

Earth Syst. Sci. Data Discuss., referee comment RC1
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Comment on essd-2022-269

Lucas Menzel (Referee)

Referee comment on "The pan-Arctic catchment database (ARCADE) " by Niek Jesse Speetjens et al., Earth Syst. Sci. Data Discuss.,
<https://doi.org/10.5194/essd-2022-269-RC1>, 2022

First of all, I would like to thank the authors of this paper for their extensive work in compiling this truly significant dataset! It will undoubtedly be the basis for further studies on the impact of global change on the sensitive Arctic regions.

The manuscript first discusses the physiographic characteristics of the Arctic regions, especially with regard to their hydrology, sediment transport, and permafrost properties. In addition to the importance of the large rivers with their catchments, the paper draws special attention to the many small basins whose characteristics are largely unknown. The authors have taken the effort to delineate more than 47,000 small catchments based on the most recent available data sets and to present their most important characteristics. In the methodological part, the underlying data sets are briefly outlined and the working steps are explained in order to ultimately derive the most important characteristics of the catchments from the data. I find the references to the tools used, e.g. from QGIS or GRASS resp. SAGA, helpful for our own work.

Numerous data from very different sources have been brought together to characterise the catchments as best as possible (more than 100 variables in total!). I do not know all of the data sets used here, so I cannot judge the quality of the entire data set, but the authors' work is based on the most recent data covering the study region.

Finally, the authors briefly present some of their results, e.g. on warming trends in the different catchment categories (see the various tables in the attachment). This makes you want to study and evaluate the data set extensively. However, it is not yet freely available, but it is hoped that once the manuscript is accepted, the data will be available for extensive testing and research, and I'm looking forward to work with some of the material. Finally, it should also be noted that the manuscript includes an extensive collection of literature on the subject, which lists the most important and up-to-date publications.

To conclude, I find this contribution extremely important and recommend that the manuscript be accepted. Although I have no real critical comments, I would still ask the authors to address the following questions:

1) short chapter on soil properties (starting line 173): Please explain shortly for which purposes you calculated SOC contents (actually it should be clear, but please name it explicitly), but especially explain how you calculated the data, particularly for the individual depth intervals. How is the calculation based on SoilGrids, and how reliable is the data / how big do you think the uncertainties are, especially for the deeper soils?

2) Vegetation index (starting line 222): please explain shortly why you determined the vegetation indices only for the month of August

3) Table 4: what exactly is "grassland"? I am surprised that this land cover occurs in all catchment categories. Is there an explanation for this? I think that these are likely to be very different subcategories, i.e. "grassland" is not the same as "grassland". In the south of the large catchments (BS), "grassland" might already refer to parts of the extensive steppes / prairies. A similar question naturally arises for the categories "trees" and "shrubland". Unfortunately, this seems to me to be too rough or not clear enough. For hydrological modelling, for example, the categories are not explicit enough.

4) Table 5: I assume the climatic variables derived from ERA5 have not yet been cross-checked for the catchments, have they? I would be interested to know, for example, to what extent the information on evaporation is correct (but that could be an investigation that follows the publication of the data).

5) Figure 1: How precise can a subdivision of catchments be on the greenland ice sheet?

6) When working through the manuscript, I felt that there were a few redundancies. I can't name them specifically, but I would like to ask the authors to check everything again for redundancies.

7) Lines 149-152: The example with snowmelt (0.021 m d⁻¹): Sorry, but I didn't get it. Can you explain it differently?

8) Line 238: Something is missing here

9) Table 3: please add OCS to the legend / the explanations

