BMKG

Australian Government
Geoscience Australia

Extending the database of pre-computed tsunami simulations for the Indonesian tsunami early warning system (InaTEWS)

Tri Handayani, M. Riyadi, S. Harig,
A. Immerz, N. Rakowsky and J. Griffin

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DMInnovation
SCIENCE AND TECHNOLOGY FOR DISASTER MANAGEMENT

HELMHOLTZ GEMEINSCHAFT

Project: May 2015 - March 2017

Funded by the Australian Government through the DMInnovation project

Conducted by Tsunami Modeling Group of the Alfred Wegener Institute

BMKG-Participants: operators/modelers, system administrators

Supported by gempa GmbH

8 workshops at BMKG
(Badan Meteorologi, Klimatologi, dan Geofisika)

Project - Outline

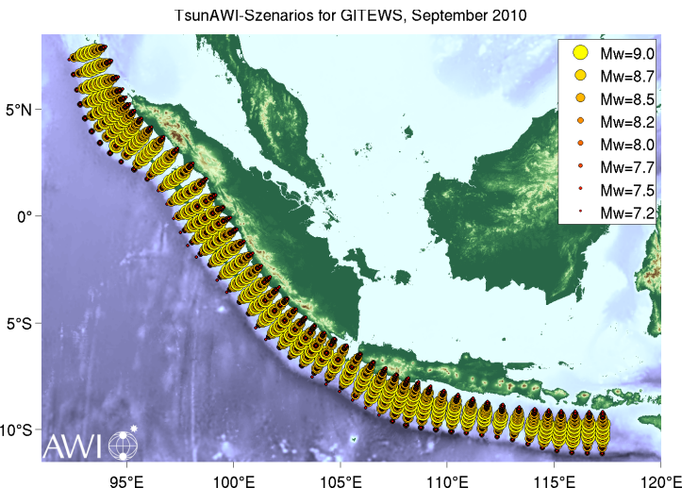
General idea of the project:

Extending the currently existing scenario database with TsunAWI simulations for North-East Indonesia

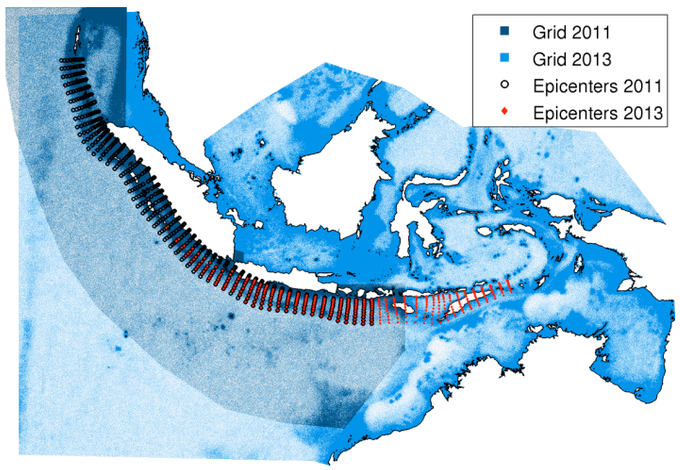
Investigating the status quo of decision support and modeling approaches

