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Impact of volcanic halogens on the ozone layer and climate, a look to the past to highlight the present

Hélène Balcone-Boissard[1], **Thiébaut D'Augustin**[1], Georges Boudon[2], Slimane Bekki[3], Magali Bonifacie[2], Omar Boudouma[1], Anne-Sophie Bouvier[4], Guillaume Carazzo[2], Etienne Deloule[5], Michel Fialin[2], and Nicolas Rividi[1]

[1]Sorbonne Université, ISTeP, Equipe PGM2, Paris, France (helene.balcone_boissard@upmc.fr)
[2]Institut de Physique du Globe de Paris - Université de Paris
[3]Sorbonne Université - LATMOS
[4]Institut des Sciences de la Terre de Lausanne (UNIL)
[5]CRPG, UMR 7358 CNRS-Université de Lorraine

Explosive eruptions of the Plinian type inject large amounts of particles (pumice, ash, aerosols) and volatile species into the atmosphere. They result from the rapid discharge of a magma chamber and involve large volumes of magma (from a km^3 to hundreds of km^3). Such eruptions correspond to a rapid ascent of magma in the conduit driven by the exsolution of volatile species. If the magma supply is continuous, this jet produces a convective eruptive column that can reach tens of km in height and transports gas and particles (pumice, ash, aerosols) directly into the stratosphere. Depending on the latitude of the volcano, the volume of implied magma, the height of the eruptive plume and the composition of the released gaseous and particulate mixture, these events can strongly affect the environment at the local or even at a global scale. Almost all studies on global impacts of volcanic eruptions have largely focused on the sulfur component. Volcanoes are also responsible for the emission of halogens which have a crucial impact on the ozone layer and therefore the climate.

The objective of our project is to revisit the issue of the impact of volcanism on the atmosphere and climate by considering not only the sulfur component but also the halogen component. We will provide field work-based constraints on the strength of halogen (Cl and Br) emissions and on degassing processes for key eruptions, we will characterise the dynamics of volcanic plumes, notably the vertical distribution of emissions and we will explore and quantify the respective impacts of sulfur and halogen emissions on the ozone layer and climate.

Here we will shed light on the methodology that will combine field campaign, laboratory analysis of collected samples and a hierarchy of modelling tools to study. We use an approach combining field studies, petrological characterization, geochemical measurements including isotopic data, estimation of the volume of involved magma and the height of injection of gases and particles by modelling the eruptive plume dynamic and numerical simulation of the impacts at the plume scale

and at the global scale. The first halogen budget will also be presented.