Current status of TsunAWI contributions to the Indonesia Tsunami Early Warning System (InaTEWS) with a comparison of warning products from near-realtime easyWave and precomputed TsunAWI simulations

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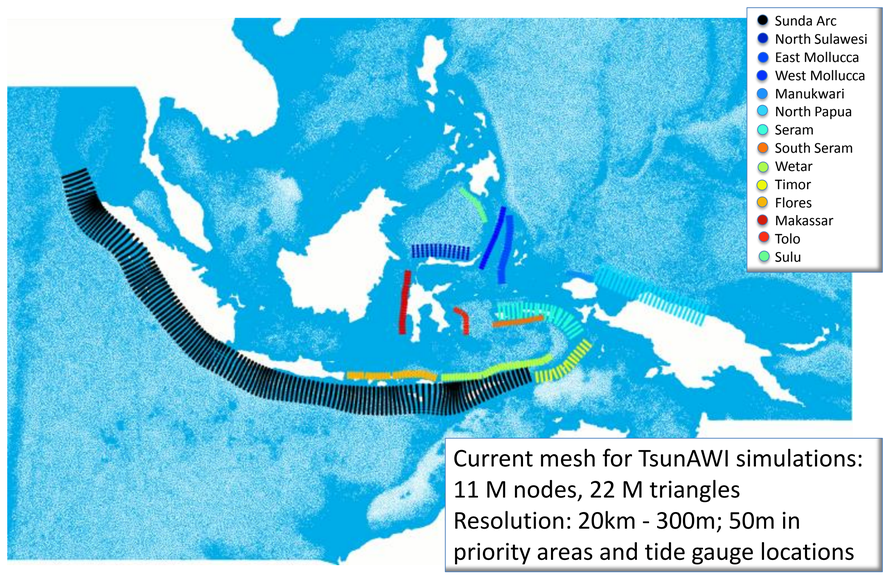
Database coverage in InaTEWS

Initially: Sunda Arc (GITEWS/PROTECTS)
Now: extended in joint project with Geoscience Australia / DMInnovation to altogether 15 trenches



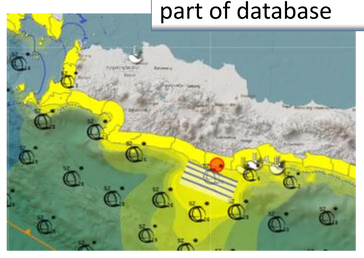
Current mesh for TsunAWI simulations:
11 M nodes, 22 M triangles
Resolution: 20km - 300m; 50m in priority areas and tide gauge locations

Comparison of modelling approaches in InaTEWS

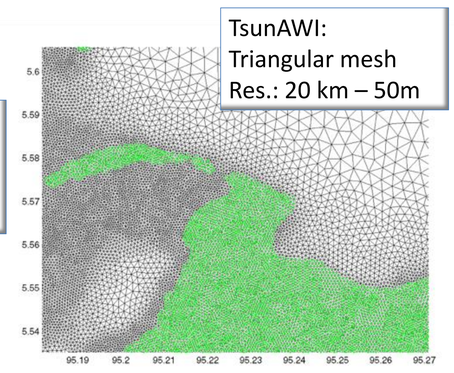
InaTEWS contains
- Database of precomputed **high resolution** tsunami scenarios (**TsunAWI**) including an inundation scheme
- **On-the-fly** modelling component (**easyWave**)

Current study investigates consistency of the warning products
- **Estimated Wave Height (EWH)**
- **Estimated Time of Arrival (ETA)**

