Proposition sujet de stage M2 – 2019

Institutes: IGE (Institut des Géosciences de l’Environnement, UMR5001, Grenoble) / LSCE (Laboratoire des Sciences du Climat et de l’Environnement, UMR8212, Gif-sur-Yvette)

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How and where? Based at IGE, Grenoble, this internship will be supervised both by IGE and LSCE laboratories.

Title: Investigation of Radon measurements as a tracer of atmospheric mercury sources using Amsterdam Island records (Indian Ocean)

Key words: Radon, Mercury, Chemistry, Environment, Meteorology, Modeling

Subject:
Since the signature of the Minamata convention on Mercury in 2017, national regulation coordinated at an international level will come into force in order to limit anthropogenic emissions and therefore protect the human health and ecosystem from this highly toxic pollutant. One needs to evaluate the efficiency of national measures, and long-term monitoring of atmospheric mercury (Hg) is an important tool to address the changes over time of emission sources, transport, and deposition patterns.

The Global Mercury Observation System (GMOS) project was funded by the European Commission (http://www.gmos.eu) and started in November 2010 with the overall goal to develop a coordinated global observing system to monitor Hg on a global scale, including a large network of ground-based monitoring stations. To date, more than 40 ground-based monitoring sites constitute the global network covering many regions where little to no observational data were available before GMOS (Sprovieri et al., 2016). All GMOS work is now continued in the framework of the international framework of GOS4M (Global Observation System for Mercury - http://www.gos4m.org).

Although essential to fully understand the cycling of mercury at the global scale, mercury species records in the Southern Hemisphere were really scarce before GMOS. In this context, an atmospheric mercury monitoring station has been set up on Amsterdam Island (37°48’S, 77°34’E) in the remote southern Indian Ocean. Since 2012, we continuously measured gaseous mercury species with a 15 min frequency. Angot et al. (2014) discussed the first two years of this record, using principally wind sector analysis and air mass back trajectories. They also include in their analysis the unique continuous record of Radon 222 and 220 (thoron) (Polian et al., 1986; Kritz et al., 1990). Radon 222 and 220 (thoron) activities can be used to distinguish local soil outgassing from remote continental source. Combined with meteorological data, the change of activities are then powerful tool to classify air mass origin for the atmospheric gaseous mercury record. Rapid and sharp variations of Radon 222 activity, referred to as “radonic storms” (Lambert et al., 1970) and ascribed to strong continental air mass advection, are then observed at Amsterdam Island. The occurrence of radonic storms was estimated to be about 4 % in 2012 and 7 % in 2013. Considering the works realized in 2014, the goal of this internship is to deeper explore the relationships between the collected gaseous elemental mercury and observed radon (222Rn / 220Rn) activities in the entire data set. In particular, we will study the specific and coupled trend of these compounds, the frequency and intensity of radonic storm occurrence and their potential link with the gaseous elemental mercury cycle. Local meteorology data as well as backtrajectories simulation (HYSPLIT and/or FLEXPART model) will be also used.

Required skills: Knowledge of atmospheric sciences is required. Data processing (R, Python, Matlab), numerical model, motivation and creativity are expected skills.