Probabilistic Tsunami Hazard Assessment

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Seismic source model –zonation, Mmax, rate parameters –from the Oman group (El-Hussain et al.,2018)

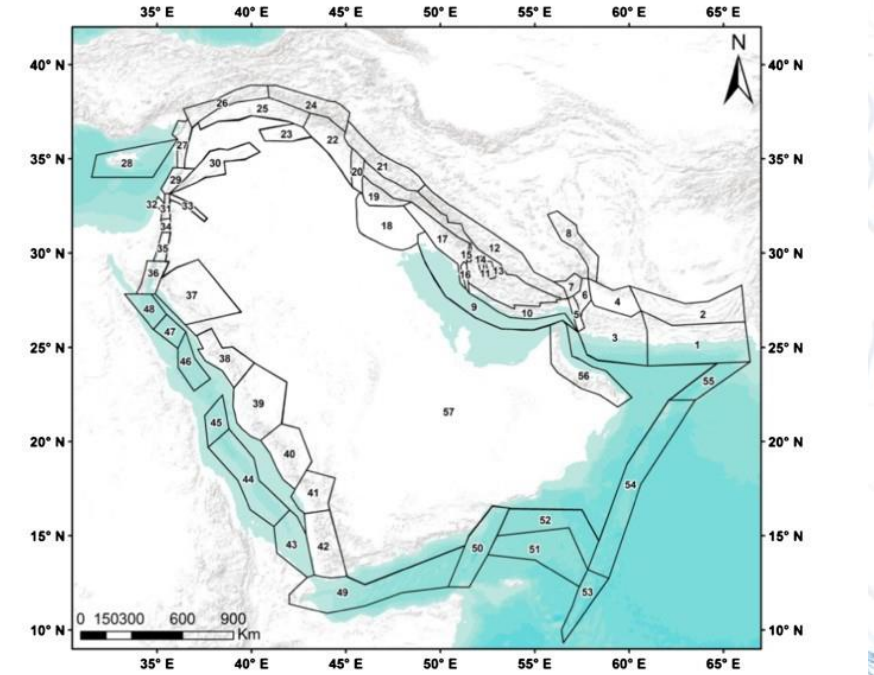
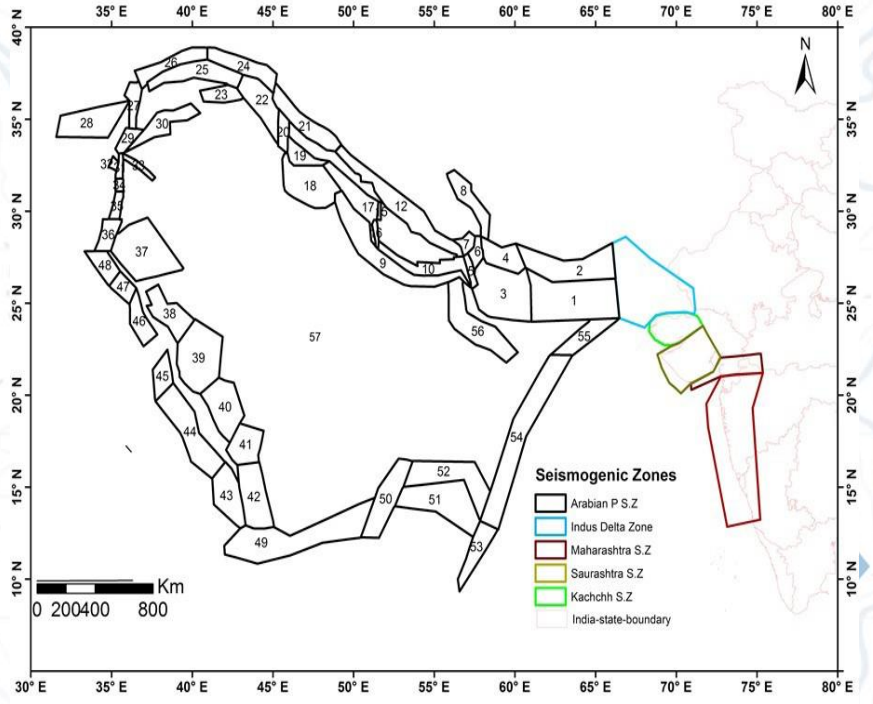


