A High-Resolution Coupled MPAS-A/MOM6 Model for Air-Sea Interaction Research and Forecasting

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High-resolution, km-scale coupled atmosphere-ocean models allow us to represent physical processes and air-sea interactions that are relevant to research and forecasting at weather and seasonal-to-subseasonal (S2S) timescales. Here we present an overview and preliminary validation for a new high-resolution system coupling the Model for Prediction Across Scales – Atmosphere (MPAS-A) with the Modular Ocean Model version 6 (MOM6). The model leverages existing coupling capabilities used by NSF NCAR for the Community Earth System Model (CESM), namely ESMF and NUOPC tools for field handling and communication, CMEPS for defining and managing exchanges, and CDEPS for data forcing. The system is being configured and developed for both regional and global applications, with target usage up to global km-scale (~3-km horizontal resolution, ~65 million horizontal grid columns). We will report on ongoing development and current test cases, including forecasts for tropical cyclones and Indo-Pacific coupled air-sea phenomena, which show realistic physical features and promising computational performance for large domains. After completion of the atmosphere-ocean system, the project plans to further leverage CMEPS and CESM tools to expand the framework into a full Earth System model with coupling to advanced land, ocean wave, sea ice, and river runoff components, enabling comprehensive study of the coupled Earth System at high-resolution and weather to S2S timescales.