

Geosci. Model Dev. Discuss., referee comment RC1  
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## Comment on gmd-2022-48

Anonymous Referee #1

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Referee comment on "Effectiveness and computational efficiency of absorbing boundary conditions for full-waveform inversion" by Daiane Iglesia Dolci et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2022-48-RC1>, 2022

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- This paper presents some common absorbing boundary conditions used in numerical simulations of wave propagation, commonly used as part of full-waveform inversion, across academia and industry. The work is quite relevant and valuable.
- High-level questions:
  - Could you add a clear "Contributions" section to the paper that highlights (bullet points) what is being claimed as new in this paper?
  - Can you comment how the choice of velocity models affects the results presented? e.g. why does the SEG/EAGE model behave so differently from the others? Or why all ABCs behave so similarly in the adjoint stage?
  - Can you comment on how different physics (e.g. elastic/viscouacoustic) might affect your results?
  - Does the adjoint field include reflection errors from the forward propagation? i.e. was the `d_sim` used the reference one or the one that potentially had reflection errors from the forward prop?
  - Are there limitations in the computational implementations (in your/Devito's code) that affect any of the results presented here? e.g. All boundary conditions augment the PDE. Are you solving the same augmented PDE in the entire domain (instead of just the boundary region)? If you could solve a simpler PDE in the physical domain and only solve the augmented PDE in the boundary regions, is it possible that the increase in computational time becomes negligible for all boundary conditions? Similarly for memory - for the fields added because of the ABCs, do you allocate memory over the entire domain?
  - If I understand correctly, the reference problem in Sections 6.1 and 6.2 are using a domain much bigger than the versions with ABCs, in order to get a version with no reflections.
    - If this same reference problem is used as a baseline for Section 6.3, this would be an unfair comparison. I don't think you're doing that.
    - However, if the reference/baseline problem has changed between sections, could you please make that more clear. e.g. by giving it another name - computational reference problem/reference problem B.
  - You are using subsampling in your gradient calculations for FWI. Could you justify the use of subsampling, as well as the chosen subsampling factors?
- Minor:
  - Line 7: DSL is written as DLS (also Line 600)
  - Line 8: Devito is primarily used for seismic modelling problems. Maybe not best to

say it targets them.

- Line 18: Psychical instead of physical
- Line 47: Devito provides simple examples. Not appropriate to call them defaults.
- Line 208-209: Combination of sponge layer and ABC is ambiguous since ABC is defined here to encompass all methods discussed, and all methods discussed so far in the paper use sponge layers.
- Line 269-270: The paper mixes the use of dampening and damping. Please double-check that it means what you want it to mean.
- Line 357: Missing reference
- Figure 9: b and c look blank. Are these supposed to be initialised at constant values of 2.5 and 3? Could you choose a colour scheme that makes this less ambiguous?
- Line 412: underling -> underlying
- Line 437: Could you highlight which C compiler was used?