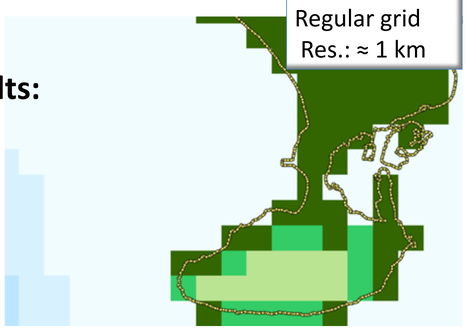
and reasons for occurring differences



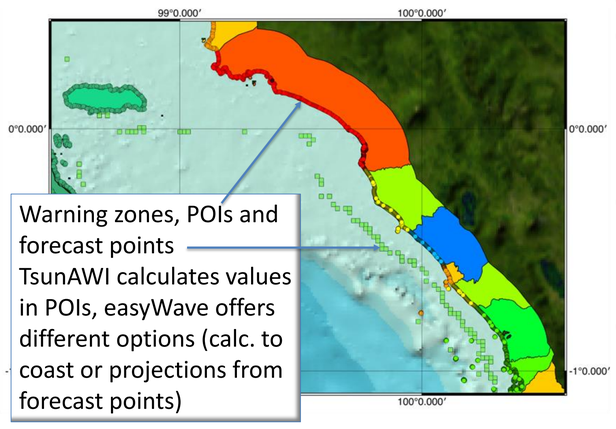
Screenshot: TOAST by gempa GmbH, warning zones and part of database



TsunAWI: Triangular mesh
Res.: 20 km – 50m



easyWavel: Regular grid
Res.: ≈ 1 km

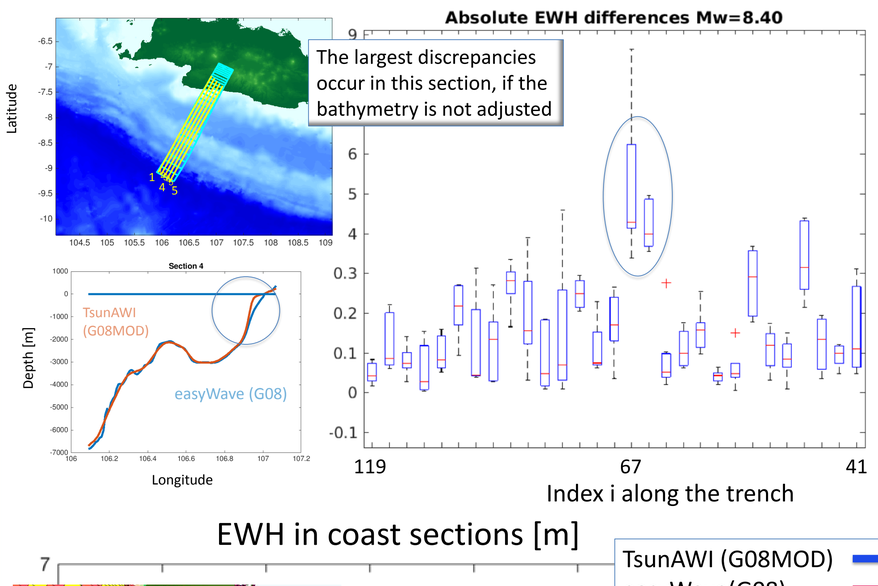


Warning zones, POIs and forecast points
TsunAWI calculates values in POIs, easyWave offers different options (calc. to coast or projections from forecast points)

Potential reasons for varying results:
- Bathymetry
  - easyWave: GEBCO (G08)
  - TsunAWI: GEBCO with additional data (G08MOD)
- Governing equations (TsunAWI with add. terms like advection, viscosity, bottom friction)
- Determination of warning products (the actual algorithm)

