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A modeling perspective of the ChArMEx intensive campaign: origin of photo-oxidant and 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.
In this paper, a modeling perspective of the 2013 campaign is given, using the CHIMERE chemistry-transport model, dealing with two aspects: 1) representativeness of the simulations with respect to the complex orography of Cape Corsica, 2) evaluation of secondary organic aerosol simulations in the western Mediterranean region with different model configurations using a variety of experimental data.
The model has been configured in a way to fit the specificities of this unique region. The base simulations are performed in a domain covering the entire Europe as well as the northern Africa with a low resolution (30 km). In order to take into account the orographic complexity of the area where the ground-based measurements were performed (Ersa, Cape Corsica), nested simulations with a high resolution (1km horizontal resolution) focused on this site were performed with the goal of increasing the representativeness of the simulations. Still, this resolution does not allow to correctly represent the altitude of the Cape Corsica measurement site (533 m asl). To solve this problem, a large number of grid cells in the vicinity of the measurements site, all having different altitudes, were used to find the extrapolated concentration of an indicative list of species towards the exact altitude of the aforementioned site and to estimate an orographic representativeness error, which was shown to be less important for organic aerosols among said species.
Alongside the base simulations, other series of simulations using multiple configurations of the Volatility Basis Set (VBS) were performed to increase the accuracy of the simulation of organic aerosols in the CHIMERE model for the western Mediterranean region. 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 . . .). A preliminary conclusion for this ongoing study is that the fragmentation processes and the formation of non-volatile organic aerosol are two critical factors to be included in the simulation of organic aerosols.