Response to Reviewer 1

1. **I see that the threshold used for marking the onset of damages of the buildings, related to ash fall, was set to 100 kg/m^2. As noticed by the authors this is true for weak buildings (line 222). Is there an estimate of the mean typology of the buildings in the considered areas or are you using a ``conservative'' approach?**

There are few detailed estimates of fragility for roofs in the region, and only one that considers the different degrees of damage that might be sustained by tephra fall loading on roofs typical to the area (Williams et al., 2020). This supports our choice of tephra load threshold as a median estimate for damage and we now include reference to this study in our text, as below:

Revised text: "Based on remote damage surveys around Kelud volcano, Java, Williams et al. (2020) identified 100 kg/m^2 as the median tephra load associated with moderate or worse damage to tiled or metal sheet roofs: roof types that are common across Indonesia and the Philippines."

2. **The nomenclature used for the concepts of ``short-term'' and ``long-term'' hazard seems different from what is found in the literature. The authors (lines 93-96 and 523-525) associate ``short-term'' with the hazard conditional to a given scenario and ``long-term'' with the probability of occurrence of the eruption scenario.**
   However, other authors (eg. Marzocchi and Bebbington, 2012) associate the terms ``short'' and ``long'' strictly with the time scale and use ``short-term'' to indicate a forecast in a time horizon of hours/weeks or months, typically of interest in managing evolving episodes of volcanic unrest; and ``long-term'' for time windows of years to decades that are required for land use and evacuation planning.
   This point should be clarified and, in case of conflict with the commonly used nomenclature, I suggest to modify the terms or explicitly state that you are using ``short-term'' and ``long-term'' in a more specific way.

We have revised our terminology around the use of short-term and long-term, and reframed our analysis to not refer to timeframes in order to address this very valid point. We now reference "conditional probabilities" (previously "short-term") to reflect when the assessment was conditional upon the considered eruption scenario occurring at that volcano, and "absolute probabilities" (previously "long-term") to reflect when the assessment incorporated the probability of the eruption scenario occurring.

3. **Concerning ``the need for new flow models that predict not only a binary inundation but also some measure of impact intensity metrics (e.g. flow depth, dynamic pressure'' (line 717), in generally I agree with the authors. However, some models are already freely available (see eg: https://github.com/TITAN2D/titan2d or https://github.com/demichie/IMEX_SfloW2D)**

Very true, thank-you for highlighting this oversight. We omitted reference to probabilistic simulation, which makes the use of the 2D flow models that do incorporate flow dynamics challenging (but not impossible) because of runtimes and storage sizes. We have reworded our text to recognise this:

Revised text: "Shifting from probabilistically estimating exposure to impact for flows requires advances in two directions. Firstly, there is a need for flow models compatible with probabilistic approaches that predict not only a binary inundation but also some measure of impact intensity metrics (e.g. flow depth, dynamic pressure) whilst requiring ESPs that can realistically be estimated for purposes of hazard assessments."

References

Williams, G.T., Jenkins, S.F., Biass, S., Wibowo, H.E. and Harijoko, A., 2020. Remotely assessing tephra fall building damage and vulnerability: Kelud Volcano, Indonesia. *Journal of Applied Volcanology*, *9*(1), pp.1-18.