

Tsunami Hazard Maps for Indonesia

The Basics for Tsunami Preparedness

To be better prepared, it is necessary to understand the possible effects of a future tsunami. Unfortunately, it is not an easy task to reliably determine the probability and the potential impact of a tsunami. Many efforts are undertaken to assess the tsunami hazard and to develop maps that indicate areas that could be affected by a tsunami. However, these maps – independent of how they were developed – can only provide an estimation of what might happen; they cannot predict exactly what will actually happen.

Nevertheless, with the right methods it is possible to produce maps that approximate the real picture and provide the best possible orientation to identify hazard zones and safe areas for evacuation. A tsunami hazard map is an important planning tool, not only for preparedness and mitigation efforts, but also for other planning purposes, such as urban and land use planning.

APPROACHES, METHODOLOGIES AND DATA

There is no universal recipe to develop a tsunami hazard map, but all available information should be taken into account:

A good way is to learn from tsunamis in the past. Wherever local knowledge and historical data from a previous tsunami in your area is available, it should be used. It is always worth checking with scientific institutions and local sources for information and data on previous tsunamis. Since the 1980s, post-tsunami assessments are conducted regularly and their data is a good source of information about inundation areas, arrival times and run-up data. Reviewing experiences in other places will certainly provide valuable data and insights about the possible impact in your own area.

As the impact of a tsunami is strongly influenced by the shape of the coastline, the elevation of the land surface and the seafloor topography, it is important to study these patterns and understand their influences on expected wave height and inundation areas.

Try to find out about the potential sources for tsunamis. As most tsunamis in Indonesia are triggered by earthquakes, it is important to understand the geotectonic setting of the surrounding areas. In some regions scientists are conducting studies to discover evidence of prehistoric and historic tsunamis, which can provide valuable hints about possible future events.

All of this information can be used to simulate what might happen in the future. For this purpose scientists have developed a method called “numerical modeling”, which allows the simulation of the propagation and the impact of tsunami waves. The method provides information on the affected areas, estimated arrival times of the waves and the expected height of the water on land. Often, the modeling is based on only one single hypothetical tsunami scenario, which is regarded as either the worst case or the most probable one.



Tsunami Hazard Map for Painan / West Sumatra



Inundation Map for Padang



Tsunami Catalog and Zones in Indonesia. Hamzah Latief et al., Journal of Natural Disaster Science, Vol. 22, No.1, 2000

Hidup Akrab dengan Gempa dan Tsunami. Subandono Dipoastono and Budiman: Bogor : Penerbit Buku Ilmiah Populer, Bogor 2008



Hazard Mapping Exercise in Pilot Area Java

As we know, in “real life”, different scenarios could occur: an area might suffer the impact of a small tsunami, but a much bigger one is also possible. Therefore, multi-scenario approaches have been developed to combine the inundated areas with a variety of potential tsunamis (or scenarios), characterised by different magnitudes and originating from various locations within a predetermined earthquake zone, on one map.

MAPPING INITIATIVES IN INDONESIA

Tsunami hazard maps based on numeric modelling have been developed by several Indonesian (e.g., ITB, BPPT, LIPI, DKP, ESDM) and international institutions for different areas across the country. The GITEWS project has used the multi-scenario approach to develop tsunami hazard maps for the GITEWS Pilot Areas.

For areas where no tsunami modelling results are available, the project developed a simple and low-tech tsunami hazard mapping methodology applicable at the district level. The method combines topography, horizontal distances from the coast, as well as geomorphologic features and the application of two different scenarios. Thanks to its participatory approach, the method also equipped local stakeholders with a better understanding of the local tsunami hazard.

Indonesia has yet to agree on a standardised methodology, but so far, no lead agency has been appointed at the national level to coordinate this issue.



