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Climate sensitivity of different organic aerosol schemes over the Mediterranean basin

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The Mediterranean basin is among one of the areas that can be most sensitive to climate change (Giorgi et al, 2006). This fact, along with the population density around this basin, the high burden in aerosol concentration that the basin experiences throughout the year and the increasing projections for shipping emissions in the future make it an important area to explore. While the organic aerosol can have an important impact on the local and also the regional air quality presently and in the future, the simulation of this aerosol in the western part of the Mediterranean basin is a subject that has not been studied thoroughly for present conditions and has been studied even less for the future.

The present work consists of two phases. The first phase explores existing climatic runs performed with CHIMERE chemistry transport model with climate inputs corresponding to RCP2.6, RCP4.5 and RCP8.5 during the French PRIMEQUAL Salut'air project; with a focus on the Mediterranean basin and the changes that these scenarios induce in the concentration of particulate matter and especially organic aerosols. The effects of boundary conditions, and anthropogenic emission changes are assessed. Major driving climate variables affecting organic and fine aerosol levels over the basin are identified.

During the second phase, sensitivity runs of the RCP4.5 scenario are performed, in which three different aerosol models are used, including a VBS scheme with and without biogenic aging (Robinson et al. 2007, Lane et al. 2008), and a modified VBS scheme containing fragmentation and formation of non-volatile organic aerosols (Shrivastava et al., 2013). These schemes have been previously compared to measurements obtained during the MISTRAL / CHARMEX summer 2013 campaign (Cholakian, 2017, in preparation). 10 years of historic and years 10 future runs have been performed, and a specific method allows chosing years maximizing the temperature and organic aerosol differences between past and future runs. This allows assessing the climate sensitivity of different organic aerosol schemes. This is a new and complex topic, as organic aerosol formation depends on several parameters (temperature playing on biogenic VOC emissions and phase partition of semi-volatile compounds, winds impacting advection, and precipitation impacting aerosol removal) and their representation in a model.