Dear Max Moorkamp,

Thank you for taking the time to review our manuscript and for the comments provided. We have gone through the annotated manuscript you provided and addressed all comments. This has helped improve the manuscript.

In what follows, we first answer your general comments and then proceed with some of the detailed comments from the annotated PDF version of the manuscript that was provided as supplementary material. We answer the rest of the comments directly in the PDF that was provided as supplementary material. The corresponding file is uploaded as supplementary material.

In blue are the comments provided. Our answers are written in green.

I have two major issues though that need to be addressed before publication:

- The description of the method and also the setup for the experiments for the most part reads like a rough summary. Important parameter values are not given, complex concepts are introduced through a single equation without much explanation and generally little effort is made to explain why certain choices have been made. As a long term joint inversion expert I can guess some things, but even for me many questions remain. I expect that the general reader will have significant difficulties to follow large parts of the description. In the pdf supplement I give detailed suggestions where the discussion/description needs to be expaned.

➔ Answer:
The point was not to drown the reader in extensive details about both MT and magnetic inversion, the probabilistic approach, ADMM algorithms etc. by detailing each of the building blocks of the method. However, in the light of your comments we have expanded the explanations introducing concepts. For instances, we have added several paragraphs to provide a more precise level of understanding of the probabilistic 1D MT inversion process and of the metrics used for uncertainty analysis. Overall, the added text is in excess of 3000 words in terms of the total paper length. For minor points and clarifications required as per the annotations in the PDF documents, we have brought clarifications in the text where necessary. We have followed most of your suggestions; also see our detailed answer to specific points below.

- The synthetic magnetic data in Figure 3 look strange to me, given that magetic measurements are only sensitive to susceptibiltiy contrasts. Either the authors have made some adjustments to the data (which should be described in the manuscript) or there could be some strong influence from thefinite extent of the modelling domain. The authors should therefore carefull check their implementation and model setup.

➔ Answer:
We have checked our implementation against analytical solutions and implemented two forward solvers for magnetic data. In this work we have used [Bhattacharyya, 1964], which we also compared to [Vallabh Sharma, 1966] for simple structures and found that results were consistent. We have also performed a third control using the Noddy modelling package [Jessell and Valenta, 1996], which uses yet another

approach. The model used in Noddy was created using information provided in the manuscript. The model and the forward magnetic data are shown in Figure 1. While its geometry a rough approximation of what is shown in the manuscript, we are of the opinion that it serves the purpose of further validating the forward modelling code we used.

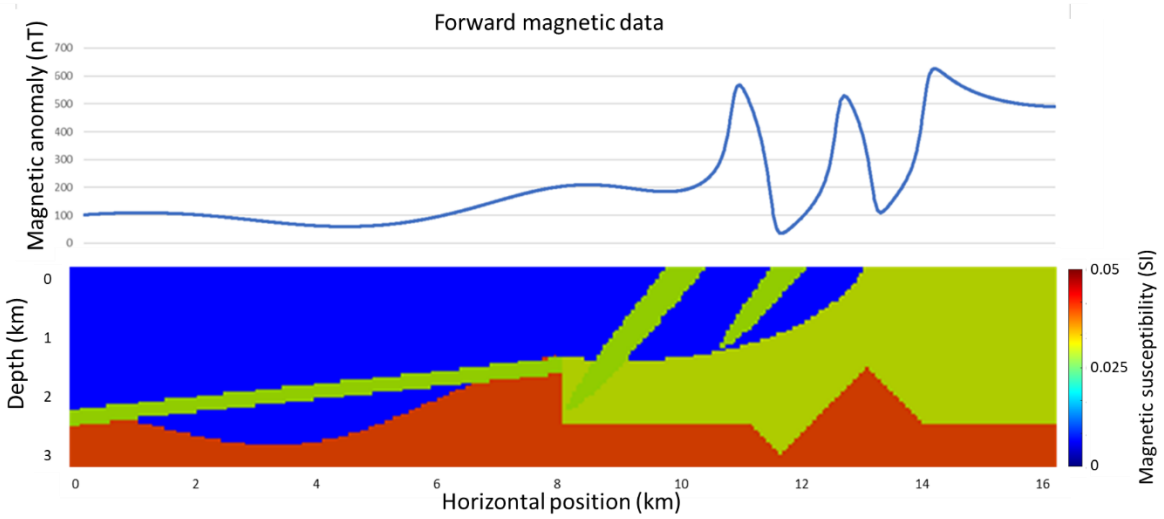

Figure 1. Benchmark model and corresponding forward data.

➔ We note that the purpose of synthetic testing as presented here is not to propose a synthetic whose setup is close to real world conditions. Rather, our aim is to propose an example somehow realistic in its structural and petrophysical setting. The model is setup with several padding cells in both horizontal and vertical direction, which may explain the phenomenon that prompted your comment.

We provide our detailed answer in the annotated document where we answer your comments, corrections and suggestions point-by-point.

References

Bhattacharyya, B. K. [1964]. MAGNETIC ANOMALIES DUE TO PRISM-SHAPED BODIES WITH ARBITRARY POLARIZATION. *GEOPHYSICS*, *29*(4), 517–531. https://doi.org/10.1190/1.1439386

Jessell, M. W., and Valenta, R. K. [1996]. *Structural geophysics: Integrated structural and geophysical modelling*. https://doi.org/10.1016/S1874-561X(96)80027-7

Vallabh Sharma, P. [1966]. Rapid computation of magnetic anomalies and demagnetization effects caused by bodies of arbitrary shape. *Pure and Applied Geophysics*, *64*(1), 89–109. https://doi.org/10.1007/BF00875535