

## ***Interactive comment on “Measured black carbon deposition on the Sierra Nevada snow pack and implication for snow pack retreat” by O. L. Hadley et al.***

**Anonymous Referee #2**

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### General Comments

This is generally a nicely presented paper with careful attention to observational detail. It would be useful to clarify how large a reduction in the snow albedo is predicted by these observations as there is still some controversy about how BC/EC from TOA applies to results based on IP photometer measurements such as those of Bond et al. In particular, some TOA analyses seem to give lower values of EC/BC and imply higher mass absorption coefficients. A consistent treatment here is recommended. Subject to a discussion of this sort and clarification of the points raised in the specific comments, I recommend publication in ACP.

C4206

### Specific Comments

Pg 1

2-13 aren't particularly high levels of BC concentration – what sort of albedo decrease do you predict for these? Is it the same ~1% in the visible spectrum as predicted by the sources you cite. Based on your 2008 paper, you obtain rather different MAE results than were generally used in the previous studies. Pg 6 – three filters in series. A most excellent precaution as recent studies by the Norwegians have confirmed the low collection efficiency of the quartz fiber filters with significant implications for reported EC retrievals.

Pg 8

Why do greater snow deposition rates cause an underestimate of the true average concentration of BC in the falling snow? Although the concentration is diluted, you can simply collect and process more snow, and the uncertainty in the snow volume would if anything be less and the amount of BC collected greater.

Visible albedo includes the wavelength range 400-700 nm rather than 200-700 nm. What do you mean by grain size? You've discussed grain diameter above (PM<sub>2.5</sub>), but the calculations you refer to, for example the modeling by Warren and Wiscombe, are using grain radius.

Julian day – change to Day of Year or something less ambiguous? The usual definition of Julian day is given by the astronomers, and the current Julian day is 2455270 plus a bit.

Pg 9

'This effect is not considered here' – I think Flanner et al. do take this into account. You might point out that your local surface forcing values are locally applicable only and subject to the large variability in the area covered by snow in California, whereas the regional value of 1.6 is a regional/large scale value.

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Pg 10

'and included in ice nuclei' – you should be a bit more definite about why you think this is true as it has significant ramifications for the absorption properties of the snow-BC system.

Pg 11

'fractional contribution was zero' – was assumed to be zero? No doubt there is some uncertainty in this, and I don't see any values of zero in figures 4 or 5, for example.

'The average Asian BC contribution to BC mass..' -> The average Asian BC contribution to total BC mass.

'Assuming that a proportionate amount of Asian BC is transported along with the dust' – Aren't the dust particles generally larger than BC so that it might tend to settle out more rapidly particularly considering the long distances involved? In fact, I'd expect to see a clearer separation in figure 4 between the data for PM 0.75 and PM 2.5, where you select for different sized (and rather large) particle thresholds. Please comment on these points.

Pg 13

I don't see how figure 5 shows that the values at your locations are spatially and temporally representative of the mountains of Northern California. I think you need to justify this statement a bit more thoroughly.

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Interactive comment on Atmos. Chem. Phys. Discuss., 10, 10463, 2010.