

Ecole Doctorale des Sciences Fondamentales



Title of the thesis: Origin and fate of gaseous organic carbon in source and transport regions

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Summary :

The atmospheric transport of Volatile Organic Compounds (VOCs) contributes to the degradation of air quality in receptor zones, which are sometimes far from pollution sources. The impact of this transport will depend both on the nature and intensity of primary emissions, but also on the physico-chemical processes. While VOC emissions are well known, large uncertainties are associated with the value of these emissions, their temporal variability and their chemical speciation. These emissions uncertainties are reflected in the processes that transform these pollutants. These chemical transformations lead to the formation of a multitude of secondary compounds but also to the formation of secondary organic aerosol (SOA), a radiative forcing agent, for which the effects on health and climate are still uncertain. However, the impact of these secondary species is difficult to quantify because our knowledge about their sources, their composition and their evolution within the plume remains fragmented.

The objective of the thesis will be to better characterize the sources and fate of gaseous organic carbon (GOC), with the Mediterranean basin and the tropics (Africa) as the main target regions. The work will be based on a cross-analysis of the data collected in the framework of international programs like ChArMeX/TRANSEMED and DACCIWA. Despite regional specificities, these two areas have in common the coexistence of anthropogenic and biogenic emissions associated with intense solar radiation, favoring the presence of GOC and the development of an active photochemistry.

The thesis work will deal in particular with the in-situ observations collected on board the French research aircraft, the ATR-42, during the ChArMeX (2013/2014) and DACCIWA (2016) campaigns, supplemented by surface observations in the vicinity of sources (TRANSEMED). These observations will be those derived from the VOC



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airborne mass spectrometer (PTRMS), combined with other measurements of trace gases (ie, ozone, CO, NO_x, formaldehyde), particulate matter, radiation and meteorological parameters. The thesis work will combine analyzes of the samples and statistical analysis of the data. The issue of emissions and fate of GOC will be approached with regards to the diversity of environmental conditions (ie, continental and marine boundary layer, free troposphere, anthropogenic and biogenic emission zones) and regional characteristics. Links with chemistry-transport modeling teams will also be promoted.

References :

Programme DACCWA : <http://www.dacciwa.eu/projects/atmospheric-chemistry>

Programme ChArMEx : <https://charmex.lsce.ipsl.fr/>

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