

International Research (Project No.: 2020W-04)

Project name: Large-scale temporal assessment of tsunami threats in the Pacific Mexican coast

Principal Investigator: Néstor Corona Morales

Affiliation: El Colegio de Michoacán A.C.

Name of DPRI collaborative researcher: Nobuhito Mori

Research period: April 20, 2020 ~ April 20, 2022

Research location: Mexico

Number of participants in the collaborative research: 10 (DPRI staff: 6, non-DPRI staff: 4)

DPRI Staff: Nobuhito Mori, Tomoya Shimura, Adrean Webb, Amin Chabchoub, Takuya Miyashita & Tungcheng Ho.

Non-DPRI Staff: Néstor Corona Morales, María-Teresa Ramírez-Herrera, Rocío Castillo-Aja, Mirta Insaurralde.

- Number of graduate students: (Master students: 0, Doctor students: 0) (Included number, 0)

- Participation role of graduate students [0]

Implementation status in FY2021

The activities were focused on two aspects: 1) Review of historical archives to find earthquakes and tsunamis records at the local scale, to complete the seismological and tsunamigenic data to recalculate probabilistic seismic hazard scenarios that include palaeogeological earthquakes. 2) Compilation and valuation of the quality of the bathymetric data available for the study area, especially the Mexican Navy's data, due to its relevance in the modeling processes.

1) Historical review results: A completed database included non-instrumental probable earthquakes and tsunamis where identified. The next step is to recalculate the Probabilistic. On the other hand, recent papers reported important earthquake sources for the Jalisco-Colima-Michoacan region.

- Map of the historical and non-historical places affected by earthquakes and tsunamis (In the process)
- Integrated database of earthquakes and tsunamis included affected places, earthquake epicenters, main focal mechanisms.

2) Cartographical Data: The input we expected that might apport substantial improvements with respect to other previous modeling was the bathymetry generated by the Mexican Navy. After a large period of requirement, they provided us its bathymetrical data. It was processed and evaluated. As a result, we concluded that it would not be useful for the main tsunami modeling because it is focused at the Manzanillo Bay, in spite of, it is a fine resolution data (20 x 20 meters). The main zone of interest is related to the continental shelf, where the GEBCO data has a coarse spatial resolution. Nevertheless, the GEBCO data will be used, but we made an improvement at the coastal interface, merging a medium spatial resolution topographical data, editing the shoreline according to its data, we corroborate that it fits with medium satellite imagery. On the other hand, a medium detailed topography preserves important topographical features such as a sand dune or swales that affect the inundation patterns of the tsunami modeling. This data will be discussed with the DPRI staff.

During the second half of the current year, the tsunami modeling will be run with the support of the DPRI staff. In parallel, the geomorphological approach will be completed, and the sedimentological approach will begin with an exploratory field work expedition with the purpose of identifying locations that were affected by a historical and ancient tsunami. By the use of the geomorphological approach, the potential sites for sedimentological sampling will be placed.

Implementation plan in FY2022

In early 2022 the expedition for the sedimentological survey will take place. By the use of geomorphological data, and the historical review and mapping, the sampling process will be improved. The objective in this phase is to identify tsunami sand deposits and its continuity and potential spreading pattern over the coastal plain and especially in low

energy micro-environments, such as swales. At this time, the sedimentological approach will be conducted at coarse level interpretation, such as textural proprieties and interpretation of the stratigraphical sequence. Here is necessary to point out that tropical environments and/or high anthropogenic transformed landscapes turn hard to preserve tsunami deposits. Nevertheless, it is mandatory to explore possible relicts or evidence of ancient tsunami deposits. This approach contemplates at least one catena from the shoreline to inland in a perpendicular way regarding it. The sample pits and core sampling will be driven by the morphological features, tending to represent a tsunami inundation area.

Planned activities.

- Sedimentological fieldwork exploration.
- Characterization of cores.
- Systemically description of stratigraphic sequence
- Textual analyst in the laboratory.
- Mapping of the spatial distribution of tsunami deposits.

In case of success, the historical data may be correlated with potential sedimentological evidence. This approach will be considered to identify horizontal inundation distances from the shoreline and potential tsunami height and fluxes capable place that sand deposits. At this point might be possible to compare tsunami modeled results, historical, and sedimentological approach, and systematically calibrate the tsunami scenarios. The richest discussion will take place at this point when all approaches will be combined.

Planned activities

- Systematization of data
- Validating of scenarios
- Discussion of interim results
- Tsunami modeling
- Recalculate and calibrate tsunami models

Acknowledgments. This is a wide idealized plan, taking into account the expectation of finding at least evidence of a big ancient tsunami. Given the pointed environmental and land use conditions, it is considered probable do not to find sedimentological pieces of evidence, or in the best case, more than one event. On the other hand, this project is highly basic, does not considers other complex approaches such as chemical, biological, diatom analysis, chronological dating, or others; that should be conducted in the future. This project tries to provide the essential elements to carry out a more intensive investigation in this crucial region of Mexico.