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Reply on RC1:

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Dear Andrea Balza Morales,

Thank you for your constructive review and the opportunity to improve the paper. We are pleased to read that you are of opinion that results are noteworthy and contribute significantly to the field.

Below are our answers to your comments.

Reviewer:

"For the synthetic data, I am not sure how much the adding of the homogenous half space and topography plus the response of the magnetic bodies is affecting the result. It would be useful to review this using other inversion codes that have the capability of forward modeling the homogeneous half space including the magnetic bodies even if it is not parallelized."

Answer:

We have compared the calculated responses of Tomofast-x and Potent for simple cuboid models which can be accurately represented by the regularisation of Tomofast-x and achieved excellent agreement. As long as the magnetism of the halfspace is purely induced and its susceptibility not high then there will be no coupling between the halfspace and the bodies, due to linearity, so adding their response should be a valid approach. If a code which can accurately map the shapes and size of the bodies used in our synthetic example and also map the response of magnetic topography becomes available and adequate computational resources can be found to run it, we would be happy to assist in confirming the validity of our approach.

Reviewer:

"The results pertaining to the reduction factor are presented with clarity. However, inclusion of computing times and computational power specifications for inversions under varying reduction factors would enhance the comprehensiveness of the paper. Such data would afford readers insights into the nuanced trade-offs between continuity in inversion results and computational efficiency."

Answer:

We included in the paper a figure that shows the memory usage and CPU time for different compression rates. We also included to the paper the following paragraph discussing the added figure:

"Figure 11 shows the memory usage and CPU time (wall time) for compression rates from Rc=0.1% to Rc=50%, for the Callisto model, using Ncpu=40 cores on a machine with shared memory system. The memory was recorded by the value of 'VmHWM' saved in the '/proc/self/status' file. This corresponds to the peak resident set size ("high water mark") memory. The total memory is calculated by summing up this value across all processors. The memory reported in Figure 11 is measured at the end of the run to calculate the maximum RAM memory used. Both the memory used and CPU time scale nearly linearly with the compression rate. The theoretical memory prediction Eq.(A1) has a constant offset from the measured memory. This can be explained by the memory internally allocated by the MPI library. The offset also scales nearly linearly with Ncpu and this is explained by the shared memory allocated by the MPI. Thus, the actual amount of the allocated "offset memory" is smaller than reported using this approach, by a factor of ~Ncpu."

Reviewer:

"The paper would really improve by enhancing the text and colorbar in the model figures. By eliminating the grey background and increasing the size of the axis labels will make the image clearer. It would be interesting to see the flexibility of Tomofast with other open-source visualization software that is Python based, such as PyVista. Other aesthetic changes to the TMI map and figures are noted in the PDF."

Answer:

We modified all model figures by increasing the colorbar size, changing the background to white, and changing the colour of the axis labels, to make them more readable. We also adjusted the TMI map and topography figures according to your suggestions from the attached PDF.

Our point-by-point answers to the comments and suggestions from your attached PDF are provided in the supplementary material.

Thanks, and regards,

The authors

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Reply on RC2:

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Dear Reviewer,

Thank you for your constructive review and the opportunity to improve the paper. We are pleased to read that you endorse the paper.

Below are our answers to your comments.

Reviewer:

"As a general remark I agree with the comment RC1 that the readability of the legends in some of the figures, particularly Fig 3 (b), Fig 6, 8, 10, 13 could be improved."

Answer:

We modified all proposed figures by increasing the colorbar size, changing the background to white, and changing the colour of the axis labels, to make them more readable.

Reviewer:

"Another issue I would see is that, although I'm not an expert in that area, the choice of color scale in some figures (Fig 3, 4 and to a lesser degree Fig 6) might be problematic for readers with impaired red-green vision."

Answer:

The colours tables for the images have caused us a great deal of difficulty. At the request of the topic editor, we changed the colours to be interpretable by a range of colour blindnesses and tested them against colour blind test sites. While for normal vision it is sometimes difficult to determine what is high and what is low perversely, the colour-blind test sites suggest that this is not the case for colour blind readers.

Reviewer:

"One specific point is that on page 4, lines 8-10, the authors state that "What has been missing from this mix is an open source, cross platform, package able to scale to continental sized problems while offering rapid answers at prospect scale". There are two aspects of this statement which might benefit from some clarification: (1) While the authors describe on the previous page why SimPEG doesn't fulfill those criteria, they do not do so for the other packages mentioned in Table 1 and (2) given that the authors mention "cross platform" it would

be nice to add some information on which platforms the packages listed in Table 1 actually run."

Answer:

(1) We added in the paper the following sentence to clarify why other listed in Table 1 codes do not fulfill the performance criteria:

"To the best of our knowledge, among the open-source codes listed in Table 1, Tomofast-x is the only one that offers wavelet compression of the sensitivity matrix."

(2) Because it is not essential to the code and to avoid confusions, we removed the mention of "cross-platform" from the manuscript.

Reviewer:

"And finally, I assume the "Releif" in the heading of Table 2 is a typo."

Answer:

We corrected this typo.

Thanks, and regards,

The authors