ALFRED-WEGENER-INSTITUT
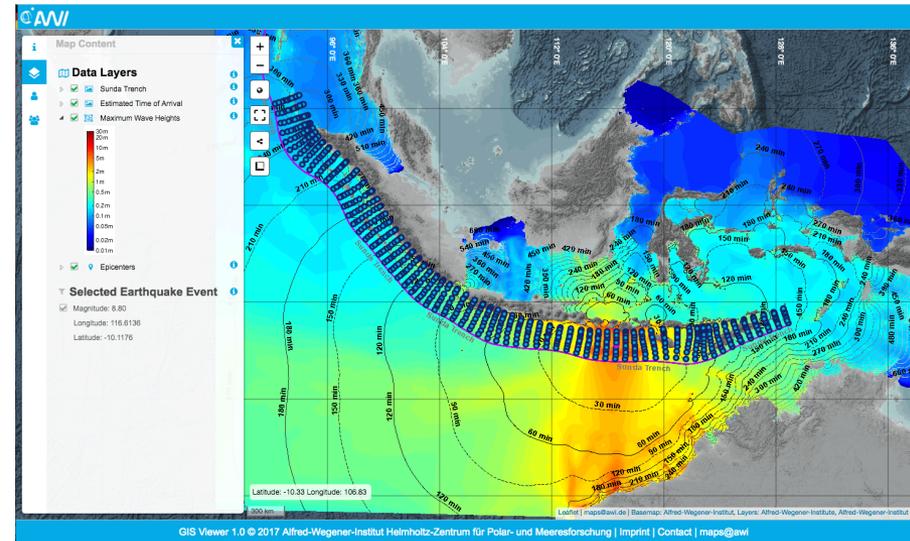HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG

Tsunami-WebGIS – Displaying Tsunami Simulations for Indonesia to a Broader Audience

Antonia Immerz[1], Sven Harig[1], Natalja Rakowsky[1], Andrey Babeyko[2], Antonie Haas[1], Gesche Krause[1], Jörg Matthes[1], Christian Schäfer-Neth[1], Angelo Steinbach[1], Andreas Walter[1]

[1]Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, Bremerhaven, Germany
[2]Helmholtz Centre Potsdam-GFZ German Research Centre for Geosciences, Potsdam, Germany

GFZ
Helmholtz Centre POTSDAM

PROTECTS GITEWS TSUNAMI EARLY WARNING SYSTEM INDONESIA BMKG cempa Australian Government Geoscience Australia DMInnovation SCIENCE AND TECHNOLOGY FOR DISASTER MANAGEMENT HELMHOLTZ

Tsunami Modelling for Indonesia

Timeline

- **2004:** Indian Ocean Tsunami
- **2005 – 2011:** Project GITEWS*
- **2008:** GITEWS inaugurated at BMKG
- **2011:** InaTEWS handed over to Indonesia
- **2011 – 2014:** Project PROTECTS*
- **2015 – 2017:** Tsunami database extension**
- **Since 2014:** Maintenance and Support

Tsunami Early Warning Center, Jakarta

(*) funded by German Federal Ministry of Education and Research
(**) funded by Australian government

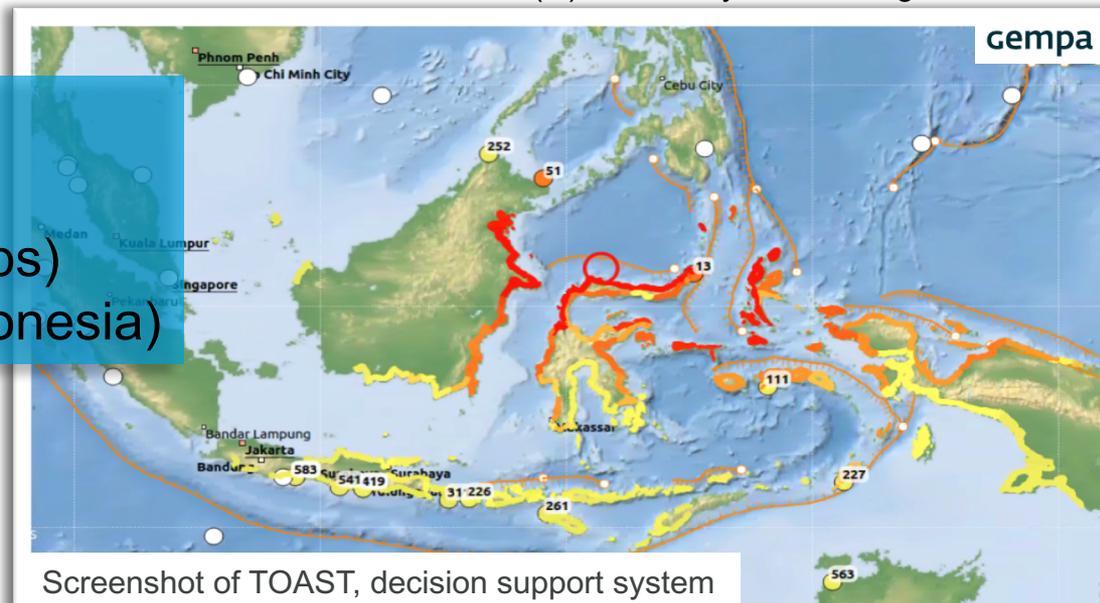## Efforts made

- 17300 tsunami simulations
- 12 trainings (8 exchange trips)
- 8 workshops (4 visits to Indonesia)

