

Interactive comment on “The seamless and multi-model coupling between atmosphere, land, hydrology, ocean, waves and sea-ice models based on SURFEX surface model using OASIS3-MCT” by Aurore Voldoire et al.

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We thank the anonymous reviewers for their very constructive comments on our manuscript. The reviewers comments have greatly help in improving the quality of the manuscript. Below, we answer point by point (RC) to the reviewer comments. Note that given the three reviewers comments that mainly stressed the lack of uniformity of the manuscript, we have largely reorganised and reworded the original text. As a consequence, it was not possible to highlight the manuscript changes. In the response to the comments, we have indicated the lines where the comment is addressed in the new

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manuscript (added as a supplementary material). We also summarize all the changes made at the end of this document (section by section).

Reviewer's Comment: The paper describes the coupling of the SUFEX surface model to a series of models using the OASIS3-MCT coupler different applications. The title is, in my opinion, misleading. To me the word "seamless" means application of the same model to different time scales which is not at all what is described in the paper. I suggest to replace the word seamless with "versatile" which, again in my opinion, better cover the fact that the same surface model (SUFEX) can be used to combine different atmospheric models with different ocean models, wave models and hydrological models.

Authors' answer: We agree that the title was not well chosen. We have decided to change it to: "SURFEX v8.0 interface with OASIS3-MCT to couple atmosphere with hydrology, ocean, waves and sea-ice models, from coastal to global scales" to better reflect the asymmetry in the system between atmosphere and the other components and to focus on the generic aspect of the interface which makes it usable at very different scales.

RC: Section 2 describes the principle of coupling with OASIS3-MCT and is the most useful part of the paper.

RC: Section 3 describes the various coupled models implemented with the SURFEX OASIS3-MCT coupling. This part is a bit repetitive with a lot of model this version that. Maybe all the various models and versions could be presented in a table instead. In line with the comment about on the title of the paper I also find the "multi-model and multi-scale" title misleading. To me the concept of multi-model means the use of multiple different models to the same problem (e.g. seasonal forecasting) with each of the models add information to the solution of the problem. The various examples of performance of the various modelling system in section 3 needs justification. The examples don't need to be changed, but I do miss a justification why they were chosen

for the various modelling systems.

AA: We agree that section 3 is a long and heterogeneous list both in form and content. We have decided to keep this section since we would like to illustrate the diversity of applications that can take advantage of the new interface. However, we have tried to shorten and make it more uniform for all systems in terms of presentation. This was easier than in the original manuscript since some of the systems have now lead to published scientific studies, that can be cited. We have also added a new table 2 on page 29 summarizing the different systems and indicated the number of cores used by each component of the coupled systems. We have also added at the beginning of section 3, a discussion on the motivation for listing these applications, but also on the coupling cost. This new part is found on page 11, lines 322-379.

RC: The equations needs some work. An example: Eq 7 looks like an imported picture and very different from Eq 8. Another example is that Eq 6 looks very different from Eq 1 even though they are very similar. The quantities from the equations should be in italics in when they are explained in the text. So I believe a careful rework of the equations are in order.

AA: We agree that there were still some formal problems with the equations, we have worked on this before the final submission of the revised paper.

RC: The way the physical quantities with units are presented is very inconsistent throughout the manuscript. As an example on line 405 is written: “. . . goes from 10 m near the surface to 700m at the model top. . .”. There are too many examples on these inconsistencies to list in a review, so I think that the authors needs to read the GMD guidelines (http://www.geoscientific-model-development.net/for_authors/manuscript_preparation.html) and adhere to those (e.g. 700m should be 700 m).

AA: For the revised version, we have checked the consistency of how the units are written and now it follows the GMD guidelines.

RC: References: There is a lot of typo's and spelling errors in the references, so they could really use a careful checking. Also the use of colours and/or underlining for links to DOI's, URL's or sometime authors is very inconsistent throughout.

AA: The list of references has been carefully revised.

RC: In summary: I think that the manuscript has quite some merits and is worth publishing, but it is a bit let done by lack of care to details which is far from publication quality.

Specific comments:

RC: Line 45-46: It might be worth mentioning that coupled NWP has been implemented operationally since 2013 at ECMWF in their ensemble system. It is described in Janssen et al ECMWF Tech Memo 712.

AA: We have added the reference Janssen et al. 2013.

RC: Line 59: Sequential versus concurrent coupling also affect the time stepping of the whole coupled modelling system. If accumulated fluxes are used then the flux user component cannot run until the producer component has accumulated the fluxes unless lagged fluxes are used. It might be worth to make this point.

AA: We have added the sentence: "For example, if the components are sequentially coupled (i.e. one component cannot do any work while the other is running to produce its coupling field and vice-versa), running concurrently on different sets of resources will lead to some waste of resources." to underline the impact of sequential vs concurrent coupling.

