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Interactive comment on "Ultra-clean and smoky marine boundary layers frequently occur in the same season over the southeast Atlantic" *by* Sam Pennypacker et al.

Anonymous Referee #3

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This is an interesting and mostly clearly-written manuscript. However, I was startled to learn that 'ultra-clean', as the authors have defined it, can still apply to boundary layers with elevated CO and rBC concentrations. It invites the question: what is a boundary layer with low Na, and non-elevated CO and rBC concentrations? 'extreme-clean' ? I suggest that the authors rephrase 'ultra-clean' as 'ultra-low-aerosol' (or something along those lines), to be more specific. The term 'ultra-clean' appears to have been defined from northern hemisphere studies in which this distinction was not relevant, but I think for a new reader that the term 'ultra-clean' is confusing. The authors themselves touch on this on p. 8, second paragraph.

p. 2, line ~18: this is where the term 'ultra-clean' is introduced, in parentheses, with the paragraph providing detail on the prior studies that have used this term. I suggest including a subsequent paragraph that discusses how this term may or may not apply well to the southeast Atlantic, and use that to define 'ultra-low-aerosol'.

P. 3, line 9: definition of 'ultra-clean' ('ultra-low-aerosol') needs more justification. Likely this follows that in prior studies, given the importance of this definition would suggest mentioning the definition within that paragraph on p.2 (and using a different term).

P.3 line 30: Would high aerosol counts but low CO/rBC qualify as 'polluted' ? The authors suggest this might occur during February. Overall a bit more description of the high-Na days would be helpful. Are they all from the months when smoke is clearly present?

Section 3.2, fig. 3: It would be interesting to also discriminate further those days that are more truly pristine. Do those correspond to the back-trajectories that more clearly go back to the southern oceans? There may not be many days with daily median CO values $<\sim$ 60ppb and rBC values within the sensitivity limit, but there should be some, and it would add interest to hear about those as well.

P. 6 line 22: what is the precipitation frequency on the UC days?

Figures:

Fig. 1: It's hard to tell how many UC days occur per month from panel a and b. One idea would be to mention how many occur each month near the top of the figure.

Fig. 2 panels c and d: I suppose this is saying something about temporal variability as well, with hourly values being shown for a given daily median threshold on Na. For completeness it would be nice to see a similar plot for the pdf of the hourly median Na. It would be a fifth panel. Not sure what to suggest for a 6th panel to balance it visually.

Fig. 4: the cumulative distributions take some study to interpret. Have the authors considered a normalized frequency distribution instead? Same for Fig. 5a.

Fig. 6: I don't see a clear correspondence between LWP and UC days through this figure. I wonder if the MWR LWP data are simply too local.

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