Screenshot of TOAST, decision support system

BMKG: Indonesian Agency for Meteorology, Climatology and Geophysics
GITEWS: German-Indonesian Tsunami Early Warning System
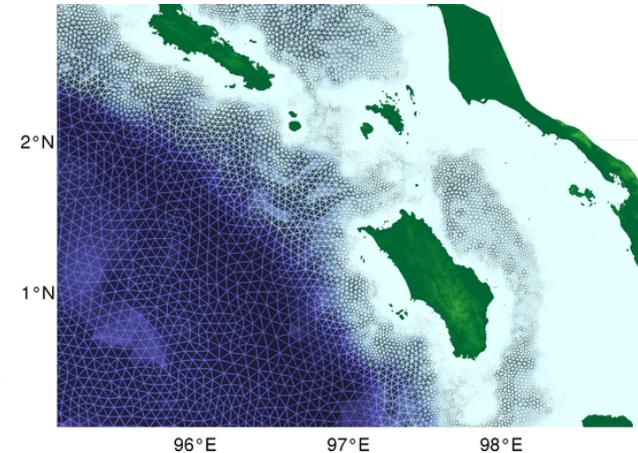InaTEWS: Indonesia Tsunami Early Warning System

TsunAWI – Tsunami Model by AWI

Properties

- Non-linear shallow water equations

- Unstructured triangular mesh

- Initialisation with different source models

- Suitable for pre-computed scenario database
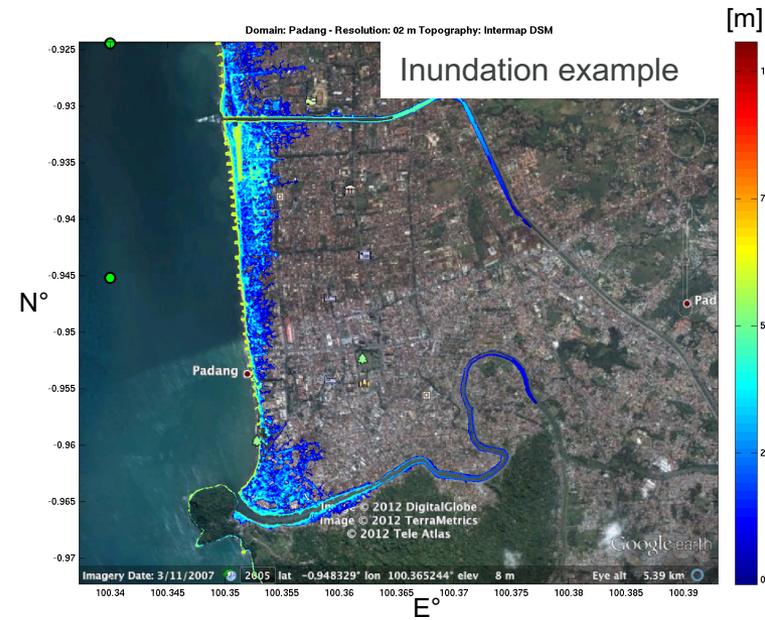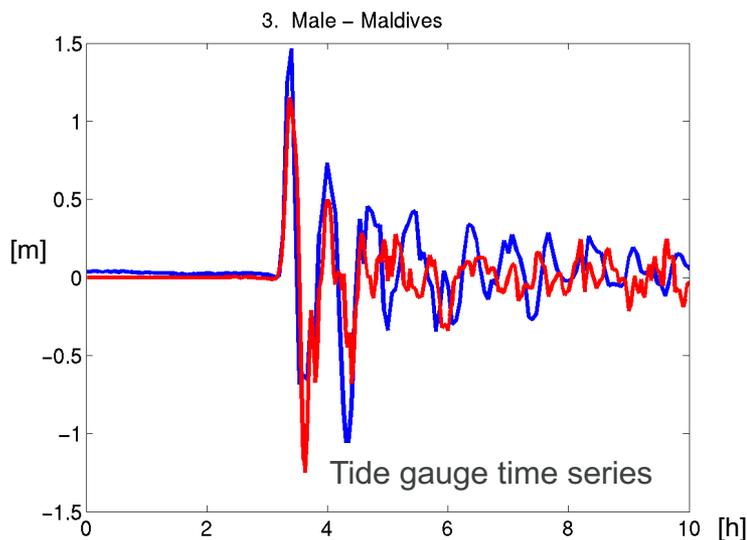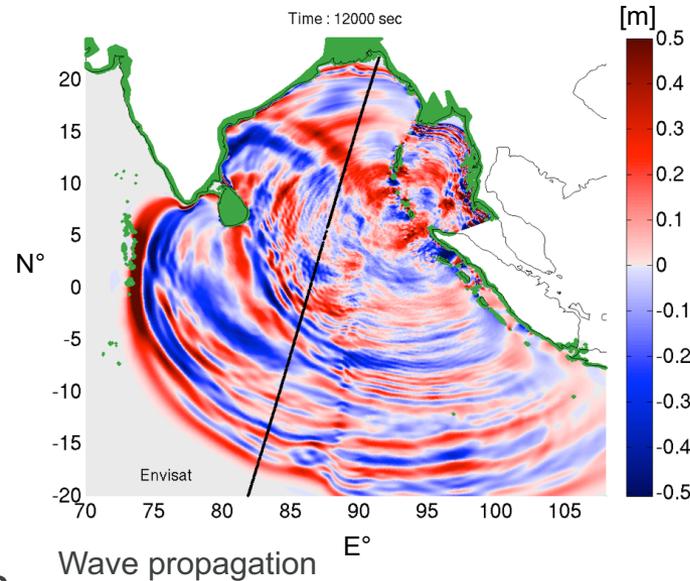
Simulations in Indonesia

