Response Letter

Dear Editor and Reviewers:

We greatly appreciate your efforts in reviewing the previous version of our manuscript (Title: Comprehensive evaluation of iAMAS (v1.0) in simulating Antarctic meteorological fields with observations and reanalysis, Manuscript ID: gmd-2024-229). We have carefully made point-to-point responses to all the comments/suggestions raised in your review reports and made the corresponding revisions in the manuscript. All the replies in this document are colored in blue, and the revisions/changes in the revised manuscript are marked in red.

Anonymous referee #1 Submitted on 13 May 2025

The authors have addressed suggestions from my previous review. I appreciate their discussion of snowfall in the simulations and the impact of the model top altitude on the stratosphere simulation.

Response:

We are pleased that the reviewers provided positive feedback on the revisions made to our manuscript. Once again, we thank the reviewer for the detailed and constructive comments offered earlier, which have been invaluable in improving the quality and clarity of our work.

Anonymous referee #2 Submitted on 27 May 2025
Overview Comments:

Thanks to the authors for their detailed responses to reviewer comments. The manuscript is nearly ready for publication and is a significant contribution to atmospheric modeling in the Antarctic.

Response:

We thank the reviewer for the positive feedback on the revisions made to our manuscript.

We also appreciate the additional detailed and constructive comments, which have been instrumental in further improving the quality and clarity of our work. We have carefully considered all the comments and have made comprehensive revisions to address each point raised. Our detailed responses to the reviewer's comments are provided below.

Specific Comments:

1. Line 45 in track change version used for comments: Manning and Powers (2024a, 2024b) are missing from the list of references.

Response:

We thank the reviewer for the careful check. The missing references for Manning and Powers (2024a, 2024b) have now been added to the reference list.

Revision in the manuscript:

We have added

"Manning, K. W. and Powers, J. G.: AMPS update – June 2024, https://polarmet.osu.edu/WAMC_2024/pdf/WAMC_2.08.pdf, presented at the 19th workshop on Antarctic meteorology and climate: June 2024, Columbus, Ohio, USA. Accessed: 2025-04-13, 2024a.655

Manning, K. W. and Powers, J. G.: AMPS: future plans, https://polarmet.osu.edu/WAMC_2024/pdf/WAMC_2.09.pdf, presented at the Workshop on Antarctic meteorology and climate: June 2024, Boulder, Colorado, USA. Accessed: 2025-04-13, 2024b."
in the revised manuscript (lines 663-666, page 33).

2. Line 63: "in these areas".

Response:

We thank the reviewer for the careful check and agree with the need to revise the statement. The wording has been corrected accordingly in the revised manuscript.

Revision in the manuscript:

We have replaced
"in this areas."
with
"in these areas."
in the revised manuscript (line 56, page 2).

3. Line 76: ", and the reanalysis and observational datasets".

Response:

We thank the reviewer for the careful check and agree that the statement should be revised.

Revision in the manuscript:

We have replaced
"the reanalysis and observational datasets."
with
"and the reanalysis and observational datasets."
in the revised manuscript (line 65, page 3).

4. Table 2, convection scheme, "Grell Freitas".

Response:

We thank the reviewer for the careful check and agree that the statement should be revised.

Revision in the manuscript:

We have replaced
"Grell-Freita"
with
"Grell-Freitas"
in the revised manuscript (Table 2, page 6).

5. Lines 201-206: This text needs to be rewritten. Blowing snow is not that important for snow accumulation in Antarctica. In some locations it is dominant, but in others it is negligible. Here is a good reference: https://doi.org/10.1029/2010JD015419

Response:

We thank the reviewer for the careful check and agree to revise the text. Based on the reference you provided (https://doi.org/10.1029/2010JD015419), we found that blowing snow plays a more significant role in the escarpment regions of the Antarctic Plateau, where strong katabatic winds prevail.

Revision in the manuscript:

We have replaced

"Blowing snow, characterized by the transport of snow by wind, plays a crucial role in snow accumulation in Antarctica. In contrast, snowfall from the sky appears to have a relatively minor contribution, as both iAMAS and ERA5 indicate that the Antarctic interior experiences significantly small snowfall (see Fig. S1 in the supplementary information)."

with

"Blowing snow, characterized by the wind-driven transport of snow, can play an important role in snow accumulation along the escarpment regions of the Antarctic Plateau (Lenaerts and van den Broeke, 2012), where strong katabatic winds prevail. Snowfall from the atmosphere appears to have a minor contribution, as both iAMAS and ERA5 indicate that most areas of the Antarctic continent—except for the coastal regions of West Antarctica—experience very low snowfall (see Fig. S1 in the supplementary information)."

in the revised manuscript (lines 177-182, pages 8-9).

References:

Lenaerts, J. T. M. and van den Broeke, M. R.: Modeling drifting snow in Antarctica with a regional climate model: 2. Results, Journal of Geophysical Research: Atmospheres, 117, https://doi.org/https://doi.org/10.1029/2010JD015419, 2012.

6. Tables 3-6. Break out station counts for RTM and HPP.

Response:

We thank the reviewer for the helpful suggestion and agree to separate the station counts for RTM and HPP. The table captions have been updated accordingly in the revised manuscript.

