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Nonlinear Processes in Geophysics
Discussions

Interactive comment on "Analysis of stochastic model for non-linear volcanic dynamics" *by* D. Alexandrov et al.

C. Michaut

michaut@ipgp.fr

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In this manuscript, the authors expand the model of Iverson et al 2006 which describes the stick-slip motion of a rigid plug of magma along conduit margins in order to investigate the effects due to noises in the friction force in the injection rate of magma. They conclude that, even in the presence of noise, stick-slip motion of the plug can occur and is thus consistent with the occurrence of drumbeat earthquakes at Mount St Helens in particular. The proposed study and approach are interesting and worth publishing. The figures are well chosen. But the manuscript, as is written, is too hard to follow, especially for readers that are not familiar with stochastic approaches and formalism. More physical explanations of the processes that are occurring are necessary and some paragraphs should be rewritten. More discussion on the effects of

noise on the occurrence or not of drumbeat earthquakes should be added as well. All the symbols used in the equations must be described. What could be at the origin of noise in the friction force? Could this be consistent with frictional melting (Kendrick et al, Nature Geoscience 7 2014) for instance ? An interesting conclusion, of value of the volcanological community, could be to describe the set of parameters and amplitude of noise that are the most favorable, and least favorable, for stick-slip motion and drumbeat earthquake to develop. i.e. predict a range of values and amplitude of noise for the model parameters (plug mass, injection rate, friction force and epsilons) for stick slip motion to occur. What would be the direct consequences of a dome collapse? What would be the consequences of strain localization and weakening on the stick-slip / drumbeat periodicity (i.e. F slowly decreasing with time) as well as on its probability to occur? What if the plug mass remains constant with time? Indeed, solidification of magma and erosion seem both too slow to induce changes of the plug mass with time over timescales much larger than the timescale of drumbeat earthquakes. The periods of drumbeat of earthquakes seem to slowly shift with time (Iverson et al, 2006). Could you provide and explanation for this shift with this model? l. 27, p. 1737 dacite (remove p) l. 9, p. 1738 p instead of rho l. 15-20 are hard to follow but essential, p. 1741 p. 1743 l. 10-15 are not understandable. What about the plug mass?

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