- Mesh: ~12.7 Mio nodes

- Resolution: 50 m – 20 km

- Coverage: ~17300 simulations in 15 trenches

- Magnitudes: 7.0 - 9.0

- Source model providers:
    - GFZ (RuptGen)
    - GeoScience Australia

- Simulation time: ~12 h
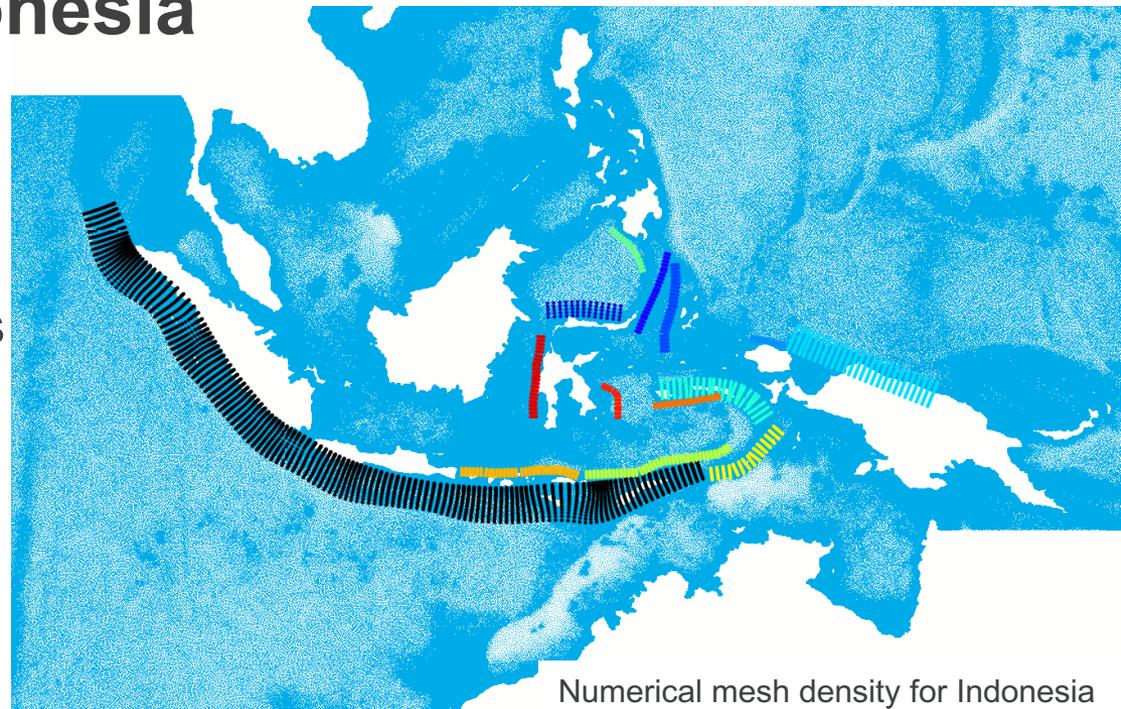
Numerical mesh density for Indonesia

TsunAWI – Data Products

- Estimated time of arrival
- Maximum wave heights
- Wave propagation
- Time series
- Isochrones
- Inundation

- ... in different data formats

Wave propagation

Coastal forecast points

Tide gauge time series

3. Male – Maldives

Inundation example

Domain: Padang - Resolution: 02 m Topography: Intermap DSM

Capacity Building & Developments

Trainings

- Install, maintain, troubleshoot simulation interfaces and databases

Workshops

- Calculate, understand and evaluate tsunami simulation data
- Import data products into database
- Investigate decision support and modelling approaches

Workshop 2015, Jakarta

Developments

- Scenario calculation with TsunAWI
- Database with data products from simulated wave propagation
- Simulation interface to decision support system

Workshop members at kick-off meeting 2015

Outreach

- Interviews and talks
- **Tsunami-GIS**

Tsunami-WebGIS

Interactive WebGIS application presenting maximum wave heights and arrival time isochrones of tsunami simulations for the Sunda Arc

