

## ***Interactive comment on “MODIS Cloud-Gap Filled Snow-Cover Products: Advantages and Uncertainties” by Dorothy K. Hall et al.***

**Anonymous Referee #2**

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The manuscript provides an overview of MODIS snow products development, including the newest snow gap-filled (CGF) maps, efforts related to their validation and clouds removal, describes the methodology of daily snow-gap-filled maps preparation, presents several examples from the western and eastern USA and concludes that the Aqua MODIS snow gap-filled maps should not be used as the basis of Environmental Science Data Record (ESDR). I recommend major revision and have the following comments:

1. Objectives, novelty -Manuscript authors are among the leading scientists in MODIS snow products development, evaluation and utilization. However, the objectives of this manuscript are not clear to me. The manuscript feels more like a collection of ideas and examples than a systematic exploration/summary of the MODIS CGF snow cover

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products advantages and uncertainties (manuscript title). At the end of the introduction it is mentioned "...In this paper, we describe the MODIS Terra and AQUA CGF algorithm, data products and uncertainties...." and "we also discuss the development of a moderate-resolution ESDR of SCE and using MODIS and VIIRS standard snow-cover maps". The latter is in my opinion not true, because the ESDR is just mentioned in the manuscript (its development is not discussed) and the same holds for VIIRS (it is not discussed, just mentioned that it exists and should extend the data through the 2030s). The CGF algorithm was already described in Hall et al. (2010). While the manuscript is informative, better indication of its novelty would be helpful.

2. Study area and period - I would welcome an explanation of study area and period selection. Why were particular study area and regions of interest selected? Fig. 1 presents western United states and part of southern Canada as the study area, but in the abstract and elsewhere, the northeastern United States are mentioned as well. Do the selected areas allow evaluation of uncertainties related to some issues mentioned in the text, e.g. rapid snow disappearance during the snowmelt or melting of the newly fallen snow during the cloudy periods? Figs 2,4,5,6 present data from spring 2012 (why namely that year?) while Fig. 7 shows the comparison of MODIS and Sentinel images for December 2016 (because the Sentinel data did not yet exist in 2012?).

3. Methodology and results - Because the objectives are not stated clearly, the methodology is in my opinion confusing as well. Lines 235-247 describe how are daily CGF maps created (methodology), but then the result on how quickly was a nearly cloud-free map obtained (in other areas and on other dates it can probably be achieved later or even earlier, a more systematic exploration would be interesting) is given. This result is followed by continuation of methodology (uncertainty based on the cloud persistence count and how the CPC is recorded). I recommend division of Methodology and Results. I agree that validation of the satellite data is only possible by comparison with measurements. The manuscript presents validation against the NOAA snow depth data provided by the dense network of meteorological stations. Such networks

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are not available in other countries. Can we trust that the CGF maps are valid also in those parts of the world where the network density does not allow detailed validation? I would welcome a comment on this. Is it possible to conclude that Aqua snow maps tend to have more clouds than the Terra snow maps globally? Can it not be only the case in some areas while in others it would be vice versa?

4. Discussion and conclusions - I appreciate the note that CGF snow products have all uncertainties of the original products as well as additional uncertainties that are related to the age of the snow measurement (l. 445-447).

Minor comment - text in lines 52-56 could be omitted.

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