Fig. 6 Developed seismic source model for the Arabian Plate

Extended…
Chopra's Group (India)



Tsunami Modelling

PTHA STEPs-2&3 “Tsunami propagation and coastal impact” **– PILOT Study**

Models Proposed

- INCOIS FEM Model – ADCIRC
- Tsunami HySEA
- FETPI – GPU based ADCIRC

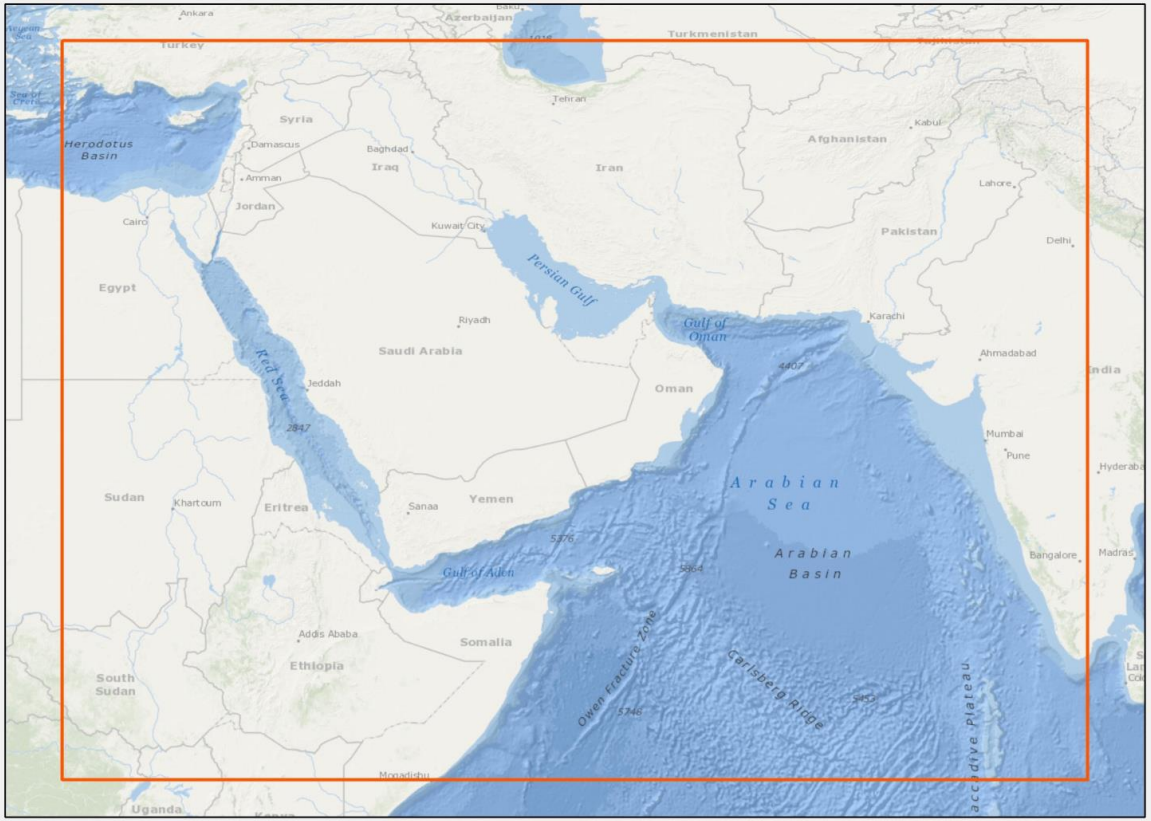
Data proposed for Tsunami Modeling

- Open Ocean Propagation – GEBCO 15 arc second
- Coastal Inundation – SRTM 01 arc second

Data Preparation

- Modeling Domain
  - Modeling Domain Preparation for ADCIRC
    - Mesh for Ocean & Subduction Zone
    - Mesh for Land part with SRTM
  - Modeling Domain Preparation for Tsunami HySEA
- CFL Criteria
- Points of Interest (POIs)

