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**Geoscientific
Model Development
Discussions**

Interactive comment on "Simulating emission and chemical evolution of coarse sea-salt particles in the Community Multiscale Air Quality (CMAQ) model" *by* J. T. Kelly et al.

Anonymous Referee #3

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General Comments

The paper is well written and clear and may be published with minor to medium modifications. The developed modules are on a sound scientifical basis within the limitations beeing necessary for a computationally efficient approach.

Specific Comments

Three versions of CMAQ are used: v4.6 is a standard release version which is used to provide a reference run. v4.6b is identical to v4.6 except that it incorporates a surf zone emission parameterization for sea salt particles. v4.6c is identical to v4.6b except that the GSD of the coarse mode is variable and a dynamic transfer of HNO3, H2SO4,

HCl, and NH3 between coarse particles and the gas phase is introduced. Results of v4.6c are compared with those of v4.6b, i.e. results from a model (v4.6c) with two modifications with respect to v4.6b are discussed. It is not completely clear to what extend contribute the two modifications in each case to the differences between the model results of v4.6b and v4.6c. The inclusion of a further version with only one of the two modifications could be helpful to explain well-founded the individual phenomena.

In the discussion of differences between predicted and measured particle size distributions (Section 4.2) the authors well demonstrate the importance of aerosol dynamics modelling. The authors note differences in coarse mode sodium concentrations predicted by v4.6b and v4.6c with the same emission parameterization which can only be explained due to size dependent processes.

Page 1352, line 8/9: "... under-prediction of sodium ... leads to under-prediction of coarse nitrate." This is not the case at the Azalea Park site. There is coarse nitrate under-predicted by v4.6c but sodium is over-predicted.

Page 1352, line 9-11: "At the Sydney side, the under-prediction of sodium in the coarse mode appears to cause the over-prediction of nitrate in the accumulation mode by CMAQv4.6c." The over-prediction of accumulation mode nitrate at the Sydney site may also be attributed to the fact that this station is farer away from the coast as the other two sites and therefore, depending on wind direction, may be more influenced by anthropogenic emissions.

Page 1352, line 18: "... differences in sodium predictions are attributable to differences in advective transport and deposition." Dry deposition (and sedimentation) is in fact size dependent, but is particle size significant for the parameterization of advective transport ?

Technical Corrections:

The allocation of CMAQ version numbers is somewhat confusing. Is v4.7 the same as

v4.6c ?

An additional column with model results (no skill scores) from v4.6 in Table 2 would be useful.

Interactive comment on Geosci. Model Dev. Discuss., 2, 1335, 2009.