Linking NEPTUNE with NAVDAS-AR: A Cycling NWP System coupling a 3D Spectral Element model and 4DVar Data Assimilation

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The Navy's next generation NWP system, NEPTUNE[1][2], is under development at NRL. The atmospheric model uses a 3D spectral element spatial discretization and has shown promising results in terms of idealized testing, computational scaling, and, most recently, in terms of relevant skill metrics when cold starting from GFS analyses. The next major step in development is coupling NEPTUNE to a data assimilation (DA) system to break the dependence on external analyses. NAVDAS-AR[3], the 4DVar DA component of NAVGEM[4] has been chosen for the task. This talk will discuss the implementation of the coupling between the two components as well as results from extended cycling experiments relative to those of NAVGEM and other operational centers; this includes experiments fixing the degrees of freedom while varying the spectral element polynomial degree. Preliminary development of tangent-linear and adjoint models of NEPTUNE for a more consistent 4DVar DA component will also be discussed.

[1] Navy Environmental Prediction System Using the NUMA Core

[2] Nonhydrostatic Unified Model of the Atmosphere

[3] NRL Atmospheric Variational Data Assimilation System – Accelerated Representer

[4] Navy Global Environmental Model