

Interactive comment on “Design of parametric risk transfer solutions for volcanic eruptions: an application to Japanese volcanoes” by Delioma Oramas-Dorta et al.

Anonymous Referee #1

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The paper by Oramas-Dorta et al. is quite interesting because of its innovative use of the parametric risk transfer function as applied to the most widespread phenomenon associated with volcanic eruptions – tephra fallout. The paper is innovative in using a numerical model to inform the scale of index based payments, in this case essentially indexed by the VEI from one of six volcanoes in the metropolitan area of Tokyo.

I think the paper will be highly cited because of the great potential for using an index approach to hazard and risk assessments. The paper is quite clearly written, the mathematics clear, and the figures well presented. Although the paper deals with a specific scenario (ash impact on an urban area), it is the most likely scenario to have

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widespread application. Therefore, I feel the paper is acceptable in its current form. I do have some suggestions for the authors, which I think can strengthen the manuscript further.

1. I am surprised that total eruption mass is not found to be a sensitive indicator of loss and does not appear in the parametric trigger design. Obviously, for explosive eruptions there is some correlation between eruption column height and loss, but not necessarily. For example, the Eyjall (Iceland) eruption mentioned in the intro did not have a particularly high plume, yet caused loss (although not for buildings – the focus of this paper). Does the point cloud shown in figure 3 collapse significantly (or is it significantly different) for eruption mass rather than plume height?

2. Similarly, eruption duration has a significant impact on loss and might be a useful part of the parametric trigger design. Unlike earthquakes, volcanic eruptions may have significant duration (years). The eruption duration not only impacts total load (and the ability to remove the load) but also the sectors (N,NE, etc.) likely to be impacted by the eruptions. Some mention of variable duration and its complicated influence on risk is warranted.

3. Plume height is measured remotely by satellite, and so fulfills a requirement of parametric trigger design to be quickly calculated and unbiased, compared with eruption mass. I think you should cite some important literature on this, like:

Prata, A.J. and Grant, I.F., 2001. Retrieval of microphysical and morphological properties of volcanic ash plumes from satellite data: Application to Mt Ruapehu, New Zealand. *Quarterly Journal of the Royal Meteorological Society*, 127(576), pp.2153-2179.

Pardini, F., Burton, M., Arzilli, F., La Spina, G. and Polacci, M., 2018. SO₂ emissions, plume heights and magmatic processes inferred from satellite data: The 2015 Calbuco eruptions. *Journal of Volcanology and Geothermal Research*, 361, pp.12-24.

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Merucci, L., Zakšek, K., Carboni, E. and Corradini, S., 2016. Stereoscopic estimation of volcanic ash cloud-top height from two geostationary satellites. *Remote Sensing*, 8(3), p.206.

4. One of the authors, C. Magill, has an important paper on tephra modeling in the Tokyo region using Tephra2 to forecast loss. It is important to cite that paper because it provides essential groundwork for using Tephra2 to make these models, which is not covered in the current manuscript, whereas the current manuscript goes much farther in terms of illustrating a workflow for designing the parametric trigger.

Magill, C., Mannen, K., Connor, L., Bonadonna, C. and Connor, C., 2015. Simulating a multi-phase tephra fall event: inversion modelling for the 1707 Hoei eruption of Mount Fuji, Japan. *Bulletin of Volcanology*, 77(9), p.81.

5. In addition to VEI, you might mention alternative eruption scales, like magnitude. See:

Pyle, D.M., 2015. Sizes of volcanic eruptions. In *The encyclopedia of volcanoes* (pp. 257-264). Academic Press.

Rougier, J., Sparks, R.S.J., Cashman, K.V. and Brown, S.K., 2018. The global magnitude–frequency relationship for large explosive volcanic eruptions. *Earth and Planetary Science Letters*, 482, pp.621-629.

Just a few detailed comments:

Line 162. Change Kg to kg (lower case). Elsewhere in the paper, some units are capitalized. They should always be lower case. Line 163. Instead of saying vertical wind speed, say variation in wind speed with height in the atmosphere. Around line 293 – what is the relationship of eruption column height with total mass and eruption duration? Around line 510: it seems to me there is a fundamental difference between tephra fallout and these other phenomena (lava flows, pdcs, etc.). Tephra causes variable loading (depending on the eruption magnitude) so it seems more analogous

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to earthquake damage. The other phenomena cause complete destruction to property in their path. So how does this influence the parametric trigger design? It must be binary for these other phenomena? Wrap this discussion back to the equations you present.

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