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Gaseous organic pollution in Istanbul megacity: composition and source apportionment during the TRANSEMED/ChArMEx experiment

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Air pollution is a significant threat to human health, air quality, climate change and environment. Some areas are more affected by air pollution and climate change than others, which is the case of the East Mediterranean Basin (EMB). This region undergoes an increased urbanization and intense solar radiation which favor intense anthropogenic emissions and photochemistry respectively. Future decadal projections point to the EMB as a possible hot spot of air quality and predict a continual and gradual warming in the region, much stronger than other regions in the context of global climate change (Lelieveld et al. 2009, 2012, and 2014). Therefore, the characterization and the quantification of present and future emissions in the EMB is crucial for the understanding and management of atmospheric pollution and climate change at local and regional scales. This is the objective of the TRANSEMED/ChArMEx initiative with Beirut (Lebanon – 2011/2012), Istanbul (Turkey- 2014), Athens (Greece 2015) and Cairo (Egypt - 2018) as target urban areas.
This contribution presents the composition and source apportionment of a large set of VOCs in Istanbul megacity by the use of the Positive Matrix Factorization model (EPA/PMF5,0). 23 Primary and secondary anthropogenic and biogenic species were continuously collected at an urban site in Istanbul in September 2014 and close to major emission sources. Instrumental set up includes an on-line GC-FID, a PTRMS, and off-line sorbent tubes.
The average atmospheric composition of anthropogenic VOCs is similar to the ones of European megacities like Paris and London. However, VOC concentrations show a great variability with maxima usually exceeding 10 ppb. Four factors have been identified by the PMF by combining data: a factor related to the leakage of butanes (8.9 %), a terpenic factor (17.7 %), a factor with a strong signature of C5-C6 alkanes and aromatics (21.6 %), and a last factor characterized by mixed diurnal emissions and composed of almost all the species (51.8 %). By only working on high temporally resolved VOC data from the PTRMS, isoprene and its biogenic oxidation products have been successfully isolated through an additional factor. These results are useful observational constraints for the evaluation of local emission inventories.