

Interactive comment on “Spatiotemporal Variability of Snow Depth across the Eurasian Continent from 1966 to 2012” by Xinyue Zhong et al.

Anonymous Referee #1

Received and published: 11 October 2016

Summary: In this paper, the authors develop a snow depth climatology across the Eurasian continent using ground-based observations over 1966-2012. A total of 1814 stations from 17 countries spanning Eurasia with snow data are used to assess mean annual and maximum snow depth and their trends for each site. The northern reaches of Eurasia typically have the greatest mean annual snow depth, revealing a latitudinal dependence on the results. Trends assessed from linear regressions show significant increases in snow depth poleward of 50°N. These trends are associated more so with increased snowfall rather than rising air temperatures.

This paper provides a comprehensive climatology and trends of snow depth across Eurasia over an extended period of time. However, it is unclear how novel the results

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are compared to previous, similar studies (as cited in the paper) apart perhaps from the geographical extent of the study. My report provides guidance the authors may consider in revising their manuscript.

General Comments:

- 1) This study examines the characteristics and trends across the Eurasian continent from 1966 to 2012. To do so, the authors assemble snow depth data from 1103 stations across the study area. How representative are the station (point) snow depth data of the overall regional landscapes of interest? For instance, are snow depth data in forested areas collected at airports or other open areas, that may not represent the regional snow characteristics?
- 2) Further to this, snow course data from the former USSR are also employed in establishing the snow depth climatology (see Section 2). Is it therefore a fair comparison to present the station (point) data with those from local (spatially averaged) data?
- 3) The Introduction section is quite lengthy and could be abbreviated by focusing on past studies that report climatologies and trends in snow depth across Eurasia only and the gap being filled by the present study. Further to this, the Introduction should emphasize the novelty of this research compared to previous studies cited in the text.
- 4) The authors should consider the Mann-Kendall test to assess linear trends or other non-parametric trend analysis rather than linear regressions.
- 5) Do the linear trends reported in Section 3.2 exceed the variability in the snow depth data? In other words, are there “detectable” trends in snow depth, i.e. with the signal greater than the noise in the system?
- 6) All figures are rather small and difficult to interpret when printed on paper.

Specific Comments:

- 1) P. 1, line 21: Insert “a” before “snow depth”. Then insert “its” before “spatiotemporal”.

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- 2) P. 1, line 27: Consider a word other than “dramatically” here. Are these statistically-significant trends?
- 3) P. 3, lines 10-20: Note that the tense for verbs changes throughout this paragraph.
- 4) P. 3, lines 22-24: Are the soil thermal conditions reported here for winter only?
- 5) P. 4, line 8: Delete “the” before “ecological”.
- 6) P. 5, line 8: Delete “In order” and begin the sentence with “To obtain. . .”
- 7) P. 6, lines 4-8: Delete “Using data from ground-based measurements” as this repeats text from the previous sentence. Also, please rephrase the statement “a detailed description of snow depth”, as this suggests the paper goes at length in describing how snow depth is defined, which is not the case. This entire sentence is awkward and quite long, so should be rephrased and perhaps divided into two sentences.
- 8) P. 6, line 14: Snow depth data from 17 countries are apparently used in the present study; yet Table 1 lists only three countries (former USSR, Mongolia and China) as sources for the snow depth data.
- 9) P. 6, line 15: Insert “a” before “daily”.
- 10) P. 6, line 18: Replace “5” with “five”.
- 11) P. 6, line 22: “SWE” has not yet been defined.
- 12) P. 8, line 2: Delete “In order” and start the sentence with “To reflect. . .”
- 13) P. 9, line 8: What is a “scale gram”?
- 14) P. 9, line 15: Delete extra spaces before “from”.
- 15) P. 10, line 11: “TP” is not defined.
- 16) P. 11, line 4: Delete extra space before “northern”.
- 17) P. 12, line 2: Insert “it” before “fluctuated”.

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- 18) P. 12, line 7: Change to “decreasing trend”.
- 19) P. 12, line 25: Rephrase “fluctuant trend”.
- 20) P. 13, line 7: Delete “variability” before “trends”.
- 21) P. 13, line 25: Delete the space in “95%”.
- 22) P. 14, line 23: Delete the extra space before “snow”.
- 23) P. 15, line 2: Variations in hydrometeorological quantities such as snow depth are due to climate variability, not climate change.
- 24) P. 15, line 7: Here reports of significant declines in snow depth are provided, while the abstract (line 27) suggests the opposite pattern is being observed – which is correct?
- 25) P. 15, line 18: Change to “increased”.
- 26) P. 15, line 27: Insert “is” before “not”.
- 27) P. 16, lines 7-8: “differences” is used twice in succession.
- 28) P. 17, line 5: Delete the extra space before “is the”.
- 29) P. 22, line 20: This should read “Liston”.
- 30) P. 26, Figure 1: The colors highlighting three regions (Sakhalin, Kamchatka Peninsula, and northern Xinjiang Autonomous region) are nearly indistinguishable. Please consider using colors of greater contrast. Why are these regions highlighted in the first place? A number of abbreviations are used on the map that are not defined in the figure caption (this is an issue in other figures as well).
- 31) P. 27, Figure 2: Given the high number of sites with high average snow depth values in the northern reaches of the Eurasian continent, would the results be better depicted using contour lines instead? Consider adding the latitudinal averages of the snow data as secondary diagrams to these figures.

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32) P. 30, Figure 4: Does the number of stations used in the composite snow depth anomalies vary over time? The statistical significance of the trends should use the symbol " \leq " rather than " $<=$ ". Why does the last sentence in the figure caption mention "simulation" of snow depth?

33) P. 31, Figure 5: See comments for Figure 4.

34) P. 34, Figure 8: The statistical significance of the linear regressions should use the symbol " \leq " rather than " $<=$ ". Are any of the stations below sea level? If not, panels (b) and (c) should have their x-axes begin at 0 m in elevation. The caption should also state that these are relationships between snow depth and latitude and elevation, not changes.

35) P. 35, Figure 9: See comments for Figure 8.

36) P. 36, Figure 10: See comments for Figure 8.

Interactive comment on The Cryosphere Discuss., doi:10.5194/tc-2016-182, 2016.