# An Accurate Sphere-Centered Coordinate System Using Semi-Analytic Metric Terms

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Researchers at the Naval Postgraduate School have developed the Nonhydrostatic Unified Model of the Atmosphere (NUMA), a 3D combined CG/DG dynamical core with optional polynomial order, a wide range of time integrators, and flexible grid options. Researchers at the Naval Research Laboratory have leveraged that effort to begin development of NEPTUNE: the Navy Environmental Prediction sysTem Utilizing the NUMA corE. While, ultimately, NEPTUNE will be composed of a full suite of physics parameterizations, pre- and post-processing infrastructure, data assimilation, and coupling components to a variety of Earth-system models, this talk will focus on the initial struggles and solutions in adapting NUMA for stable and accurate integration on the sphere using both the deep atmosphere equations and a newly developed shallow-atmosphere approximation. Results from the recently completed idealized component of the National Oceanographic and Atmospheric Administration (NOAA) High-Impact Weather Prediction Project (HIWPP) will be shown.