Geoscientific Model Development Discussions

Geosci. Model Dev. Discuss., referee comment RC2
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Comment on gmd-2022-66

Michael Tso (Referee)

Referee comment on "Massively parallel modeling and inversion of electrical resistivity tomography data using PFLOTRAN" by Piyoosh Jaysaval et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2022-66-RC2, 2022

Gmd-2022-66 review

- This article summarizes the extension of PFLOTRAN, a popular massively parallel code for subsurface flow and transport simulations for electrical resistivity tomography (ERT) modelling. ERT is one of the most popular geophysical methods.
- The article is pitched to focus on the parallel capabilities and good scaling for forward modeling and Jacobian computation.
- The authors have mentioned another well-established massively parallel code, E4D (L65). What is the motivation of including ERT capabilities in PFLOTRAN (given users won't typically expect geophysics capabilities in a flow and transport code). How different is the current ERT implementation different from E4D's? Was the goal to reproduce them as close as possible? Are there any plans to retire E4D?
- I understand the authors focus this work on ERT modeling only but it is still relevant to mention PFLOTORAN-E4D (Johnson et al. 2017), a now discontinued PFLOTRAN feature (I.e. the HYDROGEOPHYSICS mode) to call E4D for coupled hydrogeophysical simulations. I think it will help explain the motivation behind this work.
- Are all the inversion and output options from E4D available in this new implementation?
- RC1 suggests more details on parallel implementations. I think if it is not too different from PFLOTRAN in general, then a simple statement to state this fact will be sufficient. Any differences in parallel implementations should be highlighted.
- This work boasts the capability to model problems with very large DOFs. It will be helpful to discuss what practical problems may benefit from such capabilities. A modelling example with field data will be helpful. A comment on usability will be helpful too. For example, it essentially reads a PFLOTRAN input deck cards, so users familiar with PFLOTRAN can immediately take advantage of this new feature.
- The example model runs and scalability tests are sufficient to illustrate the points made in the paper.
- I understand the public version/main branch of PFLOTRAN v4.0 does not include ERT

capabilities. Make a note on which branch is copied to the repo.

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Johnson, T. C., Hammond, G. E., & Chen, X. (2017). PFLOTRAN-E4D: A parallel open source PFLOTRAN module for simulating time-lapse electrical resistivity data. Computers and Geosciences, 99, 72–80. https://doi.org/10.1016/j.cageo.2016.09.006