Chemical speciation and source apportionment of Non-Methane Volatile Organic Compounds (NMVOCs) in a Middle Eastern country

Therese Salameh (1,2,3), Stéphane Sauvage (1,2), Charbel Afif (3), Agnès Borbon (4), Nadine Locoge (1,2)

(1) Université Lille Nord de France F-59000, Lille France , (2) Mines Douai, Sciences de l'Atmosphère et Génie de l'Environnement (SAGE), F-59508 Douai Cedex, France , (3) Centre d'Analyses et de Recherche, Faculty of Sciences, Saint Joseph University, Beirut, Lebanon, (4) Laboratoire Interuniversitaire des Systèmes Atmosphériques (LISA); IPSL, CNRS, UMR 7583; University of Paris Est Créteil (UPEC) and Paris Diderot (UPD), Créteil, France

NMVOCs, emitted from various sources, are of particular interest since they contribute to the formation of tropospheric ozone, PAN and secondary organic aerosols resulting in negative impacts on human health, climate and on the environment. To identify abatement measures, a profound knowledge of emission sources and their composition is a prerequisite. Air pollution in the Middle East region remains difficult to assess and understand because of a lack of ground-based measurements and the limited information on NMVOC chemical speciation and source apportionment.

Based on a large database of NMVOC observations obtained in Beirut, the capital of Lebanon (a developing country in the Middle East region, located in Western Asia on the eastern shore of the Mediterranean Sea), the overall objective of this work is to apportion the sources of NMVOCs encountered in Lebanon. First, source profiles were determined with field measurements close to the main potential emitters namely the road transport, gasoline vapour, power generation and solvent uses. The results obtained are compared to other studies held in other regions and are used to assess the emission inventory developed for Lebanon. Secondly, two intensive field campaigns were held in a receptor site in Beirut during summer 2011 and winter 2012 in order to obtain a large time resolved dataset. The PMF analysis of this dataset was applied to apportion anthropogenic sources in this area. In both seasons, combustion (road transport and power generation) and gasoline evaporation, especially in winter, were the main sources contributing to the NMVOCs in Beirut.

The results will support model implementation especially by completing the emission inventory established for the year 2010 by Waked et al. 2012 according to the EEA/EMEP guidelines because of the lack of Lebanon-specific emission factor.