A modeling perspective of the ChArMEx intensive campaign: organic aerosol formation

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During the summers of 2013 and 2014, two three-week intensive campaigns took place over the western Mediterranean in order to investigate the origins of photo-oxidants as well as the sources and processes of formation of organic aerosols in this region. Within the frame of the MISTRAL/ChArMEx program, an extensive number of chemical compounds were investigated by means of ground-based and also airborne measurements.

The objective of this paper is to investigate the sources of organic aerosols in the western Mediterranean basin. There can be a multitude of sources (continental vs. local, anthropogenic vs. biogenic …) and they have not yet been quantified accurately neither by measurements nor model simulations. Modelling of the organic aerosols is still uncertain and needs to be improved. The large observational data set obtained during the ChArMEx intensive campaign for the period of July to August 2013 presents an opportunity to evaluate new secondary aerosol schemes within the CHIMERE chemistry-transport model. To verify the robustness of the simulations, simulation-observation comparisons were performed and also the representativeness of the simulations was investigated where the ground-based measurements were performed (Ersa, Cape Corsica).

The model has been configured in a way to fit the specificities of this unique region. The largest domain covers the entire Europe as well as the northern Africa with a low resolution (30 km), nested domains go down to a resolution of 1 km to resolve representativeness issues due to the complex orography of Cape Corsica. Multiple configurations of recent organic aerosol schemes based on the Volatility Basis Set (VBS) were implemented into CHIMERE .In order to evaluate the consistency of each configuration, the results are compared to the base simulations and a large pool of observational data (organic concentration in PM1, oxidation state, modern versus fossil carbon measurements, AirBase stations, EMEP stations …). This comparison shows that fragmentation processes and the formation of non-volatile organic aerosol are two critical factors to be included in the simulation of organic aerosols. Also, the simulation-observation comparisons show a good agreement between the concentration of organic aerosols, the oxidation stages (PMF measurements) and also the distribution of fossil/non-fossil sources for the scheme containing the aforementioned processes in the western Mediterranean area. In figure 1, a 2D image of organic aerosols concentrations in the western Mediterranean basin is shown for this scheme (Shrivastava et al., 2015).

Systematic budget simulations will be presented to determine the origin of organic aerosol over the western Mediterranean basin. The uncertainty of these simulations will be assessed from comparing results from different aerosol schemes which best fit with the available measurements.

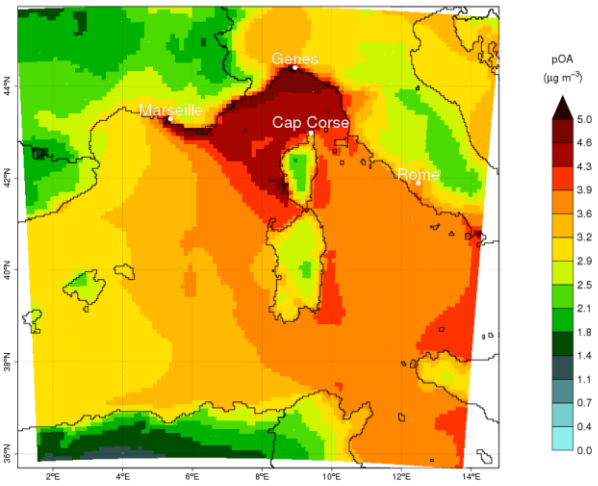

Figure 1 Surface organic aerosol concentration in the western Mediterranean basin during July-August 2013 simulated by the CHIMERE model.

Shrivastava, M., Easter, R., Liu, X., Zelenyuk, A., Singh B., Zhang, K., Ma, P., Chand, D., Ghan, S. (2015) *Global transformation and fate of SOA: Implications of low-volatility SOA and gas-phase fragmentation reactions*, Journal of Geographical Research: Atmospheres.