Observations by the International Tsunami S Regions VII-VI and V of Chile

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Abstract

On Saturday, February 27, 2010 at 06:34 UTC (03:43 local time) an 8.8 Mw magnitude earthquake occurred off the central coast of Chile, offshore Maule. The earthquake triggered a tsunami that affected more than 500 km of the Chilean coastline and also affected the Juan Fernández archipelago and Easter Island. Both events caused significant damage along a large stretch of the Chilean coast and islands, with the resulting death toll reaching nearly 500, with the majority of these due to the tsunami.

An international tsunami survey plan was initiated within few days of the event, with scientists from the United States, Greece, Germany and Chile, and coordinated by UNESCO –ITIC. The main goal of this team was to collect relevant hydrodynamic data, including maximum tsunami heights, maximum run up heights, inundation distances and inundation areas, as well as collecting witness accounts of the events. Owing to the long spatial extent of the affected area, sub teams were formed to maximize efficiency and area coverage. The present work will present the results of this survey effort for the area north from the epicenter, specifically between Constitución and Quintero, where nearly 50 transects with run up heights and water depths were collected.

Our results highlight a large variability in the maximum runup along the coast, where several hot spots are identified, in some cases suggesting amplification due to local effects. Typically, the maximum runup ranged between 4 to 6 m and showed a decaying trend north of Constitución. However, in the vicinity of Pichilemu (VI Region) the runup increased significantly and reached up to 10 m . Further north, the maximum runup decayed again. These overall trends are consistent with witnesses accounts that at least two large wave events were originated with opposing traveling directions originating at the southern and northern edges of the rupture zone. The variability was also expressed in terms of the arrival times of the observed waves.

Methods

Hydrodynamic Data

Hydrodynamic data were collected along transects by visually identifying tsunami markings, such as the debris line, inundation marks on buildings and structures, and unusual placement of floating objects.

The products of this survey were

- *run up*, identifying the maximum vertical level the tsunami reached along the transect
- *maximum inundation*, measured horizontally from the instantaneous water level to the run up
- *inundation depth*, measured vertically when possible at several points along the transect

Special care was taken to distinguish sustained inundation levels from splash, as shown in the inset figure.

Interviews

Witnesses account of the events were recorded when possible. These provide valuable information with regards to the timeline of the events, as well as to the population preparedness and actual evacuation response.

Observations Summary

Run Up and Maximum Water Depth

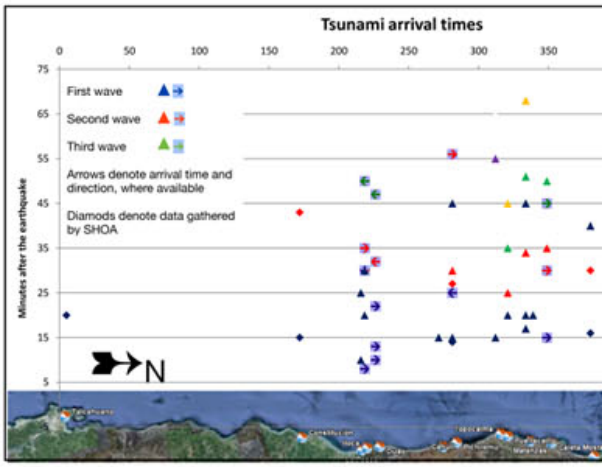
Run up information was collected at 42 transects distributed between the Mataquito River Mouth (VII Region) and Ritoque, a few km north from Valparaiso (V Region)

The resulting run up distribution shown in the figure is referred to the water level at the time of the measurement. However, the narrow tidal range of the area suggests that overall trends will not be affected by tidal corrections.

Despite the significant amount of scatter, the data show a south-north decaying trend between Iloca and Pichilemu. North of Pichilemu the run up increases to find a local maxima in Bucalemu.

Northward of Bucalemu, run up decays swiftly at first followed by sustained run up levels of about 2-3 m until Ritoque.

An overall maxima is found at Caleta de Mostazal, which is attributed to splash or local amplification effects.



This is consistent with the tide gage record at Valparaíso, which

A second wave was reported travelling from the north in locat report it traveling in the opposite direction (red symbols). Cons minimum near Pichilemu,

A third wave propagating from the north was reported on many was responsible for most of the damage.

Some reports mention a larger number of waves, which is cor nature of the event.

Descarga