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GEOS-MITgcm coupled atmosphere-ocean simulation for DYAMOND

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During the past few years, the Goddard Earth Observing System (GEOS) and Massachusetts Institute of Technology general circulation model (MITgcm) groups have produced, respectively, global atmosphere-only and ocean-only simulations with km-scale grid spacing. These simulations have proved invaluable for process studies and the development of satellite and in-situ sampling strategies. Nevertheless, a key limitation of these simulations is the lack of feedback between the ocean and the atmosphere, limiting their usefulness for studying air-sea interactions and designing observing missions to study these interactions. To remove this limitation, we have coupled the km-scale GEOS atmospheric model with the km-scale MITgcm ocean model. We will present preliminary results from the GEOS-MITgcm contribution to the second phase of the DYAMOND (DYnamics of the Atmospheric general circulation Modeled On Non-hydrostatic Domains) initiative.

The coupled atmosphere-ocean simulation was integrated using a cubed-sphere-1440 (~6-7 km horizontal grid spacing) configuration of GEOS and a lat-lon-cap-2160 (2–5-km horizontal grid spacing) configuration of MITgcm. We will show results from a preliminary analysis of air-sea interactions between Sea Surface Temperature (SST) and surface winds. In particular, we will discuss non-local atmospheric overturning circulation formed above the Gulf Stream SST front with characteristic sub-mesoscale width. This formation of a secondary circulation above the front suggests that capturing such air-sea interaction phenomena requires high-resolution capabilities in both the models' oceanic and atmospheric components.