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Interactive comment on "Snow density climatology across the former USSR" *by* X. Zhong et al.

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Reply to R.Brown's Interactive comment on "Snow density climatology across the former USSR" by X.Zhong et al.

First of all, we appreciate the reviewer for his constructive and insightful comments and suggestions for this manuscript. We consider all comments and suggestions seriously. The comments are very helpful for further revision of our manuscript. We have made all discussions based on the reviewer's comments and suggestion as described below.

R. Brown's Short Comments: It would be interesting to compare the results from a similar analysis we did with Canadian snow survey data that was published as a monthly look-up table for the Sturm snow classes in Brown and Mote (2009; Table 3 page 2129).

Reply: First of all, we had a mistake when computed monthly mean snow density for snow classes. Snow density records less than 10 years were not omitted when we did quality control. Then we had corrected the data and compared the two results of Canada and the former USSR. Results from snow classes showed that average snow density for the former USSR from 3% (prairie snow) to 38% (ephemeral snow) lower than the values in Canada.

Differences in snow density could be explained by the following causes:

1)From December to April, the differences in snow density for snow classes were not significant. However, the obvious differences were found in other months, especially in May and June. These were closely related to air temperature and wind speed. Snow density was influenced by cold temperature and wind, which compacted the snow layer and caused high snow density. Compared with the values in the former USSR, air temperature was lower and wind speed was higher in May and June in Canada. Therefore, monthly mean snow densities for snow classes in Canada were significantly larger than the values in the former USSR.

2)In the six snow classes, the differences in monthly mean snow density were larger for tundra (15% lower) and ephemeral snow (38% lower) in the two regions. For tundra snow, the number of sites in arctic and subarctic across the former USSR less than the Canadian sites. And most sites in the former USSR located at the south of 60°N. Affected by snow depth, air temperature, and wind speed, mean snow density for tundra snow across the former USSR lower than the values in Canada. For ephemeral snow, the areas were smaller and the number of sites was fewer in Canada, which may cause large differences in monthly mean snow density across the former USSR and Canada.

3)Generally, the courses are about 1000 feet long in North America. However, snow surveys run 1000 to 2000 m in open terrain and 500 m in the forest over the former USSR. There is very different in measuring length and areas. In addition, snow course are usually taken near the end or middle of the month and there is one record for

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each month (one or two records in May and June) in North America. But routine snow surveys run every 10 days in the cold season and every 5 days during snowmelt, this means that snow density is measured three times in one month at least in the former USSR. We averaged snow densities and then got the monthly mean for each site. Those differences in measurements and records may lead to the different outcomes.

We compared the two results of Canada and the former USSR in Discussion section.

Interactive comment on The Cryosphere Discuss., 7, 3379, 2013.