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The effect of pulsing of volcanic eruptions on eruption column height

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The correlation between the erupted mass and the height of volcanic eruption columns has been studied for quite some time. However, a recent study found, that the pulsing of an eruption also has an influence on column height and that certain types of pulsing behaviour can create higher eruption columns than non-pulsed eruptions even if the erupted mass is equal or even less. I am looking deeper into this matter, using the numerical model PDAC (Pyroclastic Dispersal Analysis Code). With PDAC I run 2D axisymmetric simulations. I create different forcing-functions (functions that modulate the velocity of pyroclasts and gas exiting the vent) as inputs to the model. So far my results confirm the findings of L. Scharff (2012). I found that subsequent pulses with declining amplitudes can –at certain inter-pulse-times –create higher eruption columns than pulses of the same form and duration where the amplitudes of each pulse are as high as the maximum of the declining pulses. Furthermore I found that the shape of the forcing function also seems to have an influence on the eruption column height. Currently I'm running simulations to compare the pulsed eruptions to eruptions without pulsing (practically one single pulse similar in shape to the other pulses) that have the same erupted mass and maximum-forcing. To find an explanation for the observed behaviour I calculate the vorticity of the velocity field. In the vorticity I expect to find differences in the eruption column dynamics, i.e. the evolution of vortex-rings being favoured in some setups and hindered in others. Dynamics like that have been studied in the context of optimizing transport processes in industrial settings (thrust augmentation) and might possibly be applied to volcanic settings. To better detect structures in the vorticity-field I plan to use image-processing techniques, i.e. wavelet-transformations.

Primary author: GRUNERT, Katharina (Universität Hamburg)

Co-author: SCHARFF, Lea (Institut für Geophysik, CEN, Universität Hamburg)

Presenter: GRUNERT, Katharina (Universität Hamburg)

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