

Interactive comment on “Topographic control of snow distribution in an alpine watershed of western Canada inferred from spatially-filtered MODIS snow products” by J. Tong et al.

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1. General comments

This paper analyses the relation between snow cover and topography in an alpine catchment of western Canada. The evaluation is based on MODIS snow cover dataset. The main objectives are to validate a spatial filter methodology used for cloud reduction and to assess the relationships between topography, snow cover fraction and duration based on the original and filtered MODIS snow cover products.

The analyses of regional snow cover characteristics using remote sensing data is def-

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initely within the scope of HESS. The paper addresses a relevant topic, but I have several critical comments which should be addressed before publication.

First, the scientific message of the paper is not clear. I would suggest the authors to carefully readdress and discuss the novelty of their own contribution. The presented work includes substantial computational effort; however the concepts, methods and datasets applied are not new. If the intention is to validate a spatial filter methodology, then the use of more extensive dataset of ground based measurements is needed. It will be interesting to see also the match between MODIS and station snow cover duration, but, again, using more dense ground data. Otherwise the conclusions about the spatial filter accuracy are not adequately robust.

Second, the motivation for the application of a spatial filter is not satisfactorily addressed. The results indicate that it helps to somewhat reduce clouds but it may have implications for the interpretation of results. The spatial filter mixes the snow cover information from neighboring cells and thus transposes the information from different aspects, slopes and altitude to the destination (cloud covered) pixel. I'm not convinced that methodologically is the spatial filter approach appropriate for the evaluation proposed in the title, and if so then it should be analyzed and discussed in more detail. The main question is if and how may this mixing affect the interpretations about the influence of selected topographic controls on the snow cover distribution. In this respect, I would suggest to test a simple temporal filter (e.g. 3-, 4- days) which offers a clouds reduction, good accuracy and does not affect (spatially) the relations between topography and snow cover characteristics.

Third, I wonder, if the application of 8-day MODIS product is of relevance for hydrologic applications. I would encourage the authors to provide the reasons why and where the 8-day MODIS product may be beneficial. In my opinion, the 8-day window is too large and together with the maximum snow cover assignment hides or shifts the information about important hydrological characteristics, e.g. the date when the snowmelt process starts. For many operational applications, the 8-day tolerance is simply not

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adequate. Again, I would suggest to focus on a shorter time window (e.g. 3-day) in the evaluations.

Finally, there is an open question, if the 1km grid resolution is adequate for the assessment of topographic controls on the snow cover distribution. There are studies (e.g. Trujillo et al. 2007), which explore in detail the effects of topography on snow cover distribution. Please provide a discussion, which will highlight the benefits, uncertainties and disadvantages linked with the use of coarse digital elevation model, MODIS datasets and outcomes and conclusions reached.

2. Specific comments

p.2350: The V005 MODIS version uses exclusively a conservative cloud mask. Please correct.

p.2351-1353, Data and methods section: It is not clear how the accuracy index is calculated? Please provide more details.

p.2352: What are the spatial patterns of clouds over the region? Do they differ seasonally? Where are the main differences in clouds frequency between daily and 8-day MODIS products?

p.2353: Please justify the application of the 10m elevation bands in the calculations.

p.2354: the term snowmelt is confusing. The snowmelt may start even if there is no change in the snow cover fraction. Please consider this in your interpretations.

p.2358. The term melt rate usually refers to the amount of water (in mm) melted within a given time period. Please consider to use another term for the depletion of snow covered area.

Tables and Figures: Please do not use the abbreviations (without an explanation) in the table and figure captions and keep in mind that the captions should be 'self-standing'.

Tab.2. I would suggest to omit this table; it may be described in the text.

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Tab.3. The same as for Tab.2., the regression line may be plotted in Fig.7.

Fig.1 Please consider to add geographic coordinates (e.g. as a cross) to the plot. The watershed is not delineated to the marked gauge, why?

Fig.2. Are the topographic attributes derived from the 1km grid? If so, please add this information to the figure caption.

Fig.3,4 5 and 7. Difficult to read. Please consider to use colors.

Fig.4. The term melt rate is misleading.

Fig.6. Please consider to make the maps larger. There is a lot of black-space in the figure, please minimize it. I would also suggest to change the first three colors in the palette, to be more intuitive.

References: Trujillo E., J. A. Ramírez, K. J. Elder (2007), Topographic, meteorologic, and canopy controls on the scaling characteristics of the spatial distribution of snow depth fields, *Water Resour. Res.*, 43, W07409, doi:10.1029/2006WR005317.

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