Tsunami Modelling Domain



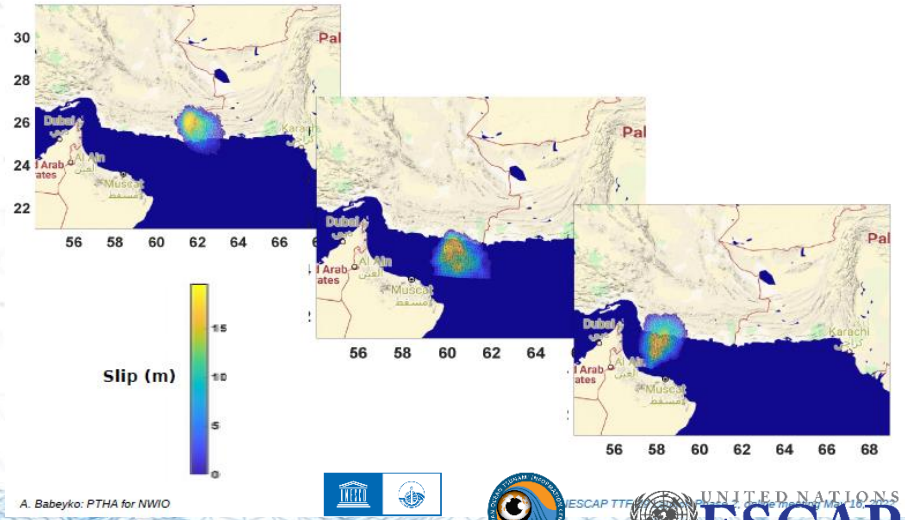
Modeling Domain extent for tsunami simulations adopted with Longitude Range: 27.0 E to 78.0 E and Latitude Range: 2.0 N to 39.0 N that covers Arabian Sea (AS), Red Sea (RS) & Persian Gulf (PG).

Exchange of latest scientific results and studies from regional/international studies on the tsunami hazard in the MSZ

Progress:

- Arabian Sea **tsunami hazard simulations** completed (GFZ/INGV))
- Red Sea and Persian Gulf tsunami hazard simulations completed (INCOIS/India)

Probabilistic Tsunami Hazard Assessment (PTHA)
Makran subduction M8.5
slip distribution examples



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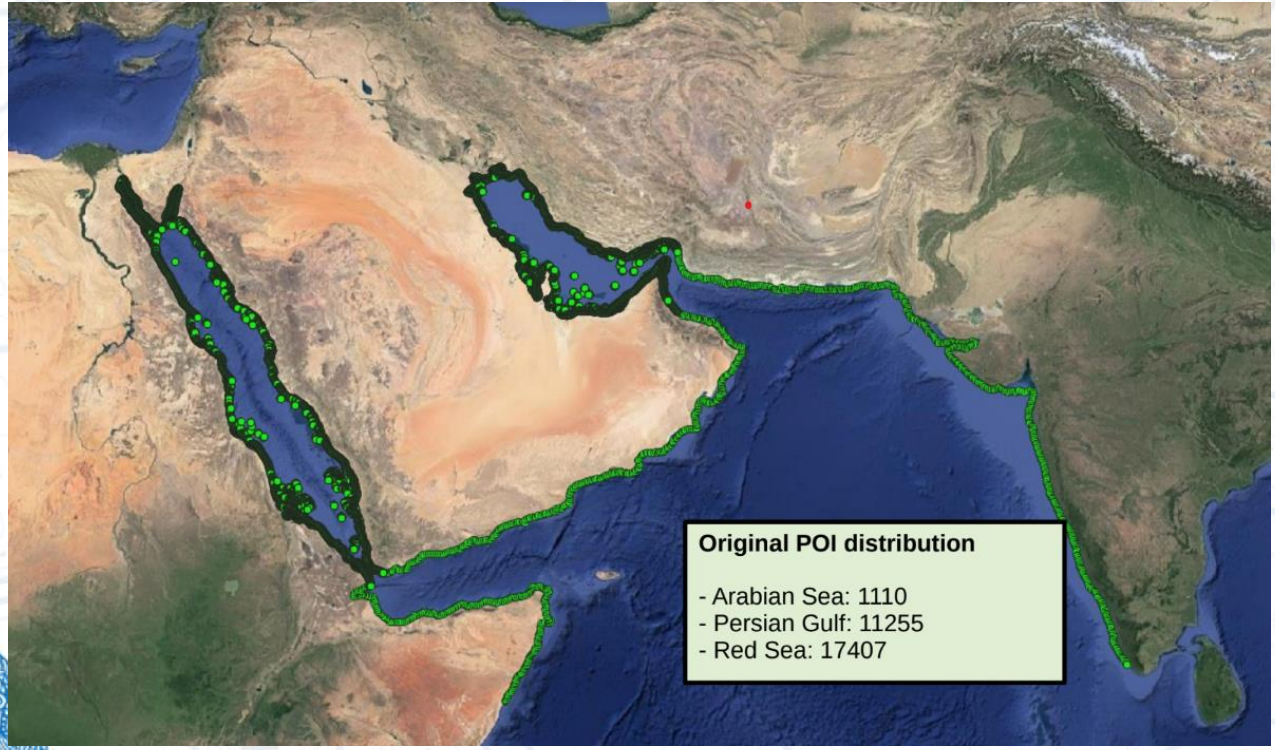