Motivation

- Provide insight into research results of tsunami modelling group
- Facilitate understanding of tsunami concepts
- Increase awareness of tsunami research
- Provide easily accessible platform for interested target groups
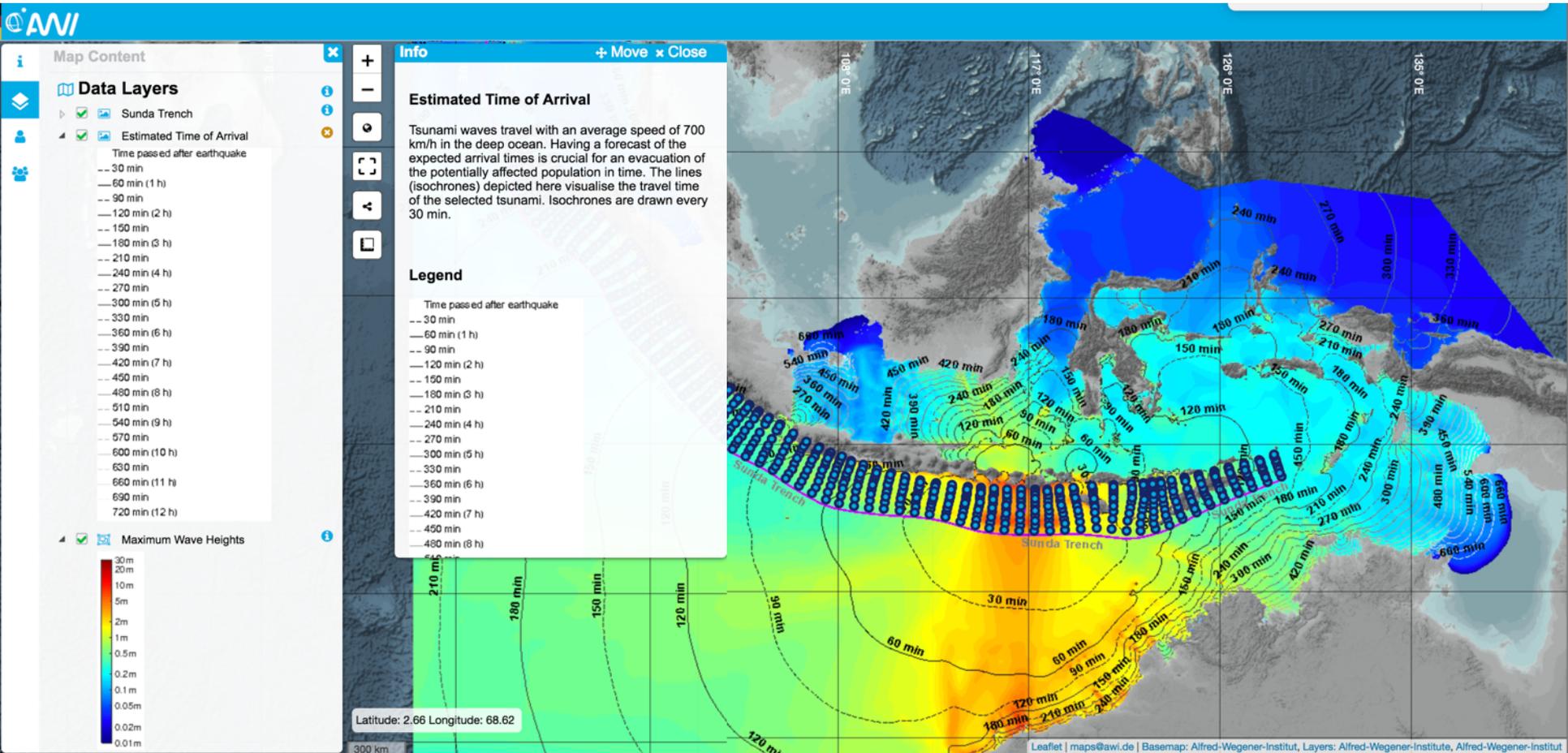- Platform to display simulation products for historical events

