4	On-job training also needs to be initiated among NWIO member countries, maybe when international travel is safe we can start with one-by-one member states.	Oman personnel were given training in India (December 2023)
5	Initiate building knowledge-based database of risk assessment (approaches adopted for hazard, vulnerability and risk assessment) that is accessible to all Member States (possibly IOTIC site or other portal).	Yet to initiate. NWIO will coordinate with IOTIC
6	Paleotsunami study has been initiated in Iran by the University of Hormozgan, to be extended in the region, this can help us to know more about historical seismicity and also achieve the required Mmax for hazard studies. It requires further extension and funding	The first field visit for trenching is expected to be in June 2023 and the analysis ongoing
7	Encourage the participation of North West Indian Ocean representatives in webinars and workshops with a focus on the Makran region.	On going
8	Chairs of WG1, WG2, WG-NWIO, and Task Teams to prepare a proposal for UN Ocean Decade with support from IOTIC and the Secretariat for enhancement by the Steering Group. Consider focusing on 1) Near-field tsunami warning and mitigation including: transforming tsunami warning services through new technology (GNSS, smart cables) through to community preparedness and infrastructure; and/or 2) Tsunami monitoring gaps in NWIO. In particular enhancing the observing networks, PTHA development, and data sharing. These activities could be expanded to the entire Indian Ocean basin **Continue updating the inundation and evacuation maps based on the experiences gained at the workshop conducted in Muscat recently on the pilot areas and extend that to the full NWIO area, in line with Risk Assessments and tsunami-ready exercise.**	Projects that are being implemented in NWIO region will be submitted for Ocean Decade (Call of Action 7)
9	Working Groups to review the recommendations of the Capacity Assessment of Tsunami Preparedness: Status Report 2024.	To review
10	Secretariat to develop template for bilateral data exchanges	
11	RWG-NWIO to prepare its report to ICG/IOTWMS, including update on progress and recommendations to ICG/IOTWMS-XIV, for review and consideration at the next Steering Group meeting prior to ICG/IOTWMS-XIV	In progress

Challenges

- Identifying all potential sources of tsunami in Makran Subduction Zone
- Assess and mitigate local tsunami threat , based on the ongoing UNESCAP Project
- Maintaining effective national tsunami warning chains for rare events such as tsunami, strengthen local and community level activities
- Integrating national tsunami warning chains with other multi-hazard frameworks
- Timeliness of tsunami warnings for near-field tsunami events, ongoing should follow now the 2nd phase.
- Need to further research the seismicity of the region and how to include features such as splay faulting in the PTHA, an example has been shown on this by a PhD student with good results
- To include Non-seismic and complex tsunami sources in the PTHA?, as mentioned in the above items, or consider as an induvial local sources.
- Optimal network design for Data Sharing , this is a very important item that a solution need to be found.
- Strengthening of observation network with advanced technologies (GNSS/SMART Cables/OBS etc.)
- Strengthening tsunami awareness and preparedness, especially for near-field threat this is a vitally important subject for the Makran region.
- The tsunami ready for NWIO should is an integrated part of the working group. We should cooperate WG-3, and the work has began in the pilot area.
- **By national team, continue updating the inundation and evacuation maps based on the experiences gain at the workshop conducted in Muscat recently on the pilot areas and extend that to the full NWIO area, inline with Risk Assessments.**

Way Forward & New Opportunities

- **Increase the geosciences information and historical/ Paleo data to improve the parameter for more accurate modeling. It is highly desirable to use the uniform model (regional) in the local sense.**
- An additional offshore seismic data acquisition should be re-activated to improve our understanding of the required simulation modeling parameters.
- **The results of the UNESCAP Projects should strongly implemented and knowledge transfer conducted right after it is final approval, in reginal as well as local sense.**
- Paleo-tsunami project…..ongoing and approved for the year 2024
- Identify new projects on the Non-Seismic and complex sources in regional senses. An application is underway to be worked out between the member states of NWIO, Europe, and Canada.
- **SOP for Non-seismic and Complex Source Tsunamis**
- **Utilize National Tsunami Working Groups established by UNESCAP Project to further coordinate, maintain, and develop national tsunami warning chains.**
- Utilize national and next IOWAVE exercises to test and enhance national tsunami warning chains mainly in the Pilot area.
- **Engage local NWIO countries for furthering the task and also consider applying for funding to expand the Paleo-tsunami to cover the whole NWIO area. In addition considering to introduce this all other area susceptible to tsunami disaster.**
- Tsunami Ready implementation a more effective cooperation with WG-3 will follow beginning at the pilot area.
- **By nations continue updating the inundation and evacuation maps based on the experiences gained at the workshop conducted in Muscat recently on the pilot areas and extend that to the full NWIO area, in line with Risk Assessments and tsunami-ready exercise.**