Internship project proposal – Geolocation and geovisualization of a global database of tsunami-related studies through automated searches of the world wide web

Bruce Thomas1, Jean Roger2, Yanni Gunnell3

1. Institute of Geodesy (GIS), University of Stuttgart, Stuttgart, Germany

2. Earth Structure and Processes, GNS Science, Lower Hutt, New Zealand

3. Université Lumière Lyon 2, CNRS UMR 5600, Bron, France

Context and purpose of the study

The number of peer-reviewed publications, governmental reports and web-based databases dealing with tsunami research has increased substantially over the last 18 years following the devastating 26 December 2004, Indian ocean tsunami. Focusing initially on earthquakes sources, the literature has more recently opened up to volcanic and landslides sources, while also studying post-tsunami surveys and historical and other paleo-tsunami deposits as a means of gaining deeper insight into how tsunamis are generated. Several countries have created their own databases of historic tsunamis, with scope for analyzing not just the hazard itself but also its impact on communities. Discussions tend to show that despite lessons learned on tsunami sources, on numerical modelling, on impact and on preparedness, more multidisciplinary research is needed for achieving reliable tsunami risk assessments and building future resilience to tsunamis.

A quick bibliometric analysis of tsunami research shows trends in the geographic focus on known tsunami areas such as South-East Asia, Japan and the USA west coast. Most of the tsunami research focuses on locations where tsunamis have already been experienced or where recurrent and multiple sources of tsunamis exist. However, studies dealing with the South Sandwich Islands, for example, also highlight the tsunami hazard source with its direct impact on the western coast of Africa, demonstrating a relative absence of tsunami research interest with wider coverage. Despite being located in a well-known hazard area, the recent 2022 Tonga volcano eruption caused an unexpected tsunami, but again indicating a scarcity of observations, of tsunami catalogues, of simulation studies and likewise of political decisions – even along the Pacific Ring of Fire, where most devastating natural hazards are generated. Reasons for those blind spots in tsunami research are unclear, but could arise from political or academic bias, or perhaps from misinformation.

An International Strategy for Disaster Reduction has been drawn up by the United Nations to define priorities for action in risk reduction by assessing and monitoring disaster risks, enhancing early warning, and by using knowledge, innovation, and education to build a culture of resilience at all levels. Despite this, different nations neither have the same needs in terms of tsunami Disaster Risk Reduction nor the same management capacities. It is therefore a collective responsibility to make sure that all countries and regions vulnerable to tsunami-related hazards are studied systematically. This decision is aligned with the new UNESCO-IOC Tsunami Ready Recognition Program, which aims to make 100% of communities at risk of tsunami prepared for, and resilient to, tsunamis by 2030. Two papers until now have attempted to collate existing tsunami research through a fine bibliometric analysis, ranking them in terms of journal of publication, author names, keywords, well-studied tsunamis, impact assessment, and vulnerability criteria. However, there is little mention of precise geolocation and of less studied geographic areas even though these may be equally vulnerable to tsunami hazards.

The goal of this project is thus (i) to achieve a comprehensive geographic overview of tsunami-related research in the existing literature using a bibliometric search algorithm, and (ii) to identify gaps in geographical coverage and highlight the absence of resources allocated to tsunami research in undocumented but vulnerable regions.

By applying methods previously implemented in a small range of papers dealing with bibliometric analysis of disaster risk research, natural hazards, and vulnerability and resilience studies, the internship assignment will contribute to a global assessment of tsunami research with an emphasis on geolocation. The methodology will focus on mapping existing tsunami studies (i) by cause / source area and (ii) by impact on communities. The aim is to depict existing coverage and to identify coverage gaps, with a view to ultimately redress the imbalance in the distribution of tsunami-related studies around the world. We expect to see areas such as Japan and the west coast of the USA standing among the most studied, whereas areas such as small islands in the South Pacific, Philippines or Central America will lack a tsunami database, with few attempts to promote tsunami resilience even though they are located in highly vulnerable tsunami hazard areas.

Workflow outline

1.   List the suitable search engines / databases containing tsunami-related peer-reviewed publications and governmental reports.

2.   Generate the tsunami database by creating an automated search algorithm of publication titles (primarily) and abstract (if possible) using keywords and filters.

3.   Identify possible errors (e.g. data filtering problems) and improve the algorithm iteratively.

4.   Access the worldwide tsunami hazard map published by UNESCO (ITIC).

5.   Update the automatic algorithm based on classifiers such as:

·   Name of country and location and identify if it is the tsunami source area (earthquake, eruption, etc.) or a country impacted by the tsunami

·   Date of publication

·   Publication ID

Deliverables

1.   Produce maps geo-locating tsunami-related research studies by number of publications, with an interactive geovisualization system in which a clickpoint on the map connects to the paper(s) and allows data to be visualized as a heat map based on publication frequency.

2.   Make the algorithm turn on a defined period of time (for future updates).

3.   Update the worldwide tsunami hazard map published by UNESCO (ITIC).

4.   Overlay the tsunami-related research webmap on existing world tsunami hazard maps to identify gaps in research effort.

5.   Provide a critical analysis of the patterns of tsunami-research deficit areas.

Desired profile

We are primarily seeking a motivated, methodic and well-organized second-year Master student in geo-informatics for an internship of 6 months. The internship is also open to suitably trained first-year Master students.

Required skills:

·   Excellent knowledge of programming for webmapping and geovisualization purposes (including in a Linux environment)

·   Good knowledge of cartography and GIS

·   At least notional knowledge of tsunami science

·   Autonomy, rigor and organization

·   Sense of initiative and enterprise

The internship will be based at the University of Stuttgart, Germany, with a negotiable component of telework from the candidate's homebase. The internship should begin in the first semester of 2023. Conditions and dates are to be agreed with the intern.

If you are interested, please send a resume to bruce.thomas@gis.uni-stuttgart.de and feel free to ask any questions.