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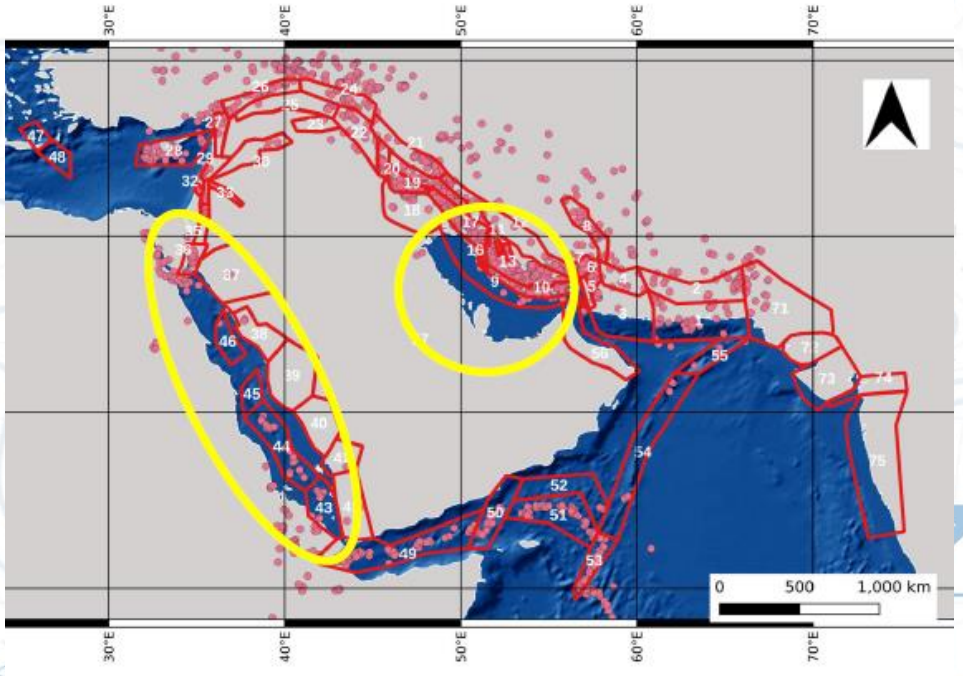
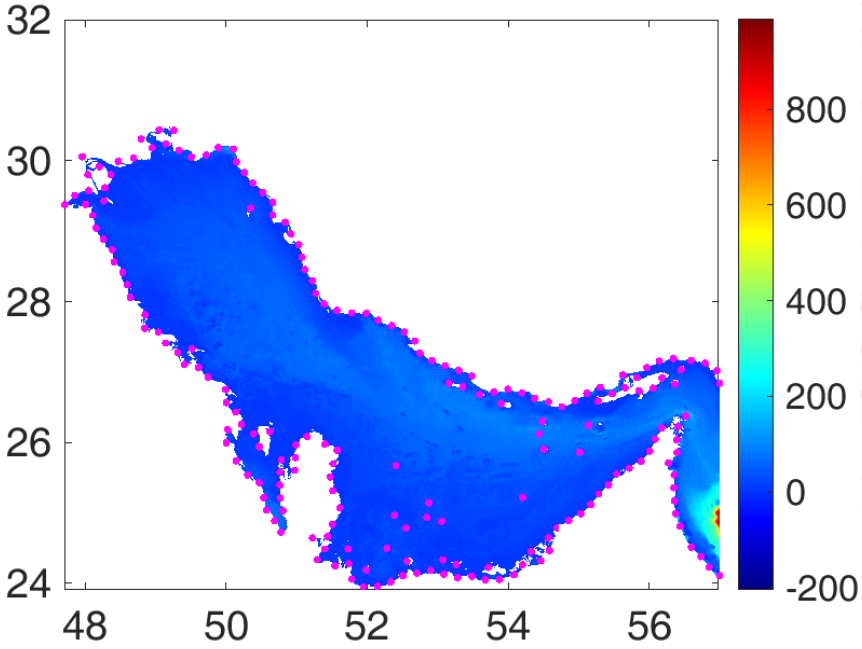
Probabilistic Tsunami Hazard Assessment

