We appreciate the effort the authors took to take our feedback into account and to extend the discussion of multiple topics. We believe the manuscript significantly improved compared to the first version. We have a few minor suggestions to some of the authors' responses. Please find these suggestions in blue below. The line numbers in our suggestions refer to the pdf containing tracked changes.

1. **Title of the manuscript**

Therefore, we revised the title to:
"Solid-Earth Geophysics and Geodesy in Antarctica: Achievements, Current Capabilities, and Future Directions"

We can agree to the proposed title.

2. **Treatment of further observation technique**

RC2, CC1: *Heat flow measurements*

The new section 2.7 is well written. Because of this addition, the mentioning of geothermal heat flow in lines 630-632 should refer to, and be consistent with, section 2.7.

RC2: *terrestrial gravity*

L498: It is not clear what is meant with "more datasets could be provided consistently inferred in the same processing".

L739: Geothermal heat-flow datasets are not generally used to derive viscosity models in Antarctica as far as we know, whereas there is an example where gravity data is used (pappa et al., 2019). We suggest to at least add gravity in the list of constraints for mantle viscosity models.

RC2: *radar observations*

We think the discussion on radar datasets in section 2.8.2 is a valuable addition to the existing literature. However, there seem to be gound-based measurement campaigns that are used in Antarctica, for example as mentioned in Saintenoy and Léger (2025). Because the paper focuses on ground-based measurements and their possible integration across disciplines we think a short mention of some of ground-based radar measurement could be useful

L636: We think BedMachine could be a valuable addition to the reference list.

Saintenoy, A., & Léger, E. (2025). Studying cold regions with ground-penetrating radar: a review. Comptes Rendus. Géoscience, 357(G1), 283-298.

Rignot, E., An, L., Arndt, J. E., Bamber, J. L., ... Zinglersen, K. B. (2017). BedMachine v3: Completebed topography and ocean bathymetry mapping of Greenland from multibeam echo sounding combined with mass conservation. Geophysical Research Letters, 44, 11,051–11,061. https://doi.org/10.1002/2017GL074954

3. Response to further comments

Our comment: *Section 2.6. It is not clear why space weather is discussed in a separate section.*

Authors' reply: "... We agree the topic was not introduced well on line 73, and we adjusted the text in the last paragraph of the introduction to better describe why this section (2.6, new section number: 2.10) is included as a separate section."

We think it provides more clarity that the introduction now mentions that there are interconnections between space weather and geophysical research. However, it is not clear in the text what these interconnections entail, and it would be helpful for better integration of section 2.10 if this section would start with an elaboration on these interconnections.

Our comment RC2: *Section 3.1 presents subsections organized by categories of scientific questions but they do not always align with the topics introduced earlier in the manuscript. For example, the topic of section 3.1.4 ("Structure of the deeper mantle and the Earth's core") is introduced only briefly in section 2.3.2. We suggest to merge section 3.1.4 with section 3.1.3. There should also be more discussion on the lower mantle, given the difficulty in imaging it with seismic measurements and its importance for GIA and mantle convection (science question 17 and 18).*

Authors' reply: We added more details to Section 2.4.2 (former 2.3.2) regarding the importance of the lower mantle for GIA estimates.

The added clause in line 396-402 is a great addition but in the motivation for the question 18 and 19 in section 3.1.4 there is mainly motivation for questions on the core and core mantle boundary, and not yet research questions 18 and 19 and the state-of-the-art on the lower mantle that is now added to section 2.4.2. We suggest adding in 3.4.1 a few lines about what is currently unknown about the deeper mantle structure and the link with GIA and convection to properly ground questions 18 and 19.

Our comment: RC2: Section 3.1.7 ("Improved general circulation models") introduces general circulation models (GCMs) for the first time. Since the discussion extends beyond

GCMs alone, it would be better to introduce the role of geodetic observations in constraining atmospheric and climate models earlier in the manuscript and to rename this subsection to "Improved atmosphere and climate models."

Authors reply: We edited the wording of this section.

