

Interactive comment on “The effect of hygroscopicity on sea-spray aerosol fluxes: a comparison of high-rate and bulk correction methods” by D. A. J. Sproson et al.

Anonymous Referee #1

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General Comments

This paper presents a novel method to correct aerosol flux data for the influences of deliquescent size changes associated with humidity fluctuations. Unlike previous approaches which were based on assumptions about the ambient size spectra, the approach put forward uses the measured size spectra and thus can represent a significant advance. Unfortunately, however, a major flaw in the fitting of regression lines needs to be corrected before the analysis can be considered suitable for publication.

The paper is generally well-written although it could certainly be made more concise

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by careful iterative revision, and the use and citation of figures could be very much improved.

Specific Comments

P 6288 lines 11-13: This section should be written more clearly and precisely. The authors should take care to define the net flux measured by eddy covariance, and separate it from the the sea-spray flux that interests them, and other processes (deposition, etc.) that they wish to exclude. Note that these can include gas-particle conversion or coagulation which, if operative in the air below the measurement height, will also invalidate the relationship between surface fluxes and the eddy covariance.

p 6290 lines 6-7: It seems to me that the number flux is not "biased", but more importantly not representative of aerosol exchange at the surface.

p 6292 line 1: rather than "turbulent data", say "turbulence data"

p 6295 lines 15-16: Rather than saying what data are "available", scientists should specify the data that were "measured" or "used".

p 6292 line 11: The main problem with the analysis is that the Junge fits have been adjusted incorrectly. This is a key aspect of the manuscript, whose purpose is to demonstrate improvement over the F84 and K01 "bulk" methods, and yet the authors appear not to have applied these methods correctly. The problem is most evident in Figure 3d, where the data display reasonably linear behaviour, and yet the black line is clearly not a the correct least-squares fit, as is evident by simple inspection. It looks to this reviewer that the authors failed to apply the log-transformation prior to calculating least squares; put another way, the relevant values on the y-axis ticks of Figure 3 should be the exponents [2, 4, etc.], rather than [100, 10000, etc.], and the least-squares distances that are evaluated must be expressed in terms of these exponents, rather than in terms of particle counts. Such a failure to log-transform prior to least-squares minimisation would have the effect of granting extreme leverage to the smallest particles

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(whose absolute numbers are orders of magnitude higher) and allow them to wrench the regression line. This would explain why the "Junge fit" in Figure 3d does not come even remotely close to representing the slope that is evident in the data. Presumably, the authors have made the same mistake in all of their regression fitting and so all of the analyses, which must therefore be corrected in order to demonstrate conclusions such as those (p 6303, line 15) suggesting that the "bulk" methods can be improved upon.

p 6297 line 23: The Junge fitting must be done via "log error minimisation", not "linear".

p 6298 line 9: rather than blue/black, the K01/F84 lines in Fig. 5 of the PDF file is grey/black.

p 6302 line 19: "there are times when none of the bulk methods considered here provide a suitable approximation". This is very likely related to errors in calculating the regression fits.

Figures:

Generally, the means of citing the figures in the text could be greatly improved. For example, rather than "Figure 1 shows a scatter plot of y versus x", it is preferable to say "A linear relation was found with generally very high correlation between y and x, but more noise at the low end (Figure 1)". In other words, the figure citation should explain generally what the Figure tells us, rather than give information that is redundant in the caption or evident when glancing at the Figure (or both).

In Figures 1-4, the ticks on the x-axis are not sufficiently labelled for the reader to understand the data. Probably, the ticks go from 0.2 to 8 microns, but this needs to be made explicit since only one tick is labelled.

Figure 2 (and subsequent figures) should have labels for panels (a) and (b).

I could find no reference to Fig. 7 in the text. Figure 10 is only briefly mentioned, despite containing 8 panels. Probably many of these results are not absolutely critical

to the story being told, and could be either reduced or omitted entirely.
In Figures 7, 10, and 12 the units are missing for the deposition velocity.

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