

## ***Interactive comment on “Measurements of light absorbing particulates on the glaciers in the Cordillera Blanca, Peru” by C. G. Schmitt et al.***

### **Anonymous Referee #1**

Received and published: 31 October 2014

This is an interesting paper; it deserves publication in TC after major revision.

Requirement for major revision:

(1) The significant defect in this paper is a lack of discussion of the vertical variation of particulate concentration in the top few centimeters. At each site the authors sampled both surface snow (top 2.5 cm) and subsurface snow, as indicated on page 5083 lines 25-30, but the paper does not show results for the difference between the two levels. Melting and sublimation are expected to enhance the surface concentrations, as the authors note, and it is the top 2.5 cm that are most important for albedo. The authors did observe huge differences between summer and winter layers in one crevasse wall, but did not discuss the results of their paired surface-subsurface samples from their geographical survey. For example, page 5089 line 19-20 states that for Figure 7 the

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surface and subsurface samples were averaged; why was this done?

Other major comments:

(2) Undercatch. The quartz fiber filters apparently did not capture small particles efficiently, as the authors indicate (p 5086 lines 5-7 and 24-29.). This observation is consistent with the thorough study by Torres et al. (2013) on the collection efficiency of quartz fiber filters, which should be cited. For typical BC concentrations in rainwater, Torres found a maximum recovery of 38%. (Aerosol Science and Technology, DOI:10.1080/02786826.2013.868596)

(3) The calibration curve. Page 5086 line 16-18. The reason for the nonlinearity in Figure 3c is that at high loading the incident light is absorbed by the topmost particles, so the lower particles will not be exposed to much light. The curvature in Figure 3c indicates that the method will be unreliable for loadings >30 micrograms. In Figure 5, the outlier at rBC=75 is beyond the end of the calibration curve in Figure 3c. Perhaps this point could be used to extend the calibration curve.

Minor comments

Abstract Line 17. How were the samples kept frozen during transport?

Page 5083 lines 8-9. Warren and Wiscombe 1980 is the wrong reference here. Cite instead Doherty et al. 2010 ACP.

Page 5084 lines 4-5. How long did the melting take? BC may adhere to the wall of the Ziploc bag if meltwater is in contact with the plastic for a long time.

Page 5086 line 13. “32.5 micrograms”. The points in Figure 3 are plotted at 30 not 32.5.

Page 5087 line 15. A better reference is Grenfell et al. 2011 Applied Optics, which carefully defines “effective black carbon”.

Page 5090 line 2. How far is Huaraz from Regions 3,4,5?

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Figure 3c. Exchange the x and y axes, because temperature-increase is the dependent variable.

Figure 5 should be a square not a rectangle, since the same units are on both axes.

Figure 5 horizontal axis. Define "rBC".

Figure 6. Exchange the x and y axes, because altitude is the independent variable.

Figure 7a. Add a latitude-longitude grid.

Figure 7b. An alternative way to plot these data would be to use the distance from Huaraz (km) as the x-axis.

Figure 7 caption line 5. Change "5 ng/g" to "8 ng/g".

Figure 8. Exchange the x and y axes.

Figure 9 vertical axis. The depth could be given in meters instead of centimeters; this would simplify the numbers.

#### Grammar and spelling

The title and abstract indicate that the topic is "particulates"; but page 5082 line 23 instead says "particles". Are you making a distinction? If not, change all occurrences of "particulates" to "particles", for simplicity and consistency. But "particulate" does still have a use; it is the adjective corresponding to the noun "particle".

Page 5084 line 23. Change understand to understanding.

Page 5085 line 4. Change affect to effect.

Page 5087 line 3. Change suggest to suggests.

Page 5089 line 13. Delete "to".

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Interactive comment on The Cryosphere Discuss., 8, 5077, 2014.