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esm-interfaces: Towards a Modular ESM Coupling Approach

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Earth system modelling is a key instrument to investigate climate change in an integrated way considering interactions between different Earth system compartments and across scales. To account for the different Earth system compartments (e.g. atmosphere, ocean, land and sea ice, biogeochemistry), Earth System Models (ESMs) are therefore composed of different components, including sub-models as well as whole domain models. Within such an ESM, these model components need to exchange information to account for the interactions between the different compartments. This exchange of data is the purpose of a "model coupler". Examples of such couplers are OASIS [Valcke, 2013] and YAC [Hanke et al., 2016]. Such purpose build couplers link entire domain models (e.g. atmosphere and ocean) by exchanging a well-defined set of variables at specific time steps.

Within the Advanced Earth System Modelling Capacity (ESM) project, one goal is to develop a modular framework that allows for a flexible Earth system model configuration. A first approach is to implement purpose build couplers in a more modular way, implying that single components can be easily exchanged.

For this purpose, we developed the *esm-interfaces*, in consideration of the following objectives: (i) To obtain a more modular ESM, that allows model components and model coupler to be exchangeable; and (ii) to account for a more adaptable coupling configuration of an ESM, e.g. which fields are supposed to be exchanged in a certain experimental setup. As a first application of the *esm-interfaces*, we implemented them into the AWI Climate Model (AWI-CM) [Sidorenko et al., 2015] as an interface between the model components and the model coupler. In this presentation, we will discuss the general idea of the *esm-interfaces*, how they can be implemented in an ESM setup, and show first results of model experiments carried out with the modular AWI-CM prototype.