- Millions of Tsunami propagation simulations were carried out using ADCIRC for the Persian Gulf and Red Sea regions in two phases.
- HySea is used for Arabian sea simulations
- Results (max elevation) were shared with the Task team on PTHA for these two regions at POIs.
- India is actively participating in UNESCAP project of PTHA for Makran Subduction Zone

Source Zones



PTHA Simulations on the Persian Gulf

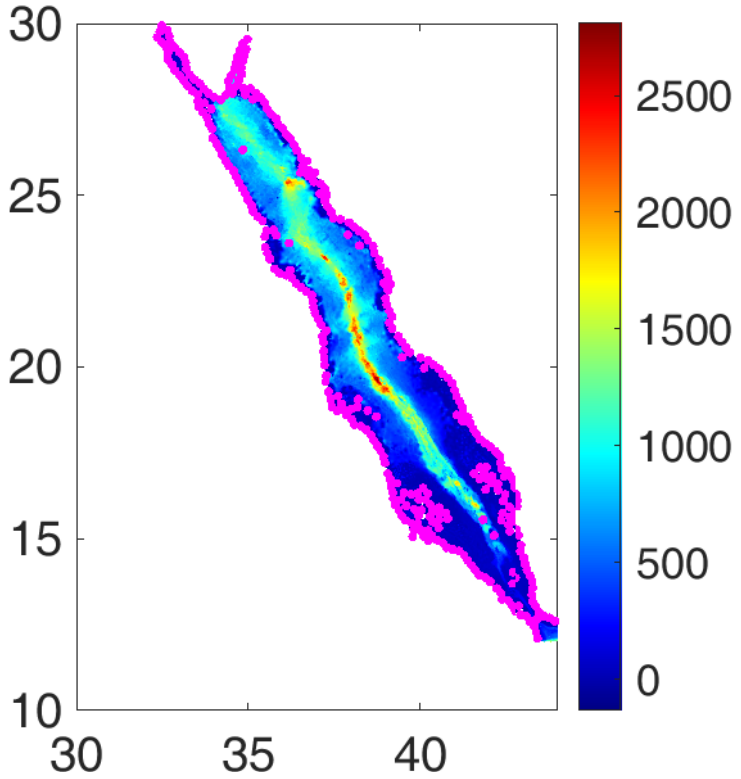


Persian Gulf region for which PTHA simulations were carried out. The magenta dots show the POIs

	Simulations	Status
Phase 1	75707	Completed
Phase 2	321991	Completed
Total	397698	

nele = 1737915;
nnodes = 874620;
Simulation time = 12 hrs;
Computational time = 1 min;
No of Processors = 180

PTHA simulations on the Red Sea



Red Sea region for which PTHA simulations were carried out. The magenta dots show the POIs

	Simulations	Status
Phase 1	354890	Completed
Phase 2	711124	Completed
Total	1,066,014	

nele = 2650346;
nnodes = 1333616
Simulation time = 12 hrs;
Computational time = 2 min
Processors = 288

