

## ***Interactive comment on “Revisiting Austfonna, Svalbard with potential field methods – A new characterization of the bed topography and its physical properties” by Marie-Andrée Dumais and Marco Bröner***

**Anonymous Referee #1**

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General comments:

In summary, because of the importance of bed topography and sparse direct measurements of glaciers, the authors re-characterized the Austfonna, Svalbard bed topography and its physical properties with airborne gravity and magnetic measurements.

Overall, I have several questions for this manuscript, first, you revised the bed topography with gravity survey (section 4), however, there are lots of limitations and lack of analysis to figure out, whether the gravity method would be a good way to this study.

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We don't know what the resolution of GPR/RES measurements is, and how good will be the gravity method. Based on your current presentation, I was not convinced. Second, since you picked two gravity profiles to do 2D forward models with them. I knew these two profiles chosen due to their location and coverage, however, do you think more 2D gravity (magnetic) forward models would help for the bed lithology reconstruction? Third, based on the profile A and B 2D forward models results (Figure 5), the bed topography from GPR/RES, corrected for observed gravity and the model elevation is quite different, which one is more reliable?

Specific comments: P1, line23-34: more and recent references should add in this paragraph. P2, line10-11: studies using gravity and magnetic data on glaciers are more than these. P3, line19: IGRF-> The International Geomagnetic Reference Field (IGRF). P4, line25: what is the resolution of this bed topography grid? P4, line33-35: In the later manuscript, P7, you said 100 m ice thickness variation is about 0.5 mGal gravity changes, so how the resolution and accuracy of the ice surface topography's influence the misfit? P5, line17-27: A statistical analysis of bed elevation between GPR/RES, corrected by observed gravity and 2D forward model results would be helpful to interpret the results. P6, line14: "susceptibility 0.006 SI in a 0.003 SI surrounding"->"0.004 SI"? typo? P6, line16: "(0.018 SI and 2730 km m-3)"-> "2750 (2725) km m-3 "? typo? P7, line24-25: how to understand this sentence? "The magnetic and gravity interpretation, having been flown in a grid pattern, are less sensitive to gridding interpolation . . .". P7, line 26: Can you explain, how did you get this 100 m ice thickness variation is ~0.5 mGal variation in gravity? P7, line 34: reference? And also, the resolution of airborne gravity measurements also depends on the gravimeter, which was not discussed in this manuscript.

Figure1. Contour lines for elevation and thickness would be much more helpful than the color bars. Figure2. It would be better to represent all the gravity survey lines in this figure to make the choice of profile A & B much clearer. Figure5(b). There is no radar topography gravity response in the gravity panel for Profile B.

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