

## International Master 2 Atmospheric Sciences: Research Training 2021-2022

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**Collaborator:**

Eventually,

**CaPPA Work Package:** WP3. Aerosol observations: instrumentation, intensive field campaigns, monitoring from ground-based networks and satellites

### Analytical method development for the measurement of volatile halocarbons

Recent changes in emission regulations for the shipping industry concerning notably SO<sub>x</sub> and NO<sub>x</sub>, have led to a large deployment of exhaust gas cleaning technologies, also called scrubbers. Shipping associations estimate that at the end of 2021 around 30-40% of large vessels will be equipped with these technologies, on new vessels as well as retrofitted on existing vessels. Open loop scrubbers use pumped seawater as solvent, with which the exhaust gas will be mixed at the exit of the engine to remove pollutants. Due to the presence of halides in seawater (mainly chloride, bromide and iodide) and the high temperature of and high concentrations of organic material in the exhaust gas, formation of halocarbons can occur. These halocarbons, emitted in the gas phase, are of particular concern as they can have a strong impact on the atmospheric composition and climate. Short lived halocarbons can photolyze to form atomic halogens, that in turn can start a photocatalytic ozone destruction cycle. Halogen oxides, particularly iodine oxides, are also thought to play an important role in particle formation in the marine atmosphere. Hence, the assessment of impacting species such as halocarbons from these widely employed technologies seems important. However, the measurement of these species is quite challenging, due to their short lifetime and high reactivity, requiring sensitive mass spectrometry techniques. In order to assess the potential release of halocarbons in shipping exhausts using scrubbers, this master project proposes (1) to perform a literature study allowing to select halocarbons susceptible to form at representative pressures and temperatures for working conditions of scrubbers and (2) to develop and validate an analytical method to analyze the selected halocarbons using GC-MS technology.

**Key words:** Halocarbons, shipping emissions, GC-MS