Coupling Different Hierarchies of Climate Models with the CliMA Coupler

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What is a coupler?
A coupler is a software component of an Earth System Model (ESM) that communicates information between model components and organizes their execution, synchronization, and output. Existing couplers include OASIS3-MCT, ESMF, CMEPS, FMS, and preCICE.

A standalone coupling module facilitates:
- Independent development of ESM component models
- Composable, modular construction of coupled systems
- Components each specify PDEs, time-steppers, discretizations, and grids
- Faster identification and assessment of numerics errors
- Easy model intercomparisons
- Parallel execution of component models

The CliMA Coupler

Model & Coupling Goals
The land-sea breeze is caused by differential heating of the atmosphere by the land and ocean. We present here a three-component coupled simulation prototyping the sea breeze using a small, coarse domain as a first step towards a coupled LES sea breeze. This step up in our model hierarchy pushed our development of:
1. Remapping spectral elements to/from finite volumes
2. Flux accumulation during atmospheric substeps within a coupling cycle
3. Remapping boundary masking and flux splitting
4. Uninvasive specification of coupled boundary conditions to modify standalone models

Future Plans: A Hierarchy of Coupled Models

Future plans include a hierarchy of coupled models to improve the representation of climate processes:
- Single-column
- 2D, 3D Cartesian Box
- Spherical

References