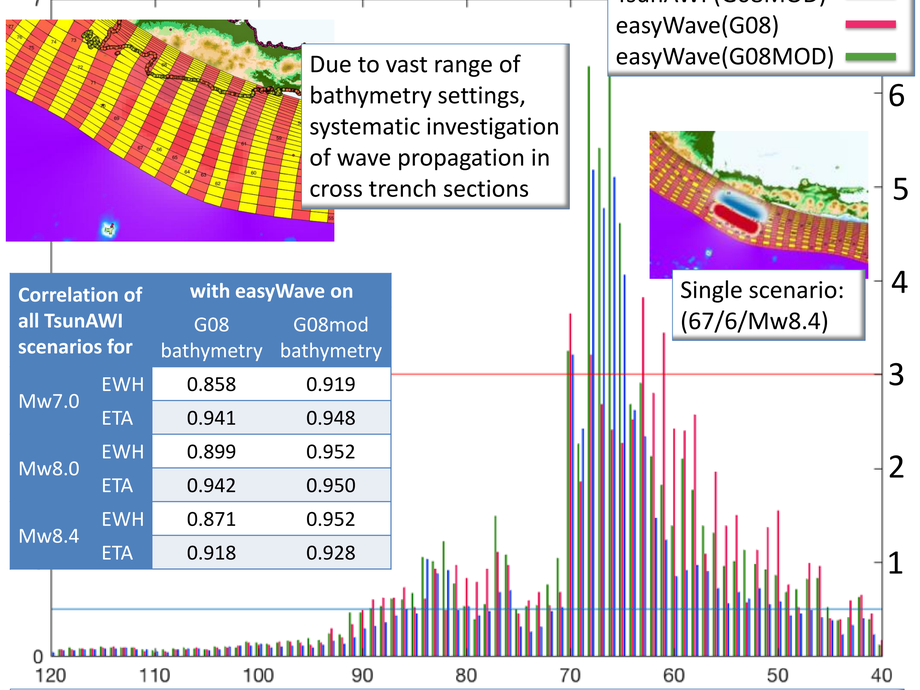
Warning products are based on values in **Points of Interest (POIs)**
Full set of POIs defined by DLR (German Aerospace Centre)

Detailed study: Role of bathymetry



The largest discrepancies occur in this section, if the bathymetry is not adjusted

EWH in coast sections [m]



Due to vast range of bathymetry settings, systematic investigation of wave propagation in cross trench sections

Single scenario: (67/6/Mw8.4)

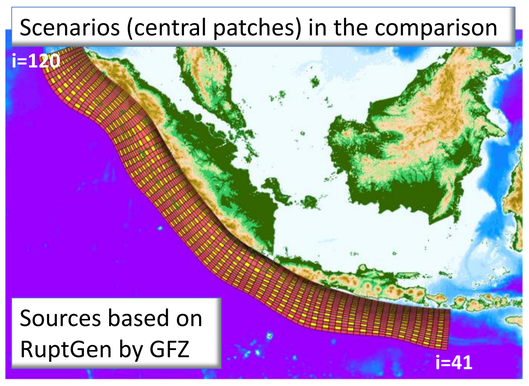
Correlation of all TsunAWI scenarios for		with easyWave on G08 bathymetry	with easyWave on G08mod bathymetry
Mw7.0	EWH	0.858	0.919
	ETA	0.941	0.948
Mw8.0	EWH	0.899	0.952
	ETA	0.942	0.950
Mw8.4	EWH	0.871	0.952
	ETA	0.918	0.928

Estimated wave height values for the three model configurations in the sections

Mismatch of warning levels

Mw	#scen
7.0	497
7.2	495
7.4	486
7.6	454
7.8	412
8.0	373
8.2	326
8.4	271
8.6	214
8.8	142
9.0	66
Total	**3636**

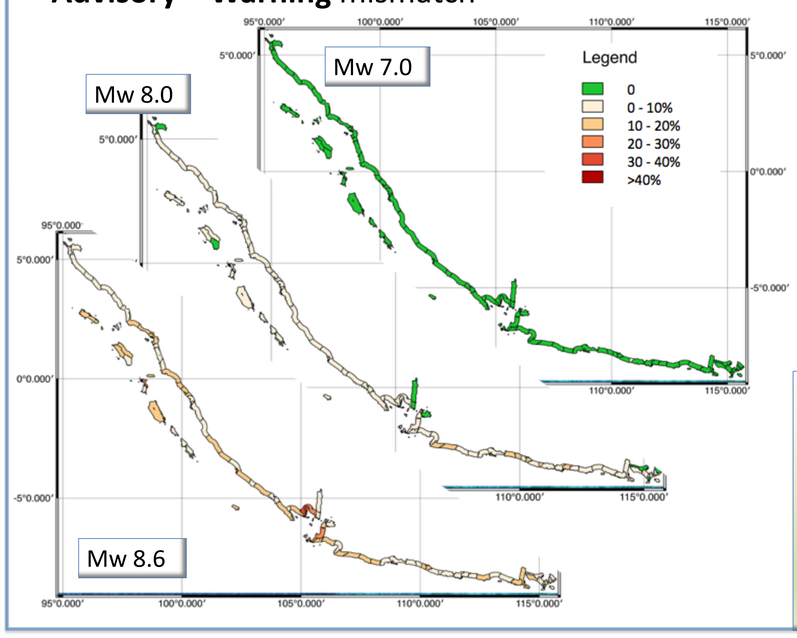
Scenarios (central patches) in the comparison



