

Interactive comment on “Lessons learnt from the first EMEP intensive measurement periods” by W. Aas et al.

Anonymous Referee #1

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The manuscript presents a honest status report on state-of-the-art aerosol measurements and modeling for Europe. It includes a comprehensive list of potential problems, difficulties and uncertainties regarding all aspects of aerosol sampling, measurements and modeling. There are basic problems in aerosol mass determination, a variety of sampling artifacts, lack of unified analytical methodologies, problems with size-cuts and instrumental capabilities, incomplete emission data, limitations of the modeling approach, to name just a few. Despite the inhomogeneity of the data the positive outcome is the relatively good match between measurements and modeling results (whatever it means). The manuscript is organized to imply that a perfect match would be desirable (using the verbs underestimate and overestimate), though previously it is admitted that sampling and measurements are themselves loaded with high biases and uncertainties due to a variety of fundamental problems. Thus, the lack of perfect agreement

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may not necessarily mean that the model results are ‘under’ or ‘over’ any true value set by the measurements. On the contrary, it follows that there is no ‘true value’ at all, a better expression would be that model and measurement do not agree. Because of the large temporal and spatial variability of atmospheric aerosols, their size distributions, chemical and physical properties, chemical formations and transformations, interactions with water vapor and droplets, nucleation, volatilization and a host of other factors, one should never expect to capture aerosol properties measured at a few sites in a short campaign with an aerosol model of 50x50 km resolution. This fundamental constraint should have been better stressed in the manuscript.

Minor comments: Page 3738 Line 19 There is no unbiased gas/particle separation. Using denuders the gas-to-particle equilibrium is disturbed and some volatilization of particle-phase ammonium-nitrate can be expected.

Page 3744 Line 4 check grammar

Page 3747 Line 12 The best example for the limitation of models with respect to point measurements is the disagreement between measured and modeled sulphate concentrations. Sulphur-dioxide has the best emission inventory, well-established chemistry and size-distribution, by far the longest history of modeling experience, and particle-phase sulphate is free of sampling and measurements artifacts. Yet the fit between modeled and measured values is not at all better than that of any other aerosol component.

Page 3748 Ammonium-nitrate deposited on filter samples may be prone to losses or gains due to changing equilibrium conditions during or after sampling. Such changes cannot be captured in models which treats instantaneous ammonium-nitrate equilibria

Page 3756 Line 25 Check grammar