

Interactive comment on “A simple relationship between cloud drop number concentration and precursor aerosol concentration for the regions of earth’s large marine stratocumulus decks” by D. A. Hegg et al.

Anonymous Referee #2

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Hegg et al. show relationships between CCN, CDNC, and aerosol number concentration data from marine stratocumulus sampled off the coasts of California, Chile, and Namibia. A high correlation was observed between the cloud droplet number and accumulation mode number concentrations. This would indeed be useful for model parameterizations. Several other manuscripts have also presented this trend and should be cited (e.g. Twohy et al. 2005, Lu et al. 2008, Lu et al. 2009). To strengthen this manuscript and go beyond that presented in these other manuscripts, it would be useful if the manuscript incorporated other datasets and perhaps looked at correlations for

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other cloud types to discern when this relationship can be utilized and when it is not valid.

General Comments:

- Page 28666: What is the estimated contribution of marine stratocumulus clouds to the global indirect radiative forcing? Could you discuss further why the cloud physics associated with the marine stratocumulus might in particular exhibit this relationship? Might it hold for other cloud regimes?
- Page 28667: Please give the size ranges of the FSSP and CAPS probes during the study. Also, please give details about the measurements made for the African dataset.
- Page 28668, Lines 12-14: Could this observation by Hudson et al 2010 explain the change in the data in Fig 2 at $\sim 325/\text{cc}$?
- Page 28670, 2nd paragraph: Since $>1 \text{ um}$ particles (e.g. sea salt) were measured, what is their estimated contribution? Previously, “giant” particles have been shown to be important in marine stratocumulus (Jensen & Lee 2008).
- Page 28671, 2nd paragraph: Several of the references for aerosol chemistry (e.g. Bi et al 2011, Pratt and Prather 2010) do not seem applicable for these marine stratocumulus clouds. Other manuscripts (e.g. Middlebrook et al. 1998; Murphy et al. 1998a,b; Guazzotti et al. 2001; De Bock et al 2000) focusing on marine environments would likely be more suitable. Overall, the discussion of aerosol chemistry could be strengthened by a thorough literature search of parallel aerosol chemistry and CCN measurements in marine areas.
- Page 28672, line 7: Again, the reference to Pratt and Prather 2010 is not appropriate here since marine air masses were not studied. A literature search for marine aerosol chemistry studies should be conducted.
- Page 28673, lines 11-13: Were only marine-influenced air masses utilized in the data analysis presented in this manuscript? This must be clarified in the methods section,

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as the reader assumed that the entire dataset was utilized. It may even be useful and informative to isolate different air masses and characterize the relationship between CDNC and AMNC under these different conditions.

- Page 28673, lines 13-14: Why was this not examined?
- Page 28674: For this simple parameterization to be used in climate models, it would be useful to note the conditions under which the parameterization is suggested to be used (e.g. only marine stratocumulus in these areas under marine influence?).
- Page 28674, lines 17-19: This is the first that it is noted that a variety of aerosol sources impacted the clouds. What were they? Can other studies in those regions be examined (e.g. manuscripts from the VOCALS campaign) to discuss this? As this is a primary conclusion, it should be discussed in the main text.

Specific Comments:

- Page 28664, Line 21-22: "...which is..." – phrase is misplaced in sentence
- Page 28666, Line 24: Please clarify "small amount of data". Was the entire dataset used? What time of year was the data collected?
- Page 28669, Lines 18-19 & 21-22: Please clarify sentences.
- Page 28670, Line 4: Please clarify sentence: "A second scenario is that usually cited."
- Page 28670, Lines 19-20: Please tell us why this explanation is "most likely".
- Page 28670, Lines 25-26: This sentence essentially repeats the previous one.
- Page 28673, Lines 27-30: Please clarify sentence.
- Page 28674, Lines 21-22: Provide reference.
- Figures – Please check significant figures for R2 values (Figs 2-3) and particle diameter (Fig 5).

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- Fig 4 – Reference?
- Fig 5 – Are there other size-resolved measurements of kappa for marine air masses?
- Fig 6 – Reference Petters & Kreidenweis 2007.

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