Geoscientific
Model Development
Discussions

Interactive comment on "Evaluating Statistical Consistency in the Ocean Model Component of the Community Earth System Model (pyCECT v2.0)" *by* A. H. Baker et al.

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Received and published: 17 April 2016

Thank you for your thorough review and suggestions for improvement. We address all comments below.

General comments

Thank you for the "kudos". Indeed many of the CESM code changes retain BFB reproducibility and are easily verified. This new tool is currently mostly used for verifying ports to new machines.

Specific comments

(1) circumstances in which pyCECT should be used

We agree and updated the Introduction in the revision to clarify when pyCECT should be used (and when it should not).

(2) non-BFB identical output due to nondeterminism in MPI communications

We agree that ideally this situation is avoided via "customized" deterministic MPI routines. Note that such functionality currently exists in the CESM atmosphere component (CAM). However, because this functionality does not currently exist in POP (nor is it realistically likely to be added in the near future), verifying that a decomposition change in POP does not result in an inconsistent result is important for POP, in our opinion.

(3) unexpected changes in model results across identical runs

We agree that changes in model results across identical runs are often symptomatic of a bug or problem. However, this is not necessarily the case. For example, on Blue Waters (at NCSA), CESM does not produce reproducible results when the FMA (fused multiply-add) capability is used. In general, newer heterogeneous architectures will make reproducible results difficult to obtain, particularly if one takes advantage of the optimizations provided (e.g., FMA).

(3) unit testing

We agree that pyCECT should *not* be used as a substitute for unit testing. Unit testing is important and an integral part of software quality assurance. We made a comment to this effect in the revision.

(4) section 4.2

We retained section 4.2 for the reason stated in (2) above. Note that we also added additional experiments (in response to another reviewer) that test changing the machine and compiler.

Technical notes

(1) plot layouts

We improved the labels and added the suggested color bar descriptions.

Thoughts*

(1) model resolution

Computational cost is certainly a consideration when considering high-resolution models, and we plan to address this in future work.