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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Tsunami hazard potential for the equatorial southwestern Pacific atolls of Tokelau from scenario-based simulations" *by* A. R. Orpin et al.

Anonymous Referee #1

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Review of the nhess-2015-15 paper:

Tsunami hazard potential for the equatorial southwestern Pacific atolls of Tokelau from scenario-based simulations

By Orpin et al.

GENERAL COMMENTS

The authors presented a scenario-based investigation of tsunami hazard potential for the South West Pacific atolls of Tokelau. Their study presents a contribution to a better understanding of tsunami hazard in the atolls in the Pacific, related to distant and a

very few regional earthquake sources. The authors use deterministic approach based on individual source scenarios together with the numerical modeling codes to assess the tsunami potential and coastal and lagoon impact. The methodology and results are questionable and improvements are needed to be accepted after major revision.

THE METHODOLOGY

The first issue is related to the list of historical and worst case earthquakes (Table 2). The authors mixed in this study real events and propose worst case scenario. Why they consider a Magnitude 9,3 in Kouril trench and only a Magnitude 8,6 in Aleutian Trench where occurred the largest tsunami known in the Pacific, the 1946 event that was a "tsunami earthquake" type, and eastern the Alaska 1964, 9.2 event ?

1 The magnitude of the famous 1960 Chilean earthquake is 9.5. There is an error in the caption (9), and in the Trans-Pacific distant source, the Mw chosen is only 9,29. A correct source magnitude fro the scenario should be 9.5 (length 1000 km).

2 The Authors have chosen the Aleutian Arc event of March 9 1957. In this area a Magnitude 9,0-9.2 (Alaska 1964) earthquake could occur, and where the 1946 "tsunami earthquake" event occurred. After the Tohoku event, one major conclusion is that on the Pacific and Indian ocean subduction zone, at least a magnitude 9,0 earthquake could occur along each subduction zone. Consequently for such study, a magnitude 9,0 earthquake is the minimum worst case scenario for each considered scenario, and in the Aleutian, due to the 9,2 Alaska event , a 9,2 scenario should be computed.

3 The slip of the Kuril trench 17 m is too small for a magnitude 9,3 event.

A global study of similar worst case magnitude 9,0-9,2 and similar slips should be performed to provide the real tsunami hazard potential. Assess the tsunami hazard potential would need to compute several scenario in each subduction zones. In particular, the main question, to provide correct tsunami hazard potential is where are located the most dangerous sources for Tokelau in the Aleutian subduction zone, and also along

the Kuril/Kamtchatka subduction zone ? In both zones, the author computed only one scenario. This study cannot conclude that these 2 scenarios provide definitively the worst case scenario and assess correctly the tsunami hazard potential, for the Tokelau atolls.

In particular, analyzing figure 5, the tsunami beam coming from the Kuril source is arriving northern Tokelau and travelling close eastern without reaching the atolls. A scenario with a fault located a few hundred Km southern or northern would produce a beam that could path through Tokelau, and the hazard at Tokelau would be larger. Unfortunately, due to the too small size of Aleutian scenario simulated by the authors (8,6), such relevant analysis could not be done with the figures of this paper.

The authors should compute several events :

- Chilean 1960 with Mw 9,5

- Several Aleutian events with Mw 9,0

- Several Kuril/Kamtchatka with Slip of 20-25 m

THE RESULTS

The major limitation of the analysis of the results is due to the fact – as explained in the methodology part of this review- , that the worst case scenario hypothesis chosen by the authors is not comprehensive and, consequently, the results obtained cannot be considered for assessing correctly the Tsunami hazard potential. A second minor improvement, is the figure 10 that is not relevant as it is. The snapshots should represent similar propagation phases in each atoll, but not at the same time. This figure as it is doesn't provide any interesting comparative result.

1 what is the exact time of each snapshot ?

2 to compare the behavior of the propagation of the wave in each atoll, the series of snapshot should be , for each island : 1st : time of arrival of the wave on the coastline ;

2nd time of crossing quite all the lagoon ; 3rd time with reflection of waves. . . Indication of the average value of the water depth in each lagoon, the existence or not of coral reef pinacles and paths would explain the wave propagation.

A figure with a series of synthetic tide gages (3-5) in each atoll should be presented to be able to compare the maximum amplitude in each atoll and which wave is the highest.

FIGURES

All maps with no coordinates cannot be published as they are : Coordinates should be added

CORRECTIONS table 2

Caption : (6) slip values estimate . . . (7) strike values estimate. . .. Table First line Dip(6) ° ; Strike (7)°

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 3, 4391, 2015.