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Earth System Science Data Discussions

Interactive comment on "High-resolution (1 km) Polar WRF output for 79° N Glacier and the Northeast of Greenland from 2014–2018" *by* Jenny V. Turton et al.

Anonymous Referee #1

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General comments:

In this paper, the authors introduce numerical atmospheric model simulation data using the Polar Weather Research and Forecasting (Polar WRF) model applied in the Greenland. The authors set three model simulation domains: D1 covering the entire Greenland (horizontal resolution is 25 km), D2 covering the northeast Greenland (horizontal resolution is 5 km), and D3 covering the North East Greenland Ice Stream (NEGIS), where ice sheet thinning, retreat, and surface melt are accelerated recently, (horizontal resolution is 1km). First, they did dynamical-downscaling of the ECMWF (European Centre for Medium range Weather Forecast) ERA-Interim atmospheric re-

analysis dataset using Polar WRF in the D1 domain, then, did additional two dynamical downscaling calculations using Polar WRF in the D2 and D3 domains accordingly. In this paper, the performance of the model simulations for the D3 setting are presented and discussed in terms of 2 m air temperature and specific humidity, and 10 m wind speed and direction by comparing them with the PROMICE in-situ atmospheric measurement data. The authors argue very high-resolution model simulation data from the D3 configuration are very valuable because the dataset can be used for a wide variety of applications ranging from atmospheric dynamics studies, to input for hydrological and oceanic modelling studies. However, at present, this reviewer has the following concerns:

1. The open-source numerical simulation model (Polar WRF) itself is not developed by the authors. In my opinion, it implies that anyone who has enough scientific budgets can do this kind of numerical simulations relatively easily, so that the data lack high-level originality.

2. The authors do not validate the D3 model simulation results in terms of downward shortwave and longwave radiations, as well as surface (snow and ice) mass balance. Because downward radiations and precipitation are very important input parameters for hydrological and oceanic models, their argument "the dataset can be used to input for hydrological and oceanic modelling studies" is not supported by any objective evidence. Please note almost no direct precipitation measurement data on the Greenland ice sheet are available, so, usually, polar regional climate models are validated in terms of surface mass balance to confirm the models' performance simulating precipitation.

In the following part, this reviewer gives specific comments. Please note that page and line numbers are denoted by "P" and "L", respectively.

Specific comments (major)

P. 1, L. 17 $\sim$ 19: In order to argue "The dataset, (Turton et al, 2019b: doi.org/10.17605/OSF.IO/53E6Z), is now available for a wide variety of applications ranging from atmospheric dynamics, to input for hydrological and oceanic modelling studies", the authors should show model validation results in terms of downward shortwave and longwave radiations as well as surface mass balance.

P. 2, L. 44: However, recently, there are several attempts that applying high-resolution non-hydrostatic polar regional climate models in Greenland (Mottram et al., 2017; Niwano et al., 2018)

P. 2, L. 46: I think this model simulation by the authors is not "novel", because the model itself is not developed by the authors, which implies that anyone who has enough scientific budgets can do this kind of numerical simulations relatively easily.

Table 1: As far as I know, T2, Q2, WS10, and WD10 are not provided by GEUS. The provided T, Q, WS, and WD data are affected by surface height changes through accumulation/ablation.

Table 2: Please indicate coefficient of determination (R2) instead of correlation. For the model validation, indicating the R2 value is more general in my opinion.

Sect. 3.2: Why not directly showing comparison results for 1hour data?

Specific comments (minor)

P. 1, L. 15: It is better to indicate time resolution here as well.

P. 2, L. 53: I think katabatic winds and warm-air advection can be simulated accurately even by a 5 km non-hydrostatic atmospheric model if the model considers detailed atmospheric and snow/ice physical processes in an appropriate manner.

P. 2, L. 54 $\sim$ 55: Which model configurations (D1 $\sim$ D3) can be used for this purpose? Please explain more.

P. 4, L. 83: What are the "other sources"? Please specify them.

P. 4, L. 109: Please explain why the Kain-Fritsch cumulus convection parameterization scheme was applied only for the D1 and D2 configurations.

P. 5, L. 121$\sim$ 122: For snowpack, how deep do the authors consider in the model? Also, how did the authors confirm "the snowpack was adequately spun up before the onset of the accumulation season"?

Technical corrections

Please unify notations of the model domains throughout the manuscript. At present, there are three types of notations like "d02", "D02", and "D2".

Figure 1: Please indicate the NEGIS area in this map as well.

References

Mottram, R., Nielsen, K.P., Gleeson, E., Yang, X.: Modelling Glaciers in the HARMONIE-AROME NWP model, Adv. Sci. Res., 14, 323–334, https://doi.org/10.5194/asr-14-323-2017, 2017.

Niwano, M., Aoki, T., Hashimoto, A., Matoba, S., Yamaguchi, S., Tanikawa, T., Fujita, K., Tsushima, A., Iizuka, Y., Shimada, R., and Hori, M.: NHM–SMAP: spatially and temporally high-resolution nonhydrostatic atmospheric model coupled with detailed snow process model for Greenland Ice Sheet, The Cryosphere, 12, 635–655, https://doi.org/10.5194/tc-12-635-2018, 2018.

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