Recent and Future Development of the US Navy Numerical Weather Prediction Systems

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Abstract

The Naval Research Laboratory (NRL) is responsible for developing, transitioning, and maintaining the Navy's numerical weather prediction systems that provide a unique environmental prediction capability demanded by the warfighters. The current NRL modeling suites consist of 1) the NAVy Global Environmental Model (NAVGEM); 2) the Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS®); 3) NRL Atmospheric Variational Data Assimilation System–Accelerated Representer (NAVDAS-AR), an observation space 4DVar for NAVGEM , and NRL Atmospheric Variational Data Assimilation System (NAVDAS), a 3DVar for COAMPS, respectively. NRL recently added a hybrid data assimilation capability to include the flow-dependent background error information for global data assimilation. The COAMPS 4DVar has been developed to replace the COAMPS 3DVar for mesoscale data assimilation.

COAMPS has been coupled in a two-way interactive sense to the NRL Coastal Ocean Model (NCOM) and the SWAN and WWIII wave models using the Earth System Modeling Framework (ESMF). Additional capabilities under development include a fully coupled sea ice model (Los Alamos CICE) capability and an integrated hydrological modeling component for high-resolution COAMPS coastal applications. The tropical cyclone system, COAMPS-TC, was transitioned to Navy operations in 2013, one of the top performing dynamical models worldwide for tropical cyclone intensity prediction. In 2016, a fully coupled version of COAMPS-TC coupled with NCOM has been implemented in operations. NRL is developing a fully coupled global extended-range prediction system including the Navy Global Environmental Model (NAVGEM), the HYbrid Coordinate Ocean Model (HYCOM), the Los Alamos Sea Ice Model (CICE), and the Wavewatch III ocean surface wave model as part of the national Earth System Prediction Capability (ESPC). Initial operational capability is planned for the end of FY18. Preliminary results for extended-range predictions of MJO, Arctic September sea ice extent and the 2015 El Nino are promising.

Plans for the future Navy's global and mesoscale modeling system include the recent development of a new nonhydrostatic dynamical core model, NEPTUNE, based on spectral element and discontinuous Galerkin techniques and targeting next-generational computational capabilities.