Review of "Variability in individual particle structure and mixing states between glacier snowpack and atmosphere interface in the northeast Tibetan Plateau " by Dong et al.

Summary

This paper presents a dataset that explores the physical and chemical properties of light absorbing particles (LAPs) in the atmosphere and in the surface snowpack at several places in the Tibetan Plateau. Observations from TEM and EDW measurements are described. A tentative scheme to explain the observations is proposed along with an assessment of the changes in radiative impact.

Recommendations

This is a really interesting, rich and fascinating dataset, the conclusions drawn by the authors are of importance for a large community and may help reconciling current discrepancies between measured RF of LAP in snow and chemical content measurements. However the paper suffers from several flaws that need, in my opinion, to be corrected before the paper can be published as described in my specific comments below.

Specific comments

1/ My first major comment is that the data and methods description lack a lot of details that are essential for the reader to understand correctly the results and conclusion of the paper :

- lines 84-101 : Please provide more details on how the sampling was performed. The snow samples are taken at the same time of the atmospheric sampling ? What is the volume ? To which snowpack depth does it correspond ?
- Lines 102-114 : Though the measurements methods are described in some other references, it would be very useful to add here the main concept, uncertainties and limitations
- Lines 115-124 : see comments 4
- Results and Discussion :
  - Whenever it's possible (description of Figures 3,5,7,9 and 10) please quantify the mean and std differences between the snow samples and the atmospheric samples
  - Figures 2, 4 and 8 : how was the classification performed ? Please explain in the methods part.
  - Line 161/162 : why are a-d representative of atmosphere ? And e-h of snow ?
  - Lines 195-197 : easily ??? please explain how (in the methods part), and add a reference.

2/ LAI is misleading (it also means Leaf Area Index). I would personally prefer the use of Ligth Absorbing Particles (LAPs) instead.

3/ The English is sometimes really difficult to understand and ambiguous. Though I am not an native English speaker, I would recommend a correction by a native English speaker.

4/ The RF change assessment is not detailed enough.

- Line 118-124, please describe again the conditions and parameters used in the simulations. It is required here even if it has been described previously in another paper. Why were such contents selected for the simulation ?
- Line 277 – 287, first describe the figure and the input for the different simulations. The difference in inputs is really difficult to guess

5/ Overall, I think the methods and data part should be largely extended to described in details all the methods used in the results part. In the results part, each Figure should be described first and then discussed or commented. The reading is really confusing otherwise.

Minor comments
Table 1 – Some spaces are missing (Sampling dates column)
Line 12 – "Aerosol impurities" this is quite redundant. Aerosols may be sufficient

Line 14 - "significantly varied " → will cause significant changes in radiative forcing

Everywhere : "glacier/snowpack" what do you exactly mean ? The snowpack on the glacier ? If yes, snowpack is probably sufficient.

Line 110-114. I don't understand this sentence. "Most" → please give a number.

Line 115 : "evaluated" → simulated

Line 160 : into → onto

Lines 186 : between the interfaces → between the snow and the atmosphere

Line 186-188 : very complicated and ambiguous sentence.