Parameterization of emissions fluxes of Biogenic VOCs. An emission modeling application for Europe using the NEMO emission model.

Markakis Kostas, Poupkou Anastasia, Giannaros Theodoros, Liora Natalia and Melas Dimitrios.

Aristotle University of Thessaloniki, Department of Physics, Laboratory of Atmospheric Physics, 54124 Thessaloniki, Greece. Tel: +30 2310 998009. E-mail address: kmarkak@auth.gr

The impact of air pollution in human health, welfare and natural ecosystems is a key environmental problem worldwide. The implementation of Chemical Transport Models (CTMs) help us to assess whether compliance with air quality limits is attained, introduce abatement measured and finally they can be used as tools in order to better understand the very nature of the atmospheric processes. A reliable emission inventory is a crucial dataset needed to support the implementation of CTMs. A limiting drawback, concerning the usability of emission inventories for air quality modeling, is always the accuracy of emission estimates. In addition the representativeness of an emission inventory depends on the incorporation of all important emission sources in a study area which can include both the manmade emissions and those emitted from natural processes.

More specifically the natural emissions of biogenic VOCs can have a significant contribution when used in air quality applications because they are an important precursor of secondary particles. Nowadays a large number of CTM applications run without including the emissions originating from natural sources because this requires the use of sophisticated tools in order to quantify the emission fluxes coming from these sources. During the past years the natural processes that emit the BVOCs have been parameterized by many researchers (an overview of which will be presented) in order to develop emission models that simulate these processes and quantify the natural emission fluxes in an area. One such emission model namely NEMO (Natural Emission MOdel) was developed in LAP/AUTH. The NEMO model is operated on-line as it is integrated into the operational WRF/CAMx modeling system operated and developed by the laboratory of atmospheric physics (LAP) in the Aristotle University of Thessaloniki (AUTH) but it can also be used in off-line mode. Emissions of BVOCs, windblown dust, sea salt and primary biological particles are calculated according to the user model setup (Markakis et al., 2011). The meteorological parameters necessary to calculate the emission rates derive from either the MM5 or the WRF meteorological model output. The methodology of the Guenther et al. (1994) is implemented for the calculation of BVOCs which uses temperature and solar radiation fields in order to calculate the emission fluxes of isoprene and monoterpenes employing the high resolution landcover database of USGS. NEMO was applied in an area covering Europe and adjustment counties and its results were compared with those of the MEGAN model (Poupkou et al., 2010).

1) Guenther, A., Zimmerman, P. and Wildermuth, M., 1994. Natural volatile organic compound emission rate estimates for US woodland landscapes. Journal of Geophysical Research, 28, 1197–1210.
2) Markakis, K., Poupkou, A., Liora, N., Giannaros, T., Melas, D. NEMO-PM: A new emission model for the calculation of wind erosion dust and PBAPs emissions. Application in the European continent. Under preparation.
3) Poupkou, A, Giannaros, T., Markakis, K., Kioutsioukis, I., Curci, G., Melas, D., Zerefos, C., 2010. Development of a model for the calculation of biogenic NMVOCs emissions in Europe. Environmental Modeling and Software 25 (12): 1845-1856.