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Evaluating a particle path of an eruption at Volcán de Colima

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During its flight a volcanic particle experiences huge ranges of temperatures and chemical environments. To constrain the chemical and physical processes acting on this particle, we need to know its flight path.

I studied 30 events measured by Doppler radar at Volcán de Colima, Mexico. From these I investigated the particle path of one event on 7th February 2015 at 15.15 UTC using additional wind data, photos and videos. Creating a model, assuming a strong plume and an inclined settling path, I estimated plume heights from the radar data. From wind data I used the wind velocity towards the radar beam and with video data I assume an approximately realistic ascent velocity. The calculation results in up to 3470 m. This maximum height fits quite well to a photo of this event (made by M. Rietze) with a plume height of 3760 m. Comparing these results to Bursik et al. (1992), who defined four particle classes, this model would fit to their second particle class, ranging from 2-10 cm. Those particles fall out at the side of the plume column, so the maximum height value is a hint for the real plume height. Additionally, assuming terminal settling velocity as the downward particle velocity component, I calculated the radius of the particles (i.e. "impact law"of Dellino et al., 2005). Assuming a drag coefficient of Cd = 1.2 (calculated out of a table from Dioguardi and Mele, 2015) gives particle radii of up to 1.6 cm, which is of the same magnitude as the particles in class 2.

This shows the possibility of inferring a particle path from radar data. However, there are more studies needed, because out of 30 events, I have only one event with visual verification (one photo).

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