Geosci. Model Dev. Discuss.,
https://doi.org/10.5194/gmd-2020-307-RC2, 2021

Geoscientific Model Development Discussions
Open Access
EGU

Interactive comment on "A Schwarz iterative method to evaluate ocean- atmosphere coupling schemes. Implementation and diagnostics in IPSL-CM6-SW-VLR" *by* Olivier Marti et al.

Anonymous Referee #2

Received and published: 12 January 2021

The paper presented is a valuable contribution to the development of coupled AOGCM configurations, presenting a tool for probing the validity of simplifying assumptions that we collectively make in the coupled climate modelling community. The Schwarz iterative method is used to achieve converged ocean-atmosphere state vector and fluxes at the interface. I have have little formal complains, as the paper is in, with one exception, in excellent shape with regards to presentation and clarity.

- My main feedback point is that, while the authors concede that the Schwarz iterative method is impractical for production runs and is envisioned to serve as a validation tool, it is nevertheless compared to production runs with double sided

Printer-friendly version

Discussion paper

lag. For validation purposes other groups may currently use a simple one sided lag configuration. In this case the production run eq. (3):

$$\left|\frac{dA}{dt}\right|_t^{t+\Delta t} = F_A(A, \langle O_\Omega \rangle_{t-\Delta t}^t), \quad \left|\frac{dO}{dt}\right|_t^{t+\Delta t} = F_O(O, \langle f_\Omega \rangle_{t-\Delta t}^t) \tag{1}$$

would be compared to:

$$\left|\frac{dA}{dt}\right|_t^{t+\Delta t} = F_A(A, \langle O_\Omega \rangle_t^{t+\Delta t}), \quad \left|\frac{dO}{dt}\right|_t^{t+\Delta t} = F_O(O, \langle f_\Omega \rangle_{t-\Delta t}^t) \tag{2}$$

In order to solve this system the models are forced into alternate execution, typically with the flux computing atmosphere going second. In the very first timestep the ocean model assumes zero surface fluxes and updates the ocean surface state based on internal dynamics only, while the atmosphere waits. Once the ocean is done the atmosphere updates and the ocean waits. The models computational performance also degrades by about a factor two compared to double lagged production runs, however the implementation is very simple. For OASIS coupled models we simply need to set lag=0 in the configuration file. For other models such as the ECMWF IFS the same is achieved by having the ocean model as a subroutine in the atmospheric code and using the same cores.

I think this paper would benefit from comparing your Schwarz iterative method with the single sided lag. Regardless of the outcome, whether you find that single sided lag already gets you close to the convergence of Schwarz step #2, or not, your work is highly valuable. Either you can provide the community with a better tool for the validation of coupled models, or you can validate the existing validation method and undergird its use. Just which one it is, is not clear to me after reading through.

- A second and smaller feedback point is that section 3.2 is somewhat detached from the rest of the paper and I wonder if it could not be an appendix. I'm also

wondering why 5 day long simulations are compared climatology. Was it an ensemble of 5 day simulations?

- line 182: spelling of coypling should be coupling
- Figure 4: values and dots don't line up. (E.g. 2 on the axis is actually 2,5 rounded down)

I recommend the paper for major review. While method presented appears solid, more targeted validation could improve the relevance further.

Printer-friendly version

Discussion paper