Maximum modeled wave heights (deterministic)

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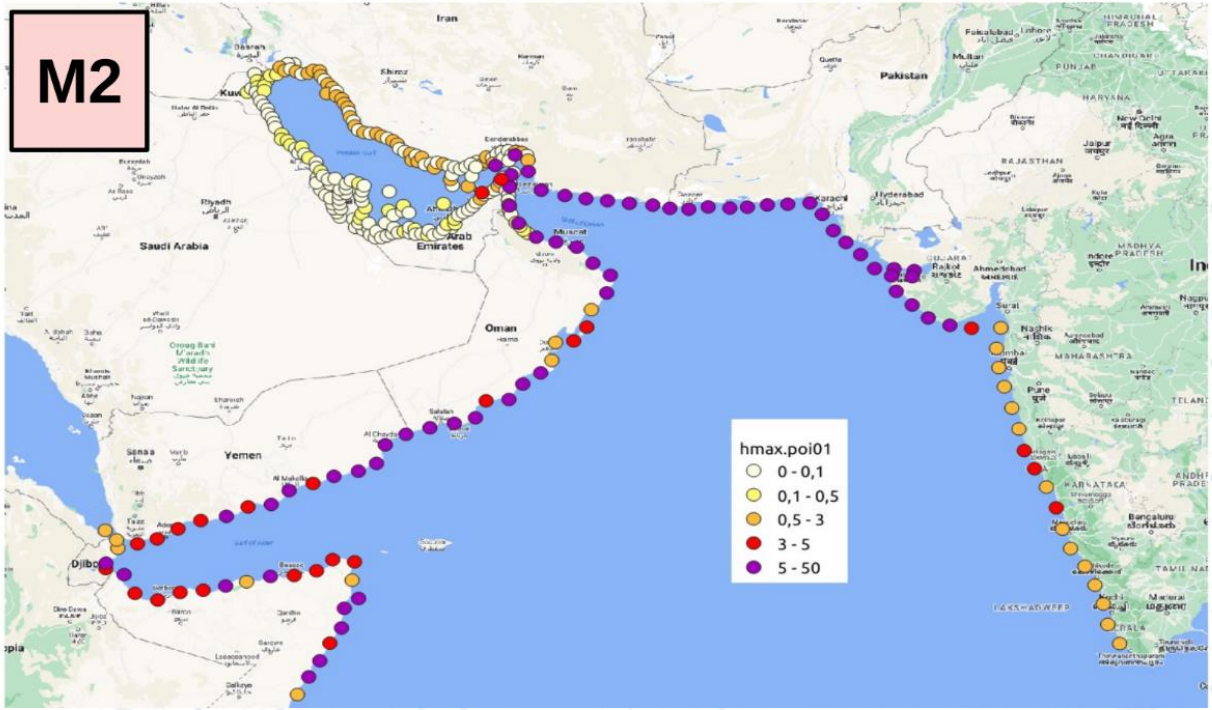
Maximum modeled wave heights (deterministic)



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PTHA1.0 Results

- PTHA modelling incorporation in unified approach and method for tsunami modelling and inundation mapping for the NWIO region discussed at science exchange meeting 14 -16 Nov 2022, Abu Dhabi, United Arab Emirates
- INCOIS, India agreed to host the results and share them with Member States
- The results will be used as inputs to the “Gap analysis and development of guidance on tsunami inundation mapping and evacuation planning in the NWIO region”
- PTHA2.0 - Hazard curves, maps and non-seismic etc.

Project Impacts

With the help of experts outside the region, Makran countries are taking ownership of producing a unified **Probabilistic Tsunami Hazard Assessment (PTHA)** for their region.

Enhanced regional scientific understanding of the Makran Subduction Zone and its potential tsunami hazard is improving through expert discussion and sharing of recent science among North-West Indian Ocean countries.

Through international collaboration, **scientists in Makran countries are enhancing their expertise in seismology, modelling and tsunami hazard assessment** and building networks with like-minded researchers.

By highlighting the tsunami hazard to Makran countries, the regional **PTHA will help influence disaster mitigation initiatives** such as community education, land use planning, and tsunami emergency response plans and procedures.

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Thank You