Enabling BMKG to independently extend the database in the future

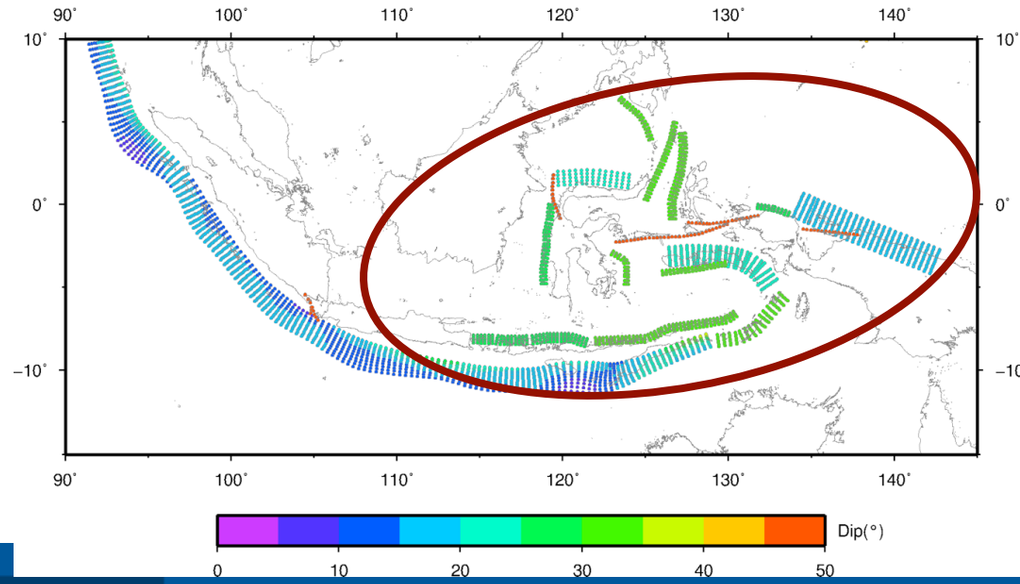
2010



2013



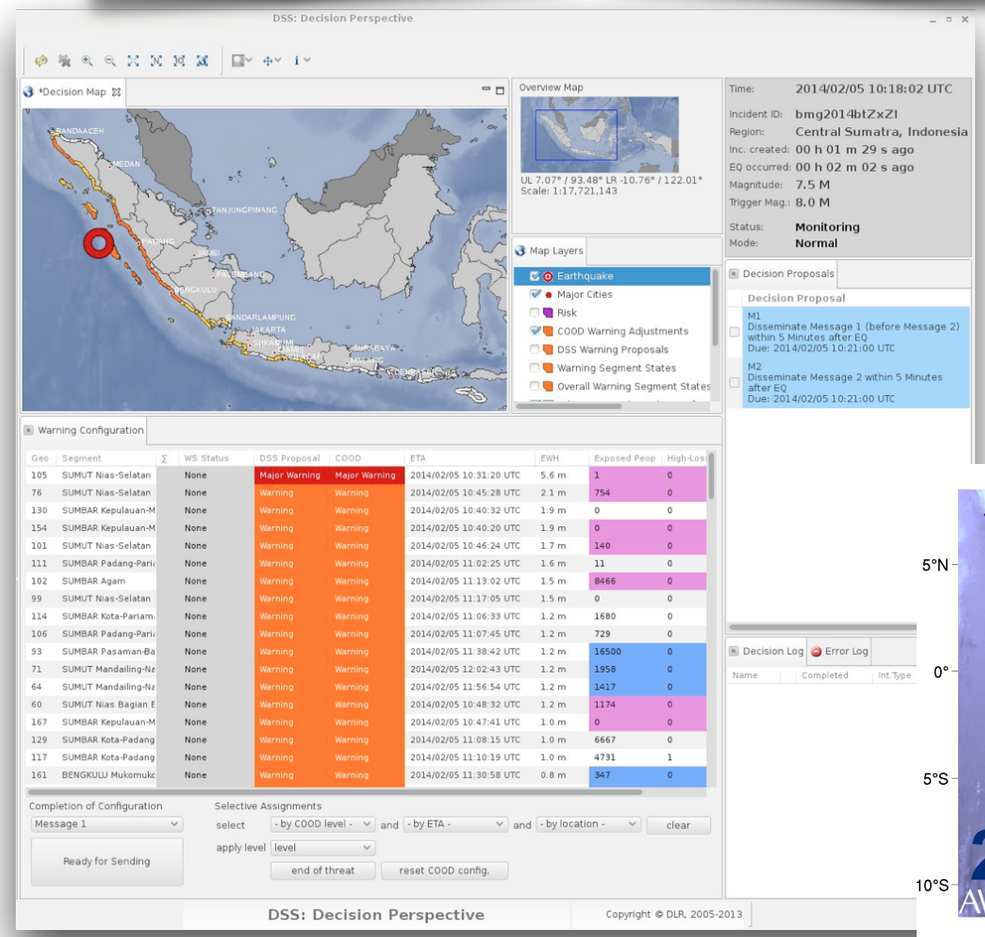
Project Goal



Current Tsunami Early Warning Systems

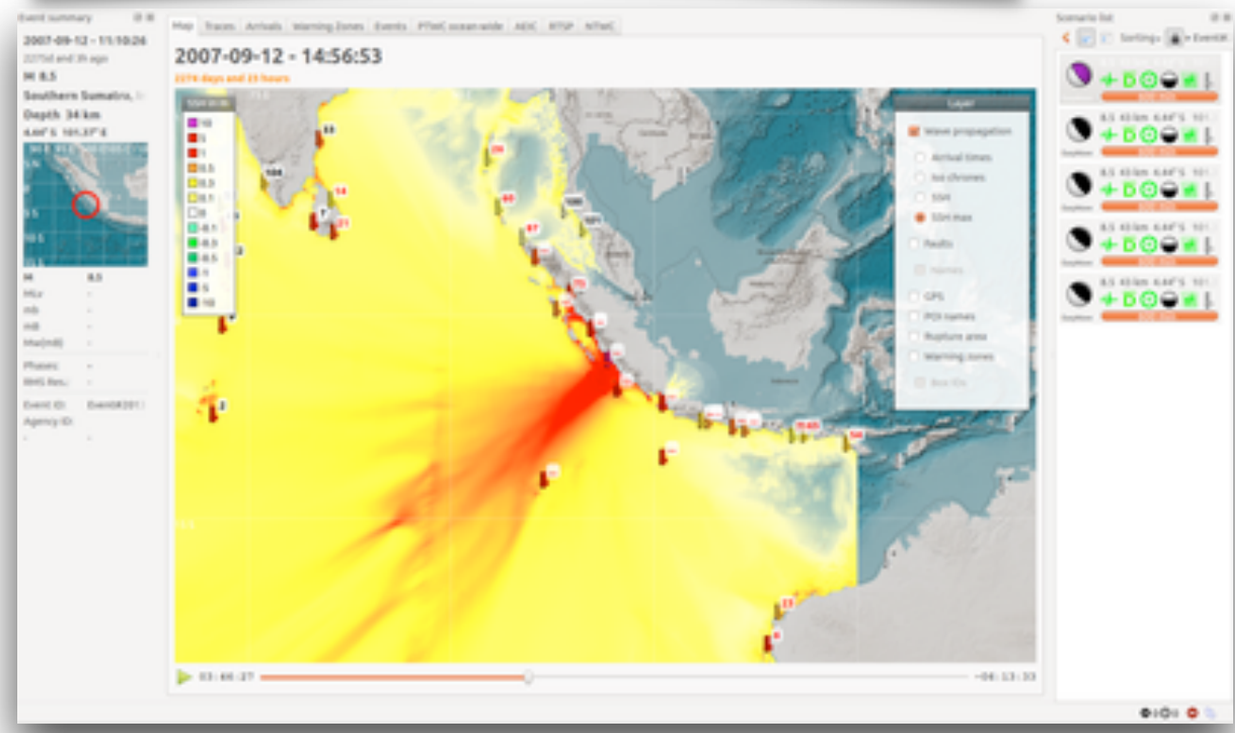
DSS - Installed and maintained in GITEWS *(German-Indonesian Tsunami Early Warning System)* and subsequent PROTECTS projects (2005 - 2013)

- TsunAWI for Sunda Arc
- easyWave outside Sunda Arc

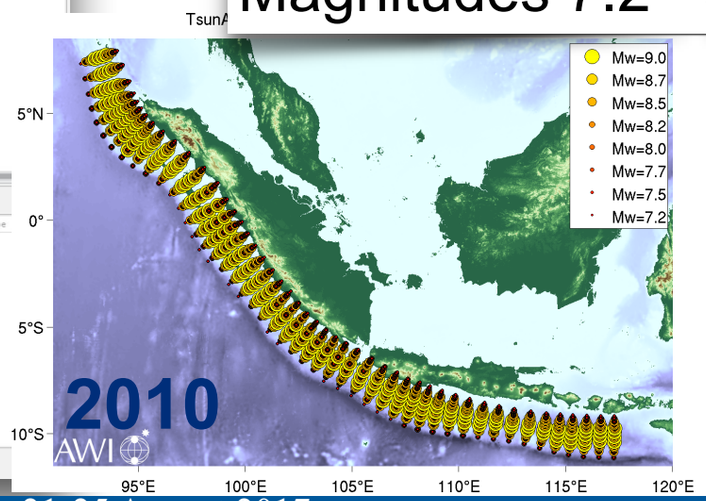


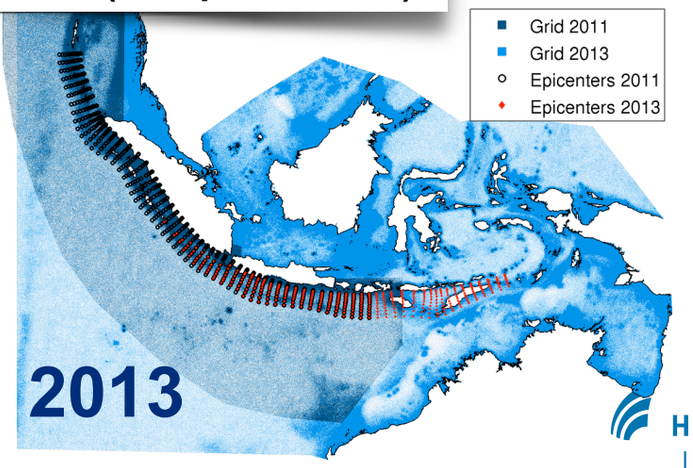
TOAST - provided by gempa GmbH

- easyWave (prior to project)



Magnitudes 7.2 - 9.0 (step of 0.2)





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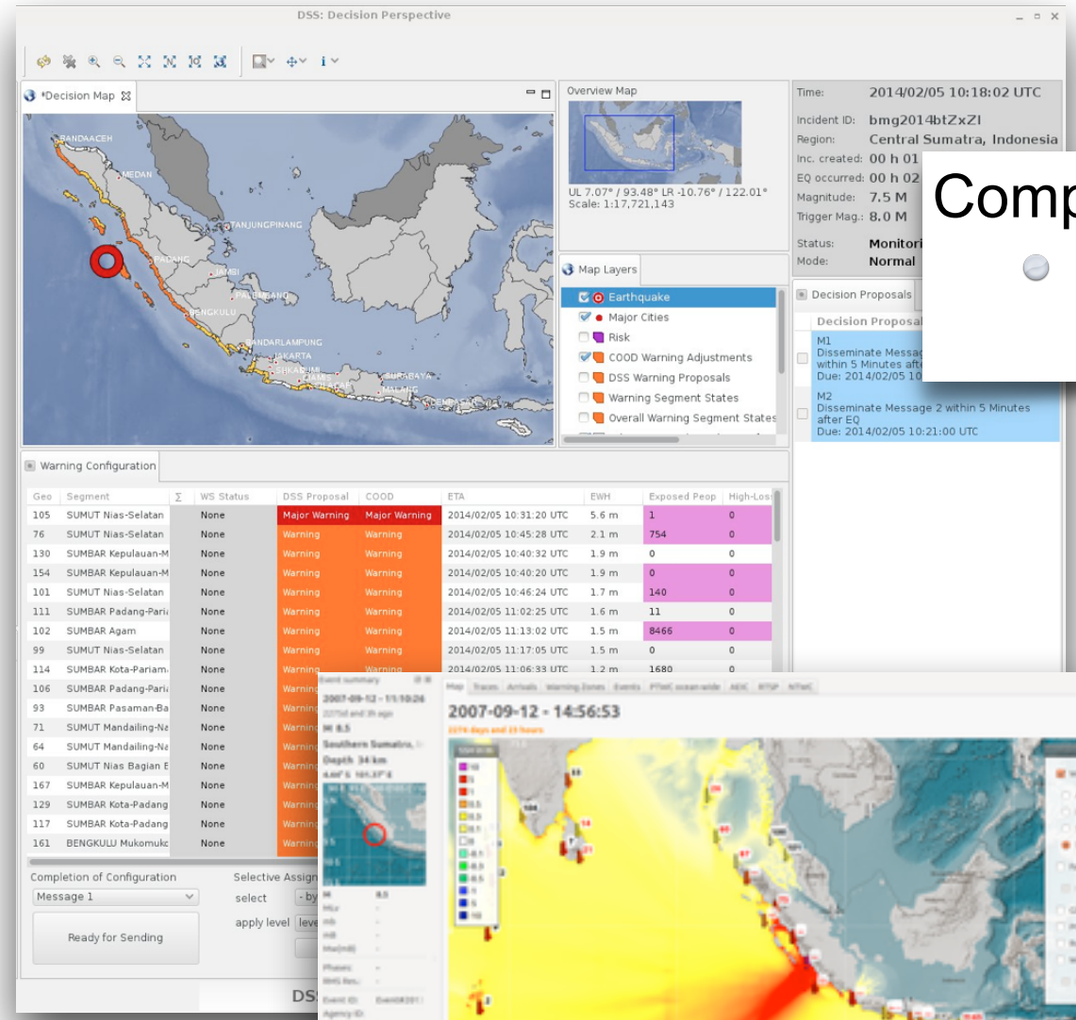
Decision Support Approaches

