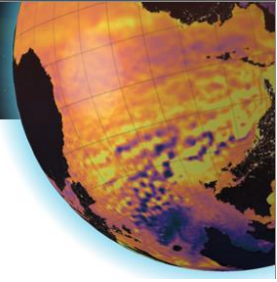




## U.S. Navy Earth System Prediction System (ESPC) development from R&D to operations

The U.S. Navy Earth System Predictability Capability (Navy ESPC) is a global coupled forecast system that consists of the NAVy Global Environmental Model (NAVGEM) for the atmosphere, the HYbrid Coordinate Ocean Model (HYCOM) for the ocean, the Community Ice CodE (CICE) for sea ice, and WAVEWATCH III® (WW3) for wind-forced surface waves. The atmosphere, ocean and sea ice models assimilate real-time observations to constrain the numerical solution. The system meets Navy needs for high horizontal resolution global environmental forecasts on timescales from days to months. After the research and development work, the systems are validated against independent observations and transitioned to the Fleet Numerical Meteorology and Oceanography Center where they run operationally on Navy DoD Supercomputing Resource Center (DSRC) computers. Weekly subseasonal probabilistic forecasts are generated from a 16-member Ensemble system (ESPC-E) whereas daily Deterministic forecasts (ESPC-D) are made with higher horizontal resolution ocean and sea ice components. Over the development cycle, new capabilities are incorporated into the system. ESPC-E v1 (version 1) became operational in August 2020, but does not include a wave component. It provides weekly 45-day forecasts of the ensemble mean along with a measure of uncertainty based on the standard deviation. Ensemble mean forecasts have been shown to be more accurate than any single individual ensemble member. More recently, ESPC v2 (version 2) is being developed with these key new capabilities: the addition of one-way coupled WW3, an increase in the number of levels and the extension of the NAVGEM model top to 100 km for improved representation of the middle and upper atmosphere, updates to the sea ice rheology with the addition of a landfast (grounded) ice, and inclusion of astronomical tidal forcing in the ensemble system that generate internal waves important to undersea operations. ESPC-D v2 system is undergoing operational testing at FNMOCC and is expected to be declared operational by June 2024. Samples of the validation metrics will be presented for each model component.

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