Navy Interests in Mesoscale Probability Forecasting

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Overview

- Geographic Areas of Interest
- Technical Areas of Interest
- Research Areas of Interest
- Current Status
- Summary

Geographic Areas of Interest

- Coastal and Maritime
- Rapid relocation
- Data sparse areas
- Field campaign areas
- Arctic

Technical Areas of Interest

- Probability of High impact weather for Navy (high winds/seas, visibility, cloud height, tropical storm track and intensity)
- Forecast certainty/uncertainty/reliability

Research Areas of Interest

- Coupled atmosphere-ocean-land-ice model
- Within model variation (parameter variation, stochastic physics, surface variation)
- Multi-model ensemble
- Ensemble post-processing for improving probability distribution
- Tropical storm forecasting
- Ocean and wave model ensembles

Current Status

- Based on Navy Coupled Ocean-Atmosphere Mesoscale Prediction System (COAMPS®)
- Uses Navy Operational Global Atmospheric Prediction System (NOGAPS) boundary conditions
- Initial condition perturbations using Ensemble Transform
- Can use members with native and WRF physics packages
- Can use members with varied parameters for cumulus, boundary layer parameterizations
- Can be run on Linux cluster and IBM AIX machines
- Typical nests 45/15/5 km, have run down to 1.7 km
- Near realtime runs not currently possible (maybe in one year)

COAMPS is a registered *trademark* of the Naval Research Laboratory

Summary

- The U.S. Navy has developed a mesoscale ensemble forecast system for probabalistic forecasts of high impact weather and forecast reliability estimates which is currently being used primarily in research on improving the forecast skill of the system (expected operational transition in one year or so).
- The Navy is primarily interested in a system which is highly relocatable for coastal and maritime forecasts, robust in areas of sparse observations and capable of atmosphere-ocean-land-ice model coupling..

Questions ?

BACK-UP SLIDES

COAMPS

Basic equations: Primitive equations including non- hydrostatic effects
Field formats: latitude-longitude grids or cartesian coordinates on horizontal map projection
Output Fields: Wind components, potential temperature, mixing ratio, surface pressure, ground temperature, ground wetness, SST
Numerical techniques: Arakawa C-grid, vertically/horizontally staggered with split explicit time integration
Grid Structure: Arakawa C with a Sigma Z vertical coordinate
Integration domain: Regional, surface to sigma (30 to 40) = 31500 m (approx. 10 mb)
Horizontal resolution: User specified, most often 54/18/6 km, triple nested
Vertical levels: 30 to 40 Staggered user specified vertical levels from the surface to 31 km
Nested grids: One way nesting communication
Forecast time: Nominally 48 h (up to 72 hr used operationally)
Initial fields: NAVDAS 3-d var analysis maps real and synthetic observations from NOGAPS on the model grid. Analysis increments to the first-guess are interpolated in the vertical to the model vertical levels
First-guess analysis: from the previous COAMPS 6 hr forecast
Boundary conditions: Davies (1976) or Parkey-Kreitzbery (1976) from NOGAPS forecasts at 3-hr intervals
Orography: Envelope topography from 1 km terrain data base based on the DMA DTED level 1 data set
Horizontal diffusion: Fourth-order diffusion for all prognostic variables, but the Exner perturbation (pi')
Moisture physics: Explicit moist physics (Rutledge and Hobbs, 1983) for horizontal grid resolutions less than specified value (typically 10 km). Cumulus convective process (Kain and Fritsch, 1990)
Radiation: Longwave & shortwave radiation (Harshvardhan, 1987)
Planetary boundary layer: 1.5 order turbulence kinetic energy closure (Deardorff, 1980)
Land surface: single layer/bucket model
Ocean surface: COAMPS makes its own SST analysis at the surface using optimum interpolation techniques

References

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