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Modular AWI-CM: An Earth System Model (ESM) prototype using the esm-interface library for a modular ESM coupling approach

Advanced Earth System Modelling Capacity (ESM)

- One goal of the project is to develop a flexible framework for the effective coupling of Earth System Model (ESM) components.



<u>www.esm-project.net</u>

models models models

Modular AWI-CM 2 Prototype

The modular version of the AWI-CM 2 includes the following components:

- Ocean: FESOM 2 [1]
- Atmosphere: ECHAM6 [4]
- Coupling interface: esm-interface supporting the following model couplers:
 - OASIS3-MCT [5]
 - YAC [2]

Development steps

- 1. Departing from AWI-CM 1.4 [3] we developed and implemented the esm-interface library as a wrapper to the corresponding coupler calls of OASIS3-MCT [5]
- 2. Implementation of esm-interface into FESOM 2 [1] for a modular ESM setup of AWI-CM 2

esm-interface

- Enables a modular coupling of ESM components
- Fortran library
- Provides wrapper procedures to different model couplers
- Provides derived data types, type-bound procedures ("object-oriented" approach) to model components
- Coupler switch in ESM setup via precompiler flags
- Debugging mode configurable via namelist
- Will be fully integrated into **ESM-Tools** [6]
 - E.g. creates coupler configuration files and sets corresponding precompiler flags to esminterface library

Open Tasks

- Debugging routine of coupled fields within esm-interface library
- 3. Extend the esm-interface library by a second model coupler: YAC [2]



Figure 1: Different coupled ESMs can be assembled using different components and/or different model couplers. Changing to a different model coupler needs the adaptation of each model component, leading to many different ESM setups that basically use the same components that trace back to different source codes.

Figure 2: Different ESM setups can be derived from the same model components (and the same source code) when the coupling is executed via esm-interface library. Each model component in the different setups are based on the same source code which ensures intercomparablity of experiments done with different ESM setups. Each model component will get technically independent of the model coupler. The number of ESM setups will increase since model components using the esm-interface can be integrated more easily into a setup that uses a specific model coupler that is supported by esm-interface library. This extends the modularity to other model components that are tailored to specific model couplers.



Acknowledgements

We would like to thank Moritz Hanke (DKRZ) for his support during the implementation of YAC in the esm-interface library.

Nadine Wieters has received funding from the Initiative and Networking Fund of the Helmholtz Association through the project "Advanced Earth System Modelling Capacity (ESM)".

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