

## ***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.***

**Anonymous Referee #2**

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### **General Comments**

The manuscript introduces novel work about interoperability of the existing coupling libraries/technologies such as ESMF, BMI to address multi-scale, multi-dimension coupling of shelf and coastal sea processes. The manuscript is also extended to include the brief results of newly designed modeling system (MOSSCO) by providing different combinations of the component of modeling system to solve different problems, which are described detailed in referenced papers. The flexibility of the modeling system also

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allows to define variety of applications in a range of one-dimensional models to three-dimensional hydrodynamical model components, which is also important contribution of the current work even still 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.

### **Specific Comments**

- In Introduction section (probably in the section after line 25-30 in page 2), following items can be given as other efforts to create modular and generic modeling systems/frameworks

#### **OMUSE framework**

- [https://www.projects.science.uu.nl/oceanclimate/nonlin\\_dynamics.php2-4](https://www.projects.science.uu.nl/oceanclimate/nonlin_dynamics.php2-4)
- <https://imum2016.sciencesconf.org/data/pages/pelupessey.pdf>

#### **CSDMS (community surface dynamics modeling system)**

- [http://csdms.colorado.edu/wiki/Main\\_Page](http://csdms.colorado.edu/wiki/Main_Page)

- **page 5, line 31:** 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 (especially 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 efficiency and scalability of the overall system when 3d ocean model component and multiple 1d and 2d model components are used together. what will be the distribution of the model components across the underlying hardware system?

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it is better to give more information about the overall overhead of the coupling interface and potential bottlenecks.

- **section 2.3:** 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.
- 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).
- **section 3.3.2:** 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.
- **section 5:** 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 especially in the context of coupling in different dimensionality such as one and three dimensional models? The ESMF library supports only first order conservation, which does not perform well especially when the resolution of computational grid of different model components is high.

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### Technical Corrections

- **page 7, line 21:** replace "meta data" with "metadata"
- **page 8, line 6:** replace "meta data" with "metadata"
- **page 10, line 13:** replace "meta data" with "metadata"
- **page 13, line 18:** (to be submitted) ? it is better to give it in the reference section
- **page 13, line 28:** (submitted) need to be replaced with a appropriate reference by indicating that it is still in under review
- **page 15, line 6:** remove ? or replace with /
- **page 15, line 14 and 15:** couplable? Couplability? it is better to rephrase the sentence.
- **page 16, line 17:** replace : with .
- **page 17, line 9:** The reference given in the manuscript is belongs to workflow integrated atmosphere-ocean modeling system (WRF+ROMS), which is the early attempt to create coupled modeling system with semi-autonomous configuration and setup environment. The correct reference for RegESM modeling system can be found in following links
  - <https://link.springer.com/article/10.1007/s00382-016-3241-1>
  - for wave coupling <http://meetingorganizer.copernicus.org/EGU2015/EGU2015-3644.pdf>
  - The two component prototype version is in <https://www.geosci-model-dev.net/6/283/2013/>

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