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Discussions

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Interactive comment on "Evaluation of snow cover and snow depth on the Qinghai-Tibetan Plateau derived from passive microwave remote sensing" *by* Liyun Dai et al.

Anonymous Referee #2

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Snow cover is one of most important factors affected the land-atmosphere interaction and water budget on the Qinghai-Tibetan Plateau. And snow depth estimated from passive microwave remote sensing has been reported with uncertainties and the source of them has been discussed for many years. This paper utilized multi-source data including MODIS snow cover data, station measurements and snow course data, to evaluate the snow depth derived from AMSR-E and AMSR2 based on a spectral gradient algorithm. Many factors have impacts on the discrimination of snow from snow-free ground, and the linear relationship between the brightness temperature difference and snow depth. This is an interesting work. The impacts factors affected snow depth retrieval algorithm have been discussed thoroughly in this work. But the

authors still need to consider the following questions.

General comments/suggestions: 1. The threshold of MODIS snow fraction >10% is too small to definite snow covered surface. I suggest snow fraction should use a larger value. Since passive microwave remote sensing cannot detect snow when the grid is covered with 10% snow fraction. 2. My another question is on the explanation of soil temperature effect on snow depth algorithm. The authors should justify the explanation on this. The reason might be difficultly discriminate dry snow from frozen soil. The soil temperature could be contributed to discriminate dry snow from frozen soil. There are similar scattering existing between dry snow and frozen soil. While the soil temperature is different between them as the authors stated in this work. The soil temperature might be higher when the surface is covered with snow. 3. Section 2.1, "The relationship equation is SCF = 0.06 + 1.21 * NDSI". This equation is confusing given that for MOD10A1 in C5 and C6 and MYD10A1 in C6, SCF =-0.01 + (1.45 * NDSI6) and for MYD10A1 in C5, SCF =-0.64 + (1.91 * NDSI7). Please check it again and reference it to published papers. In which collection the NASA MODIS standard snow cover products were collected should be clearly stated as well because of some differences among different collections.

References: V. V. Salomonson and I. Appel, "Development of the Aqua MODIS NDSI fractional snow cover algorithm and validation results," in IEEE Transactions on Geoscience and Remote Sensing, vol. 44, no. 7, pp. 1747-1756, July 2006. G. A. Riggs and D. K. Hall, "MODIS Snow Products Collection 6 User Guide," 2015.

4. Details of the snow identification algorithm is suggested to be more specific, such as the criteria of dry snow determination, how the "offset" value was determined in the equation "snow depth (cm) = 0.7*(TB18H-TB36H-5)+offset". The thresholding snow identification algorithm used in this paper was referenced to Che et al.(2008), in which threshold values were separately determined using SMMR and SMM/I data. In addition, AMSR-E and AMSR2 employed a same suite of thresholds in this paper. Given different design characteristics and other factors causing bias among sensors, it should

be explained why this threshold-based method was applied consistently across sensors before inter-calibration. 5. As far as I know, both commission error and overestimation error in snow mapping are related with false snow detection on snow-free ground. Equations are needed to clarify how commission, omission, overestimation and underestimation errors were calculated in this paper. 6. Was wet snow excluded from ground observations before the evaluation of AMSR-E/AMSR2 snow depth? The capability of detecting snow depth from passive microwave data is limited by liquid-water content in snow cover. Also, it is better to discuss the effect of forest cover on evaluation of snow depth retrieval algorithm.

Minor comments/suggestions: 1. I suggested that it would be better that "Passive microwave (PM)" used in this manuscript replaced with "PMW". Since "PM" also is the abbreviation of Post Meridiem, meaning after midday. 2. Page5 Line 25, there is a typo appeared on "Cold desert: TB19V-TB18V >=18 (K) . . .".

3. In Fig. 1., please check if several selected meteorological stations on top left are out of the range of the Tibetan Plateau. 4. As for the title of Fig. 4 and Fig. 8, there are some sub-figures in the sequence of alphabets. But these alphabets are supposed to be ahead of sub-titles. 5. In Fig. 7, the value of X-axis is missed. 6. In Fig. 8, it's better use the density plot i.e. scatter points in different color varying with point density, to see whether most points are gathering around the 1:1 line. 7. In Fig. 9., the geo-location of Binggou watershed would be more understandable with frame ticks and latitude/longitude labels.