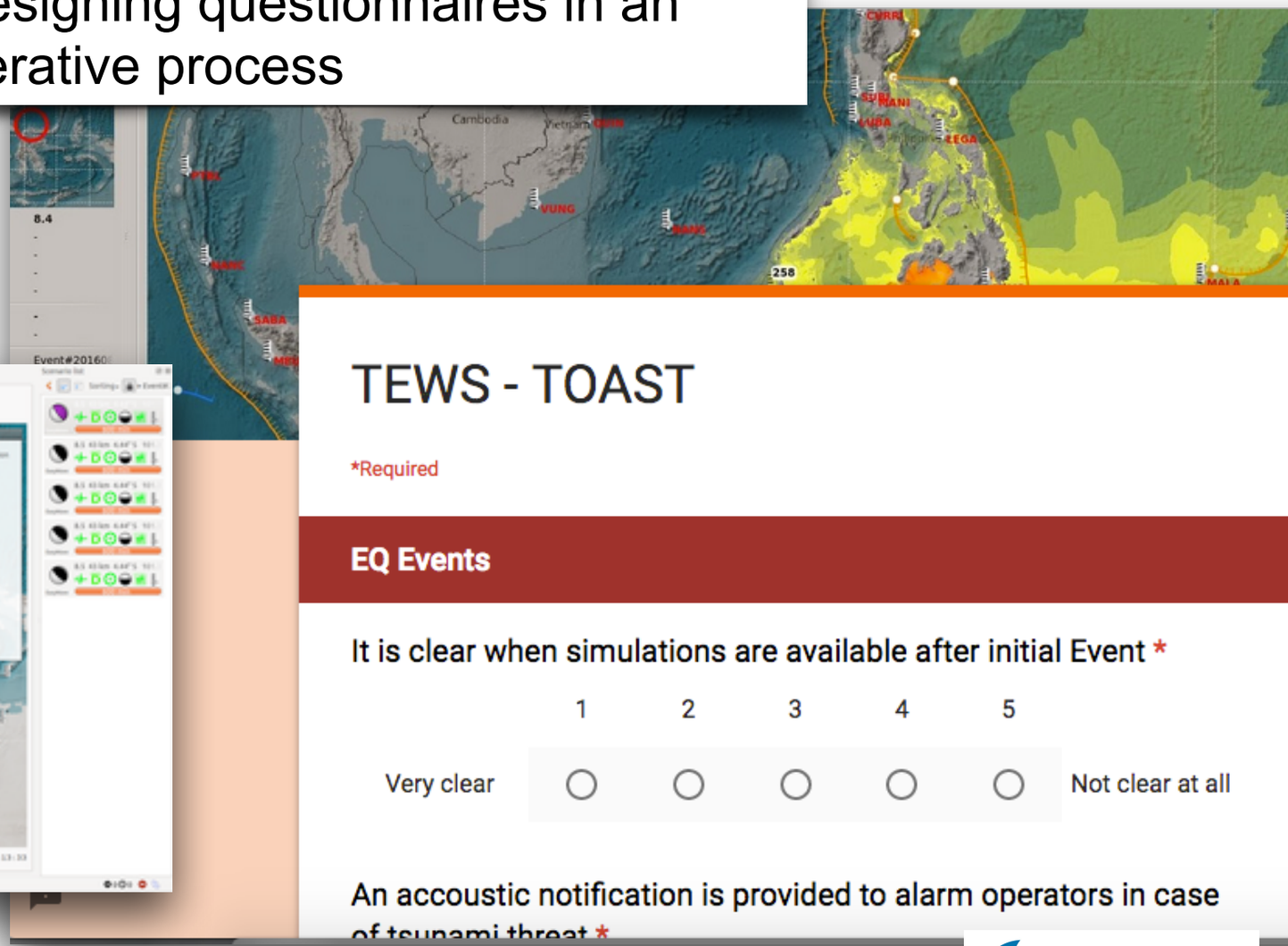
Discussing Decision Support approaches

Methodology and work plan for comparison of DSS and TOAST

Compare usability of TOAST and DSS

- designing questionnaires in an iterative process





TEWS - TOAST

*Required

EQ Events

It is clear when simulations are available after initial Event *

	1	2	3	4	5	
Very clear	○	○	○	○	○	Not clear at all

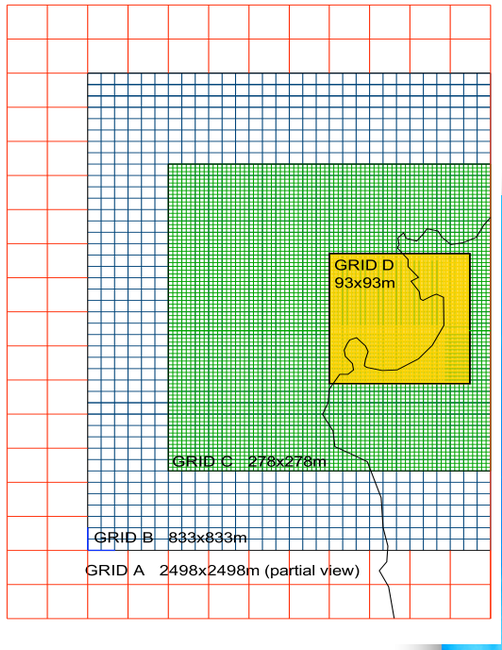
An accoustic notification is provided to alarm operators in case of tsunami threat *

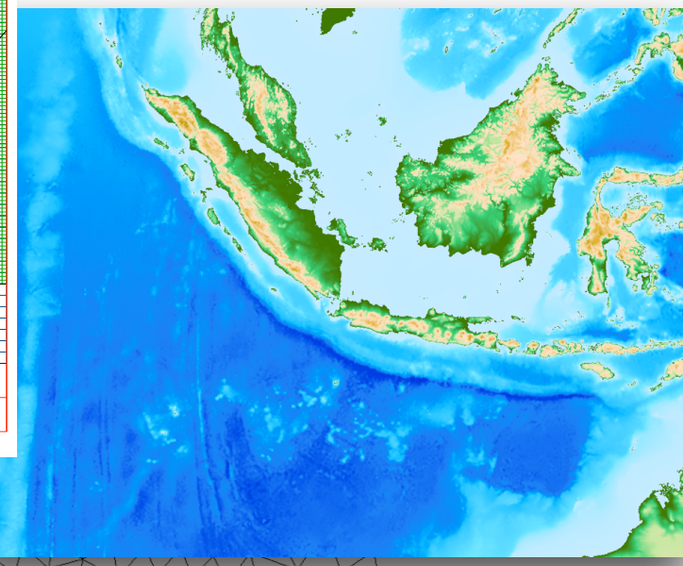
Tsunami Models: TsunAWI & easyWave

Discussion on different modeling approaches

TsunAWI *(AWI)*

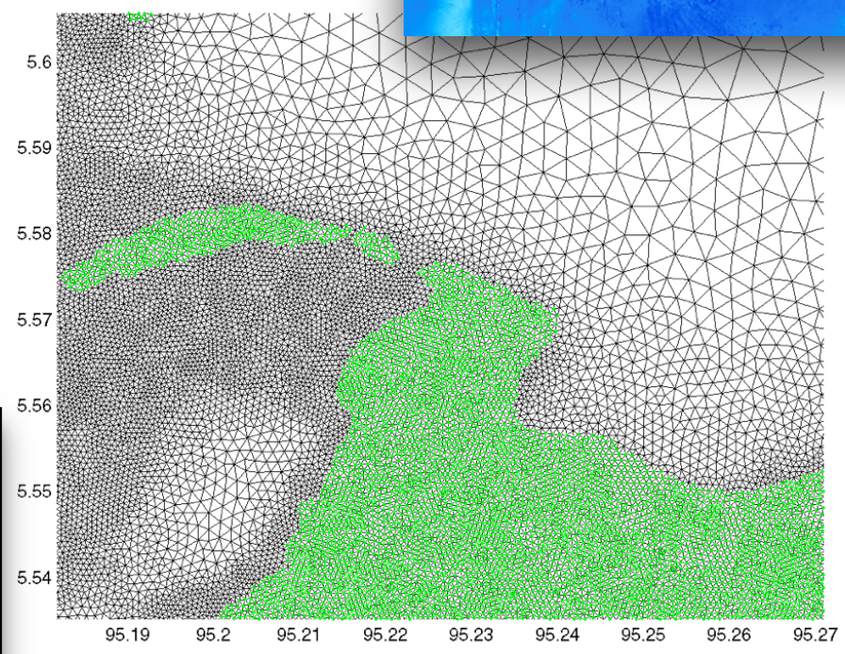
- Non-linear shallow water equations
- Unstructured triangular mesh
- Source model RuptGen *(Andrey Babeyko, GFZ)*
- Pre-computed scenario database





easyWave *(Andrey Babeyko, GFZ)*

- Coarser regular grid
- On-the-fly modeling



Theoretical and practical comparison of easyWave and TsunAWI tsunami models for use in DSS and TOAST

