

Nat. Hazards Earth Syst. Sci. Discuss., author comment AC2  
<https://doi.org/10.5194/nhess-2021-213-AC2>, 2021  
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## Reply on RC2

Warner Marzocchi et al.

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Author comment on "A Unified Probabilistic Framework for Volcanic Hazard and Eruption Forecasting" by Warner Marzocchi et al., Nat. Hazards Earth Syst. Sci. Discuss.,  
<https://doi.org/10.5194/nhess-2021-213-AC2>, 2021

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COMMENT RC2: It is very good to see this exposition of the probabilistic framework for PVHA. However, the testing of this framework is disappointing, because of the low eruption frequency at Campi Flegrei, which is a limitation recognized by the authors. The ideal laboratory for testing alternative PVHA methodologies is a volcano which has sporadic bouts of activity over a decade or more. An example is Montserrat from 1995 onwards. Some attempts have been made to validate probabilistic forecasts for Montserrat against actual eruptive events, but this has not been done in a systematic manner, because these were early days in PVHA, and the resources were limited for updating PVHA regularly.

The paper makes much of the experimental concept of testing model validation, so there should be a convincing example of such validation. The convenience for the authors of Campi Flegrei is of course well appreciated. However, the authors should identify a more active laboratory for adequately testing their PVHA approach.

ANSWER: We thank the reviewer for appreciating the discussion on the probabilistic framework. However, we do not agree with the fact that Campi Flegrei is a less interesting example than Montserrat. In essence, at Campi Flegrei we have a complete PVHA made with different models (Figure 1). This allows us to discuss a coherent way to handle the uncertainties, defining an unambiguous hierarchy of uncertainties. This case can be reproduced easily for many volcanoes with a limited effort.

Hence, the problem of testing is of course very important, but it is not the only reason to consider this probabilistic framework. Similar discussions have been made also in long-term seismic hazard; although the validation of the model is practically very unlikely (due to the long time to get several 50 years time windows of data) there has been a long discussion on how to interpret the outcomes of the logic tree, which is a very popular tool to estimate the epistemic uncertainty (a deeper discussion can be found in Marzocchi et al., 2015; Marzocchi and Jordan, 2017). As regards the Montserrat case, the validation of the model could be hard (but maybe solvable; we were not involved in that experience) for two main reasons: first, it is not clear what the experimental concept is; second, a complete forecast (EEDs), which separate aleatory variability and epistemic uncertainty is not available; third, if the subjective framework has been adopted (this is what we perceived from literature), it does not make sense to validate the model. In the subjective

framework we can only compare the performance of one model with respect to other competing models (we discuss this topic in Marzocchi and Jordan, 2014).

To conclude, with this paper we do not aim at ending the discussion about the importance of the probabilistic framework in PVHA, or saying which one has to be used. But we do aim to raise awareness on the importance to use one of the legitimate probabilistic frameworks and to remain coherent with that.