

Interactive comment on “Exploiting the weekly cycle as observed over Europe to analyse aerosol indirect effects in two climate models” by J. Quaas et al.

Anonymous Referee #1

Received and published: 18 June 2009

This paper seeks to exploit both professional and popular interest in weekly cycles in meteorological phenomena and explores the potential role that could be played by aerosol. As the paper states clearly in the introduction, this concept is not new. However, the approach here is to use the observations of weekly cycles to examine qualitatively the representation of aerosol processes in the model. It concludes that: Significant weekly cycles exist in some observed aerosol and meteorological variables, e.g. SO₂ and sulphate amount, aerosol optical depth and cloud liquid water path, but that others, e.g. cloud fraction show disagreeing cycles in different observation sets or show no discernible weekly cycle. The presence (or lack of) a similar weekly cycle in model quantities is used to infer the quality of various aspects of the aerosol represen-

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tation in the model are well represented - e.g. aerosol activation, whilst other aspects are less well simulated (e.g. transformation from precursor to aerosol in ECHAM 5).

In general the paper is well written and concise, if a little short on detail (model processes included, observations used etc). The summary section repeats a lot of the results and could be shortened in order to allow more details of the models/observations to be put in earlier sections. It would also be good to comment on the wider implications of the work and whether the understanding could be improved by additional/different simulations.

Scientific points: Method Is it a problem that the different observational and model data sets used apparently have very different lengths, e.g. around 5-8 years for the satellite data, 5 year model simulations and up to 130 years for the EMEP data? It is a little disappointing that in the case of HadGEM2, the control simulation does not contain enough diagnostic variables to adequately discuss many of the points. It is also not explained why the 10 year simulation was analysed as two 5 year simulations. Results Line 139. The paper states that both the models show "a reduction of the same order of magnitude as in the observations" for SO₄ despite a very much overestimated cycle in the SO₂ in both models. This is used to state that the processes in the sulphate aerosol cycles in both models are qualitatively well simulated. However, I would have liked to have seen more discussion of why the weekly cycle in aerosol is buffered so dramatically compared to SO₂ both in the real world and in models. Line 165: why is the amplitude of the weekly cycle in CDNC different by a factor of 2 between Terra and Aqua? Does this point to a time of day effect and if so does this indicate any issues with the extraction of daily data from models and different times of day for other observations?

Technical issues: In figure 1 it is often very difficult to distinguish between the light and dark green of the two HadGEM simulations.