Sources based on RuptGen by GFZ

Fraction of mismatches on warning zone level for all easyWave vs. TsunAWI scenarios in the specified magnitude

Advisory – Warning mismatch

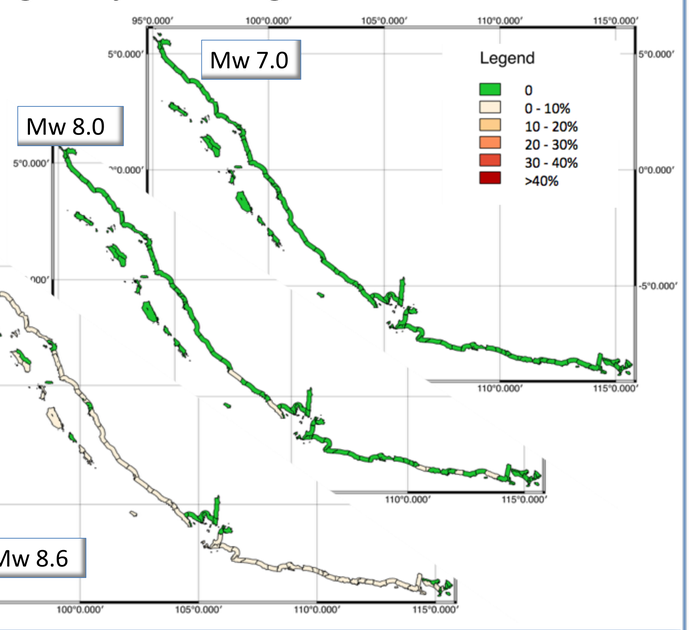


easyWave / TsunAWI products for identical sources and bathymetry

InaTEWS Warning levels

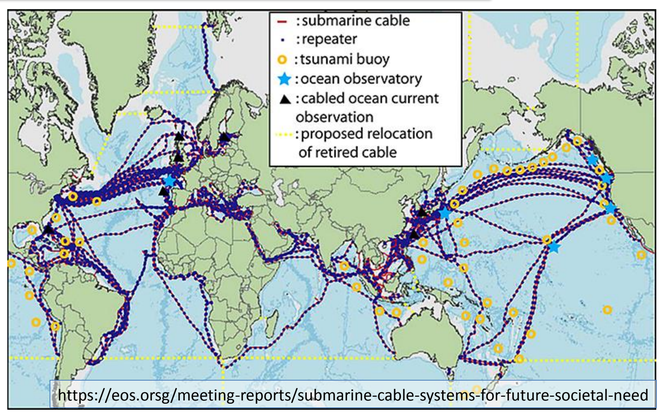
Category	Warning Level	Max. Wave Height
<none>	<none>	mwh < 0.1m
Minor Tsunami	Advisory	0.1m ≤ mwh < 0.5m
Tsunami	Warning	0.5m ≤ mwh < 3.0m
Major Tsunami	Major Warning	3.0m ≤ mwh

