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Interactive comment on "Modular System for Shelves and Coasts (MOSSCO v1.0) — a flexible and multi-component framework for coupled coastal ocean ecosystem modelling" *by* Carsten Lemmen et al.

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We thank the anonymous reviewer for bringing to our attention that we did not provide sufficient detail in several aspects of the coupled model description. Below, we provide a point-by-point reply to the issues raised by the reviewer.

1. *. . . performance of the modelling system is questionable. Some details about coupling of ESMF and BMI is still missing and also it would be useful to include some performance benchmark of different model configurations.*

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Discussion paper

Response: As the coupling framework is flexible, the performance of the system depends on the coupled components and on the performance of the infrastructure used. A typical speedup achieved, e.g., in the bivalve application on 192 processors is 3000: a full simulation year is completed in three compute-time hours, such a speedup allows decadal up to multidecadal simulations. One of the identified bottlenecks (that varies strongly with the HPC system used) is data transfer from memory to disk: this will be in the future addressed by the use of parallel NetCDF and/or leveraging the XML I/O Server.

Response: We ensured that it is now clearer that we use BMI conceptually and ESMF/NUOPC phases in the actual implementation.

2. *. . . following items can be given as other efforts to create modular and generic modeling systems/frameworks: OMUSE, CSDMS.*

   Response: We added references and discussion of these two frameworks to the introduction and to the design section.

3. *. . . what type of coupling used in sequential mode. explicit or semi-implicit? it is better to be more clear about the execution order of the model components and supported coupling time step configurations. most of the model components (expecially 1d models) that are used in the framework are sequential codes. To that end, how this is handled with the modeling framework in terms of efficency and scalablity of the overall system when 3d ocean model compoenent and multiple 1d and 2d model components are used together. what will be the distribution of the model components across the underlying hardware system? it is better to give more information about the overall overhead of the coupling interface and potential bottlenecks.*

   Response: We added more information on the coupling in sequential mode. There is no coupling between 1D and 3D components in the examples that we currently operate. All of the current examples run in sequential mode on the same

compute element distribution. A regridding implementation, also with redistribution between different compute elements is currently in development and will be described in a different manuscript. We added performance, coupling overhead and bottlenecks in the discussion section.

4. *. . . it will be better to include simple text based specification to create ESMF driver component along with the command to trigger it. It is also same for the command line utility. Also, it could be good to mention similarity and difference with Cupid Eclipse interface (https://www.earthsystemcog.org/projects/cupid/) about creating driver component automatically.*

   Response: We added a new figure showcasing a coupling configuration. The section on driver component creation was expanded according to the above comments.

5. *How sediment component inherits grid information from the coupled system. Is NUOPC grid transfer feature used in here? It is better to add detail about the design. Again, how GETM export its grid information to other components (section 3.1.4).*

   Response: We expanded the section describing grid inheritance. We also added a subsection in the applications section that exemplifies the data flow in a modularly coupled application.

6. *Is this component solves transport equations on the fly using input data coming from 3d ocean model component using mediator component? or it just exports data to ocean component to calculate transport inside of it. please clarify it.*

   Response: We clarified this in the description of the transport connecter. Indeed, the transport connector only repackages the tracer fields such that they can be transported within the hydrodynamic component.

7. *. . . conservation of mass and energy fluxes plays important role in the overall performance of the modelling system and needs to be addresses carefully. It is better to extend discussion about*

conservation of mass and energy fluxes. How MOSSCO handles conservation expecially in the context of cou- pling in different dimensionality such as one and three dimensional models? The ESMF library supports only first order conservation, which does not perform well expecially when the resolution of computational grid of different model components is high.

Response: We added a cautionary note on potential divergence of mass introduced by the coupling framework itself in the section describing sequential coupling. As the implementation of specific scientific couplers that, e.g. calculate ocean–atmosphere fluxes, is beyond the scope of the coupling framework itself, we added consideration of conservation in the sections describing special currently existing couplers where conservation is indeed challenging.

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