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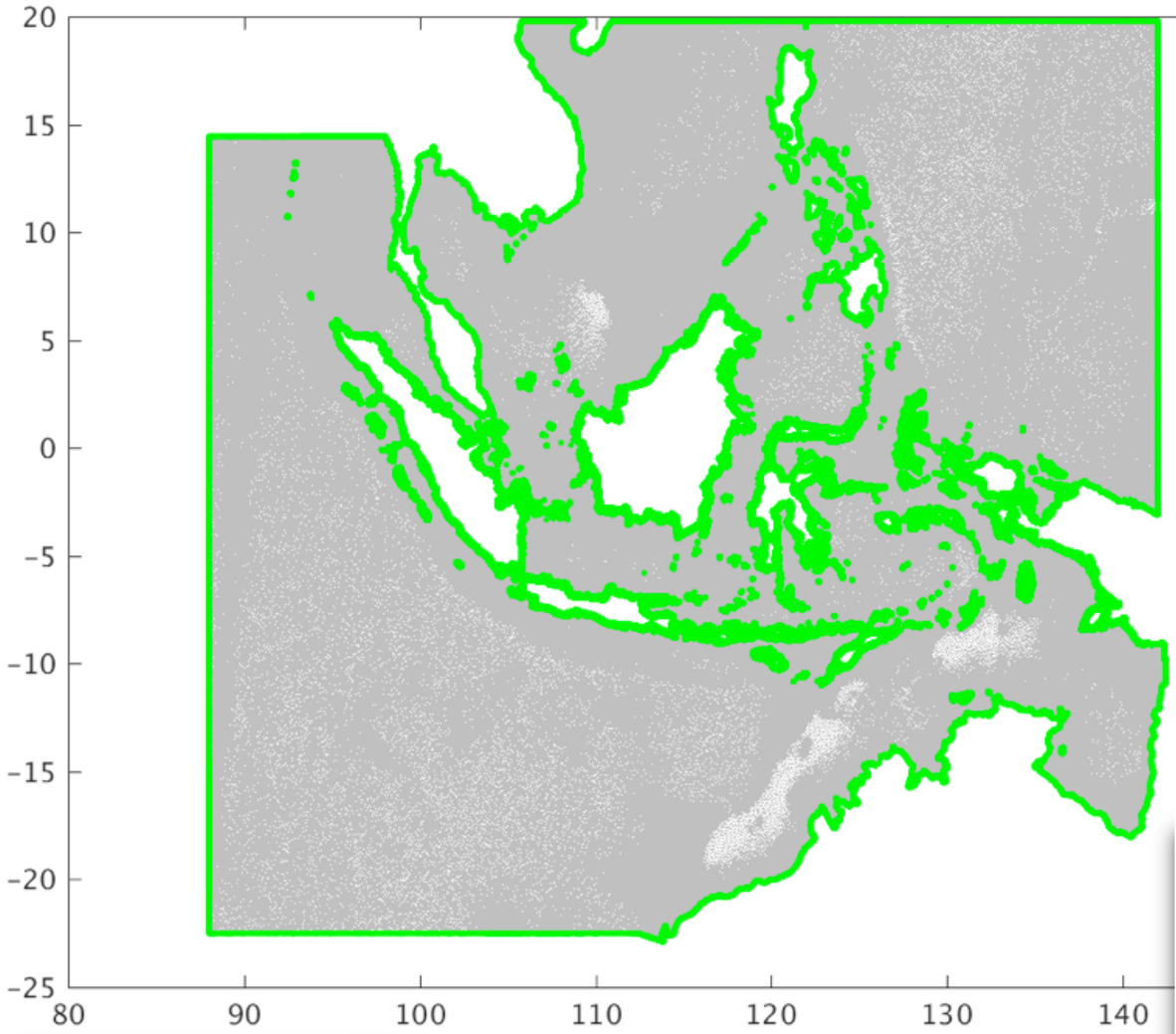
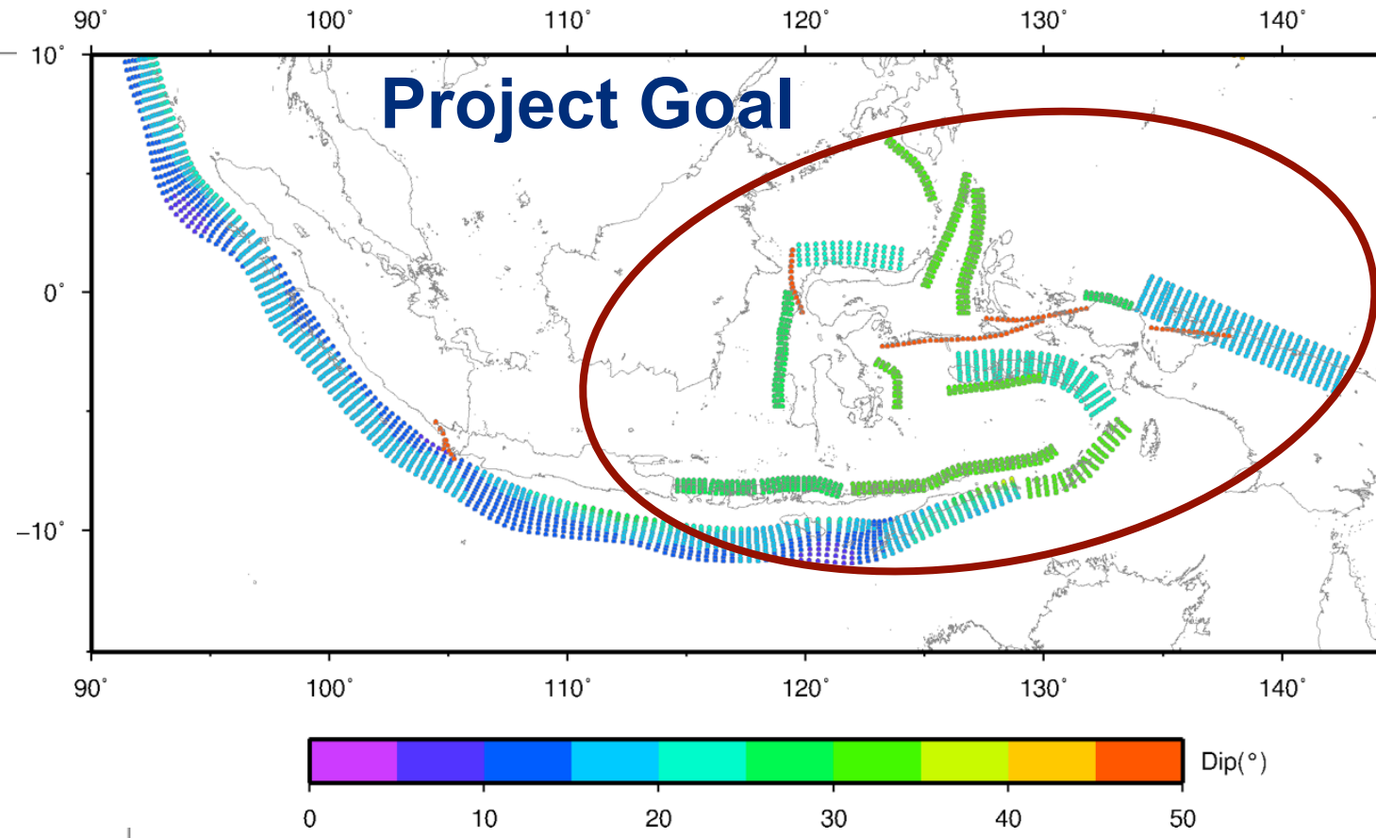
Extending the Scenario Database

