

## **Reply to Anonymous Referee 2, (NHESS)**

**Interactive comment on “Reconstruction of flow conditions from 2004 Indian Ocean tsunami deposits at the Phra Thong island using a deep neural network inverse model” by Rimali Mitra et al.,**

We thank the reviewer for the insightful assessment of our manuscript and for the numerous comments and suggestions. We have provided answers to your questions as listed below (in bold italics).

**Q1:** The figures presented as Figure 1 in this paper have already appeared in M2020 (their Figs. 1 and 2). This is at least acknowledged in the caption. Figure 2 also appears identical to Fig. 3 of M2020 (apart from some color changes), but this does not seem to be indicated in the Figure caption. Is this indeed essentially the identical figure? If so, this ought to be acknowledged. (It could just be very similar, and the differences not perceptible).

***RE: Thank you for identifying this. We agree that Figure 1 in this manuscript looks similar to the appeared figure in Mitra et al., (2020). However, we have made slight changes in the Figure 1 by changing the number of grain size classes from six o five, hence the number of output nodes should be 8, here we did the typo by mentioning the number of nodes as 9. We will correct the typo and add the reference of Mitra et al., (2020). For Figure 2, although the figure looks similar and imperceptible, we changed the number of training datasets and the performance of loss function is slightly different from the previous paper as the grain size distribution is different for 2004 Indian ocean tsunami at Phra Thong island. Thus, we generated separate artificial dataset and that Figure 2 shows that performance.***

**Q2:** Several details of the numerical model used to generate test data sets in Section 2.1 are seemingly missing. These include, the following issues: How are the friction velocity ( $u_*$ ), the setting velocity ( $w_{s,i}$ ), the sediment entrainment coefficient ( $E_{si}$ ), and other variables ( $r_{0i}$  and  $F_i$ ) determined?

***RE: Thank you for your suggestion. We did not add the details of the parameters mentioned as we thought it would be repetitive as we the details are already in Naruse and Abe, 2017 and Mitra et al. 2020. In response to your comment we will either add the details of the parameters or cite the reference properly in our revised manuscript.***

**Q3:** Regarding the friction velocity ( $u_*$ ), in particular, it should be noted that great care ought to be taken for this quantity if standard (based on steady flow) friction formulas are used, as several recent research papers have shown that tsunami induced boundary layers may span only a fraction of the water depth, and hence these may well be invalid. See e.g. Lacy et al. (DOI: 10.1029/2012JC007954), Williams & Fuhrman (DOI: 10.1016/j.coastaleng.2015.12.002), Tinh & Tanaka (DOI: 10.1080/21664250.2019.1672127) or Larsen & Fuhrman (DOI: 10.1016/j.coastaleng.2019.04.011). Please clarify this point, and if this is indeed being done, this potential defficiency ought to at least be acknowledged.

***RE: We understand the point the reviewer makes. We have used standard friction formula for our model. In response to your comment, we will add the mentioned references and will acknowledge this potential deficiency in our revised manuscript.***

Q3: Can a definition sketch of the model domain (etc.) being used for the generation of the training data sets please be provided? This will help readers immensely to get an idea as to the actual setup being used. Plots just showing performance (like Figs. 2 and 3) fail to provide this.

***RE: Thank you for the comment. We will add a diagram on the explanation of model configuration in the revised manuscript.***

Q4: I do not find that the DNN architecture being used is presented with sufficient clarity. In Section 2.2 (top) it is stated that the DNN model accepts grain-size and thickness distribution at an input layer, and that the outputs are the "tsunami characteristics through several hidden layers". This is rather unclear. Further clarification is also provided in Fig. 1, though it is not clear if this is the actual architecture or just intended as an example. Please (just in a sentence or two) summarize the DNN architecture i.e. clarify precisely the no. of inputs, the number of hidden layers (and nodes in each layer), and the number of outputs to remove any ambiguity. Such details are rather important should one attempt to reproduce this work.

***RE: Thank you for the valuable suggestion. We agree with the reviewer that we should add the details of input and output layers. We will add one paragraph in methodology section, 2.2 on the workflow inside the DNN architecture and will mention about the number of inputs, output nodes, hidden layers.***