

Interactive comment on “On the link between Earth tides and volcanic degassing” by Florian Dinger et al.

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Anonymous Reviewer #1, Heading Paragraphs: This is an interesting paper. The manuscript reports a model of a simplified magmatic system response to tidal stresses. The model provides compelling evidences that the effects of periodical signals (i.e., tidal forces) may enhance bubble coalescence in the magma thus explaining periodical changes in volcanic gas emissions. The paper is clear, well written and right to the point. The subject is of general interest and, as far as I am aware, no significant portions of the manuscript have been published elsewhere.

Nolwenn Le Gall, Heading Paragraphs: In this review, the authors present a model quantifying the impact of Earth tides on volcanic gas emissions, by

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enhancing bubble coalescence. This model has the merit of being the first of its kind. The paper is well written and the model clearly exposed, although I have made some comments and minor technical corrections, see below.

We thank the Anonymous Reviewer #1 and Nolwenn Le Gall for highlighting the relevance and in particular the clear style of the manuscript. It was a major intention to keep it that clear in order to provide a well-prepared foundation for the subsequent tackling of some potentially too oversimplified assumptions. We also want to thank for pointing out some minor inaccuracies in the submitted manuscript. We are convinced that we were able to answer their comments comprehensibly and comprehensively either by specifying the marked paragraphs on the manuscript or by respectfully rebutting.

All of our references to pages and lines refer to the new version of the manuscript.

Anonymous Reviewer #1, General Comment: the here proposed model tacitly assumes that 1) tidal stresses do not affect the wall-rock permeability... We indeed ignored any tide-induced variations of the host rock permeability in our model. This has been stated explicitly in the Appendix A (“(3) The host rock is assumed to be gas-tight”, page 13, lines 16-17) and also in the conclusions “(2) incorporating macroscopic tidal mechanisms affecting the host rock explicitly, (3) adding several further microscopic mechanisms such as a tide-induced loosening of bubbles attached to the conduit walls”, page 13, lines 3-5). We admit that an earlier and more to the point mentioning of this simplification is appropriate and thus added some sentences.

Change: We added (1) a variation of the host rock permeability (Bower, 1983; Elkhoury et al., 2006; Manga et al., 2012), on page 2 lines 16-17 and (2) Furthermore, the tide could also cause a variation of the host rock permeability (Bower, 1983; Elkhoury et al., 2006; Manga et al., 2012). This mechanism and its possible interference with the here presented concept is ignored in our model. on page 5, lines 11-13.

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Anonymous Reviewer #1, General comment (continued): ... and 2) tidally induced gas loss from the wall rocks cannot explain the observed periodic variations of the volcanic degassing. There is no evidence/quantitative estimate available that the periodic variations in the volcanic degassing can be explained by wall rock effects alone. In particular, there is no evidence that no other tide-induced mechanisms can act simultaneously. Our manuscript can give rise for a quantitative comparison once such a quantitative model has been established.

Anonymous Reviewer #1, Minor correction: the max. vertical tidal acceleration a_0 reported in table 1 has the dimension of a velocity. Any consequences on the reliability of the model? Just a typing error?

Change: We corrected the typo. No consequence for the numerical model output.

Interactive comment on Solid Earth Discuss., <https://doi.org/10.5194/se-2019-14>, 2019.