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Atmospheric
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Discussions

Interactive comment on “Vertical distribution of sub-micron aerosol chemical composition from North-Western Europe and the North-East Atlantic” *by* W. T. Morgan et al.

Anonymous Referee #1

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This paper presents results that not only are useful to the scientific community but may eventually be helpful to environmental decision making in Europe (if interpreted for EU policy makers and others). The “Atlantic origin” (181 cases) and, somewhat less so, the “stagnant air mass” (67) conditions’ vertical distribution submicron aerosol chemistry data are of sufficiently high confidence to be of value for a range of environmental policy discussions. This does not appear to be so for the Easterly, Southerly, and Northerly condition results due either to the small number of cases (Southerly, 18, and Northerly, 29) or the great variability of aerosol chemistry input (Easterly).

Focusing on the Atlantic and stagnant conditions, thus largely on over ocean results, is of greatest value from my view. First, it must be noted that the “Atlantic” condition does not imply clean marine. The authors are fully aware that the North Atlantic is, largely, a polluted region of the global marine boundary layer (MBL). Yet, these April through September results are, very likely, representative of the N. Atlantic MBL during the bioactive months.

Overall, the organics and sulfate median mass concentration profiles (Fig. 5) are of very similar magnitudes throughout the first 3000 m of their profiles (dropping from 0.7-0.8 ug m^{-3}, near surface, to $\sim$0.2 ug m^{-3}, at 3000 m). One may wonder whether there is enough pollutant organics material available to produce this result. To what extent are the Atlantic oceans’ surface waters contributing to the organics mass?

For the Atlantic and stagnant conditions only, the organics and sulfate concentrations appear to be similar as well, at least throughout the MBL (Fig. 6). Despite the N. Atlantic being (perhaps) the most polluted region of the global MBL, the organics mass is not overwhelmed by the sulfate mass. The authors note that “the vertical structure of sulfate and organic aerosol profiles were shown to be primarily driven by large-scale [atmospheric] dynamical processes”. Is this true for the lowest $\sim$1000 m asl, the MBL?? I suspect that oceanic dynamics come into play within the MBL, implying that a significant source of the observed organics mass (at least for the Atlantic and stagnant conditions) is the oceans’ surface waters. I hope these thoughts will lead to further discussion.

The vacuum aerodynamic dia. range of the Q-AMS, given as 40-700 nm, equates roughly to 25-500 nm ambient dia. (spherical particles of density = 1.5). Thus, only a small percentage of particles analyzed by the Q-AMS were observed by the PCASP. It is unfortunate that a particle sizing instrument, reaching well below the PCASP’s low end, was not available.

Minor point:

The reader would benefit from a statement, in 2-3 locations, about the ambient and dry equivalent diameters for the 40-700 nm vacuum aerodynamic dia. range of the Q-AMS. It is not clear how to relate these AMS diameters to actual ambient and dry diameters of the measured aerosols.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 9117, 2009.