

## **New Particle Formation (NPF) within the volcanic plume of Piton de la Fournaise at Maïdo observatory (21.1° S 55.4° E), on La Réunion Island.**

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Volcanic emissions can have a significant effect on the environment, and may impact climate through the injection of gases and aerosols in the upper troposphere where they have a long residence time and an impact on clouds formation [Makkonen et al., 2012]. The Piton de La Fournaise volcano on La Réunion Island erupted four times in 2015 [Peltier et al., 2016] and volcanic particles were ejected in the atmosphere both as primary particles rapidly deposited due to their large size and secondary particles mainly derived from oxidation of sulphur dioxide. In this study, we focus on this secondary process of forming new aerosol particles (NPF). Sulphuric acid (H<sub>2</sub>SO<sub>4</sub>), resulting from SO<sub>2</sub> oxidation in the presence of light, is known to be the major precursor to nucleation events [Kulmala et al., 2004 and Kerminen et al., 2010]. During the April 2007 eruption of Piton de la Fournaise, Tulet and Villeneuve [2010] estimated by OMI and CALIOP space sensors analysis a total SO<sub>2</sub> release of 230 kt, among of which 60 kt that have been transformed into H<sub>2</sub>SO<sub>4</sub> supposing NPF processes. However, the nucleation phenomenon has rarely been directly observed in volcanic environments [Kulmala et al., 2004] except for Mauna Loa volcano on Hawaii [Weber et al., 1995] and for Eyjafjallajökull plume caught at the Puy de Dôme station [Boulon et al., 2011].

Within the STRAP project (Synergie Trans-disciplinaire pour Répondre aux Aléas de Panache Volcanique), a multidisciplinary tracking of a volcanic gas and aerosol plume that has been conducted by Tulet et al. [2016] through a strong collaboration between volcanologists and meteorologists. Part of the measurements were performed at Maïdo observatory (21.1° S 55.4° E) which is located at 40 km from the volcano but which has been reached several times by the volcanic plume, each time accompanied by a NPF event. A statistical analysis of the influence of the plume presence on the NPF frequency, intensity and new particles growth rates is performed over a one year observation period. Then, focusing on the NPF events and according to Kuang et al. [2007], we developed a parameterization of the nucleation rate as a function of a proxy of sulphuric acid within the volcanic plume which can be used in meteorological meso-scale models.

Keywords:

aerosols, nucleation, volcanic plume, parameterization