**The Cryosphere
Discussions**

Interactive comment on "Retrieval of snow grain size and albedo of Western Himalayan snow cover using satellite data" *by* H. S. Negi and A. Kokhanovsky

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General comments:

1. Though I understand the difficulties of finding a validation data set for the grain size, it would have been important to show the results of a snow model, for example, showing the differences between the results of the algorithm and those obtained with the snow model. I would strongly encourage the authors to perform such exercise in the future.

Reply: Thanks for your suggestion that we will take care in our future study showing the differences between the results of algorithm (discussed in the present paper) and

results obtained from the snow model (as discussed in detail in our previous publication Negi and Kokhanovsky, 2011).

2. Another point that I would have liked to see is the comparison of the results from Hyperion with those obtained from other sensors with a similar resolution such as LANDSAT or ASTER.

Reply: Landsat (ETM) and Aster sensors are having good number of bands 8 and 14 from visible to thermal region respectively and having good spatial resolution 30m and 15m in VNIR region respectively. However, the spectral bands required for grain size in NIR region are not present in these sensors. Therefore the Hyperion data was selected due to its suitable spectral bands for snow study. The spectral albedo can be estimated in VNIR region using the discussed ART theory for both the sensors.

3. It would be good to have a sensitivity analysis of how the results would be affected when different atmospheric corrections (that might be used for this case) are applied.

Reply: The sensitivity analysis using different atmospheric and aerosol models have been carried out to see its effect on atmospheric corrected images and the same has been incorporated in the revised paper.

Specific comments:

1. p 607 - contamination, of what ? specify

Reply: This is pollution in snow i.e. soot, soil / local contaminated snow

2. p 607 - 'snow characteristics' - Specify and expand

Reply: snow characteristics such as fractional snowcover, grain size, albedo, snow surface temperature etc.

3. p 607 - Line 16 - 'initially' -> in previous studies reported in the literature p 607 Line 22 - this sentence does not make sense. Please elaborate

Reply: The above sentences have been modified in revised paper.

4. p 610 - The word 'significant' should be used only in a statistical sense. Please replace it with, for example, 'considerable' or similar p 611 - at Sect. 5 - in Sect. 5 p 611 - Line 10 - delete Average (if that's a range how can that be the average?)

Reply: Suggested changes have been made in revised paper.

5. p 611 - Line 19 – highly glaciated - what do you mean?

Reply: study area is having large area covered by glaciers and permanent snow.

6. p 612 - what is the 'standing snow'? please use technical terms.

Reply: This is 'snowpack thickness'

7. p 615 why did you pick up 0.6 as a new NDSI value? why not 0.5 or another number ?

Reply: Many researchers have worked on the NDSI threshold value for snow cover and its value 0.4 was reported for binary snow cover mapping (i.e. snow vs non snow). In this case a pixel can be classified as a snow pixel if it is covered by 60% or more snow (SNOWMAP: Hall et al. 1995). Negi et al. (2009) studied NDSI values of contaminated and mixed objects snow reflectance using spectroradiometer and observed for 100% snow pixel its values are approx. more than 0.7 but in case of contamination, NDSI value may come down. This was equal to 0.6 in the present study so that pixels of light contaminated snow with 100% snow cover are also included in the retrieval process.

8. p 626 Line 2 - is simple: something seems to be missing here

Reply: Corrected as 'The main advantage of ART theory is simple approach using analytical equations as compared to other radiative transfer theories for retrieving the snow characteristics.'

9. p 626 Line 6 - were used –> was used

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Reply: Correction made in revised paper.

References:

Negi, H.S. and Kokhanovsky, A.: Retrieval of snow albedo and grain size using reflectance measurements in Himalayan basin, The Cryosphere, 5, 203-217, 2011.

Negi, H.S., Kulkarni A.V. and Semwal, B.S.: Study of Contaminated and Mixed Objects Snow Reflectance in Indian Himalaya using Spectroradiometer, International Journal of Remote Sensing, 30(2), 315-325, 2009.

Hall, D.K., Riggs, G.A. and Salomonson, V.V.: Development of methods for mapping global snow cover using moderate resolution image spectroradiometer data. Remote Sensing Environment, 54, pp. 127-140, 1995.