Influence of isoprene emission on secondary organic aerosols near a source region: A case study during the ChArMEx campaign simulated with the meso-scale Meso-NH model

M. Leriche[1], C. Delon[1], P. Tulet[2], C. Jambert[1], P. Durand[1], A. Borbon[3], E. Freney[3], A. Colomb[3], K. Sellegri[3], C. Gaimoz[4], A. Feron[4], S. Triquet[4]

[1]Laboratoire d'Aérologie, CNRS, Université Paul Sabatier, Toulouse, 31400, France
[2]Laboratoire de l'Atmosphère et des Cyclones, CNRS, Météo-France, Université de la Réunion, Saint-Denis, 97744, France
[3]Laboratoire de Météorologie Physique, CNRS, Université Blaise Pascal, Clermont-Ferrand, 63178, France
[4]Laboratoire Interuniversitaire des Systèmes Atmosphériques, IPSL, CNRS, Universités Paris Est et Paris Diderot, Créteil, 94010, France
Keywords: ChArMEx, biogenic emissions, secondary organic aerosols, meso-scale modelling.
Presenting author email: maud.leriche@aero.obs-mip.fr

Biogenic volatile organic compounds (BVOC) are the main emitted VOC representing about 90% of the total emitted VOC at the global scale (Guenther *et al*, 2006). These species are known to participate to the formation of secondary pollutants such as ozone and secondary organic aerosols (SOA). BVOC are oxidized in the atmosphere leading to the formation of less volatile and more oxygenated species, which are precursors of SOA. Among BVOC, monoterpene species are well known for efficiently leading to the formation of SOA, but also isoprene, the main emitted BVOC, which is strongly suspected to significantly contribute to the formation of SOA (Kroll *et al*, 2006).

During the ChArMEx airborne campaign in July 2014, several flights were dedicated to the study of the influence of BVOC emissions on the formation of secondary pollutants. Aerosol size distributions were characterized on board of the ATR42 using a set of sizing instruments (SMPS, UHSHA, OPC) while the chemical composition of the aerosol phase was analysed using an airborne C-ToF AMS, and the chemical composition of the gas-phase analysed using a PTRMS. These flights were operated over a white oak forest near the obervatoire de Haute Provence (OHP), which emits quasi-exclusively isoprene. Among biogenic flights, we selected the flight operated the 3 July 2014, during which meteorological conditions were very favourable to the emission of isoprene, with high temperatures and solar radiation and low wind speed.

This case study was simulated with the meso-scale Meso-NH model, coupling online meteorology and chemistry (Tulet *et al*, 2003). The Meso-NH model includes an aerosol module simulating the evolution and the formation of aerosol particles from gaseous precursors. The chemical mechanism included in Meso-NH was designed to represent the formation of secondary pollutants in the troposphere including the semi-volatile organic precursors of SOA. The performed simulation includes two nested domains with the larger one at 10 km horizontal resolution covering Europe and the smallest one at 2.5 km resolution covering the South-East of France and including the area covered by the flight of interest.

A first simulation was performed using standard fixed emission inventories for natural and anthropogenic species. The comparison between model results and airborne observations shows a very bad representation of isoprene concentrations by the model due to fixed emission inventories with no diurnal variations. On this basis, a second simulation was performed using an online coupling between biogenic emissions computed by the MEGAN (Guenther *et al*, 2012) model and the surface model SURFEX (Masson *et al*, 2013) used in Meso-NH. This online coupling provides a realistic representation of biogenic emissions taking into account the vegetation type and the meteorological conditions. Results show a large improvement of the simulated isoprene concentrations compared to airborne data.

Guenther, A., Karl, T., Harley, P., Wiedinmyer, C., Palmer, P.I., and Geron, C. (2006) *Atmos. Chem. Phys.* **6**, 3181-3210.

Guenther, A.B., Jiang, X., Heald, C.L., Sakulyanontvittaya, T., Duhl, T., Emmons, L.K. and Wang, X. (2012) *Geosci. Model Dev.* **5**, 1471-1492.

Kroll, J.H., Ng, N.L., Murphy, S.M., Flagan, R.C. and Seinfeld, J.H. (2006) *Environ. Sci. Technol.* **40**, 1869-1877.

Masson, V., Le Moigne, P., Martin, E., Faroux, S., Alias, A., Alkama, R., Belamari, S., Barbu, A., Boone, A., Bouyssel, F., Brousseau, P., Brun, E., Calvet, J.-C., Carrer, D., Decharme, B., Delire, C., Donier, S., Essaouini, K., Gibelin, A.-L., Giordani, H., Habets, F., Jidane, M., Kerdraon, G., Kourzeneva, E., Lafaysse, M., Lafont, S., Lebeaupin Brossier, C., Lemonsu, A., Mahfouf, J.-F., Marguinaud, P., Mokhtari, M., Morin, S., Pigeon, G., Salgado, R., Seity, Y., Taillefer, F., Tanguy, G., Tulet, P., Vincendon, B., Vionnet, V. and Voldoire, A. (2013) *Geosci. Model Dev.* **6**, 929-960.

Tulet, P, Crassier, V., Solmon, F., Guedalia, D. and Rosset, R. (2003) *J. Geophys. Res.* **108**, 4021.