Nucleation of nanoparticles in volcanic passive plumes and impact on clouds (MONUVO project)

Post description: Post-doc, 1 year, starting expected in November-December 2020,
@ Laboratoire de Météorologie Physique (LaMP),
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Project objectives: The aim of the project is to apprehend how important the formation of ultrafine particles from volcanic plumes is for cloud properties and climate relevant parameters in general under diverse atmospheric conditions.

Project context and description: Atmospheric particles are important components for climate and air quality issues. Their atmospheric concentration is largely determined by their sources, which are dominated, in term of number concentrations, by the process of new particle formation (NPF) from the gas phase (*i.e.* nucleation). Volcanic emissions are one of the major natural sources of particles in the atmosphere and the particles may have a significant impact on cloud properties, through their abilities to form cloud droplets.

NPF has been observed worldwide in a broad variety of environments, but some specific conditions, such as those encountered in volcanic plumes remain poorly documented in the literature. Yet, these conditions promote the occurrence of the process, as evidenced in the volcanic plume of the Eyjafjallajokull (*Boulon et al. 2011*), of the Etna and Stromboli (*Sayhoun et al. 2019*) and of the Piton de la Fournaise (La Réunion Island, France) (*Rose at al., 2019.*).

Sulfuric acid (SA) is commonly accepted as one of the main precursors for atmospheric NPF, and its role is even more important in volcanic plume conditions, as recently evidenced by the airborne measurements conducted in the passive volcanic plumes of Etna and Stromboli (Italy) (*Sahyoun et al., 2019*). Indeed, the flights performed in the Etna and Stromboli plumes have allowed direct measurement of SA in such conditions for the first time, and have enabled to evaluate the relation between the cluster formation rate and SA concentration.

Following these observations, the MONUVO project aims to further quantify the formation of new particles in a volcanic plume and assess the effects of the process at a regional scale. For that purpose, the new parameterisation of nucleation derived by *Sahyoun et al. (2019)* has been recently introduced in the WRF-Chem model, further optimized for the description of NPF. Using Etna cases, the main objective of this study will be to evaluate the effect of the new parameterisation on the cluster formation rate and particle number concentration in various size ranges, including CCN (i.e. climate-relevant) sizes. Then, particle number concentration fields will be updated considering the new NPF parameterization in order to initialize a cloud mesoscale model and assess the impact of such emissions on cloud formation and properties.

Deliverables: 3D-meso-scale model upgraded with new sources, updated particle number concentration fields.

Candidate profile: the applicant should have a background in atmospheric sciences (physics and/or chemistry), a strong expertise in modelling will be valuable, especially WRF-Chem model.

Applications: Please email your application by **July 31, 2020** to the contact persons below. This application must include resume, cover letter, list of publications and two contacts for further references.

Contact persons:

Céline Planche: Celine.PLANCHE@uca.fr
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