

Geosci. Model Dev. Discuss., author comment AC1
<https://doi.org/10.5194/gmd-2021-411-AC1>, 2022
© Author(s) 2022. This work is distributed under
the Creative Commons Attribution 4.0 License.

Reply on RC1

Ludovic Räss et al.

Author comment on "Assessing the robustness and scalability of the accelerated pseudo-transient method" by Ludovic Räss et al., Geosci. Model Dev. Discuss.,
<https://doi.org/10.5194/gmd-2021-411-AC1>, 2022

Dear Dr. Wang,

Thank you for reviewing our manuscript draft. We addressed all your suggestions and hope we provided answers to the still open questions you pointed out. Find hereafter a detailed reply to your comments.

Best regards,

Ludovic Räss on behalf of the authors.

Detailed replies:

Line 8: 1.2 trillion degrees of freedom

I noticed 1.2trillion is not equal but about 10 time larger than 4995^3 , which cause my confusion. This means there would be about 10 different physical variables in each cell. But I don't think it is mentioned anywhere directly in manuscript.

Thanks for reporting this. It was indeed not very clear. We now provide a new table listing the number of DoFs per grid point as well as the number of fields used to compute the T_{eff} metric, and precised how to compute the total number of DoFs we report.

Line 12: low resolution

It would be nice to mention how low the resolution, like 254x254?

Thanks for suggesting. The resolution is given in the main text and we feel this information may not significantly enhance the abstract, thus we prefer not to include it.

Line 90: wave-like or mechanical process

Why would mechanical processes be the same with wave like process? It needs more explanation if it is written like this.

We do not state wave-like processes being the same as mechanical ones. We say that many geo-processes of interest can fall in one of these three categories.

Line 135: "The choice of the boundary conditions type affects only the values of optimal iteration parameters"
Is there example in this study? Or do you mean boundary condition affect the iteration count?

We mean what is written in the text, i.e., changing the type of boundary conditions will have an impact on the optimal values of the iteration parameters.

Line 212: "the iteration parameters"
It is probably better to specify which parameter should be locally defined. "C" is also iteration parameter. Do you change it locally?

We now explicitly enumerate the iteration parameters.

L. 484: single-loop iterative procedure,
I found this sentence is a bit confusing. You have dual time iteration: inner loop and outer loop. Here you say single-loop.

Thanks for pointing this out. We clarified the situation in the text. We here have one single iterative loop (combining the nonlinear and linear solve that usually require two nested loops). On top of this implicit iterative solver, we have the physical time loop.

Fig 5 and line 538-540 and line 546-547
It show that 3D case (yellow line) require higher value of normalized iteration count. This is just the opposite with what line 538 says. Explain?

Thanks for highlighting this poor explanation. We rephrased the sentence making the example clearer.

Line 560-561. 17 nx for 1023x1023 is good

It is good in the context of this study.

Line 590. This sentence for a single paragraph? Fig 9 caption has already said something about this. Perhaps this sentence can be removed.

Thanks, we added the missing info to the caption and removed the sentence.

Line 605-607. What does "the best known single-XPU implementation" refer to. I can not see from the context. A bit confusing for me. Would "the parallel efficiency of a single GPU is also below 100%" sound better?
It should be "than" instead of "then" in line 607. I also notice there are other place "then" is used instead of "than". Please check!

We slightly re-phrased the paragraph. Explanations in the follow sentence should be sufficient to set the context.

We also fixed the then vs than in the entire document.

Fig 11. What might be the reason for Tesla A100 behave differently in the diffusion and stokes solver? It was the worse parallel efficiency for the diffusion problem and it become the best for stokes problem.

Thanks, we added some suggestions in the text.

Line 630-631 and Fig 12

This description is not consistent with Fig 12. Please check! Also, why would viscosity contrast of $1e5$ need higher iteration time than viscosity contrast of $1e6-1e9$ in F12.b,c.?

The pseudo-transient method convergence rate is defined in the robustness study by the interaction between the "internal geometry", i.e., the spatial distribution of the material properties, and the boundary conditions. In the general case, the accurate prediction for the iteration count is possible only through the proper spectral analysis of the discrete finite-difference operator. Such an analysis could be impractical for large-scale problems. We aimed to demonstrate in that study that the simple analytical estimate for the optimal iteration parameter Re that we present in the paper remains a good starting point for numerical experiments that gives satisfactory convergence rate.

Line 634-635

Which iteration parameter do you use local values in each grid cell? Re ?

We clarified the parameters and added a cross ref.

Line 651. η_{vp} is not consistent with Eq.46.

Thanks, we fixed it.

Line 794: extremely low

I agree it is very low. But it would be nice to have a comparison when one say "extremely low". What are the normal/standard value for the iteration count when other iterative method is used!

We acknowledge the lack of clarity and rephrased the sentence.

Line 795. Or numerical additions

It is not clear here what you want to express here!

We acknowledge the lack of clarity and rephrased the sentence.

Line 802: shear bad

You mean "shear band", I suppose.

Thanks for spotting that one.