Revision in the manuscript:

We have replaced

"Monthly RMSE (BIAS in parentheses) of the 2-m temperature for ERA5 and iAMAS compared with AWS. The unit is ˚C. Number of stations: 45 (January), 47 (April), 44 (July), 51 (October)."

with

"Monthly RMSE (BIAS in parentheses) of the 2-m temperature for ERA5 and iAMAS compared with AWS. The unit is ˚C. Number of stations within RTM: 25 (January), 26 (April), 25 (July), 27 (October). Number of stations within HPP: 8 (January), 8 (April), 6 (July), 8 (October)."

in the revised manuscript (Table 3, page 12).

We have replaced

"Monthly RMSE (BIAS in parentheses) of the surface pressure for ERA5 and iAMAS compared with AWS. The unit is hPa. Number of stations: 42 (January), 46 (April), 44 (July), 48 (October)."

with

"Monthly RMSE (BIAS in parentheses) of the surface pressure for ERA5 and iAMAS compared with AWS. The unit is hPa. Number of stations within RTM: 22 (January), 24 (April), 24 (July), 24 (October). Number of stations within HPP: 8 (January), 8 (April), 6 (July), 8 (October)."

in the revised manuscript (Table 4, page 13).

We have replaced

"Monthly RMSE (BIAS in parentheses) of the 2-m specific humidity for ERA5 and iAMAS compared with AWS. The unit is g kg^{-1}. Number of stations: 32 (January), 34 (April), 35 (July), 35 (October)."

with

"Monthly RMSE (BIAS in parentheses) of the 2-m specific humidity for ERA5 and iAMAS compared with AWS. The unit is g kg^{-1}. Number of stations within RTM: 20 (January), 21 (April), 21 (July), 20 (October). Number of stations within HPP: 5 (January), 5 (April), 4 (July), 5 (October)."

in the revised manuscript (Table 5, page 15).

We have replaced

"Monthly RMSE (BIAS in parentheses) of the 3-m wind speed for ERA5 and iAMAS compared with AWS. The unit is m s^{-1}. Number of stations: 41 (January), 42 (April), 41 (July), 47 (October)."

with

"Monthly RMSE (BIAS in parentheses) of the 3-m wind speed for ERA5 and iAMAS compared with AWS. The unit is m s^{-1}. Number of stations within RTM: 23 (January), 24 (April), 24 (July), 26 (October). Number of stations within HPP: 8 (January), 8 (April), 6 (July), 8 (October)."

in the revised manuscript (Table 6, page 16).

7. Line 283: "that spatially smooths the topography".

Response:

We thank the reviewer for the careful check and agree that the statement should be revised.

Revision in the manuscript:

We have replaced

"the iAMAS model spatially smooths the topography"

with

"the iAMAS model that spatially smooths the topography"

in the revised manuscript (lines 253, page 12).

8. In comparing iAMAS with observations and ERA5, it should be emphasized that iAMAS is a forecast model that has drifted away from its initial conditions. ERA5 is an analysis that assimilates many of the observations being considered, surface pressure and radiosonde observations in particular.

Response:

We thank the reviewer for the valuable suggestion and agree to emphasize that iAMAS is a forecast model that has drifted away from its initial conditions, whereas ERA5 is an analysis product that assimilates numerous observations, including AWS and radiosonde data. We have noted this particularly in the comparisons involving surface pressure and radiosonde observations.

Revision in the manuscript:

We have added

"Table 4 demonstrates that the surface pressure of ERA5 is closer to the AWS observations, showing smaller RMSE values than iAMAS. This is expected since ERA5 is an analysis product that assimilates AWS observations. In contrast, iAMAS operates as a forecast model: it starts from initial conditions (i.e., ERA5) at the first time step and, as a global model, does not require boundary conditions during the run. Consequently, its forecasts may drift away from the initial conditions over time."

in the revised manuscript (lines 269-272, page 14).

We have added

"The temperature deviations between ERA5 and radiosonde observations are smaller than those of iAMAS. It is important to note that ERA5 is an analysis product that assimilates radiosonde observations, whereas iAMAS operates as a forecast model whose forecasts may drift away from its initial conditions (i.e., ERA5)."

in the revised manuscript (lines 359-362, pages 18-19).

9. Line 303 and 304: "8.29 to 2.41 hPa" and "4.84 to 2.14 hPa" for correct meaning.

Response:

We thank the reviewer for the careful check and agree that the statement should be revised.

Revision in the manuscript:

We have replaced

"as the pressure RMSE decreases from U120km (RMSE: 2.41 to 8.29 hPa) to V4km (RMSE: 2.14 to 4.84 hPa)"

with

"as the pressure RMSE decreases from U120km (RMSE: 8.29 to 2.41 hPa) to V4km (RMSE: 4.84 to 2.14 hPa)"

in the revised manuscript (lines 273-274, pages 14).

10. Line 368: "RMSE statistics".

Response:

We thank the reviewer for the careful check and agree that the statement should be revised.

Revision in the manuscript:

We have replaced

"RMSE statistic"

with

"RMSE statistics"

in the revised manuscript (lines 326, pages 17).

11. Line 456: Reverse the order of the two pairs of RMSE numbers for correct meaning.

Response:

We thank the reviewer for the careful check and agree that the statement should be revised.

Revision in the manuscript:

We have replaced

"from U120km (RMSE: 2.30 to 7.78 hPa) to V4km (RMSE: 1.45 to 4.15 hPa)"

with

"from U120km (RMSE: 7.78 to 2.30 hPa) to V4km (RMSE: 4.15 to 1.45 hPa)"

in the revised manuscript (lines 413, pages 21).