Approach to extending the scenario database with TsunAWI

Source modeling tools and access to HPC provided by GA/DMInnovation



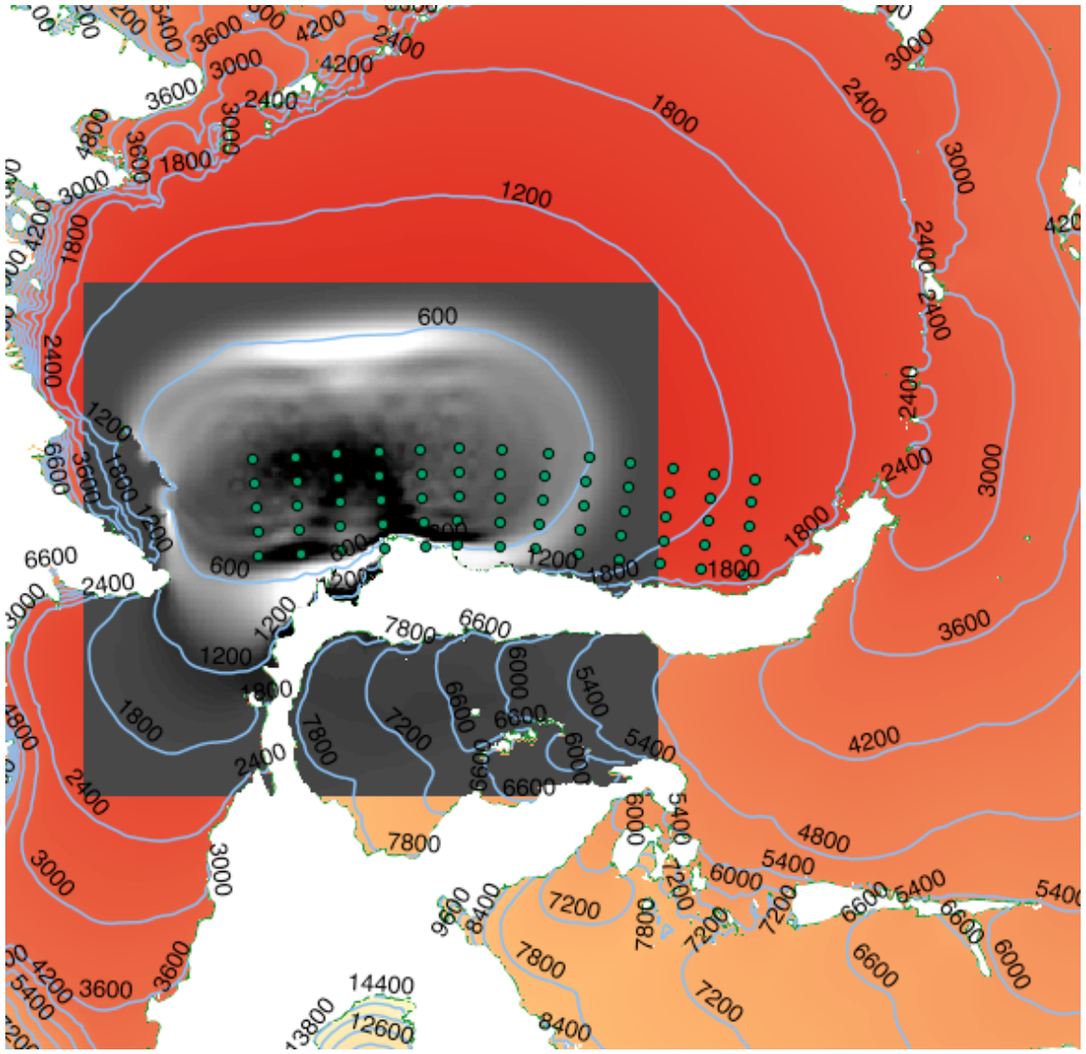


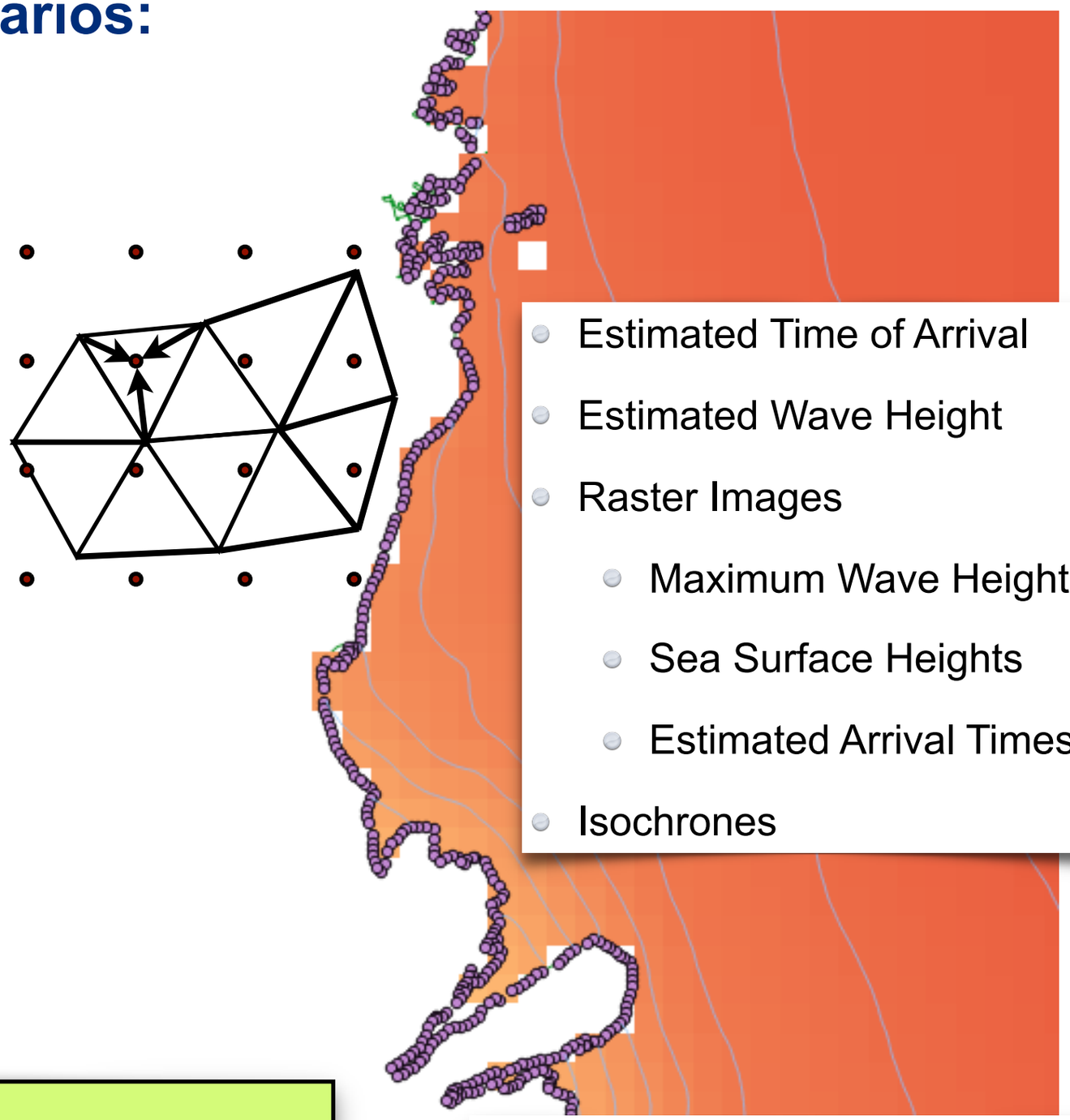
Mesh size: 11 Mio nodes
Coarsest res.: 20 km
Finest res.: 57 m

Pre-processing for tsunami simulation calculation - decision about model domain - introduction to HPC facilities

Data Products

Post-processing of tsunami scenarios:





