

Interactive comment on “Projecting the risk of damage to reef-lined coasts due to intensified tropical cyclones and sea level rise in Palau to 2100” by Chuki Hongo et al.

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We greatly acknowledge the constructive and very helpful reviews given by Referee #1. All comments have been carefully addressed. Broadly, we have improved three points. Please see also supplementary PDF for our detailed response.

(1) The referee asks whether there is an observed data of incident waves at offshore in Palau under the present-day. If there is the observed data, we should use the data to run our wave simulation. We attempted to find an observed data of ocean wave and water level in Palau Islands. Unfortunately, there is no in situ observation systems for ocean wave and water level at offshore and onshore using underwater loggers and/or

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radar observational systems in Palau. Therefore, we conducted the wave simulation using as forcings significant wave height and wave period by the Global Forecast System (GFS) model.

(2) In this context, the referee is wondering whether wave height and water level by our wave calculation correspond to observed data of wave height and water level on the study site at recent tropical cyclones (Typhoon Bopha and Typhoon Haiyan). There is no observed data for wave height and water level at the study site, but we asked local people a state of flooding at the study reef during Typhoon Bopha. Fortunately, local people said that the road (+2.86 m above MSL) along the shore at the study site was flooded at this event and local people had never seen for a past ca. 70 years. Although the eyewitness record was not quantitative data, our water level simulation showed the flooding event at a modeled tropical cyclone (i.e., Typhoon Bopha) (Please see new Figure 3 on our detailed reply). It implies the flooding events correspond to an eyewitness record by local people. However, it was difficult to identify a record of wave height at the study site during Typhoon Bopha.

(3) The referee is also wondering whether only a few of change in wave height (maximum 0.44 m) between healthy reef and degraded reef will cause a significant change of impact to coastal damages. We believe that there is a difference in only 0.1 m of wave height a between healthy reef and a degraded reef whether to begin coastal damages or not. Our results showed that future water level at the shore (WLs) will increase from maximum 2.10 m at present to maximum 3.45–3.51 m by 2100. In many cases for our calculation, the WLs will almost reach the elevation of the road (+2.86 m above present MSL) and the sea water will inundate the road. This implies that the risk of flooding at the coastal area will be increased. Additionally, increased wave heights will enhance the risk of flooding and other coastal damages such as destructions of constructions (houses and buildings), saltwater intrusion into groundwater, and coastal erosion. Therefore, when water level is approaching the elevation of constructions which are located at ~3m above the present MSL, an increased wave height of only

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0.1m will lead to damages of the constructions.

Please also note the supplement to this comment:

<https://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2017-3/nhess-2017-3-AC2-supplement.pdf>

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., <https://doi.org/10.5194/nhess-2017-3>, 2017.