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Geoscientific Instrumentation Methods and Data Systems Discussions

Interactive comment on "Performance of snow density measurement systems in snow stratigraphies" *by* Jiansheng Hao et al.

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Snow density is a fundamental property of snowpack and plays a key role for a wide range of applications and almost all of them require density values. Snow hydrology and climatology require snow density. A precise measurement of snow density and its variation in horizontal and vertical directions is of major importance to better understand and model a wide range of snow physical processes. Snow density varies with crystal size, shape, and the degree of riming during a snow season. Snow density is a complex parameter that can vary spatially, temporally and vertically within the snow pack profile. A precise measurement of snow density has been sought for a long time, and various measurement systems are used to obtain snow density so as to produce many data sets with significant differences. The idea of this research is novel,

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Discussion paper

especially the influence of snow hardness on different measuring systems. The result will help us to choose more effective and reasonable measurement system based on snowpack characteristics in the field, and will give us a better understanding of the snow characteristics of the instrument for carrying out snow hydrology research. The study has important scientific significance and practical value. However, there are few details that need to be revised before accepting this article. 1.The description of the global snow density database and spatial and temporal variability in seasonal snow density refers to Bormann (2013). Bormann, K. J., Westra, S., Evans, J. P., and Mccabe, M. F.: Spatial and temporal variability in seasonal snow density, J. Hydrol., 484, 63-73, https://doi.org/10.1016/j.jhydrol.2013.01.032, 2013. 2.The influence factors on the accuracy of density measurement system are described and studied by referring to LópezâĂŘMoreno (2020) and Kaur (2017). Kaur, S., and Satyawali, P. K.: Estimation of snow density from SnowMicroPen measurements, Cold Reg. Sci. Technol., 134, 1-10, https://doi.org/10.1016/j.coldregions.2016.11.001,2017. LópezâĂŘMoreno, J.I., Leppänen, L., Luks, B., Holko, L., Picard, G., SanmiguelâĂŘVallelado, A., AlonsoâĂŘGonzález, E., Finger, D.C., Arslan, A.N., Gillemot, K. and Sensoy, A.: Intercomparison of measurements of bulk snow density and water equivalent of snow cover with snow core samplers: instrumental bias and variability induced by observers, Hydrol. Process., https://doi.org/10.1002/hyp.13785, 2020. 3.In the section of "2.1 Measurement systems of snow density", The permittivity is measured directly by the snow fork instead of the snow density. The author needs to supplement the principle and relevant formula of obtaining snow density based on permittivity. 4. P7: Too much information about the environment of the experimental observation site is introduced. Much of the information is irrelevant to this study. 5.The performance of different measuring systems under dry and wet snow conditions was compared. But a detailed definition of dry and wet snow was not given in the study. This makes it difficult for field observers to refer to the results. 6.A discussion of the causes of the error of the gravimetric measuring systems refer to a recently published paper LópezâĂŘMoreno (2020). 7.Some editing and proofreading need.

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