

Reply on RC1

Hui Wan (on behalf of all authors)

We sincerely appreciate the referee’s careful review and positive assessment of the manuscript. Below please find our responses to the specific comments.

Referee comment: ll. 181 ff.: If I understand this sentence correctly, it states, that some quantities are calculated at discrete points and become inconsistent with the model’s prognostic state (at least as long as the variable field is not updated). Maybe the authors could clarify, that the values consistent with the prognostic state evolve within the time step, but the field values are not updated (only at the points of calculation).

Author response: Thanks for the suggestion; a clarification has been added.

The comment also motivated us to add another important note. At the end of the paragraph containing the original line 181, we mention that one needs to be cautious when obtaining values of diagnostic quantities for use by our tool. Later in Section 4.1.2 (“Key algorithm module”), we clarify the following:

Assuming the host model has a diagnostic quantity whose values are saved in the physics buffer under the name ABC.

- If the user’s intention is to understand the host model *code* by tracking where ABC in the physics buffer is updated within a model time step, a code block like the following is needed to retrieve values from the physics buffer (which can be consistent or inconsistent with the prognostic state):

```
case('ABC_PBUF')
  idx = pbuf_get_index('ABC')
  call pbuf_get_field( pbuf, idx, ptr2d )
  arrayout(:, :) = ptr2d
```

- If the user’s intention is to understand the *model physics* by monitoring the evolution of ABC, a code block like the following is needed to recalculate ABC from the current model state:

```
case('ABC_EVOL')
  call calculate_abc( state, ..., arrayout )
```

The RHI budget example shown in Section 6.3 belongs to the second category.

Referee comment: l. 346: For readers familiar with EAMs structure and calling sequence it might be clear when (in the model’s time stepping) the two subroutines tphysbc and tphysac are called, and it is even written in the manuscript (in the descriptions of Table B1 and B2), but it may be worth to mention the point in the calling sequence here (before/after coupling), which also explains the naming.

Author response: This is a good point. Even the developers and users of EAM might find these subsections hard to follow. A new figure is added to the revised manuscript to show the sequence of calculations for the four main parts of EAM: dynamical core, atmosphere-land-ocean exchanges, and the “before-coupling” and “after-coupling” subsets of parameterizations. Also illustrated are code snippets that add checkpoints to tphysbc and tphysac. In response to a comment from referee 2, we also added a subsection titled “Data and code structures” to the “Host model features” section, in which the subroutines tphysbc and tphysac are introduced.

Referee comment: ll. 350 f.: All the implemented checkpoints are listed in Tables B1 and B2. However, at some point later in the manuscript (l. 514) I got lost, as it was not clear to me where to find all the checkpoints and their calling sequence. Maybe the authors could clarify. Suggestion: “All checkpoints added to the EAMv1 subroutines tphysbc and tphysac are listed in Tables B1 and B2, respectively. Most of the checkpoints are implemented by inserting code like...”

Author response: Sorry for the confusion. We had a single table listing all of the checkpoints in an earlier draft and then split it up into B1–B3, but some sentences in the manuscript were not updated properly. This is addressed in the revised manuscript.

Referee comment: l. 539: “model sub-cycling”: Is it the sub-cycling in the model’s parameterizations?

Author response: For clarity, we replaced the last part of the sentence by “and its value can also change across the sub-cycles used for the parameterizations and their coupling”.

Referee comments:

Technical corrections

l. 111: “5 hypothetical processes label” → ”five hypothetical processes labeled”

ll. 180 f.: “sequential method” → ”sequential splitting method”

l. 267: Could a link to Zenodo be inserted here?

l. 386: “carry” → ”carry out”

l. 431: add “)” after ”checkpoint”

l. 529: “3 wind speed” → ”three wind speed”

Author response: All corrected or addressed in the revised manuscript. Thanks for the careful review.