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Earth System Science Data Discussions

Interactive comment on "Glacier terminus retreat, mass budget, and surface velocity measurements for the Jankar Chhu Watershed, Lahaul Himalaya, India" *by* Suresh Das and Milap Chand Sharma

Anonymous Referee #2

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This manuscript presented the glacier terminus retreat, mass budget, and surface velocity measurements for the Jankar Chhu Watershed, Lahaul Himalaya, India using remote sensing and field observations. Such an investigation is definitely welcome to understand the impact of current climate warming on Himalayan glaciers. However, there are many issues with the overall structure, scientific language, and presentation of the work particularly with the repetition of work that will not create any significant contribution in glacier research. The language and grammar of the manuscript also need a thorough revision. Major Comments. Objective 1: The first objective is completely repetition of previous work, which does not contribute anything new for the research community. As most of the results related to glacier change already

published in another journal by the same authors (i.e. Das & Sharma 2019; Journal of Glaciology). In addition, taking consideration of nine studied glaciers will not fulfil the objective of ESSD journal to provide high-quality regional data to Earth System Sciences. Objective 2: Several studies have provided better data/information on surface elevation and geodetic mass balance for the study region (Brun et al. 2017; Maurer et al. 2019; King et al. 2019). Some studies have reported the long-term surface elevation change for the past four decades (King et al. 2019; Maurer et al. 2019). Vijay & Braun (2016) also analysed the geodetic glacier mass balance change in the Lahaul Himalaya from 2000 to 2012 then just for two more years mass balance change computed in the present study (till 2014) did not show any novelty. Also, Vijay & Braun (2016) have provided their data in the public domain and covered the large region. The geodetic and velocity changes for glaciers of Lahaul Himalaya already available freely from NSIDC (https://nsidc.org/data/HMA_GlacierAvg_dH). Therefore, the present study does not significantly contribute to the current knowledge of the status of glaciers in Western Himalaya. Objective 3: Recently a number of studies produced or developed velocity data for Himalayan glaciers and some data are freely available from NSIDC (https://nsidc.org/data/golive). I would suggest to compute seasonal variations in velocity instead of annual changes (e.g. Scherler et al. 2008; Satyabala 2016) and connect with mass balance changes which are missing in this study. Specific Comments: Abstract: Page 1 Line 20: "Field observations/measurements also support the findings". I could not find comprehensive ground data that support the validation of velocity and mass balance changes. Most of the fieldwork shows some photographs of glacier features and debris cover thickness. Such limited field data just provide the glimpse but does not validate the results. Introduction: Page 2 Line 41: It may be ELA elevation. Page 2 Line 41: You may include surface elevation change or geodetic mass balance as same calculated in the presents study. Page 2 Line 48-50: It would be better to revise the sentence as in recent years' number of studies used High resolution declassified images for this part of the region (Negi et al. 2013; Chand & Sharma 2015a; Chand & Sharma 2015b; Chand & Sharma 2016; Chand et al. 2017). Page 2 Line 51:

There is a need to provide gaps area for the Lahaul region instead of directly jumps into the comparison of retreat rate for the glaciated basin of Lahaul Himalaya. Page 2 Line 55: Several studies carried out a detailed analysis of geodetic mass balance for the Lahaul Himalaya including study area (Vijay & Braun 2016; Brun et al. 2017; Maurer et al. 2019; King et al. 2019). Some studies extended glacier surface elevation change or mass balance change for the past three decades to 2016-2017 (Maurer et al. 2019; King et al. 2019). Therefore, in this case, it is not true that "no study exists for this region". Data Sources & Methodology: Page 4 Line 104-106: There is a need to provide the brief description about the correction of elevation difference due to change in vertical reference between these two used DEM datasets (Mukherjee et al. 2013). In addition, you may use recently available high-resolution DEMs for Himalaya e.g. HMA DEM (8 m) or ALOS DEM (12.5 m) for mass balance estimation. Page 4 Line 114: Justification is required to use ASTER DEM as this study already used two DEMs. Page 5 Line 122: You may use the name of the glacier, as it has been written in Survey of India topographical map. Page 5 Line 126: There is a need to provide the uncertainty of Infrared (IR) Laser Thermometer sensor. What is the use of this data? How you will link single time observation with mass change and surface velocity estimation, which is the primary objective of the study? Page 5 Line 130-131: The handheld GPS measurements are collected for a few points, which can be used in general but does not contribute much in mass change and surface velocity estimation. Page 9 Line 188: Why select 25 degrees threshold where most of accumulation or ablation part has such slope. Justification is needed to use this slope threshold whereas most of the glaciological community use threshold of 40-45 degrees. Page 9 Line 202: Why used 2016-glacier boundary instead of 2014 as you used the 2014 TANDEM for the geodetic mass balance estimation?

