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## Comment on nhess-2021-369

Anonymous Referee #2

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Referee comment on "Characteristics of two tsunamis generated by successive  $M_w \approx 7.4$  and  $M_w \approx 8.1$  earthquakes in the Kermadec Islands on 4 March 2021" by Yuchen Wang et al., Nat. Hazards Earth Syst. Sci. Discuss., <https://doi.org/10.5194/nhess-2021-369-RC2>, 2021

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### Overview

This paper describes the source spectrum of the tsunamis generated by two earthquakes ( $M_w$  7.4 and  $M_w$  8.1) that occurred in the Kermadec subduction zone on 4 March 2021 using tsunami data recorded at tide gauges. The study produced the dominant wave period range for each event and the spectral ratio for the larger earthquake (second event) by utilizing the data from the smaller event (first event) as Green's Functions.

### Comments

- High-quality water level data at DART stations are available for this event. The DART stations are in the deep ocean which means the records are not affected by the coastal geomorphology, unlike tide gauges. It is not clear why the study is only using tide gauge but not DART data. I suggest the inclusion of spectral analysis of DART data in this study.
- The paper provides the dominant wave period ranges for the first and second events. But what the meaning of those numbers is not explained. The dominant period ranged from 8 to 28 minutes for the  $M_w$ 8.1 earthquake (the range is 7-28 min in lines 175-180, which one is the correct one). Is this a normal range for this kind of earthquake?
- It is not clear how the period range was determined. Was it from the Fourier or the wavelet analysis? Lines 130-135 describe that the range was determined from the peak spectral power. But the peak for the first event at some of the stations like Owenga is longer than the upper limit of the 5-17 min range. Please indicate the peak at each station for each event with an inverted triangle in Figure 3.

- Similarly, the period range determination using the wavelets is also not so clear. The period range for the second event detected at Ouinne was 20-30 min. But the paper finally concluded the period range of 8-28 min for the second event. Was the period at Ouinne simply ignored? Moreover, if we chose the peaks in the Ouinne wavelet using the contours, we would get a range of 10-30 min instead of 20-30 min. Please provide a table with the range for each station.
- Figure 4: Provide purple and red boxes for the other tide stations.
- Lines 185-190: the paper argues that the spectral analysis validates the USGS source model. But the calculation of the model source periods used the total fault length and width instead of the dimension of the main slip region, which is about 120 km long and 120 km wide. Outside this main slip region, the slip amounts are almost zero, so the total fault dimension should not be used in the calculation.
- Provide the spectral ratios from the simulated waveforms and then compare them with the observed ones.
- Error bars are required for Figure 5c and 5d.