

## ***Interactive comment on “Brief Communication: Light-absorbing impurities can reduce the density of melting snow” by O. Meinander et al.***

**Anonymous Referee #1**

Received and published: 5 February 2014

This study observed that density in a melting snowpack decreases as BC content increases. For a cold non-melting snow there is no correlation between BC content and density, except for a single data point forced with an artificial LAI deposition with extremely high BC content.

While the title specifies light absorbing impurities, the relationship is based on measured BC (EC). The observed relationship that results between measured BC and reduced density is mainly dependent on artificially deposited impurities at one location. The result is very interesting, but would be strengthened by additional measurements in more locations for both cold and melting snow (which is acknowledged by the authors).

Comments

C19

Clarification on density measurement methods- i.e. density cutter, snow tube, or other method? Why was only surface density, and not full column, measured during SoS-2013?

The relationship between impurity content and density is really dependent on measurements at 1 location (SoS-2013), the discussion of the other studies may be unnecessary. This paper could be simplified to a process study at one location.

Given the relative low contribution to bolstering the results of the study, discussion of hard hardness, grain size, and grain shape observations in the methods section could be summarized in a more concise fashion.

A greater discussion of the impurities deposited at the SoS-2013 site would be useful both in section 2 and section 3. How were they deposited- sprinkled over the surface? Is there any knowledge of the absorbing qualities (i.e optical properties) of these impurities? It is mentioned that only 3 spots are used in the study- were more study plots administered with other impurities? What were they and what were the relationships for density in those plots?

In the result section the concentrations for melting snow are said to range from 9-730 ppb, would plot 2b change if individual samples, rather than spot averages, were plotted? How was each spot sampled and why do the number of samples vary per plot? Additional description in this section would strengthen the results presentation.

Figure 1- Which impurity plot is pictured in C- sand or soot? The picture of the gravel surface under the snow is not necessary unless the authors are concerned it played a role in absorption for a snowpack that was not optically thick- if this this the case for any of the points, they should be thrown out because the relationship is not only due to surface absorption by measured concentrations.

Figure 2- Color-coding would make these plots more clear. Natural (control) points should be a different color from the artificial points- differentiating the artificial points

C20

between soot/volcanic sand would also be useful.

Interactive comment on The Cryosphere Discuss., 8, 259, 2014.