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Interactive comment on "Snow depth on Arctic sea ice from historical in situ data" *by* Elena V. Shalina and Stein Sandven

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The study "Snow depth on Arctic sea ice from historical in situ data" evaluates observations of snow and sea ice surface properties from the Sever aircraft landings on Artic sea ice from the 60th through 80th of the 20st century. The data contains snow depth from surfaces representative of the area near the landing site as well as some information on the snow depth distribution, from which the authors deduce average snow depth. This information is used to construct a climatological snow depth map based on significantly improved observational density in the Russian part of the Arctic compared to the Warren climatology. However, this climatology is only valid for the month between March and May due to visibility constraints for the landings.

The necessity and value to document and utilize these extensive observational datasets from the past cannot be understated and the paper constitutes a valuable contribution to this effort. The paper is generally well written and adds a thorough analysis to the documentation of the methodology. There are however a few general minor points and specific comments where the analysis and the presentation of the results could be improved before publication:

1) The authors provide a detailed climatology of average snow conditions but without a magnitude of the snow depth variability. It would be important to have this information as a measure the uncertainty of the climatology. Of course, variability can only be estimated in areas with repeated observations, but might be possible with pooling data on the Russian shelves.

2) The authors also did not show the difference to the Warren climatology. The improvements on the Russian shelves are obvious, but it would be valuable to assess the impact of the localized nature of the NP observations compared to the regional coverage of the Sever program on the generation of climatologies in regions where the observations should be comparable.

3) As the authors state themselves, the comparison with modern data is difficult due to different methodology of point measurements and the surveys at landing sites. Therefore, the result are not very insightful, especially without a magnitude of interannual variability in the timeframe of the Sever program. I would therefore suggest reducing the space allocated in the manuscript for this comparison.

Specific comments:

- replace 'fastice' with 'fast ice' throughout the document

- P10L16: Specify section number that you mean with "later"

- P12L6ff: Did the authors exclude MY thicknesses in this regression, because these would not be "undeformed"?

- P16L23: Rephrase sentence: "In the Kara Sea, there was the second (?) after ..."

- P20L6: Please provide the formula

- P20L6: Would it not be necessary to include the snow dunes in the estimation of average snow depth? Is there not information (ridge density) to do this?

- P20L15: Please provide coefficients of the quadratic fit

- P22L17: The author correctly state that it is difficult to draw any conclusions from a direct comparison of modern buoy data and historical in-situ data. Consider to shorten section 4.6 and move the main message to the discussion/conclusions section.

Figures:

- Figure 5: Consider to replace the contour plot with a colour-coded plot in Figure 11

- Figure 10: Consider adding histograms for the three month. It is very difficult to make out any changes other than seemingly random snow redistribution.

- Figure 11: Panels b and d are quite redundant. Consider showing W99 or difference to W99 instead

- Figure 11: The scale of the colorbars in panels c and d are slightly and unnecessary different

- Figure 14: Should the standard deviation (std) not be shown in both directions from the different snow depth values

- Figure 14: Consider spelling out level ice snow depth (SD) as the acronym is ambiguous with standard deviation (std)

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