**ESTABLISHMENT :**

**Laboratory(ies) of affiliation :**

**Scientific field, Speciality:**

**DS3 | Earth and Universe Sciences**

**DS3 | Earth, fluid envelopes**

**Thesis director: GOLOUB, Philippe, Professeur Univ. Lille (LOA),** **philippe.goloub@univ-lille.fr**

**Co-director: BOICHU, Marie, CR CNRS/Univ. Lille (LOA),** **marie.boichu@univ-lille.fr** **(aims at validating HDR over the course of the PhD project)**

**Co-supervisor (non HDR): --**

**Affiliate programme(s):** CaPPA LabEx, CPER ECRIN, Horizon Europe FAIR EASE

**Planned (co)-funding** *(mention: in progress/obtained)* **:** applications submitted to 1) Hauts –de-France Region (in progress) and 2) CAPPA LabEx (obtained)

**Title of the thesis : The size of aerosols from major volcanic eruptions or megafires : a key parameter to evaluate their impact on climate**

THESIS SUBJECT (about 1/2 page)

Stratospheric aerosols play a fundamental role in the atmosphere as they are capable of perturbing atmospheric chemistry and Earth’s climate. However, crucial information about the size of these aerosols, a critical parameter in climate models, is generally missing (Mann et al. 2015, Marshall et al. 2022). To address such gap, a novel method of analysis of ground-based photometric remote sensing measurements from the AERONET (AErosol RObotic NETwork) network has been recently developed ([Boichu et al. 2023](https://doi.org/10.1029/2023JD039010)). Applied in synergy with various satellite observations, this approach has provided, with improved temporal and spatial resolutions, the size distribution of stratospheric sulfate aerosols from the record-breaking 2022 eruption of Hunga Tonga-Hunga Ha'apai in the satellite era.

Benefiting from these novel developments, the PhD project aims at retrospectively investigating the multi-decade archive of observations from the worldwide AERONET network (1993-today) to analyse extreme atmospheric events with an impact on climate, such as major volcanic eruptions or megafires.

The interactive use of the AERIS [VOLCPLUME web portal](https://volcplume.aeris-data.fr/) ([Boichu & Mathurin, 2022](https://doi.org/10.25326/362)) will support the development of a synergistic analysis of satellite and ground-based observations to track the dispersion of aerosols from their emission source. Another part of the PhD project will evaluate the advantage to use the information from polarized photometric channels to better characterise the properties of sulfate aerosols, which represent key components to understand the impact of volcanism on climate and air quality. The joint analysis of photometric data together with Raman multi-wavelength LIDAR observations from the ATOLL (ATmospheric Observation at liLLe) instrumental platform, will bring supplementary information on the vertical distribution and microphysical properties of volcanic aerosol events observed over Lille.

Eventually, modeling studies, in collaboration with METEOFRANCE, will allow for evaluating the sensitivity of climate model simulations to the size of stratospheric aerosols.

**Key words:** Aerosols, volcanic eruptions, megafires, climate, size distribution, AERONET, photometry, satellite, VOLCPLUME web portal, LIDAR, climate model

**References:**

Boichu, M., Grandin, R., Blarel, L., Torres, B., Derimian, Y., Goloub, P., Brogniez, C., Chiapello, I., Dubovik, O., Mathurin, T., Pascal, N., Patou, M., & Riedi, J. (2023), “Growth and global persistence of stratospheric sulfate aerosols from the 2022 Hunga Tonga-Hunga Ha’apai volcanic eruption”. *Journal of Geophysical Research : Atmospheres*, 128, e2023JD039010, <https://doi.org/10.1029/2023JD039010>

Boichu, M. and Mathurin, T. (2022). VOLCPLUME, an interactive web portal for the multiscale analysis of volcanic plume physico-chemical properties [Interactive Web based Ressource], AERIS, <https://doi.org/10.25326/362>, Portal access: [https://volcplume.aeris-data.fr](https://volcplume.aeris-data.fr/), Homepage: <https://www.icare.univ-lille.fr/volcplume/>

Mann, G., Dhomse, S., Deshler, T., Timmreck, C., Schmidt, A., Neely, R., & Thomason, L. (2015). Evolving particle size is the key to improved volcanic forcings. *Past Global Changes Magazine*, *23*(2), 52–53. https://doi.org/10.22498/pages.23.2.52

Marshall, L.R., Maters, E.C., Schmidt, A., Timmreck, C., Robock, A., Toohey, M. (2022), “Volcanic effects on climate: recent advances and future avenues”. *Bulletin of Volcanology*. 84(5):54. doi: [10.1007/s00445-022-01559-3](http://dx.doi.org/10.1007/s00445-022-01559-3)

**Expected date of recruitment : October 2024**

**Contact (e-mail address) :** **marie.boichu@univ-lille.fr**

**Additional remarks/comments:**