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Interactive comment on “A global process-based study of marine CCN trends and variability” by E. M. Dunne et al.

Anonymous Referee #1

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Review of “A global process-based study of marine CCN trends and variability” by E. M. Dunne, et al. The paper presents the variability of CCN concentrations in marine environments for the period 1990 to 2004, and uses advanced statistical software to examine correlations in possible sources of these variations within an atmospheric chemistry model GLOMAP. The paper appear well presented and concise, and the paper contains findings of scientific significance.

General comments:

As stated, both Northern Hemisphere boxes are downwind of North America, the north Atlantic box in the westerlies, the pacific box in the trade winds. Increasing wind speeds here also give shorter travel time from the continent, thus increasing the fraction of

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continental CCN.

I have a few specific comments to the authors:

Pg 15774 line 16-17 I assume GLOMAP can also be run on different resolutions? If so, change “It runs. . . “ , with “It was . . .”

Pg 15775 The source function used in GLOMAP, from Mårtensson et al. 2003 has a temperature dependence in production. I cannot see that the effect of this is accounted for in any way. This needs to be addressed as it may well influence the production of CCN significantly.

Pg 15776 line 22- 24 As production of marine CCN are highly non-linear, thus a monthly average wind speed may produce significantly different numbers of CCN. Taking a non-linear average would sort this as is suggested later on page 15780 line 19, the emission trend.

Pg 15781-82 “The inclusion of nucleation scavenging also dampens the effects of other processes. This damping can be seen in the much greater absolute variation between peaks and valleys in the black lines compared to any of the other simulations” –How does nucleation scavenging affect new particle formation, primary sea spray and DMS emissions? By visual inspection, this does not appear true in terms of the relative variability to the mean CCN concentrations, at least for the second month of the simulations. This statement needs some explanation.

Pg 15786 line 12-14 I would limit this statement to indirect effect as other climate effects than CCN such as the direct effect has not been examined.

Pg 15786 line 20 This dampening effect needs some more explanation. If I understand it correctly, the effect is that a higher percentage of CCN are removed by nucleation scavenging when there is above average CCN numbers and a lower fraction of CCN is removed when there is below average CCN numbers. Why? Alternate interpretations of the dampening would also need some physical explanation.

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Interactive comment on Atmos. Chem. Phys. Discuss., 14, 15771, 2014.

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