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Geoscientific Model Development Discussions

Interactive comment on "The OASIS3 coupler: a European climate modelling community software" *by* S. Valcke

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Dear Referee #2

Thank you very much for your detailed review. Please find here below some answers to your comments and questions

General overview:

My intention in writing this paper and submitting it to the GMD special issue "Community software to support the delivery of CMIP5" was to provide a general technical overview of the OASIS3 coupler and its use, in particular in CMIP5 models. The intention was not to provide, in the text, a detailed technical description on how to use OASIS3 to build a coupled system, as this is already done in the existing OASIS3 User

Guide. I therefore propose to slightly reduce the technical aspects in the text (i.e. Sections 4.1, 4.2, and 4.3 where possible) but add the OASIS3 User Guide as an electronic supplement, as you suggested.

Main concerns:

-"OASIS acronym" :

Of course, the acronym should be explained in the text. It will be on the 2nd page.

-"OASIS3 manual" : As stated above, I propose to add the OASIS3 User Guide as an electronic supplement, as suggested. This is now mentioned at the beginning of section 4.

-"Performances" :

I agree that performance quantification is rather vague. I propose to present additional measurements of OASIS3 coupling exchanges performed on Bullx Curie platform with a toy coupled model composed of two components simulating no dynamics and no physics but performing realistic "ping-pong" exchanges between the NEMO ORCA0.25 degree grid (1500000 grid points) for the first component and the ARPEGE Gaussian Reduced T799 grid (843 000 grid points) for the second component, for different number of cores (from 1 to 2048 for each code). In a "ping-pong" exchange, the processes of the first component send the coupling field to the OASIS3 coupler that gathers, interpolates, and sends it; the processes of the second component receive the coupling field, and send it back to the first code still through OASIS3 process for interpolation. The measurements (see Fig1 below) show that each ping-pong exchange takes about 0.2 second at low number of cores and about 0.3 second for 256 cores and more. The fact that the time for an exchange does not decrease with higher number of component cores is expected as each exchange always goes through the non-parallel OASIS3 single process. There is even a significant increase in the ping-pong time at higher number of cores (from 0.3 to 0.2 seconds) that can be explained by the fact that the

single OASIS3 process receives many different messages from many different component processes. For real scalable components, it is expected that the time spent in the components will decrease with increased number of cores (of course, this cannot be measured in the current tests that involve only toy components with no dynamics or physics). So for a real coupled system, it is expected that the time spent in the coupler will becomes proportionally more important when the parallelism of the components will increase; this is what we will call the "bottleneck" effect of OASIS3. These results will be presented in an additional figure and explained in detail in the revised version of the article.

-"Discussion and next developments" :

I agree that "With the increase of resolution and decrease of available memory for each process, the interpolation on full grid is not possible anymore. Additionally, the large increase of processes will reduce the overall speed due to the global gathering." I think this is already clearly stated in the text in the last paragraph of section 5. Our current efforts to remove this bottleneck (i.e. development of OASIS3-MCT and Open-PALM) are already described in detail in Sect. 7.

Regarding the question: "Would you argue that, for future development of new GCMs, it would be more advantageous to plan also an "integrated framework" for the coupling, as mostly done in the USA?", the answer is yes. I hope it is clear in the text that I consider that the integrated approach offers more potential for performances when I write that this approach "offers more opportunities for optimization as the components can be run concurrently or sequentially on the same set of cores" (L25, p.2165 of the submitted paper). To make it clearer, I propose to add at the end of this paragraph: "In any case, as it is likely that to address efficiently the exascale the model codes will need significant rewriting, the adoption of the initialization-running-finalization code structure, recognized as best-practice and favouring the more efficient integrated approach, should be encouraged." I will also add a reference to the report from the workshop "Coupling Technologies for Earth System Modelling: Today and Tomorrow" organized

at CERFACS in 2010 where this best practice was fully recognized.

Minor concerns:

-"Introduction. The description of the manuscript structure should be in the introduction."

The description of the manuscript structure is already done in the last paragraph of the introduction.

-"Section 3. Section 3 and 6 seems redundant to me. The models using OASIS3 are already discussed in detail in section 6. Therefore section 3 could be removed for better readability of the manuscript."

Section 6 is only about European CMIP5 models using OASIS3 whereas section 3 is a summary of all coupled models using OASIS3. For better readability, I will move the only paragraph of section 3 as an introduction of section 6.

-"Page 2144, line 2. "Appendixtable A1" should be "table 1" (please rename the table as well)."

Yes I will do so.

-"Page 2144, line 2. Is any coupled model used in Europe that is NOT using the OASIS3 coupler? Maybe it would be worth to see if this is the case and just cite the few cases (if they exist!)."

Of course they do exist. In section "OASIS3 use in CMIP5", I will mention that the UK Met Office CGCM to the Norwegian CGCM used in CMIP5 are not based on OASIS3.

-"Page 2148, line 11. Missing a space."

Yes, I will correct this.

-"Page 2166, line 6. I find remarkable that OASIS4 description was published before the OASIS3. From the manuscript one can guess that the development was almost

independent. Was it that the case ?"

Yes, OASIS4 development started from a blank page. I will mention this in the text.

-"Page 2166, line 20. Maybe the work of Pozzer et al. (2012) should be cited here. Can it be considered an example of "integrated framework" coupling used in Europe?"

Yes, of course. I will add the reference.

-"Page 2166, line 24. Are you totally sure that the code changes required in a OASIS3 type of coupling is much less that what required by the "integrated framework"? In principle this should be the case, but I expect that this mostly depends on the GCM code itself, rather than the coupling method."

I think honestly that this remark is justified because, as explained in the text, the integrated approach requires the adoption of the "initialization, running and finalization" unit structure and because the unit interfaces need to be standardized; this was also recognized at the 2010 workshop at CERFACS, to which a reference will be added in the text.

Please also note the supplement to this comment:
http://www.geosci-model-dev-discuss.net/5/C1150/2013/gmdd-5-C1150-2013-supplement.pdf

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Interactive comment on Geosci. Model Dev. Discuss., 5, 2139, 2012.

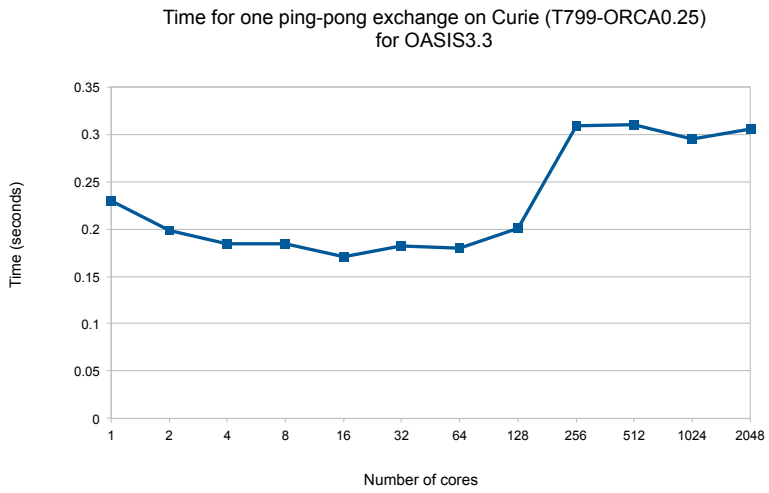

Fig. 1.