Target Groups

- Scientists
- Non-expert audience
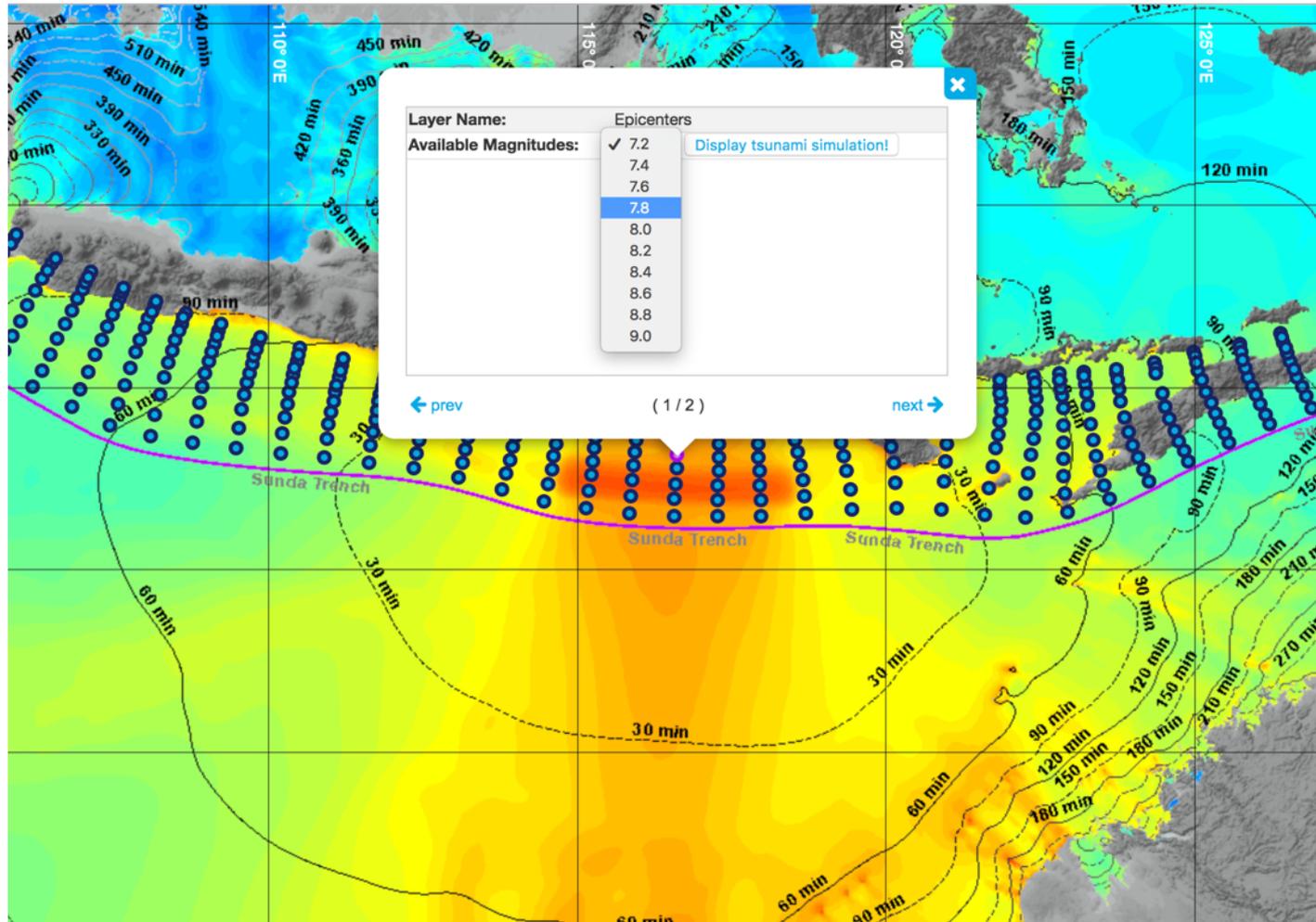- Media
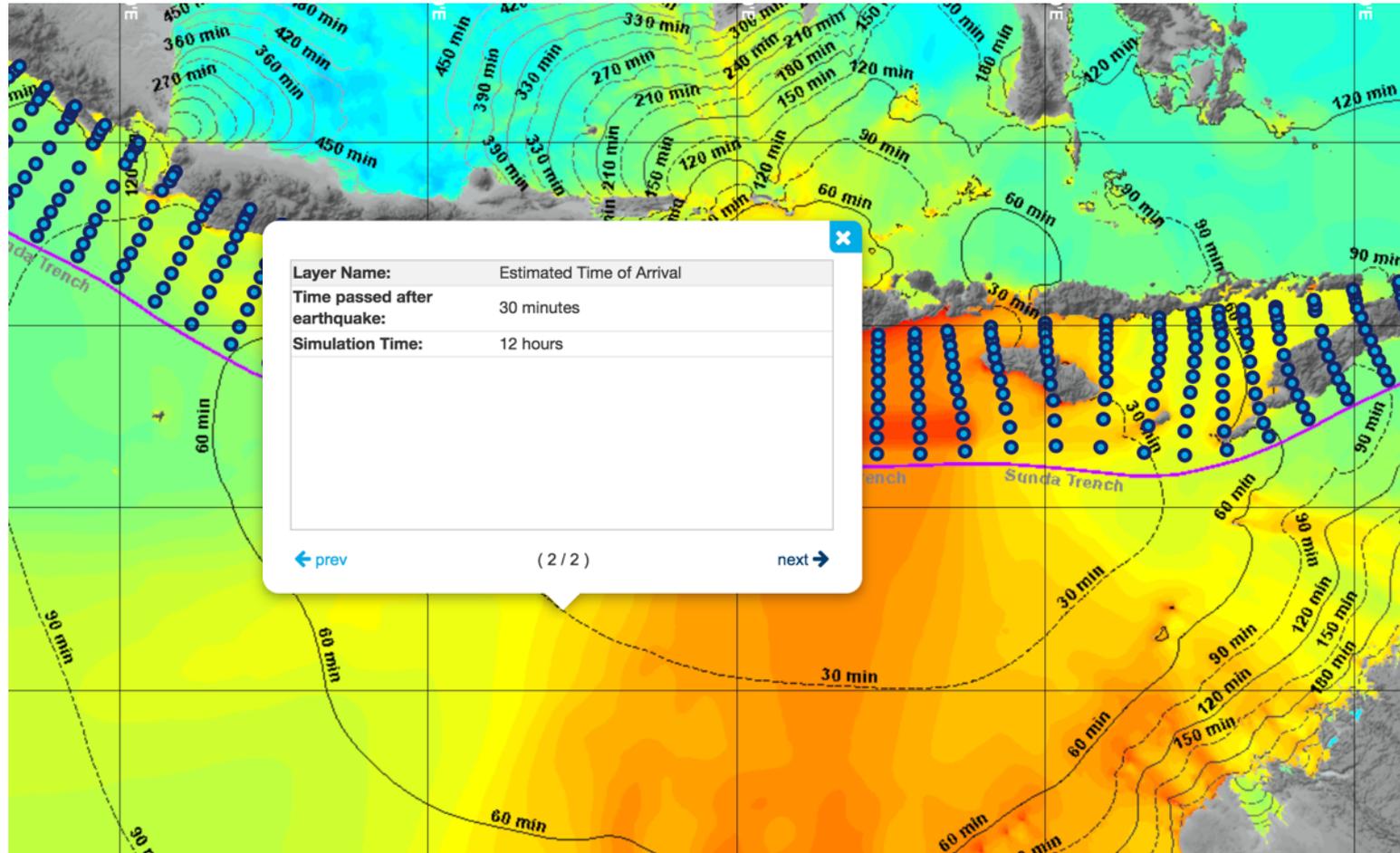- Students