RC: Line 99+101: SURFEX versioning conventions are inconsistent across V7.3 or v8

AA: v8 has been replaced by v8.0.

RC: Line 135: The subroutine names below are not in italics on my print.

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AA: This is corrected.

RC: Line 203: It might reflect conventions of different communities, zonal/meridional and x/y is used to present vector components. but both

AA: x/y have been removed.

RC: Line 210: z_a should be z subscript a . Also keep in mind the general comments on equations.

AA: Changed

RC: Line 244: H_s should be H subscript s .

AA: Done

RC: Line 247: There is no mentioning on sea-ice in the coupling between ocean and waves. Are the sea-ice wave interactions (an active research topic) not taken into account yet?

AA: This is not taken into account yet. We now mention in the conclusion this missing point that would require further investigations.

RC: Section 3.2: The normal convention is to use DJF, MAM, JJA, SON for seasons, but the authors have chosen JFM, AMJ, JJS, OND. Why?

AA: These seasons are the usual conventions for the ocean diagnostics.

RC: Line 364: I believe that the ORCA grid family denotes tri-polar global grids.

AA: Yes, but only a regional (irregular rectangular) fraction of the global grid is used. This mention of the ORCA grid was deleted in section 3.3.

RC: Line 374: UT should be UTC.

AA: Done

RC: Line 452: Why is the “Marshall and Schott 1999” underlined and in blue?

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AA: There was a link in the electronic version, it has been removed.

RC: Line 473: Replace “no longer coupled” with “uncoupled”.

AA: Done

RC: Line 526: Why does global conservation make the model expensive?

AA: This remark has been removed since there is a new option in OASIS3-MCT that enables to speed up such calculations. The main problem for global conservations calculations is that it necessitates to recombine information from all processes and this can hinder the parallelism efficacy.

RC: Table 1: Charnock name is just a square. Meridian should be meridional.

AA: Done

RC: Figure 5: The right hand text box only applies to b) since it explicitly states the 26/27 of October. It should be changed to e.g. “first/second”.

AA: The terms “first day (D)” and “second day (D+1)” are now put in the text box and the corresponding dates for (a) and (b) are indicated in the legend.

RC: Figure 6: Bottom panels: OAV/OA should be OAV – OA since this is actually what is plotted. The number on the lower legend are very close (special on the right hand plot). I also find that the white colour for the SST contours a poor choice making it very hard to see these.

AA: The Figure 8 (old Fig. 6) has been modified following your comment and guidelines.

Summary of all changes made in the manuscript (and rationale for the changes):

Title: changed

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Abstract: few rewording, mainly unchanged.

Introduction: beginning unchanged until line 45, then mainly a reorganisation of existing text to provide examples along the different types of interpolation, plus clarification of pros and cons. From line 80-108 : rewording and adds on the implementation to better state the motivation, clarify the atmosphere/SURFEX coupling.

Section 2: section 2.1, only slightly modified (rewording) Creation of new section 2.2 on OASIS3-MCT to better describe the technical implementation and highlight the capabilities of the implementation. This new section is partly based on existing paragraph from section 2.1 and 2.3.

Section 2.3: Changed to detail the necessary work to be done to set up a new coupled model and clarify the SURFEX version in which the developments have been made.

Section 2.4: The header is only reworded

section 2.4.1: The beginning is unchanged. Mainly adds for the ICE coupling. Also detail the interaction between the tiling and the coupling.

section 2.4.2: the first part on the ATM-WAV coupling has been reworded to better introduce the motivation and to clarify the methods. Second part on OCE-WAV coupling only reworded.

section 2.4.3 : only slight rewording.

Section 3: creation of new paragraphs before section 3.1 to clarify the motivation for the examples described in this section and discuss the cost of coupling. This comes with new table 2.

Section 3.4 and 3.6 have been switched to provide examples from the largest scale to the smaller one (figures 6 and 8 have been switched accordingly).

Sub-sections of section 3 have all been shortened and reworded for uniformization.

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Conclusion: The conclusion has been largely revised to better discuss the pros and cons of the implementation. Some new perspectives have been added (new coupling fields, two-way nesting).

Authors contribution: unchanged

References: checked

Figures

Figure 1: unchanged

Figure 2: layout changed for uniformisation (and figures d and f switched)

Figure 3 unchanged

Figure 4: unchanged

Figure 5: simplified

Figure 6: add differences CPL-UNCPL (e and f)

Figure 7: remove one lag

Figure 8: improved following reviewer suggestions, captions reworded.

Tables

Table 1: rewording (“remove x and y components of”)

New table 2

Please also note the supplement to this comment:

<https://www.geosci-model-dev-discuss.net/gmd-2017-91/gmd-2017-91-AC2-supplement.pdf>

Interactive comment on Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2017-91>,

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