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# *Interactive comment on* "PatCC1: an Efficient Parallel Triangulation Algorithm for Spherical and Planar Grids with Commonality and Parallel Consistency" *by* Haoyu Yang et al.

**Anonymous Referee #1**

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General Comments

This paper describes the parallel computation of spherical and planar Delaunay triangulations, which can be used by grid point models and related interpolation schemes. The basic idea of the proposed method lies in the efficient combination of well-known building blocks: stereographic projection of subdomains, local triangulation, parallel domain merging and dynamic task scheduling. None of these components is presented in the context of spherical grid generators for the first time. Still, the presented results are interesting and they certainly deserve attention.



Many related subproblems are discussed and handled reasonably, for example the detail of "false triangles", the use of a memory pool, the calculation of finger prints for comparison, and the way how a unique triangulation is chosen from multiple valid Delaunay triangulations.

Specific Comments

- The strength of the paper lies in the discussion of parallel consistency and the hybrid-parallel task scheduling. However, the objective of the overall design should be made more clear: Do the authors aim for a data-parallel algorithm in order to avoid memory bottlenecks? In this case the step (1) in 4.7 would need revision. Otherwise, why should the principal goal be a task parallel algorithm if "most existing couplers can read in offline remapping weights" (l.28)? Furthermore, enforcing a unique triangulation would have no practical use for the calculation of offline remapping weights.
  – Please clarify the design objective.
- Strictly speaking, the paper does not formulate a concise algorithm. The scientific results will be reproducible only after the source code has been published (announced in the manuscript summary).
- The introduction is well written; however, the problem of data interpolation in Earth system modelling is formulated in a rather narrow sense: Vertical remapping, grid staggering, the treatment of over- and undershoots, interpolation of tangent vector fields etc. should be mentioned. All these aspects highly depend on the set of variables and the grid under consideration.
- The proposed algorithm applies to horizontal interpolation of scattered data sets only. Neglecting the grid topology and rebuilding a Delaunay triangulation means

that the algorithm is unsuitable for masking and conservative remapping of finite volume data.

Domain decomposition and pre-processing:

- The decomposition method is actually very similar to classical algorithms like kd-tree half-space subdivision in lon-lat space. The authors should at least expose this similarity and maybe shorten their presentation.
- How do the authors deal with load imbalance due to meridional convergence of a source latitude-longitude grid?
- Points which geometrically coincide at the poles are modified in an elaborate way. For Earth system models, this should not be of practical use, since the source grid points may be topologically different but (should) consistently contain the same value.
- Does the computing resource manager take the faster shared-memory communication into account when decomposing the domain?

Not covered by the manuscript, but of interest:

- A practical parallel algorithm for merging the local triangulations is not presented (e.g. k-way merge)
- Round-off problems, which typically appear (e.g. in the local triangulation step) are not discussed.
- The user-defined expansion rate (l.255) is not explained in detail. How could this rate be determined automatically, ensuring an optimal workload?



Technical Corrections

- l.42: “horizontal grid*s*”

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