

Interactive comment on “Modelling sea salt aerosol and its direct and indirect effects on climate” by X. Ma et al.

Anonymous Referee #2

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This manuscript describes estimates of direct and indirect effects of seasalt using a novel representation of the seasalt size distribution. The representation of the size distribution is particularly appealing because it is capable of resolving the separation of the size distribution into interstitial and activated components when cloud forms. The manuscript provides a first estimate of the indirect effect of seasalt aerosol, and as a bonus provides estimates using two quite different representations of the size distribution of seasalt aerosol production.

Its primary weakness is that it does not attempt to treat the competition between seasalt and other aerosol, in which under some conditions enhanced seasalt can actually decrease the droplet number concentration. Others have shown that this competition can be quite important in determining droplet number and, by inference, indirect effects. A

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secondary weakness is that it only treats indirect effects of seasalt and sulfate. The authors argue that an empirical treatment of droplet nucleation is chosen rather than a physically-based treatment "because subgrid variations in vertical velocity, maximum supersaturation, and availability of CCN are difficult to parameterize in GCMs" (2007). Yet physically-based schemes are quite adept at diagnosing maximum supersaturation given a known updraft velocity and CCN spectrum from multiple competing aerosol types. Predicting the CCN is the focus of many aerosol modeling efforts. This leaves subgrid vertical velocity as the key source of uncertainty in any indirect effect estimate. If subgrid vertical velocity can be reliably represented it should be possible to use physically-based schemes with confidence to study the competition between seasalt and all other important components of the CCN spectrum. Thus, although this manuscript provides a first estimate of the indirect effects of seasalt, it should be treated with some caution because of the limitations of its treatment of the competition with other aerosol.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 14939, 2007.

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