



## ***Interactive comment on “OASIS4 – a coupling software for next generation earth system modelling” by R. Redler et al.***

**Anonymous Referee #2**

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The paper presents a description of new extensions to OASIS to support parallel coupling. In particular, the parallel computation of interpolation weights and parallel communication of data are described. Relative to OASIS3, this is an important extension of the model. The most important new algorithm is the hierarchical search implementation. As the authors point out, the OASIS coupler is developed for a specific type of coupling that focuses on minimal modifications in the scientific components and a relatively flexible run-time interface to specify coupling fields and methods.

In a general sense, the performance of the new algorithm seems reasonable although specific comments or data about the performance of OASIS3 would be helpful. There are still some gaps in capability that need to be filled including support for more general grids (which the authors mention in the final section).

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— Several aspects of the paper could be clarified —

- How is data transferred in both the "direct" and "transformer" methods. Is it an M to N transfer or a gather/send/rcv/scatter implementation. Are the methods just parallelized or is the data transfer also parallelized?
- What decompositions are generally supported? And how is connectivity of a grid decomposed across different processors described? Are only "single block" decompositions supported so the connectivity is implicit?
- What is the memory use and memory scaling of the implementation? Are global grids allocated to support search and/or interpolation?
- Is a fully concurrent component processor layout the only implementation supported?
- Description of the "local-only" parallel interpolation has little value in the scientific community and need not be included.
- Are there any specific concerns with respect to use at very high resolution?
- There are many grammatical errors, and I point out several below.

— Specific scientific questions —

pg 800, line 15, "avoid complex technical problems", what are they?

pg 806, line 9-11. I'm not sure what the purpose of that sentence is.

pg 808, line 19. "To minimize the transfer of source data". In general, the algorithm chosen does not necessarily minimize the transfer of total data. There are other options including interpolation on the source grid plus communication/sum. The authors have chosen communication of source data plus interpolation on the target grid. This is the easiest parallel interpolation scheme, but not necessarily the fastest or the one that minimizes communication cost.

pg 818, line 25. It looks like the bicubic is less accurate (4.2% error) compared to the

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bilinear (0.8% error). Is this difference the algorithm or the grid?

pg 822, line 5, In section 8, it might be helpful to add info about the decompositions of the test cases. Can the tables be converted to graphs somehow? Is the 1-1-1 "number of processors" equivalent to OASIS3?

pg 824, line 14, No statistics is somewhat dangerous, especially with timing of routines that include communication. I suggest running at least a few cases a few times to get an idea of the inherent variability and document that information.

pg 826, lines 3-11. I need to understand better the general communication implementation to understand why only 2 pes are active in that configuration.

pg 826, line 24. Do you know for certain you are getting "cache effects"? How?

— Grammatical concerns —

pg 800, line 2, "not to forget" is not correct.

pg 800, line 4, "just to mention a few" is not needed, rewrite sentence.

pg 800, line 22, "90ies" should be "nineties"

pg 800, line 27, "a new ... software", is not correct, drop "a".

pg 801, line 11, unclear sentence, rewrite.

pg 803, line 23, not sure "standard-conform" is correct. "conforming" maybe?

pg 803, line 24, "With the current version" needs a comma or another phrase.

pg 805, line 15, contents ... "are" read, not "is".

pg 805, lines 22 and 23, "have to be", try "must be"

pg 805, line 23, "announced" is not the right word. try "specified" or "defined"?

pg 806, line 5, remove "to that"

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pg 807, line 27, reformat Balaji reference to (Balaji, 2001)

pg 808, line 24, "which allows to determine" should be "which determines"

pg 809, line 16, "to the grid points" should be "with the grid points"

pg 809, lines 17-19. those two sentences need to be rewritten

pg 810, line 2, "what is happening behind the scene inside" needs to be rewritten

pg 810, line 15, "star" is not the right word, use "stencil"

pg 810, lines 24-26, last part of that sentence starting with "until it is ..." needs to be rewritten

pg 811, line 8, "allows to handle" needs to be rewritten

pg 811, line 10, last sentence could be removed

pg 811, line 29, "it may be that" can be removed

pg 812, line 5, "the choice" could be "an option"

pg 812, line 15, "in general" needs some punctuation

pg 813, line 4, stars to stencil

pg 813, line 14, sentence needs some punctuation

pg 814, line 9-10, "for each target cell" needs some punctuation?

pg 814, line 10, "as many functionality" should be "as much functionality"

pg 814, line 12, "up to the point" should be rewritten

pg 814, line 13-15, rewrite sentence

pg 815, line 2, "and more important" phrase makes no sense

pg 815, line 5, "extend" should be "extent"

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pg 815, line 11, "extent" should be "extend"

pg 815, line 13, "in general" could use some punctuation

pg 816, line 8, "process". do you mean "single pe", "processors", or "component"

pg 816, line 25-, sentence makes no sense

pg 818, line 12, "as cosine" should be "by cosine"

pg 818, line 25, "even about" could be removed

pg 818, line 26, "as for" should be "like"

pg 821, line 20, "performant" is "a performer". "efficient" or "fastest" are suggestions

pg 822, line 1-4, suggest having multiple sentences connected with ", and it performs" and "or IO, so only the"

pg 822, line 6-8, sentence should be rewritten

pg 823, line 5, "in general" could use some punctuation

pg 823, line 6, "to be" can be removed

pg 825, line 9, "as it is only at the very end" needs to be rewritten

pg 825, line 15, "only one answer" could be "problem provide one explanation of this behaviour"

pg 825, line 15, "beyond control of PSMILe" is not clear. I think you want to say that load imbalance in the scientific components or in the communication network cannot be overcome by PSMILe. And that's fine, but there are implementation choices in PSMILe that might minimize the impact (like non-blocking sends which you are doing).

pg 825, line 17, don't use "e.g.", use "for example" or similar.

pg 828, line 23, "for that being that OASIS4" needs to be rewritten

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pg 829, line 5, "which we now see arriving at the horizon" needs to be rewritten

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