L856-861: This is a bit generic and does not fully clarify the link between geophysical and geodetic observations discussed in the paper and "global change" We recommend to add a few examples. For example, the possibility of measuring water vapor with GNSS (e.g. Negusini et al., 2021) .

Negusini, M., Petkov, B. H., Tornatore, V., Barindelli, S., Martelli, L., Sarti, P., & Tomasi, C. (2021). Water Vapour Assessment Using GNSS and Radiosondes over Polar Regions and Estimation of Climatological Trends from Long-Term Time Series Analysis. Remote Sensing, 13(23), 4871. https://doi.org/10.3390/rs13234871

Our comment RC2: *527: suggest to add van Calcar et al. (2025) to the references.*

Author's reply: Thank you for this suggestion; we've done so. Even more, we made a more complete reference list of coupled modelling studies at the start of the section, where the reviewer suggested to add van Calcar et al. (2025). Indeed this was missing, and so were a few other relevant studies. Drawing from our list on the ISMIP7GIA protocol, here is what we came up with there: Gomez et al. (2015), Konrad et al. (2015), Larour et al. (2019), Kachuck et al. (2020), Coulon et al. (2021), Book et al. (2022), Gomez et al. (2024), Houriez et al. (2025), Han et al. (2025) and Van Calcar et al. (2025).

Great improvement that all relevant literature is cited. We just couldn't find Coulon et al. in the text and list of references.

Our comment 531: Coupled models are the means to investigate how the solid Earth influences the ice sheet. They are referred to in the abstract and form critical need 2 (line 1025) It seems appropriate to discuss them in more detail and we suggest this location in the text. Ice sheet coupled to 3D solid earth models include Gomez et al. (2018), van Calcar et al. (2023), Albrecht et al. (2024). They have the draw-back of long computation time. Swierczek-Jereczek et al. (2024) and van Calcar et al. (2026) introduce methods to approximate solid earth deformation from 3D viscosity which could be very suitable for ensemble modelling that is necessary to get projections of Antarctica ice sheet melt with uncertainties.

Author's reply: We agree that coupled model frameworks are a key point that deserves more discussion, and thank the reviewer for raising that topic. In our revision we expanded

this paragraph to include a broad overview of recent developments, such as ISMIP7, including but not limited to the suggested publications. The revised text addresses process representation, mantle structure and rheology models, and emulation and other scalable approximations to address increasing computation costs.

We appreciate the effort to extend section 2.9 and believe the section now covers all the relevant aspects.

The structure of the text in lines 716-722 is not entirely clear. As currently written, the connection between solid earth response, the exclusion of MISI/MICI from the likely-range GMSL projections and the discussion of submarine portions is not clear.

The paragraph up to this point covers 3D rheology and the availability of faster models. We suggest splitting what follows into a new paragraph with a clearer internal structure: (1) solid-Earth response is important for sea-level rise projections (with references), (2) 'water expulsion' adding more details on one of the pathways , and (3) IPCC projections and ISMIP6 projections have so far only marginally incorporated solid-Earth feedback

ISMIP7 could be mentioned as ongoing efforts to include solid Earth feedbacks in upcoming projections.

Our comment RC2: Other remarks. *Topics of science questions 13 and 22 are not really found in the paper. Could this be addressed with a short text on marine geophysics? Reflection seismic could and sonar can reveal past grounding lines and sedimentation and the shape of the ocean basin where it interacts with the ice sheet.*

Author's reply: Since the focus of our paper is on the onshore part of Antarctica and on groundbased observation systems in geophysics and geodesy, adding a description of marine geophysics would go beyond the scope of our manuscript. We added respective reference to these questions in Section “The ice-bedrock interface zone from multidisciplinary studies” (2.8.2, new numbering). (The numbers are now 14 and 23, according to the further revisions made in the text.)

Regarding Question 14, we understand and agree that offshore work is outside the manuscript's scope, but it is in the questions proposed, which are an important outcome of the paper; we suggest at least adding short context, for example about why the connection between on-shore and off-shore structure is relevant.