Tsunami-WebGIS - Features
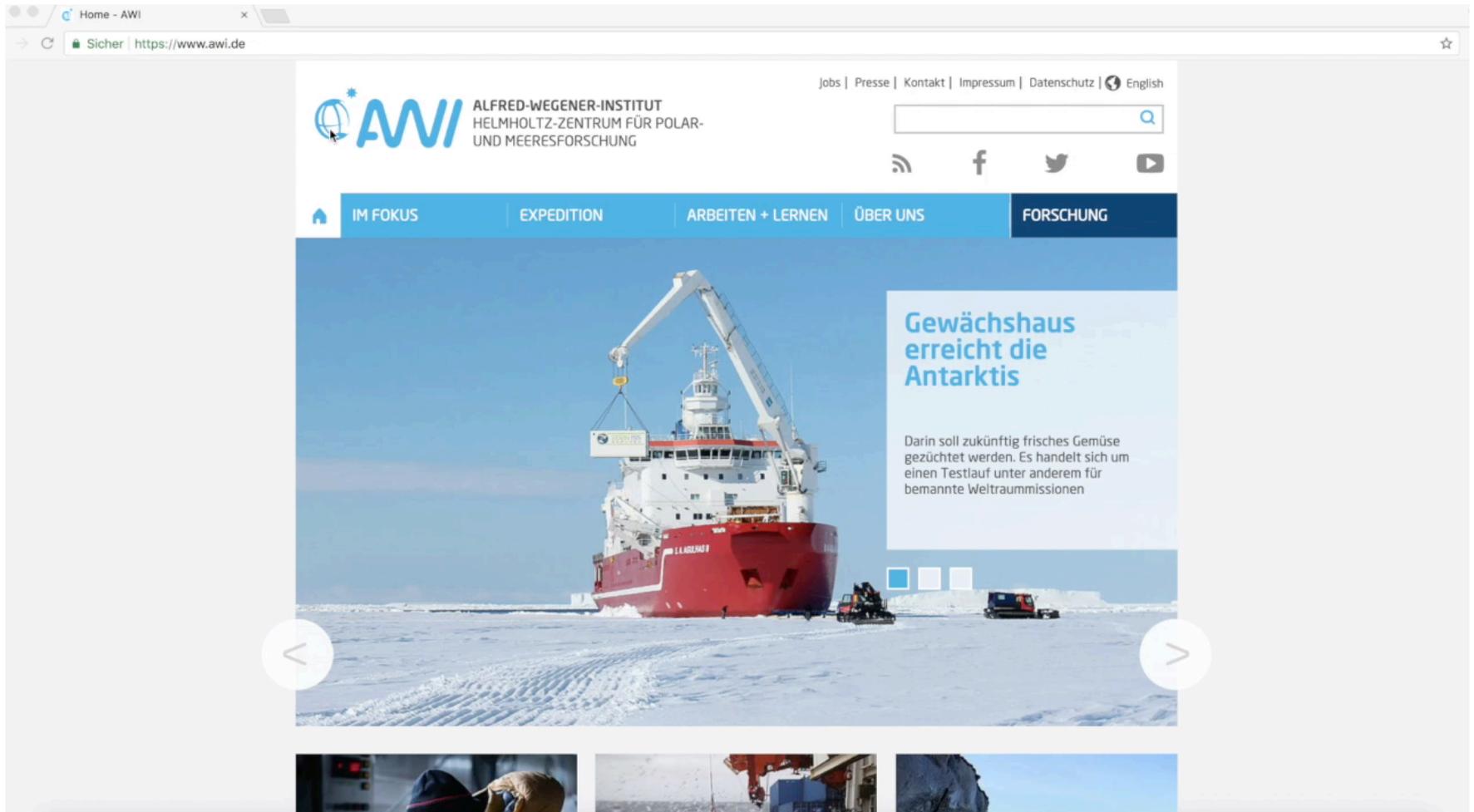
Developed within the project Earth System Knowledge Platform (ESKP)

