

Dear Editor and Reviewer #1,

thanks for your comments.

Please find below our replies in italic and highlighted in yellow.

Best regards,

Manuele Faccenda

Dear Manuele Faccenda and co-authors,

We have now heard back from Referee #1, who had raised some concerns during the first round of reviews, but found the revision significantly improved. Before accepting the manuscript, I would like to give you the opportunity to address the technical comments from Referee #1. In addition, the similarity report we run as a routine check detected that there is some overlap in text between the ECOMAN manual and this manuscript (about 10% overall, mostly in Sections 2.1.2 and 3.1), and it would be great if you could rephrase these parts. (Finally, I also noticed a typo while reading: The reference Banghert et al., 2020 should be Bangerth et al., 2020.) Thank you for being so patient, and for submitting your work to Solid Earth!

Sincerely,
Juliane Dannberg

Dear Editor,

the content in sections 2.1.2 and 3.1 have been removed from the manual, which in fact was redundant. The typo has been fixed.

I have also added the additional reference Rappisi et al., 2024, GJI, an article from my group and collaborators that was recently accepted and that shows an application of D-REX_M to a geodynamic model in polar coordinates.

Replies to Reviewer #1

The authors significantly improved the manuscript and reviewing it now. I am happy with the extra information and explanation the authors provided. I only have specific and technical comments left. Other than that I would be happy to see this paper published.

Specific/Technical comments

- Line 132: Just to make sure I understand what is happening: when an LPO particle moves from for example a location where it is in the Wadsleyite phase (2), to a location where it is in the ringwoodite phase (3), it is assumed that no LPO is preserved and the LPO is set to be random?

When a particle enters the stability field of another anisotropic phase, the LPO can be either reset or retained (which implies axisymmetric topotactical growth).

This is now clarified at lines 195-196, and better explained in the manual (see section 4.6).

- As a general note, the scaling tests only go up to 8 cpu cores on a single workstation. This scales well, and it good to show, but it only really shows the shared memory scaling (OpenMP

I assume), but in line 276-277 HPC clusters are mentioned. These benchmarks do not show scaling on HPC clusters, which usually use MPI communication over many nodes. The authors do not show scaling for this purpose. Given that these tools seem to be mostly focused on post-processing, that may not be needed. So the authors should either clarify this in the text or add information to support their claim of HPC MPI scaling.

The HPE Superdome Flex is a full shared memory machine which performs at best if there is no communication among the CPUs. Otherwise, the runtime increases notably due to communication among the CPU nodes. In other words, the superdome architecture allows to have the illusion that the memory is shared, but physically it is distributed on the 8 different sockets.

As D-REX_M is parallelized with both MPI and OpenMP, and to exploit the best performance of the Superdome, the scaling tests shown in Fig. 5 are performed distributing the load across up to 8 CPUs with 28 cores each. Thus, in these tests each CPU works independently from the others, and they effectively represent HPC MPI scaling tests, although with a limited number of nodes (but that's what we have currently available in our department). This is clarified in the caption of Fig. 5.

- Figure 5 mentions CPU nodes, this is a bit confusing. I think this should be either be just CPU's or CPU cores.

The 8 CPUs present in the Superdome are actually different nodes (sockets) with their own memory, which can be shared thanks to fast interconnections.

- Figure 5: The purple line is very hard to see since it is behind the red line. It may be good to make the purple line a bit thicker to improve clarity

The thickness of the purple lines has been doubled, which improves their visibility as suggested by the reviewer.