

## ***Interactive comment on “Application of MODIS snow cover products: wildfire impacts on snow and melt in the Sierra Nevada” by P. D. Micheletty et al.***

### **Anonymous Referee #1**

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#### General comments

The authors provide an analysis of pre and post-fire conditions over the Moonlight Fire affected region using MOD10A1 and MODSCAG imagery. Their conclusions show a significant change in several SCA metrics, including CDFs and melt-out dates.

The manuscript is well written and the analyses are consistent. I would point out to a couple of moderate observations though:

1) The objective of the paper is not to compare MOD10A1 and MODSCAG in terms of accuracy of SCA. The authors should be careful when saying that one product is better

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than the other based on the results of this particular work. In order to say that one product is “better”, a ground truth comparison is required (which is beyond the scope of this paper). The authors are on the right path when pointing out the MOD10A1 limitations though.

2) The adjustment of the canopy must be performed with annually varying canopy fractions from the MOD44B product. However, I am not sure if the authors performed this for the post-fire conditions. I checked the webpage of MOD44B and it seems that the product is available only until 2010. Please check this. I don't expect the conclusions to change significantly though.

3) It is important to distinguish between effects of the fire on ground SCA vs. effects on viewable SCA by the sensor. Whenever you detect and analyze changes in SCA from pre to post-fire conditions, be sure to assess if the detected change could correspond to changes in viewable SCA conditions.

4) Is there the chance to compare the behavior of the SCA over the Moonlight fire region to a region with a lower forest cover? It would be very interesting to analyze if the post-fire SCA conditions are similar to a non-forested watershed (i.e., has the “SCA regime” changed from forested to non-forested?). I understand this analysis is difficult as probably most of the similar elevation watersheds/regions have similar forest cover.

I recommend accepting the paper with minor revisions.

#### Specific comments

Figure 1 - Include geographical coordinates information for each of the regions.

Figure 4 - Increase the contrast between non-canopy and canopy adjusted fSCA (it is very difficult to distinguish both).

Page 7516

Line 22: You mention that part of the objective is to determine "the better indicator of

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SCA" between MOD10A1 and MODSCAG. Is this really part of the objectives? This has been studied previously, for example Rittger et al. (2011) does a comprehensive review of current MODIS snow products. I would rephrase the statement.

Page 7517

Lines 3-4: Do you mean "total cumulative burned area"? Or "annual burned area"? This part is not clear.

Page 7520

Line 11: Maybe this is a question for Painter et al., but does MODSCAG include a "burned canopy" endmember in the spectral library? If it doesn't, how does it account for the reflectance of burned canopy?

Page 7521

Lines 18-19: Why do you apply a vegetation correction to MODSCAG and not to MOD10A1? By applying the correction to MODSCAG you are scaling up the MODSCAG fSCA values, while leaving MOD10A1 untouched. I wouldn't recommend doing this as the results are not comparable if the correction is not applied to both values. It would be interesting to extend the analyses you perform in this paper to canopy adjusted MOD10A1.

Furthermore, what is the effect of fire in the MOD44B product? Is this a continuously updated dataset? I would expect that a fire would introduce a significant difference in tree cover, and thus correcting post-fire fSCA with pre-fire MOD44B would result in an error.

Page 7524

Lines 1-2: Is this relationship between exceedance probability and SCA calculated with your data? If it is, explicitly mention that you already did that calculation.

Lines 3-4: A basin average of 10% fSCA doesn't necessarily include many individual

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pixels with relatively high fSCA. This statement must be backed up with observations first.

Lines 5-6: Is the concept of exceedance probabilities used in SCA analyses in other papers? Even though 70% might be used for low-flow analyses, the choice of the value should be justified. A short analysis relating SCA CDF and streamflow CDF would be useful to justify the choice of exceedance probability.

Page 7526

Line 17: Please define how "duration of the winter precipitation" is calculated.

Line 17: How do you relate fSCA ensembles to duration of the winter precipitation? I am not sure if I am understanding this statement.

Page 7527

Lines 1-10: See comment for Page 7521, Lines 18-19. Clearly state what are the limitations of the MOD44B product in terms of representation of annual conditions. I am not sure if the MOD44B is updated annually. If it isn't, is the canopy adjustment valid after the fire?

Lines 11-25: This is an interesting analysis. Could it be repeated using the CDFs for the entire time periods? For example, calculate the CDF for the entire pre-fire SCA time series, and do the same for the entire post-fire SCA. I am not sure if you mean this in lines 14-16, please clarify if this is what you calculated.

Page 7528

Line 5: Does this result imply that there is more SCA on the ground, or only SCA viewed by the sensor? It is important to clarify this point: the larger number of days with higher SCA can be interpreted as "the sensor is seeing SCA that didn't see before".

Page 7530

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Line 21-23: Have you quantified the number of storms over the season? How do lower temperatures affect the persistence of SCA? These statements must be quantified.

Page 7531:

Line 14-21: Again, check how frequently MOD44B is updated. Be explicit in the methodology of which MOD44B years are used to correct canopy. I checked the MOD44B website [https://lpdaac.usgs.gov/products/modis\\_products\\_table/mod44b](https://lpdaac.usgs.gov/products/modis_products_table/mod44b) and it states that the availability is from 2000 to 2010.

Page 7534

Lines 11-13: What do you mean by “active and continuous spectral mixing analysis”? MODSCAG is based on spectral mixing analysis, however I do not understand what you mean by “active and continuous”.

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