Geophysical Research Abstracts
Vol. 19, EGU2017-8258, 2017
EGU General Assembly 2017
© Author(s) 2017. CC Attribution 3.0 License.

Sensitivity of Aerosol Mass and Microphysics to varying treatments of Condensational Growth of Secondary Organic Compounds in a regional model

Douglas Lowe (1), David Topping (1,2), and Gordon McFiggans (1)

(1) Centre for Atmospheric Science, University of Manchester, Manchester, United Kingdom, (2) National Centre for Atmospheric Science, University of Manchester, Manchester, United Kingdom

Gas to particle partitioning of atmospheric compounds occurs through disequilibrium mass transfer rather than through instantaneous equilibrium. However, it is common to treat only the inorganic compounds as partitioning dynamically whilst organic compounds, represented by the Volatility Basis Set (VBS), are partitioned instantaneously. In this study we implement a more realistic dynamic partitioning of organic compounds in a regional framework and assess impact on aerosol mass and microphysics. It is also common to assume condensed phase water is only associated with inorganic components. We thus also assess sensitivity to assuming all organics are hygroscopic according to their prescribed molecular weight.

For this study we use WRF-Chem v3.4.1, focusing on anthropogenic dominated North-Western Europe. Gas-phase chemistry is represented using CBM-Z whilst aerosol dynamics are simulated using the 8-section MOSAIC scheme, including a 9-bin VBS treatment of organic aerosol. Results indicate that predicted mass loadings can vary significantly. Without gas phase ageing of higher volatility compounds, dynamic partitioning always results in lower mass loadings downwind of emission sources. The inclusion of condensed phase water in both partitioning models increases the predicted PM mass, resulting from a larger contribution from higher volatility organics, if present. If gas phase ageing of VBS compounds is allowed to occur in a dynamic model, this can often lead to higher predicted mass loadings, contrary to expected behaviour from a simple non-reactive gas phase box model.

As descriptions of aerosol phase processes improve within regional models, the baseline descriptions of partitioning should retain the ability to treat dynamic partitioning of organics compounds. Using our simulations, we discuss whether derived sensitivities to aerosol processes in existing models may be inherently biased.

This work was supported by the Natural Environment Research Council within the RONOCO (NE/F004656/1) and CCN-Vol (NE/L007827/1) projects.