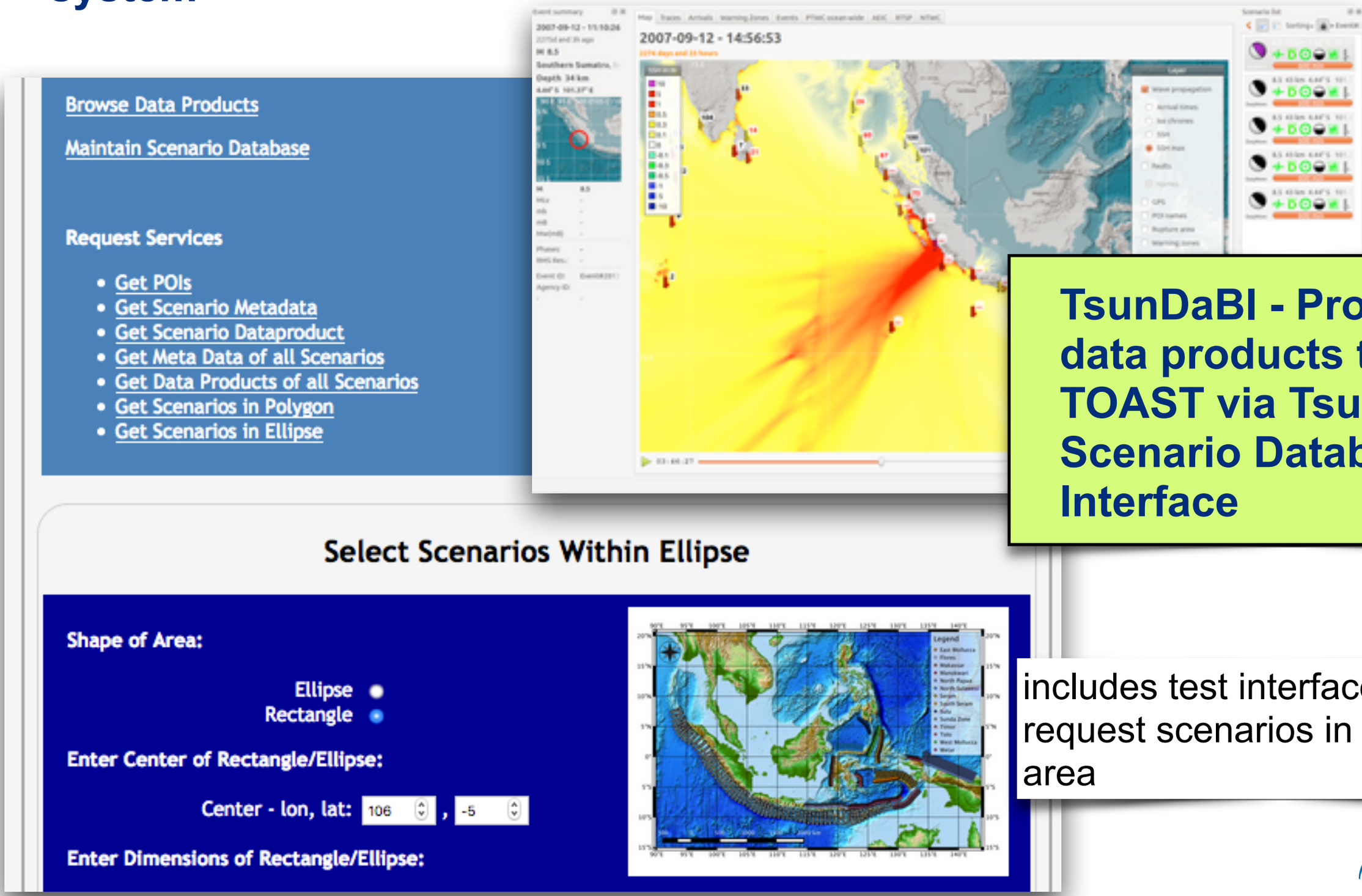
- Estimated Time of Arrival
- Estimated Wave Height
- Raster Images
  - Maximum Wave Height
  - Sea Surface Heights
  - Estimated Arrival Times
- Isochrones

Points of Interest provided by DLR

Generating data products for early warning

Integration of Data Products

Integration of data products into warning system



TsunDaBI - Provide data products to TOAST via TsunAWI Scenario Database Interface

includes test interface to request scenarios in specified area

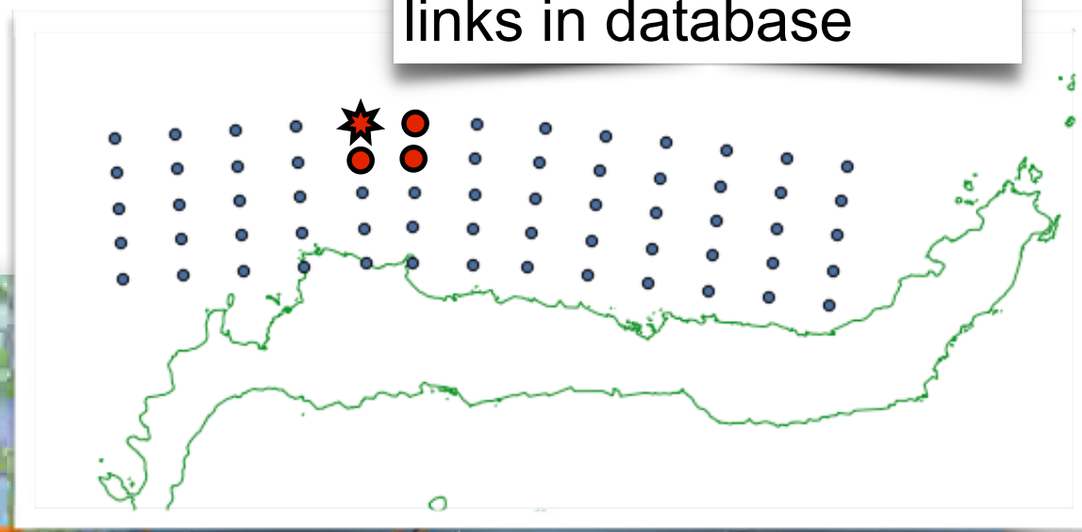
Validation and Optimisation

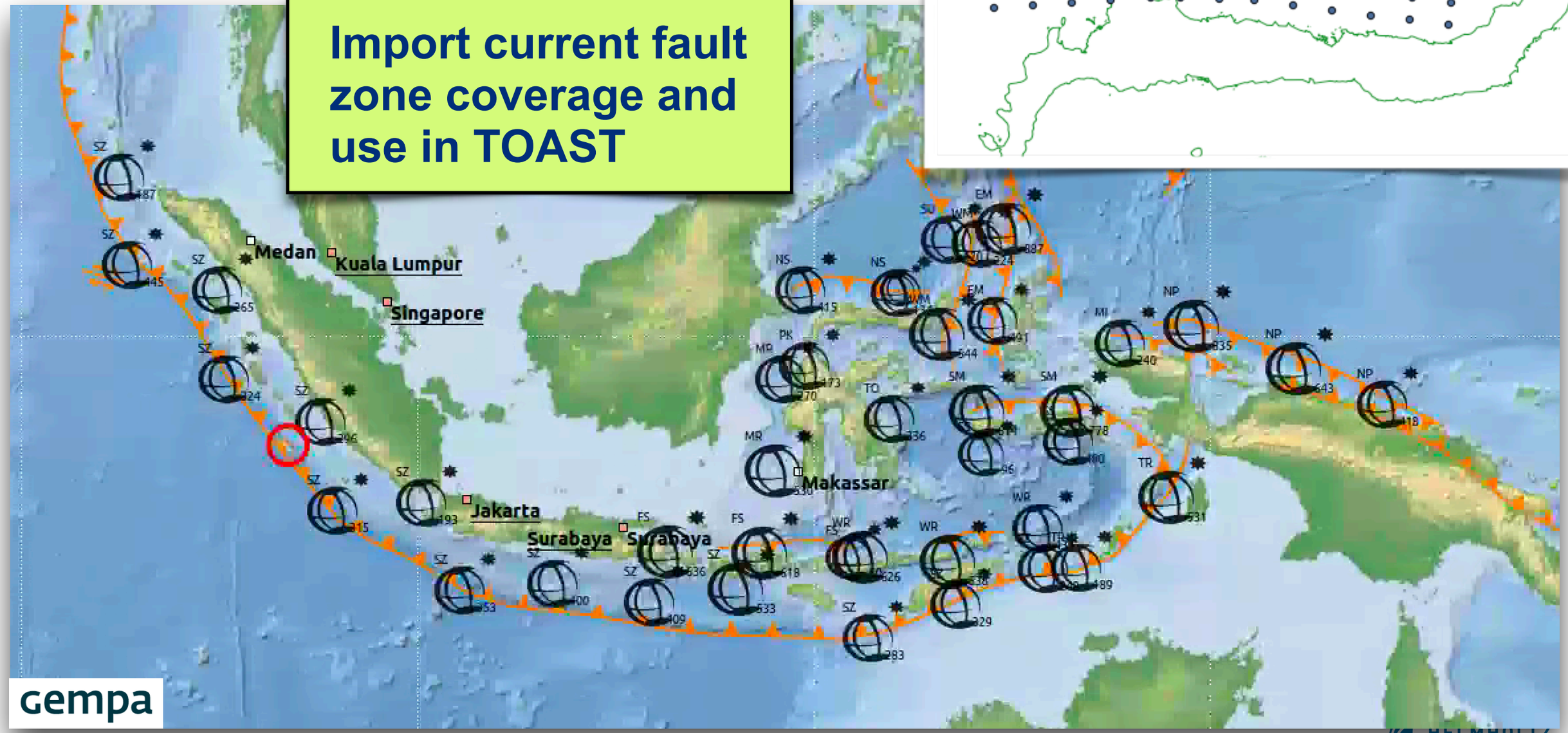
Evaluation of interface and validation of integration into TOAST

