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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Evaluation of the warming structure in the Arctic" *by* C. E. Chung et al.

Anonymous Referee #1

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Review of the paper 'Evaluation of the warming structure in the Arctic' by C.E. Chung, H. Cha, T. Vihma, and P. Räisänen submitted to 'Atmos. Chem. Phys. Discuss. (acp-2013-565)

The manuscript evaluates the horizontal and vertical temperature structure over the Arctic region north of 70oN as reproduced by four reanalyses products. In particular the authors discuss the recent changes in the vertical warming structure over the Arctic in dependence of the season. These changes have been recently discussed in the literature, see e.g. Graversen et al. (2008, Nature, 451, 53-56) and Screen and Simmonds (2010, Nature, 464, 1334-1337) and the results depend strongly on the used reanalysis data set. This underlines the great importance of this study which evaluates the newest available reanalyses products. In the Arctic region with its very

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low data coverage reanalysis data-sets are commonly used as “quasi-observations” in many studies on changes of the Arctic climate system. Therefore it is fundamental to evaluate these data sets in order to get reliable estimation of Arctic climate changes and further on, to achieve a better understanding of these changes.

Although the manuscript is already in the ’fair’ to ’good’ range, it needs improvements concerning the clarity of the discussion of the results. Because the main part of the paper is related to estimated trends of temperature changes, the calculation of the trends and their significance have to be described and discussed in more detail, the application of more extended tests of the statistical significance is suggested. Overall, I would require minor revisions and I would recommend to accept the paper after addressing all my comments, given below.

General comments

(1) In the introduction the study of Alexeev et al. (2012) is mentioned who evaluate the warming structures in the older NCEP/NCAR and ERA-40 reanalyses. It would be appropriate to compare the results of the present study with those by Alexeev et al. (2012). An according discussion has to be included in the manuscript.

(2) At some places the description of the results is not in systematic order which make it difficult for the reader to follow the text, e.g.∼in section 2, P21932 or section 3, P21933. Please rewrite the accordant parts of the manuscript.

(3) Section 4 on temperature trends: Due to the importance of the trend calculations for the main conclusions of the study, a detailed description of the trend calculations and in particular of the applied significance tests is required. Have different test been applied? Have temporal auto-correlation effects taken into account? If not, this has to be included.

Furthermore, I suggest to include an assessment of the significance of trend differences between data sets and to test the significance of a trend in the time series of

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differences between a pair of data sets. (In the time series of differences between a pair of data sets the variability common to both time series is removed).

Minor comments

(1) Section 2, P21932, L7-10: The description of the calculation of the GISTEMP temperature anomalies has to be clarified.

(2) Section 3, P21934, L27 and several other places: 'true Arctic-mean values' seems not the appropriate term. At least, an exact definition should be given.

(3) Section 3, P21936, L19-23: 'It is surprising that the old NCEP II reanalysis is superior to the new CFSR in summer at 925 hPa.' When looking at Figs,.∼7 and 8 I was not able to confirm this statement. Furthermore, the main message for this paragraph was unclear to me.

(4) Section 4, P21937, L14: 'Figure 9 shows the observed trends...' should be changed to 'Figure 9 summarizes the observed trends from 1998-2011..'

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 21927, 2013.