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# Integration of atmosphere and ocean general circulation models into the Earth System Model Framework (ESMF)

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The Earth System Modeling Framework (ESMF) is a structured collection of software building blocks to assist in the development of model components, and assemble them into an Earth System Model (ESM). We have integrated three ESM components into the ESMF (versions 2.0.1 and 2.1.0): 1) UCLA atmospheric General Circulation Model (AGCM), 2) Los Alamos Parallel Ocean Model (POP), and 3) MIT Ocean GCM (MIT OGCM).

The ESMF version 2.0.1 supports sequential code execution, rectilinear regridding with logical decomposition at the grid specification level, and halo data redistribution. Version 2.1.0 allows for concurrent execution and virtual machine layout, and will support other regridding methods.

For integration, each ESM component was made “ESMF compliant”. In our implementation, the components were restructured to isolate Initialize, Run, and Finalize tasks. Next, we designed an ESM Driver Program (EDP), which controls the sequence in which those Initialize-Run-Finalize tasks are executed. The EDP also handles data transfers utilizing ESMF routines and keeps track of ESM simulated time. Our current version of the EDP has about 3,600 lines of code. Additions or replacement of ESMF compliant components to the system only requires modification of about 2% of the EDP.

In summary, the UCLA AGCM, POP and MIT OGCM were made ESMF compliant and integrated into the ESMF that provides the regridding, data transfer, I/O, time management, and component API and context services. Required code modifications were minor. Details an the computational performance of the code, as well as selected comparisons between the performance of the different coupled models, will be presented at the conference.