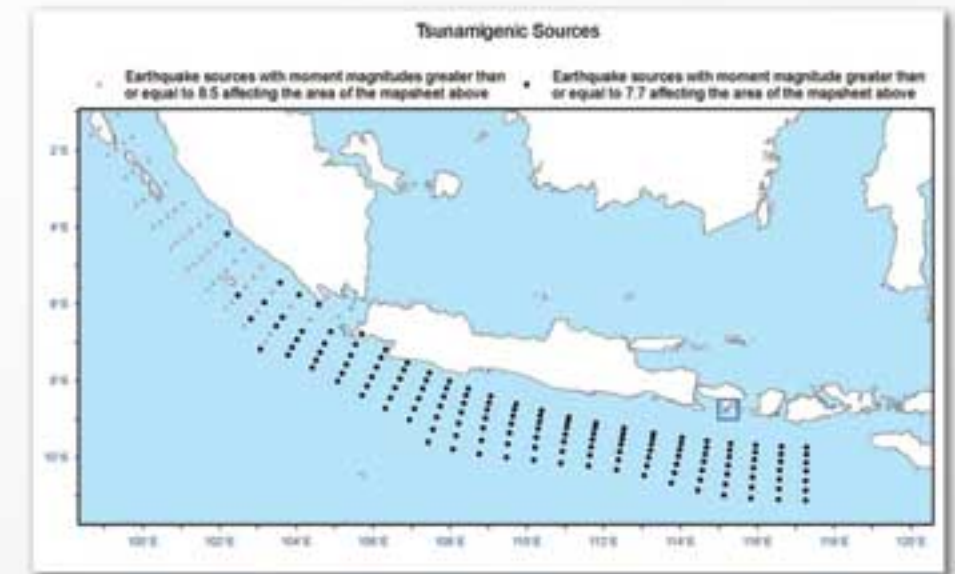
Where is the Safe Area? A Suggestion for a Tsunami Hazard Mapping Methodology for the District Level – GTZ IS, September 2009

THE MAPS

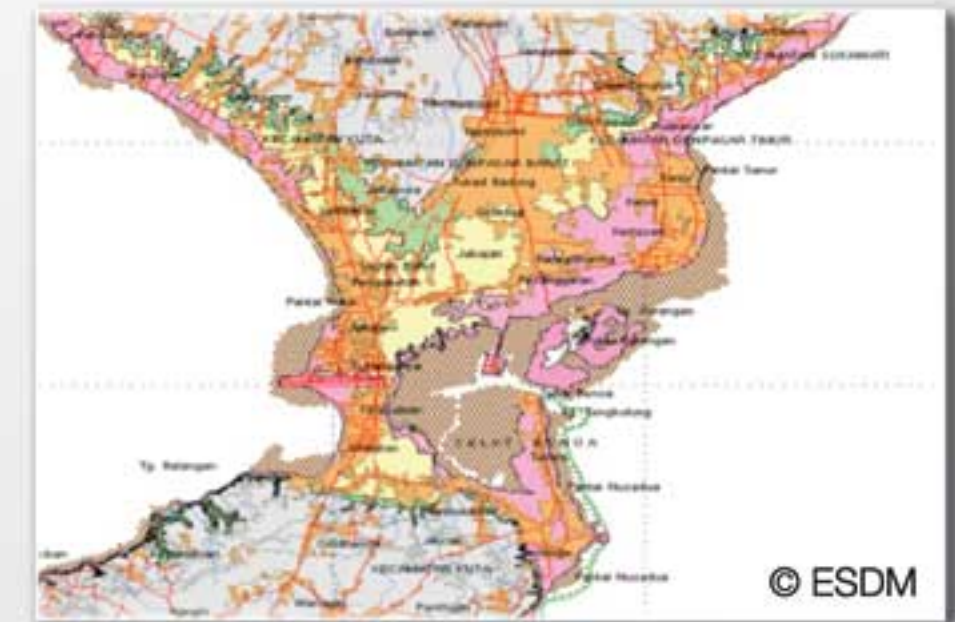
A variety of tsunami hazard maps are circulating in the country. For certain locations, such as like Padang, you may find a number of different maps, while other areas are not covered at all. As different methods and data sets have been used, it is always important to get a proper understanding about the characteristics of the maps.

Always check carefully the meaning of the zoning. You will find maps that show zones according to the estimated height of the water on land, whereas the zones in other maps might indicate just the probabilities to be hit by a tsunami. Also, be aware that the quality and reliability of the modelling depends highly on the quality of the data that was used. Experiences show significant changes in the mapped inundation areas when the originally used topography data was replaced by corrected or high-resolution data sets.