Reducing size of data products and calculation time

Import current fault zone coverage and use in TOAST

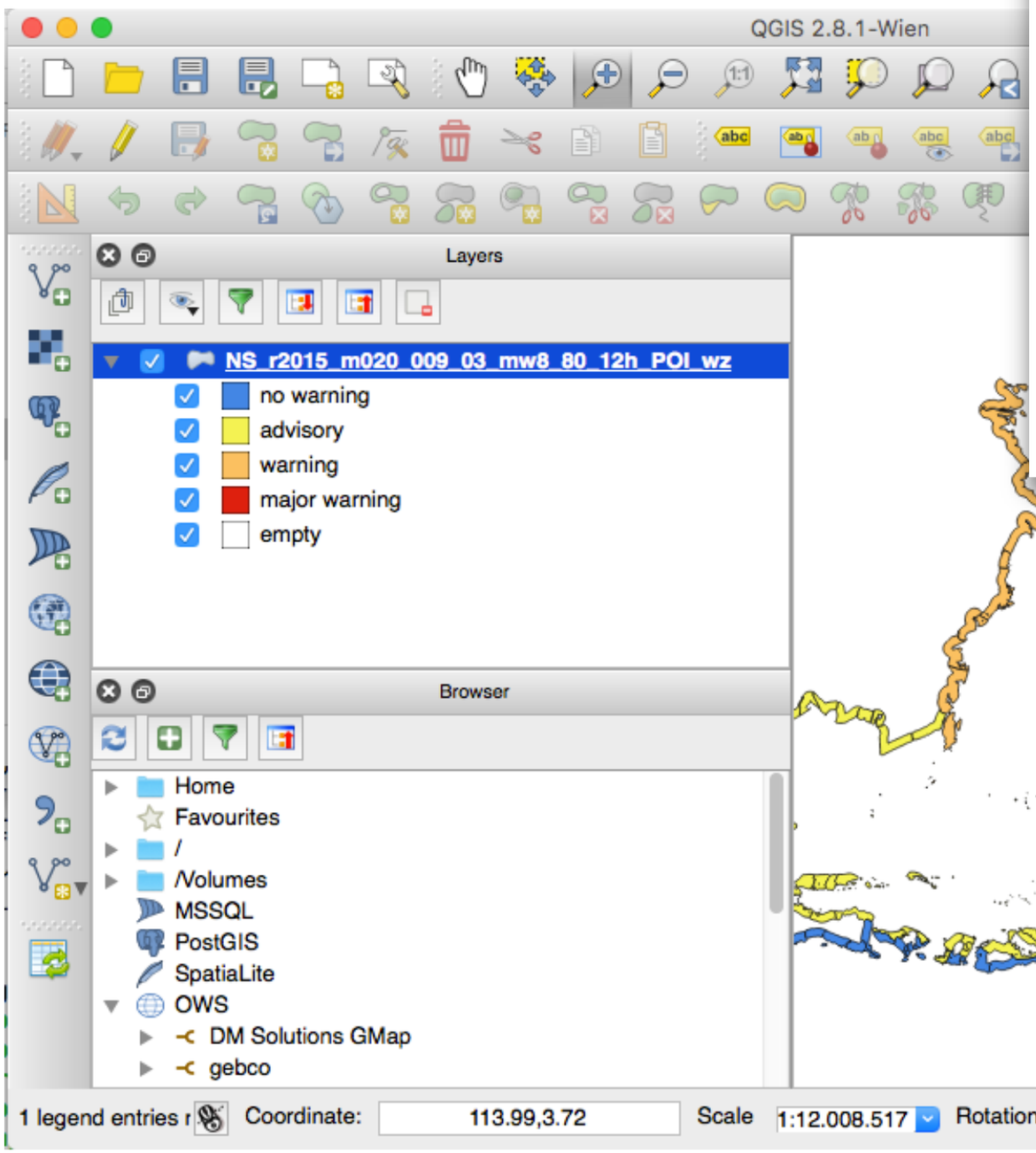
redundant scenarios:
links in database

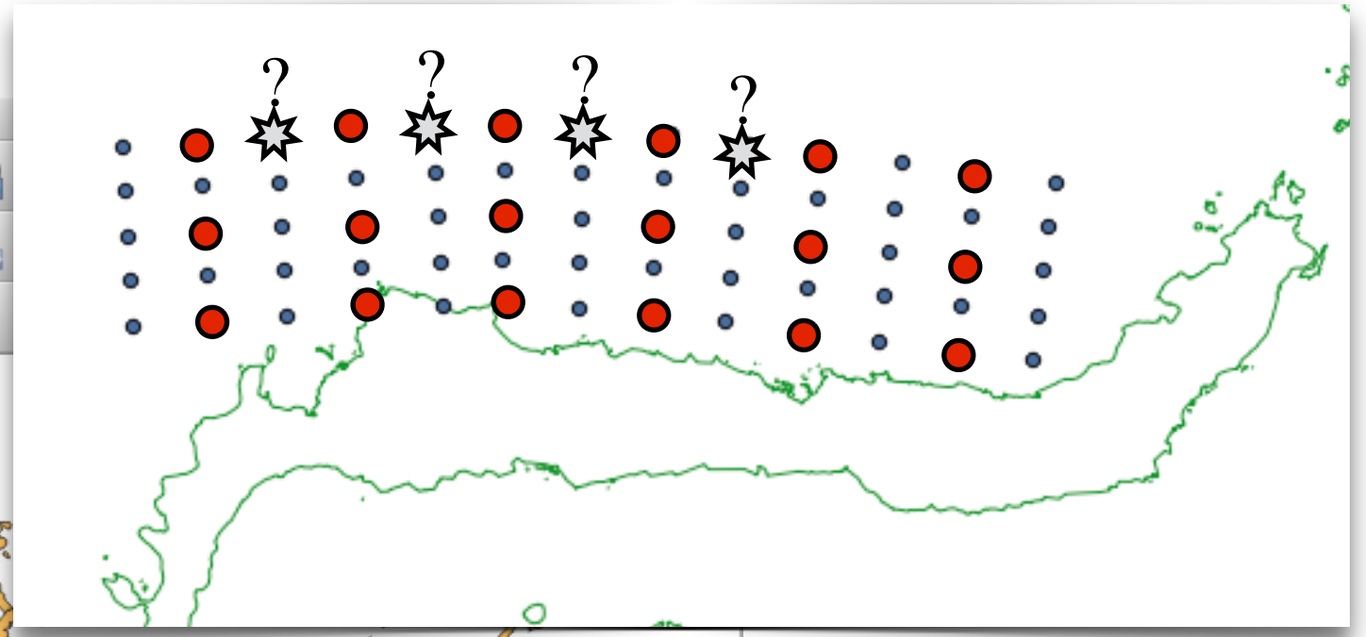




Sensitivity Studies

Sensitivity assessment of the scenario database with respect to epicenter and magnitude density regarding warning levels



