We are particularly grateful to have received extensive and constructive feedback from 4 reviewers. Since the reviewers' comments sum to more than 20 pages, we summarise, in the present document, the main changes that we envision for the revised manuscript. We believe that the vast majority of the reviewers' concerns will herewith be addressed.

Main changes:

1. Some reviewers were confused by the dimension of FastIsostasy's domain. This is partly due to the acronym "FI3D" used in Test 3 and Test 4, where "3D" refers to the dimension of the viscosity field. We understand this concern and will replace "FI1D" and "FI3D" with "FI (ELVA)" and "FI (LV-ELVA)" respectively. In addition, we will make clear, from the beginning, that FastIsostasy is a 2D model by slightly modifying the title to *FastIsostasy v1.0 – An accelerated, regional 2D GIA model accounting for the lateral variability of the solid Earth.*

   The title of the article and the naming of the experiments was changed accordingly. In particular see l. 552-554. and l. 604-605.

2. The 4th reviewer suggests performing comparisons to ELRA in some of the tests. We will include such tests in the revised manuscript. We believe this new material will complement the existing analysis and make clearer that FastIsostasy represents a significant methodological improvement relative to commonly used regional approximations of the GIA response in ice-sheet modelling.

   This was included (see Fig. 8 and 9).

3. The original version of the manuscript defines a maximum error tolerance of 20% for all tests. Several reviewers suggested that this choice was arbitrary. We will therefore remove this threshold in the revised manuscript and replace it with additional comparisons of the error metrics across models.

   This was changed (see Section 4).

4. The 2nd reviewer argued that Section 2.4. is incomplete. In the revised version of the manuscript, we will address this by describing more extensively how sea level is modelled and coupled to the deformational response. This is made possible by introducing the mask of active region; this is mentioned in the manuscript but material will be added to the supplement in the revised manuscript. We will explore the impact of the sea-level treatment in Test 4 by including a simulation with fixed sea level.

   Section 2.4 has been extended to include a more thorough description of the se-level treatment.

5. The 2nd, 3rd and 4th reviewer expressed concerns about the mask used in Test 4 to quantify the error, given the importance of the peripheral forebulge. This mask includes the forebulge during the vast majority (~90%) of the glacial cycle since it is based on the maximal extent (LGM) of the AIS. To avoid any concern in this regard, we will use a mask defined by the active region instead. We emphasise that this new mask will not affect the error metrics substantially.

The active mask is mentioned there and shown in Fig. 9, pointing out that it is larger than the LGM extent of the AIS. This did not impact the error plot (panel a). The transient errors in Fig. 9 (panel b) are computed for the whole domain and not only for the mask. This was not mentioned in the previous version of the manuscript and has now been included at l. 627.

6. The 3rd reviewer recommended indicating the location of load and forebulge in several of the figures appearing in the results section. We agree that this revision will ease the interpretation of the plots.

   This was included in Fig. 6, 7 & 8.

7. The 1st reviewer expressed concerns about the derivation of the governing equation of LV-ELVA. The submitted version of the manuscript clearly indicated that our approach stems from an ad-hoc combination of the equations used in Bueler et al. (2007) and Coulon et al. (2021). However, we will add a new section in the supplementary material to describe our approach in more detail.

   This was included in Appendix A.

8. The 1st and 3rd reviewers expressed concerns about the correction factor applied to the effective viscosity. To address this, we will show a comparison between relaxation times computed using a compressible and an incompressible 1D GIA model and will describe the limitations of lumping the depth dimension more extensively. In particular, we will discuss the choice of the characteristic wavelength in greater detail.

   This was included (see Fig. C1 and l. 265-280).

9. The 3rd reviewer suggests extending the comparison between Seakon and FastIsostasy by including a discussion of energy consumption (see detailed answer to 3rd reviewer for more details). We will do so in the revised manuscript.

   This was included at l. 666-670.

10. The 3rd and 4th reviewer pointed out that the run times of 3D GIA models mentioned in the submitted manuscript are somewhat overestimated. We will revise this discussion by including the timing statistics cited in Albrecht et al. (in revision).

    This was included, among others at l. 664-665.

11. The reviewers suggested additional references, some of which we were not aware of. We will include all of these in the revised manuscript. In addition, we will improve the referencing to Coulon et al. (2021), Gomez et al. (2018), Van Calcar et al. (2023) and Albrecht et al. (2024).

    This was improved (in particular see Introduction).

12. In agreement with a comment of the 2nd reviewer, we will move the sections regarding the limitations of FastIsostasy to Section 2.

    Done. See Section 2.5.

In addition to these revisions, we will address all the individual comments raised in the reviews, including the correction of small errors and confusing phrases.

We believe that FastIsostasy presents significant advantages relative to regional GIA models (by significantly increasing accuracy without an increase in computational cost) and to global 3D GIA models (by being simpler to implement and reducing time and energy consumption by at least three orders of magnitude, whilst introducing errors that are acceptable for most applications). FastIsostasy is not a replacement for a 3D GIA model in studies of global sea level variations across ice age cycles and into the modern world. However, FastIsostasy can be an important tool in ice sheet modelling by improving the representation of the deformational and gravitational feedbacks associated with laterally-variable Earth structures. We will emphasise this motivation in the revised manuscript.

To our knowledge, FastIsostasy is the only GIA model with a dynamically built documentation, a suite of automated tests and a fully transparent development process. Additionally, the Fortran version of the software is now ready to use, thus allowing the user to choose between the advantages of a modern programming language and those of a statically compiled code that is compatible with any language. These aspects are important, though admittedly of a more technical rather than scientific nature.