

## ***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.***

**Anonymous Referee #1**

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Comments on the paper " The seamless and multi-model coupling between atmosphere, land, hydrology, ocean, waves and sea-ice models based on SURFEX surface model using OASIS3-MCT"

General comments The paper describes the capability of the surface model SURFEX to couple a whole range of different model components. The possibility to switch between different components i.e. for the ocean model with their individual pros and cons is a great advantage in climate research. Several examples on the usage of SURFACE on different scales are described in the paper. The title is not so well chosen, the

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word “seamless” does not appear in the paper. And its meaning is still unclear after reading the paper. Is it possible to use SURFEX in a coupled global model with two-way nesting refinements to have a seamless model in the spatial sense? Or is it meant in a temporal sense? If seamless is meant as the usage of SURFACE from global to high resolution models, the wording is not appropriate. The general focus of the paper is the description of the coupling interface and not to discuss the advantages of coupled modelling. But reading the paper gives a different impression. The examples of the different applications with SURFEX (Chap 3.) take a lot of space and they are only a loose listing of studies, where in all examples different variables are discussed. The frame is not so well defined as they all seems to use different SURFEX versions (Version 8, Version 7.2 and Version 7.3) and the differences are unclear. According to the introduction, the standard interface was introduced in Version 7.3. Please discuss the differences and the reason why there not using the same version. The conclusion fits well to the intention of the paper and it would have been better to focus more on the points in the conclusion as most of them are not discussed in the paper itself (i.e. computational costs of the coupling, grid interpolation, etc. ). As it is a more technical paper, it would have been better to discuss the technical aspects a bit clearer. Why is the atmospheric coupling omitted and which model component is calculating which fluxes and what problems could arise. This issue is superficially discussed in the conclusion, but it is very important for the coupling philosophy. And what about a two way nesting in the atmosphere with 3D coupling? This is not part of the SURFEX interface nor of the discussion (see seamless comment above). The approach of a general interface seems to be very tempting. What would be the problems to adapt the models for simulations i.e. over Africa? This is not clear to the user after reading the article. Every component seems to be available with certain license agreement, so how much more work is necessary? The last sentence of the conclusions discusses the question about the initialization of the coupled system. It would be better to discuss the advantages of the SURFEX community a bit earlier and maybe in more details. The discussion could also be centered around the interpolation of different grids and

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the lateral boundary conditions in regional models. So the last sentence seems to be not really part of the rest of the paper. Please embed and write a nicer paragraph on this subject as it is very important when using SURFEX to have a community behind with a lot of support and possibilities for discussions and strategies for the future model development of SURFEX. There are a lot of citations in the article where the authors give credit to related work. The number and quality of the references are appropriate. The abstract give a good overview over the article, the discussion of the interface with its pros and cons could be added. The language is fluent and precise.

Specific comments In the introduction, page 3, line 84: this sentence is unclear. Why and when is the surface parametrization implemented in SURFEX not valid? Which 0D cases are available? For radiation studies? Please explain this in more detail and maybe not in the introduction. Page 5, line 122: "The fluxes are aggregated of the model grid-mesh". Are the aggregated fluxes passed directly to the corresponding model? What about a tile approach? First pass on the state variables for each tile to the corresponding model and then calculated the fluxes for each tile separately and average in the end. (See Barthélemy et al 2016). Page 5, line 140: What do the numbers refer to? Kind of obvious, but please use them first before you refer to them. Page 6, line 150: Where is this discussed again? This was not obvious in sections 3.2 or 3.3. It could be found in between the lines but please write a proper discussion about it. This is actually a very important subject for a coupling interface. How are the grids defined and what additional work is needed to adapt them to specific needs. Page 6, line 156: What is SYMPHONIE (mentioned later but not here). Page 15, line 441-442: This is an important issue and could be discussed also in more details and show up in the conclusions. It seems to be that the wave model so far is only coupled dynamically to ocean models and not to the atmosphere. Maybe it could be already mentioned in 2.3.2?

Technical corrections The size of the pdf is much too large. The figures, especially Fig 1 and some of Fig 2 seem to be enormous. Please reduce the size substantially,

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there is no scientific gain to have a super high resolution topography figure with several layers in this pdf.

Barthélemy, A., Fichefet, T., Goosse, H., & Madec, G. (2016). A multi-column vertical mixing scheme to parameterize the heterogeneity of oceanic conditions under sea ice. *Ocean Modelling*, 104, 28-44.

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