HELMHOLTZ

Tsunami WebGIS – Functionality

Tsunami WebGIS – Functionality

Tsunami WebGIS – Functionality

Hosting Architecture

GIS-GDI@AWI

- GIS-based Geodata Infrastructure of AWI

- ArcGIS for Server 10.x

- File storage or PostgreSQL DBMS 9.x incl. SDE

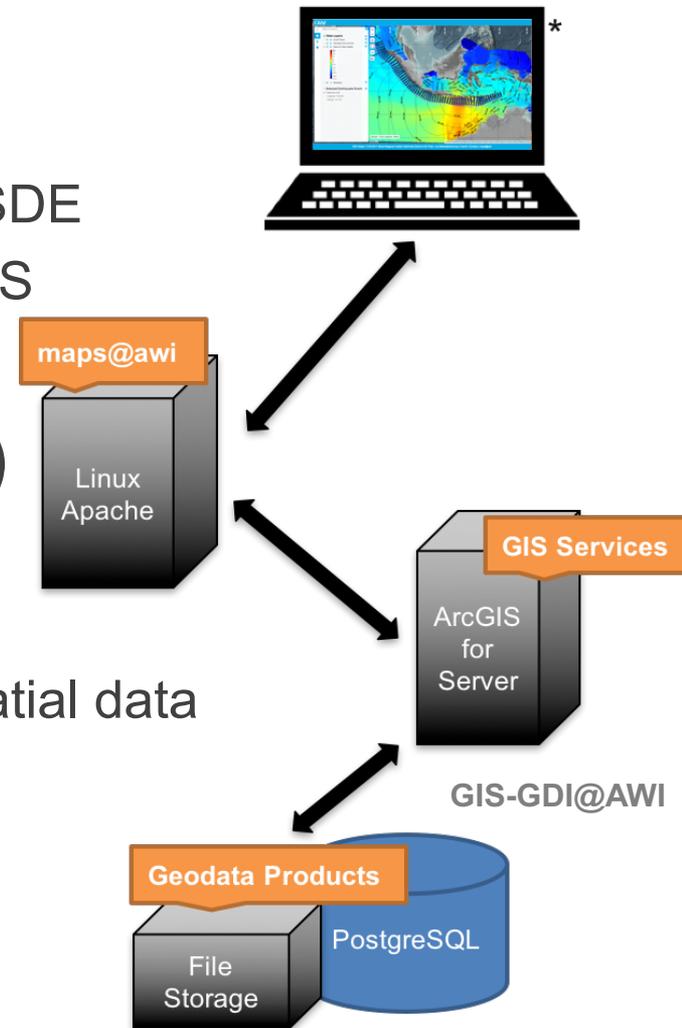- OGC-Standardized web services: WMS, WFS

- ESRI Image Service

maps@awi (http://MAPS.awi.de)

AWI WebGIS-Viewer

- JavaScript application based on leaflet.js

- Platform independent visualisation of geospatial data

- Meta data display, configurable filters

- Customizable interactive features

GIS Maps Portal

- Portal to available WebGIS-Projects at AWI

maps@awi

Linux Apache

GIS Services

ArcGIS for Server

GIS-GDI@AWI

Geodata Products

File Storage

PostgreSQL

HELMHOLTZ

(*) Icon made by Freepik from www.flaticon.com

Tsunami-WebGIS – Data Structure

Vector Data

- Arrival time isochrones, trenches, epicenters*
- Source data format: SHP
- Data structure: feature dataset
- Storage: PostgreSQL database
- Service: published as WMS or WFS*

Raster Data

- Maximum wave heights
- Source data format: GeoTIFF
- Data structure: image mosaic
- Storage: file geodatabase
- Service: published as ESRI Image Service

Outlook

Planned to include

- Simulations for
  - North-East Indonesia
  - Historical tsunami events
  - Recent tsunami events
  - Chile and Peru
- Tide gauge data

Database coverage in Indonesia

Maximum wave height [m]

