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Interactive comment on "Efficient ensemble data assimilation for coupled models with the Parallel Data Assimilation Framework: Example of AWI-CM" *by* Lars Nerger et al.

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Dear authors,

Thanks a lot for making this article of the latest improvement of PDAF online on GMD for discussion.

I am Li Liu from Tsinghua University, China, leading the development of C-Coupler that is a Chinese coupler family for Earth system modelling. I am very interested in the software framework for ensemble data assimilation, even leading a research in this topic. So I am very interested in your PDAF work, and have learned a lot from its

documentations, source codes, and this article.

After reading this article, I have the following concerns:

1. After downloading and then reading the latest available code version of PDAF from your website, I guess that it does not fully include the implementation for this article.

2. Figure 3 of this article and the source code of PDAF may indicate that the certain order of processes in the MPI_COMM_WORLD among ensemble members of the coupled model as well as its component models is required, and different members of the same component model must have the same number of processes. For example, the IDs of processes of atm_member1, ocn_member1, atm_member2, ocn_member2, atm_member3 and ocn_member3, and the processes not involved in ensemble data assimilation, must be in an ascending/descending order. Is there any restriction about the processes not involved in ensemble data assimilation?

3. Regarding P9L261∼270, it seems unclear how to split the communicator for a set of processes exclusive from ensemble data assimilation when splitting MPI_COMM_WORLD into a group of COMM_CPLMOD. Is there any new modification in the APIs or input files of PDAF for this functionality?

4. Regarding the weakly-coupled application mentioned in P10L285∼L288, it seems unclear how to generate separate COMM_FILTER for ECHAM and FESOM? Regarding this functionality, I guess that PDAF should know all component models of the coupled model and the number of processes of each component model, and know that weak coupling but not strong coupling is used. It may be interesting to know how PDAF is extended for this kind of input.

5. Regarding Figure 2, it is still unclear of the code flowchart of different component models in weak coupling. For example, given that only ECHAM is involved in data assimilation but FESOM is not, it is unclear whether only ECHAM calls init_PDAF and Assimilate_PDAF, or FESOM has to call these two APIs cooperatively?

6. PDAF requires the filter to use the same parallel decomposition with the model. Is it possible to introduce challenges when integrating an existing filter that already has its own parallel decomposition that may be different from the model. For example, a land surface model generally uses a round-robin parallel decomposition for load balance in parallelization, which may be not suitable for a filter or will introduce new code development or lower efficiency to the filter.

I really hope these concerns can be further discussed in the final version of this article. I am sorry if some of them are incorrect or even wrong.

Best regards,

Li

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