

Interactive comment on “A multi-layer physically-based snowpack model simulating direct and indirect radiative impacts of light-absorbing impurities in snow” by Francois Tuzet et al.

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Tuzet et al. use a sophisticated model to investigate the direct and indirect effects of light absorbing impurities on the melt of snow. The conclusion that the direct effect dominates over the season is expected, but it is interesting to see it demonstrated and quantified. I have some minor corrections and suggestion.

page 3

Explain briefly why radiative forcing increases as SA decreases.

C1

page 5

It is not correct that LAI deposition fluxes measured in the field are used in this study.

page 7

Equation (2) seems to use subscript i twice for different purposes: D_i for deposition of impurity type i as in equation (1), and z_i for layer i . Δz_i is missing from the numerator.

“Each layer is affected the depth value of its center” is unclear.

M_i and SWE_i in equation (3) should be M_o and SWE_o .

Is impurity content really stored on the ground after the snowpack has melted, and not just discarded by the model?

page 8

Equation (4) should really have subscripts for both impurity type and layer.

page 9

Is there a reference for ATMOTARTES?

What difference would also considering low cloud make?

Explain what SBDART is.

page 11

It is not correct to say that C5 is not included in the model evaluation; it can be seen in Table 2 and Figures 3, 4, 5 and 7.

page 13

While pointing out that C1 has the largest RMSE for snow depth, it should be noted that it has the smallest bias (and both the smallest bias and RMSE for SWE).

Why is the size of the bias between manual and automatic SWE measurements so

C2

large? Morin et al. (2012) stated that the instrument is calibrated to manual measurements.

page 15

Transport of BC from Grenoble to Col de Porte could be suppressed by persistent winter inversions.

Rather than using remote observations of dust in snow for the February event and none for the April event, why not scale ALADIN-Climate deposition in C5 to be closer to local BC equivalent measurements?

page 16

Albedo measurements are available at Col de Porte and could be compared with the simulations.

Figure 3 contradicts the assertion that C2, C3 and C4 improve the simulation at the end of the season compared to C1.

Table 2

The 20% scavenging is in the wrong column for C4

Figure 3

Why are the configuration lines broken in the upper panel and solid in the lower?

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