Warning – Major Warning mismatch



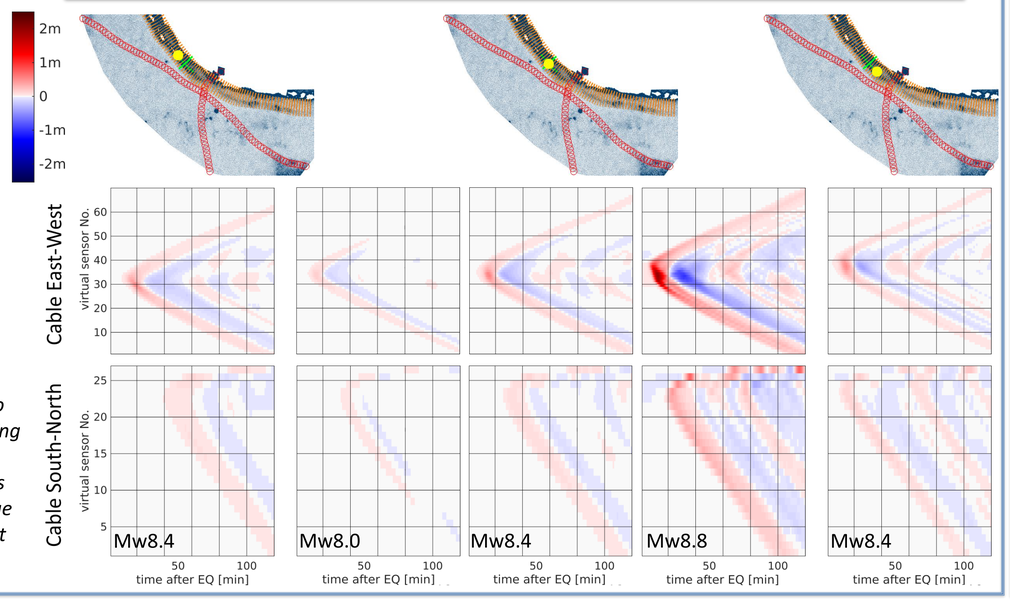
Study ongoing – Conclusions so far
- Overall consistency, in particular small discrepancies for small magnitudes
- Vast range of bathymetrical settings
- Improvements are possible, many factors contribute to deviations

Outlook: SMART cable monitoring



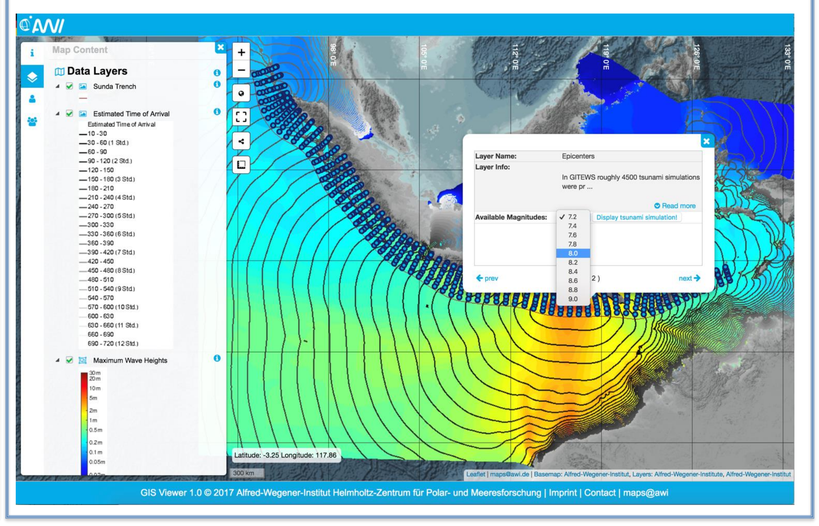
"Telecom companies continually add new submarine cable system installations to satisfy Internet demand. A new global-spanning component of the ocean observing system can be established over the next decades in these systems by adding environmental sensors to repeaters (blue dots, every fourth repeater shown). This new component would focus on the societal issues of climate and sea level change and earthquake and tsunami risk mitigation. Credit: ITU/WMO/UNESCO IOC Joint Task Force. Cable distribution data from Global Marine Systems, Ltd. "

Virtual sea height measurements at hypothetic sensor locations, extracted from TsunAWI scenario database for earthquakes South-East off Sumatra



TsunAWI-WebGIS

All Sunda Arc scenarios are visualized at **maps.awi.de** -> TsunAWI. To be extended!



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