



TSUNAMI_RISK – Multi-risk assessment and cascading effects analysis in Indonesia

CLIENT II – International Partnerships for Sustainable Innovation

In 2018 alone, Indonesia experienced not one but two tsunamis that claimed numerous lives. Both tsunamis followed a chain (cascade) of events, with landslides triggering tsunamis. New detection and early warning strategies need to be developed for tsunami events like these. The TSUNAMI_RISK project takes mapping and monitoring as its starting point and will investigate how geoscientific findings can be used to inform social discussions and disaster risk management in Indonesia.

Background and motivation

The both tsunamis in 2018 followed a cascade of events: On 28 September in Palu, on the island of Sulawesi, the cascade consisted of a sequence of earthquakes – landslides – while on 22 December, after a prolonged period of volcanic activity, a flank failure occurred on Anak Krakatau, which in turn triggered a tsunami. In both cases, the resulting tsunamis caught the local population largely unawares, leading to a high death toll. The existing tsunami early warning system, designed to detect tsunamis triggered directly by earthquakes, was unable to provide efficient warnings in these cases.



Satellite image of the Anak Krakatau volcano (Indonesia) before and after the landslide that triggered a tsunami in 2018.

Solutions

The TSUNAMI_RISK project described new takes mapping and monitoring as its starting point, investigating the processes during landslides and the resulting tsunami-genic effects. In close cooperation with Indonesian partners, the project aims to identify unstable slopes; to measure mass movements with state-of-the-art satellite observations and geodetic and seismic methods; to investigate their dynamics in simulations and experiments; and thus to investigate their relevance and precursors in geoscientific and technical terms.

The project will test the seismic detection of landslides, which can be used as a concrete early warning method; however, these signals are more subtle than those of tsunamigenic earthquakes, and the work planned for this project will help develop possible warning strategies for this class of events. Furthermore, TSUNAMI_RISK will explore how geoscientific findings can be used to inform societal discussions and disaster risk management in Indonesia. To ensure that knowledge and technologies are developed in line with societal needs, the project aims to achieve a better understanding of the underlying social and socio-political causes of vulnerability of the affected population; to determine what kind of knowledge and information can actually be used by whom and in what way; and how these findings can be translated into concrete actions.

Overall scientific and technical objectives

The TSUNAMI_RISK project aims to contribute to three different key areas: Geoscientific research; Social scientific research; Policy recommendations and their transfer into practice.

With respect to geoscientific research on the physical processes of tsunamis caused by non-seismic sources, the project will (a) identify areas potentially at risk from tsunamis induced by volcanoes and landslides; (b) conduct analyses at selected localities to better understand the underlying physical processes and driving forces that cause a tsunami; and (c) conduct experimental and numerical modelling studies of tsunami generation and propagation through volcano-induced landslides, including the analysis of land management options.

Furthermore, the project will investigate how geoscientific findings can be used to inform societal

discussions and disaster risk management in Indonesia. Therefore, the social scientific research questions deal with (a) the culture of handling different hazards, risks and disasters; the risk perception of the population and institutional actors; (b) the analysis of the institutional framework and the current state of disaster risk management (DRM); early warning and crisis response; behaviour of authorities at local, regional and national levels; and will assess Standard Operating Procedures; and (c) eliciting an understanding of local conditions and the range of possible community responses to events like these.

Finally, the research results as well as the conclusions and recommendations will be made available and transferred to practical application. This requires training and qualification measures as well as corresponding training concepts.



The project results should be integrated into existing monitoring and early warning chains.

Funding initiative

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TSUNAMI_RISK – Multi-risk assessment and cascading effects analysis conducted as part of a cooperation between Indonesia and Germany – Joint research on tsunamis induced by volcanoes and landslides

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