TsunAWI simulation for Andaman Event 2004
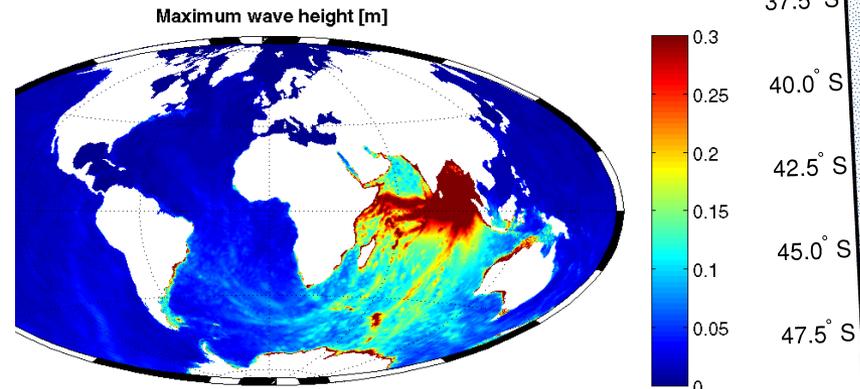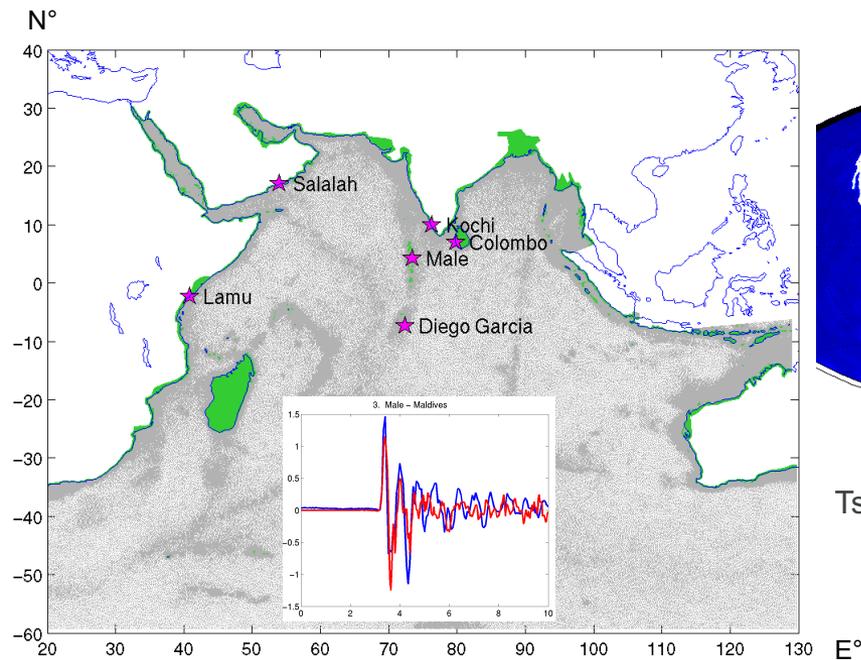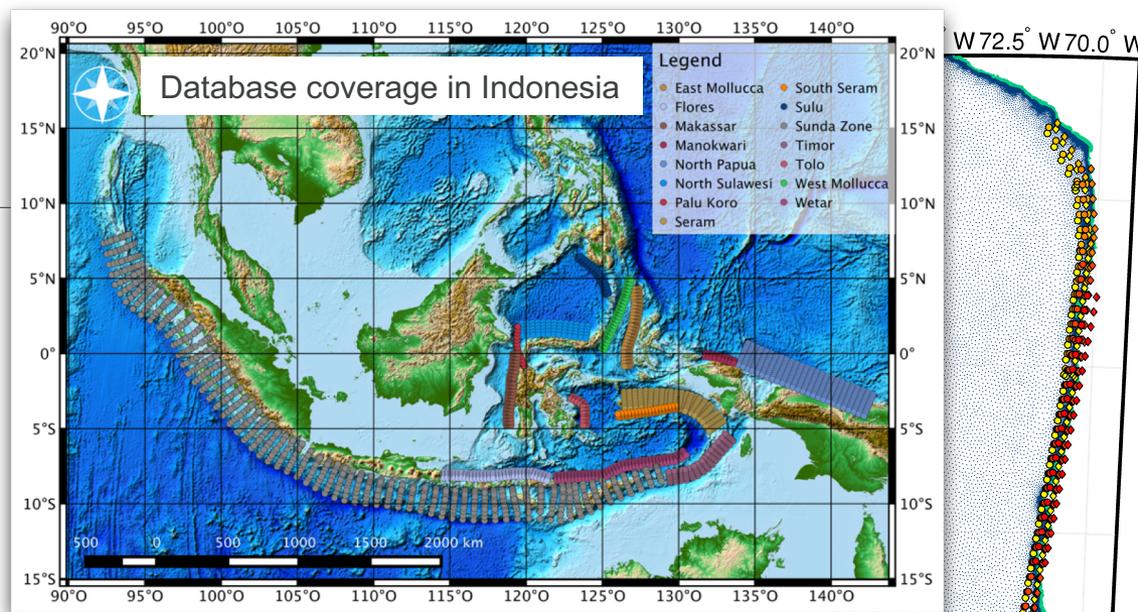
TsunAWI simulations for Chile

Questions?

Acknowledgements to our former student assistants

- Felix Freiberger

- Matthias Hardner

- Franziska Hoppe

- Saghi Yousefi

… who contributed substantially to the process of visualising our data products

HELMHOLTZ