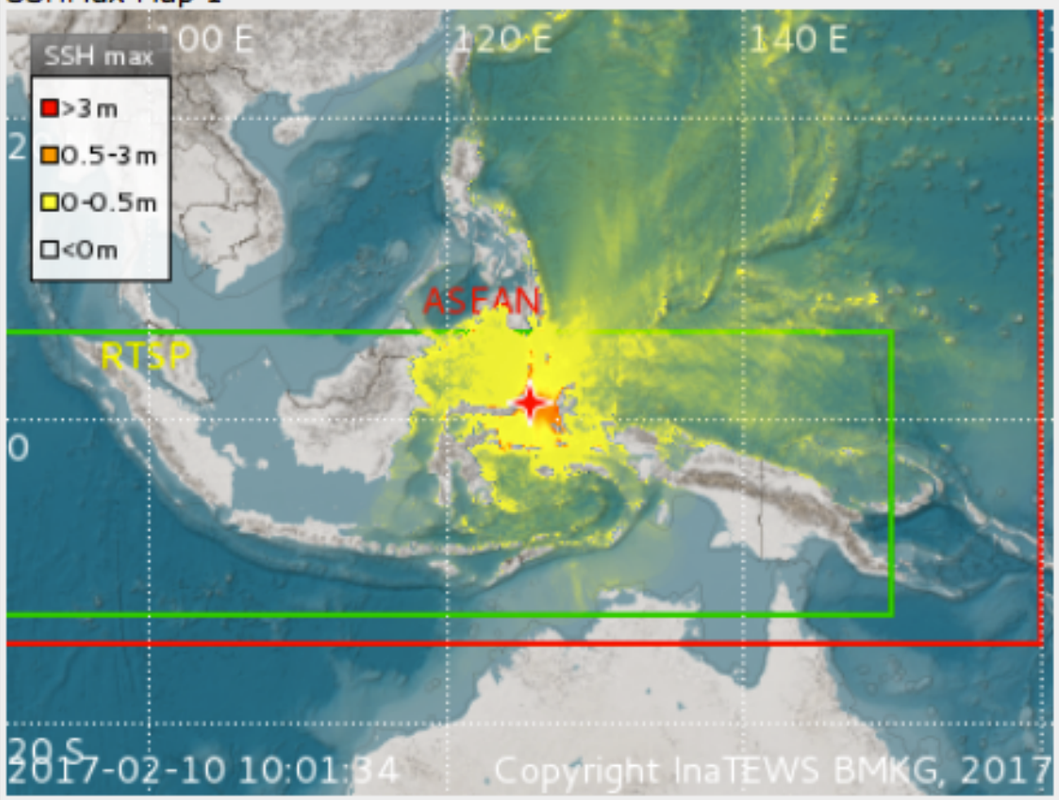
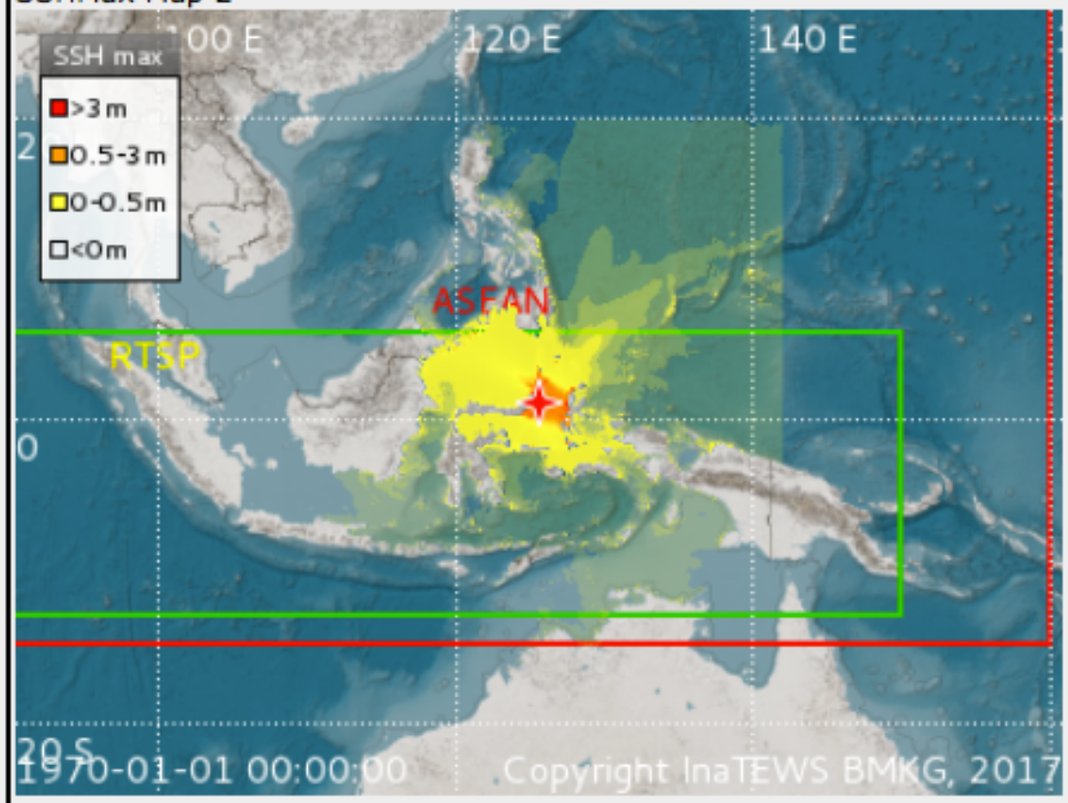
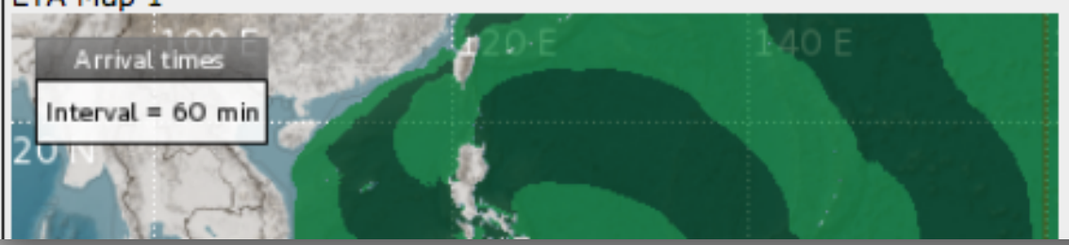
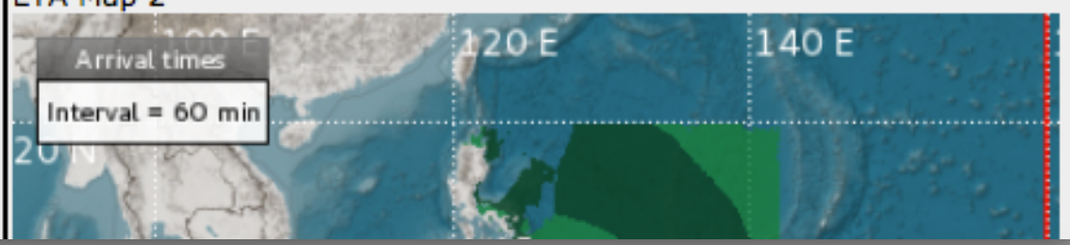


Methodology: Study warning level in affected warning zones for neighbouring scenarios

Comparison of Data Products

Comparison of TsunAWI and easyWave results in TOAST

Web application to facilitate comparison of model results on warning level

Event_20170210100136.368899.9744 easywave_1.14E_125.72E_8.00E_simdata.txt	Event_20170 tsunawi_1.20E_
--- Simulation Data --- Magnitude: 8.0 SR Latitude: 1.14 N Longitude: 125.72 E Depth: 17 Km Region: Northern Molucca Sea	--- Simulation Data --- Magnitude: 8.0 SR Latitude: 1.20 N Longitude: 125.54 E Depth: 18 Km Region: Northern Molucca Sea
SSHMax Map 1	SSHMax Map 2
	
ETA Map 1	ETA Map 2
	

State of Database at Project Completion

Initially: Sunda Arc with 4580 scenarios

Now: 15 trenches (14 new),
2570 new scenarios calculated,
magnitudes 7.0 - 9.0 (step of 0.2)
=> 17317 scenarios in database

Legend
- East Mollucca
- Flores
- Makassar
- Manokwari
- North Papua
- North Sulawesi
- Palu Koro
- Seram
- South Seram
- Sulu
- Sunda Zone
- Timor
- Tolo
- West Mollucca
- Wetar

Updated mesh size: >11 Mio nodes
Coarsest res.: 20 km
Finest res.: 57m