References Brun F, Berthier E, Wagnon P, Kääb A, Treichler D. 2017. A spatially resolved estimate of High Mountain Asia glacier mass balances from 2000 to 2016. Nat Geosci. 10(9):668–673. Chand P, Sharma MC. 2015a. Frontal changes in the Manimahesh and Tal Glaciers in the Ravi basin, Hi-

machal Pradesh, northwestern Himalaya (India), between 1971 and 2013. Int J Remote Sens [Internet]. [accessed 2015 Aug 27] 36(16):4095–4113. http://www.tandfonline.com/doi/abs/10.1080/01431161.2015.1074300?journalCode=tres20# Chand P, Sharma MC. 2015b. Glacier changes in the Ravi basin, northwestern Himalaya (India) during the last four decades (1971–2010/13). Glob Planet Change [Internet]. [accessed 2015 Oct 28] 135:133–147. http://www.sciencedirect.com/science/article/pii/S0921818115300953 Chand P, Sharma MC. 2016. Monitoring Frontal Changes of Shah Glacier in the Ravi Basin, Himachal Himalaya (India) from 1965 to 2013. Natl Acad Sci Lett. 39(2):109–114. Chand P, Sharma MC, Bhambri R, Sangewar C V, Juyal N. 2017. Reconstructing the pattern of the Bara Shigri Glacier fluctuation since the end of the Little Ice Age, Chandra valley, north-western Himalaya. Prog Phys Geogr [Internet]. [accessed 2017 Oct 25] 41(5):643–675. http://journals.sagepub.com/doi/10.1177/0309133317728017 Das S, Sharma MC. 2019. Glacier changes between 1971 and 2016 in the Jankar Chhu Watershed, Lahaul Himalaya, India. J Glaciol. 65(249):13–28. King O, Bhattacharya A, Bhambri R and Bolch T 2019. Glacial lakes exacerbate Himalayan glacier mass loss. Scientific Reports, 9(1), pp.1-9. Maurer JM, Schaefer JM, Rupper S, Corley A. 2019. Acceleration of ice loss across the Himalayas over the past 40 years. Sci Adv. 5(6). Mukherjee Sandip, Joshi PK, Mukherjee Samadrita, Ghosh A, Garg RD, Mukhopadhyay A. 2013. Evaluation of vertical accuracy of open source Digital Elevation Model (DEM). Int J Appl Earth Obs Geoinf [Internet]. [accessed 2014 May 27] 21:205–217. http://linkinghub.elsevier.com/retrieve/pii/S030324341200195X Negi HS, Saravana G, Rout R, Snehmani. 2013. Monitoring of great Himalayan glaciers in Patsio region, India using remote sensing and climatic observations. Curr Sci. 105(10):1383–1392. Satyabala SP. 2016. Spatiotemporal variations in surface velocity of the Gangotri glacier, Garhwal Himalaya, India: Study using synthetic aperture radar data. Remote Sens Environ. 181:151–161. Scherler D, Leprince S, Strecker M. 2008. Glacier-surface velocities in alpine terrain from optical satellite imageryâĂŤAccuracy improvement and quality assessment. Remote Sens Environ [Internet]. [accessed 2013 Jun 4]

112(10):3806–3819. http://linkinghub.elsevier.com/retrieve/pii/S0034425708001934
Vijay S, Braun M. 2016. Elevation change rates of glaciers in the Lahaul-Spiti (Western Himalaya, India) during 2000-2012 and 2012-2013. Remote Sens [Internet]. [accessed 2017 Feb 5] 8(12):1038. http://www.mdpi.com/2072-4292/8/12/1038

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