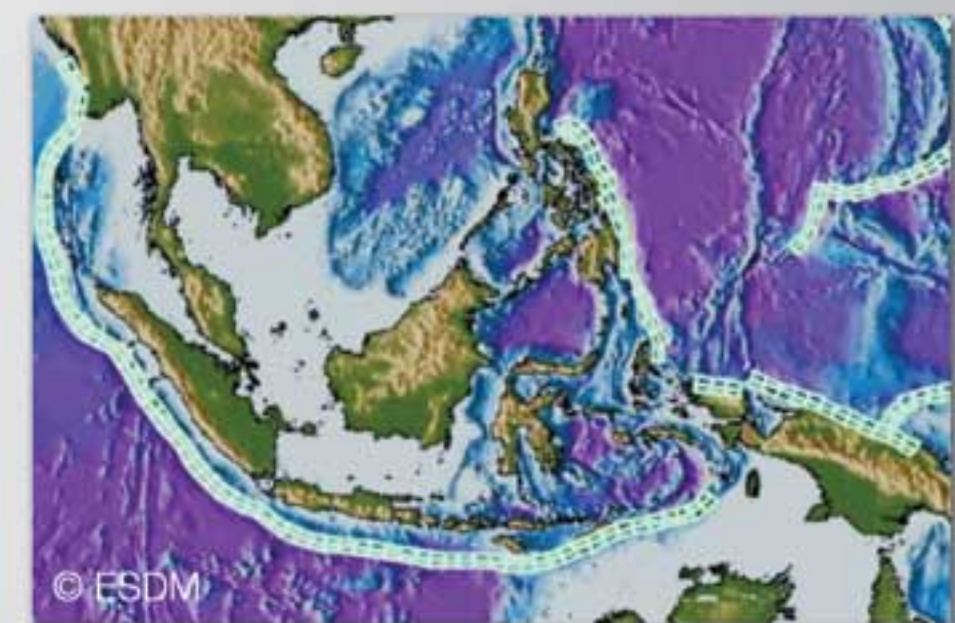
For local preparedness planning purposes, tsunami hazard maps should be developed at the district level with a scale of approximately 1:50.000. A consultation process between the science community and local stakeholders has proven to be a suitable way to agree on local hazard maps. Regardless of which approach is finally used to develop the local tsunami hazard map, it must be officially recognised by the local authorities.



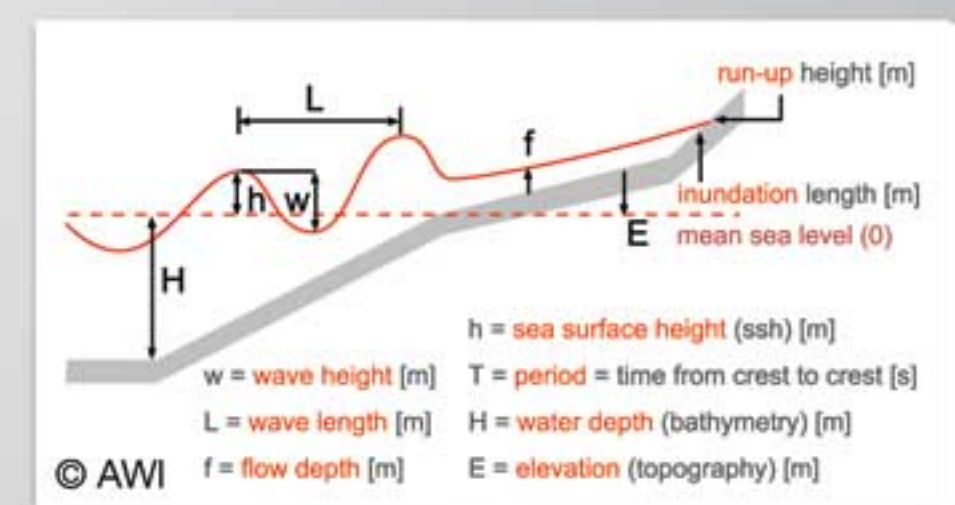
Tsunami Source Areas for Modeling



Bali Tsunami Hazard Map



Tsunami Source Areas for Modeling



Definitions used for Tsunami Hazard Assessments

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