

Interactive comment on “Development and performance optimization of a parallel computing infrastructure for an unstructured-mesh modelling framework” by Zhuang Liu et al.

Anonymous Referee #2

Received and published: 27 October 2020

This paper describes the aspects of parallel computing, index optimization and an efficient group I/O strategy in the development of a parallel computing infrastructure for an unstructured-mesh global model. Computational performance of an unstructured-mesh global model is an important research topic as it impacts overall model performance especially in the high resolution grids. This paper is composed of the detailed steps to construct mesh using METIS tool, to communicate between processes using MPI non-blocking APIs, to evaluate three mesh index reordering strategies, to select a process for group communication, and to use MPI API for completing the group communication. Finally, numerical test results are provided with varying process numbers showing the speed-ups. Overall, this paper has merit of exploring multiple options in its

C1

design and implementation with enough details. However, it is not clearly addressed claiming the parts that are noble in this paper.

Scientific questions / issues

1. According to several parts of this paper, three mesh index reordering strategies are investigated to improve cache efficiency. However, there is no discussion about the cache efficiency differences in the three index reordering strategies. Therefore it is unclear if the outcome of the investigation is due to cache efficiency or something else.
2. In section 2.2, it is claimed that scientific model developers can implement communication without knowing the communication details by using "exchange_data_add" and "exchange_data" based on "linked list". It is unclear how much details of communication this tool hides when compared to conventional methods.
3. It is unclear if the timing of group I/O in Fig. 8 includes any overhead for implementing group I/O such as selecting one designated process for communication.
4. In section 2.3, there are statements: "It should be noted that all the actual run times of the G10 grid are shorter than the corresponding ideal run times, that is, the super-linear speedup is achieved for the G10 grid. This abnormal phenomenon indicates that there is still room for improving the computational efficiency of running with smaller numbers of processes." It is unclear why the super-linear speedup happens. Also, it is also unclear why the super-linear speedup indicates that the room for improving the computational efficiency exists.
5. In the paper, there are terms of "toolkit" and "framework". It is unclear what is the relationship between them.

Interactive comment on Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2020-158>, 2020.

C2