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Interactive comment on "A mathematical formulation for estimating maximum run-up height of 2018 Palu tsunami" *by* Ikha Magdalena et al.

Anonymous Referee #1

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<General comment>

The paper deals with tsunami amplification in a closed bay. The authors applied an analytical model to the case of the 2018 Palu Tsunami and claimed that the model described the tsunami run-up in a narrow bay well. The analytical model itself is an existing one and I do not see anything new in it. The way of applying the model to the case appears to be rough, and thus, the results are not convincing. I do not think the paper is in publishable quality. The authors need to carefully discuss the model applicability and validate the model from different perspectives.

<Specific comments>

(1) The bay topography is shown by a 3D plot in an ambiguous way (Figure 1). I suggest

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Discussion paper

the authors to provide the longitudinal cross-section and transversal cross-sections at some representative locations with a length scale (not in longitude/latitude). Additionally, the authors need to compare the longitudinal transition of the cross-sectional area in comparison to the idealized bays in the model, which is important in discussions of the wave funneling effect.

(2) Please describe the general characteristics of the tsunami in Palu bay and justify the use of the section-averaged shallow-water model prior to the model introduction. The model is based on some assumptions that hold for specific bay geometries relative to wavelength (e.g. shallow-water and narrow-bay assumptions).

(3) The analytical model is introduced separately for different bay types: rectangular (plane beach), parabolic, and triangular bays. But they can be derived in a unified manner using a single geometric parameter. This is recommended not only for the preciseness of the paper. It enables the authors to consider, for example, an idealized bay between the rectangular (plane beach) and parabolic bays for a better fit to the real bay bathymetry. See [1] for the general expression of the model.

(4) The run-up formulas presented in Page 7 are based on asymptotic approximations of the Bessel functions that appear in (27)-(29). As a result, the runup amplification factor (R/A) in Figure 4 goes to zero for a very long wave because the approximation does not work in the range of small omega*t. The authors need to clarify this and show that the Palu case is not in this range. The run-up formulas without the asymptotic approximation are given in [2].

(5) The model gives run-up height in an equilibrium state under a monochromatic wave. The actual tsunami is a transient one. The authors need to discuss the model applicability in this regard. If there are available tide records at different locations in the bay as shown in Table 1, the authors can validate the model from a different perspective other than the maximum run-up height at the bay head which might be affected by very short waves and local topography.

(6) The numerical result in Figure 6 exhibits strong transverse variations of the highest crest level in the bay indicating significant effects of transverse flows. This suggests that the tsunami propagated in the bay not as a plane wave as assumed in the model. The authors need to discuss the model applicability in this regard and associated limitations. See [2] for the effect of transverse flows in a closed bay.

(7) I do not deny the possibility that the model result agrees with the observed value at 10ˆ-2 m accuracy as presented in the paper. It can happen by coincidence. But the authors need to carefully justify the model inputs since the agreement level is far beyond the model capability.

(8) In relation to the previous comment, the authors need to provide a basis for the choice of the input wave amplitude at the midpoint of the bay from the numerical result. There is a considerable degree of arbitrariness. The numerical result in Figure 6 gives a variation of the highest crest level within the bay, which was not necessarily produced by the same wave that caused the maximum run-up at the bayhead.

<References>

[1] Zahibo, N., Pelinovsky, E., Golinko, V. & Osipenko, N. 2006 Tsunami wave runup on coasts of narrow bays. Intl J. Fluid Mech. Res. 33, 106–118.

[2] Shimozono, T. (2016). Long wave propagation and run-up in converging bays. Journal of Fluid Mechanics, 798, 457-484.

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