



Assessing the contribution of anthropogenic and natural sources of particulate and gaseous air pollutants over the Mediterranean basin within the ChArMEx project

Stéphane Sauvage (1), Agnès Borbon (2), Valérie Gros (3), Charbel Afif (4), Claire Delon (5), Fatma Ozturk (6), Solene Turquety (7), Karine Sartelet (8), Vincent Michoud (9), Nicolas Marchand (10), Jean Sciare (11), Nikos Mihalopoulos (12), Karine Sellegri (2), Antoine Waked (1), Thérèse Salameh (1), François Dulac (3), and the joined author list

(1) IMT Lille-douai, S.A.G.E., Douai, France, (2) Laboratoire de Météorologie Physique, LaMP, OPGC, Clermont-Ferrand, France, (3) Laboratoire des Sciences du Climat et de l'Environnement, LSCE, CEA-CNRS-UVSQ, IPSL, Univ. Paris-Saclay, Gif-sur-Yvette, France, (4) Centre D'Analyses et de Recherche, Faculty of Science, University Saint-Joseph, Beirut, Lebanon, (5) Laboratoire d'Aérodynamique, LA, OMP, France, (6) Environmental Engineering Department, Faculty of Engineering and Architecture, Abant Izzet Baysal University, Bolu, Turkey, (7) Laboratoire de Météorologie Dynamique, UMR CNRS 8539, Université Pierre et Marie Curie – Paris 6, ENPC, Ecole Polytechnique, Palaiseau, France, (8) Centre d'Enseignement et de Recherche en Environnement, CEREA, Marne la Vallée, France, (9) Laboratoire Interuniversitaire des Systèmes Atmosphériques, LISA, Universités Paris Est et Denis Diderot Paris 7, CNRS, Créteil, France, (10) Laboratoire Chimie Environnement, LCE, Marseille, France, (11) The Cyprus Institute, Nicosia, Cyprus, (12) National Observatory of Athens, Institute for Environmental Research and Sustainable Development, 15236 Palea Penteli, Greece

The Mediterranean basin is the recipient of anthropogenic emissions from Europe and densely populated coastal urban areas combined with natural emissions from the surrounding vegetation, the sea, and African and Middle East deserts. Accurate emission inventories of gaseous and particulate pollutants are among the prerequisite factors to study atmospheric pollution and climate change in the region. This is one of the main scientific objectives of the MISTRALS/ChArMEx project, and the topic of one of its work package, which aims at better characterizing and quantifying sources of air pollutants that affect the Mediterranean region. The proposed presentation will give an overview of the main results obtained within this ChArMEx work-package.

A first (bottom-up) approach consisted in updating and developing spatially resolved emission inventories (EC-CAD/ChArMEx; http://eccad.sedoo.fr/eccad_extract_interface/JSF/page_charmex.jsf) over the Mediterranean region with key emissions from agriculture, forest biomass burning, soil, aviation, shipping, volcanoes, sea surface, desert dust, and vegetation. In addition, a series of experimental studies have been performed to improve our knowledge of specific sources of major importance like biofuel combustion, biogenic emissions, and marine emissions to name a few.

Then, as part of the TRANSEMED initiative supported by the MISTRALS/ENVIMED program, a source-receptor methodology was developed specifically for emission inventory evaluation in Mediterranean urban environments. The approach consists in combining existing and newly collected in-situ observations with complementary source-receptor approaches over large urban areas such as Beirut (Lebanon), Istanbul (Turkey), more recently, Athens (Greece) and, in the near future, Cairo (Egypt) and Marseilles (France). First results obtained for Beirut pointed out high uncertainties associated to large-scale emission inventories and, to a lesser extent, highly resolved local emissions inventory when comparing to observations, leading to uncertainties in air quality (O_3 and $PM_{2.5}$ concentrations).

Finally, sources impacting the Mediterranean basin could be apportioned at regional scale. Two field campaigns were conducted for that purpose in the western and eastern basins; namely in Corsica (2013) and in Cyprus (2015) in the framework of ChArMEx. Very detailed atmospheric database (<http://mistrals.sedoo.fr/ChArMEx/>) have been built from observations from these two regional background sites and exploited to address the temporal and spatial variability of various sources over the Mediterranean region.