USE OF NOGAPS PRODUCTS FOR MEDIUM-RANGE FORECASTING

Randal L. Pauley and Mary Alice Rennick
Fleet Numerical Meteorology and Oceanography Center
Monterey, U.S.A.

1.   INTRODUCTION

The Navy Operational Global Atmospheric Prediction System (NOGAPS) is the global numerical weather prediction system of the U.S. Navy's Fleet Numerical Meteorology and Oceanography Center (FNMOC). As the NOGAPS horizontal resolution has increased (to a current maximum spectral resolution of T159) and forecast skill has improved over time, the demand by U.S. Navy (USN) customers for forecast products in the medium range has increased concomitantly. In response FNMOC has extended the length of the NOGAPS T159 deterministic forecasts and has also developed a modest T63 ensemble forecast system.

2.   MEDIUM-RANGE FORECASTING AT FNMOC

2.1   FNMOC customers and forecast requirements

FNMOC has a world-wide base of customers, primarily USN and other military services, including the U.S. Air Force Weather Agency (AFWA) and the Air Force and Navy Joint Typhoon Warning Center (JTWC). Recently the National Weather Service (NWS) Western Region Forecast Offices have begun routinely receiving NOGAPS products. NOGAPS products are also available at various web sites on the Internet. Access to NOGAPS products on the official FNMOC web site is currently password restricted to military and U.S. governments users. The primary requirements for medium-range forecasting for the USN include protection of fleet assets (from tropical cyclones and extra-tropical maritime storms) and fleet operations and exercise planning. The former is particularly concerned with the 3-5 day forecast period and the latter with the 5-7 day forecast period. The NWS Western Region has requirements for 3-5 day outlooks and medium-range high-wind forecasts and precipitation and hydrological forecasting. So forecasting to seven (or at most eight) days is the primary requirement for NOGAPS in the medium range.

2.2   NOGAPS deterministic forecasts

The current T159 NOGAPS has 18 vertical levels and runs a six-hour update with an optimum interpolation analysis scheme. Six-day (144-hour) forecasts are run twice daily with a data cutoff at three hours past the synoptic time; the model runs with a wall time of approximately 12 minutes per forecast day. Consequently, the 3-6 day NOGAPS products are available to forecasters several hours before they can get other medium-range model forecasts, especially on the 12Z watch. So NOGAPS forecasts have proven valuable to the customer even if they may not quite match other models in skill. The NOGAPS T159 also has a very strong reputation as a tropical cyclone track forecasting aid, something of particular value to the USN. In view of the above noted requirements, we may eventually extend our deterministic forecasts to seven days as resources allow.

2.3   NOGAPS ensemble forecast system

FNMOC has also developed an ensemble forecast system (EFS) using a T63 version of NOGAPS (Rennick, 1995). The FNMOC EFS currently consists of ten members, each a ten-day NOGAPS forecast. The breeding cycle method of forecast perturbation developed and implemented at the National Centers for Environmental Prediction (NCEP) and described in Toth and Kalnay (1993) is the basis for the FNMOC ensemble. Our ten-member bred ensemble conforms closely to the recommendation of Houtekamer and Derome (1995) for cost-effective operational ensemble mean forecasting. A simple average of the ensemble members extends the NOGAPS medium-range forecast skill by 6-18 hours. A variety of EFS products are available on the FNMOC web site including (1) plume displays, (2) single height contours, (3) probability contour displays for gale winds and precipitation, (4) ensemble means and standard deviations and (5) ensemble perturbations. Ten-day animations of many of the products are also available.

2.4   Customer feedback and future plans

The customer feedback we have received to date indicates growing confidence in NOGAPS utility in the medium range. Tropical cyclone track forecasting performance has received particularly positive notice. The gale wind probability displays have proven to be the most used EFS products. Animation is also popular with customers. The NWS Western Region has been positive in their assessment of NOGAPS for 3-5 day forecasting for the U.S. west coast. Many customers have expressed a desire for more information on NOGAPS verification in the medium range. Improved validation and verification of the EFS are required for development purposes to improve the forecast system and are also needed to demonstrate the utility of the medium-range products to the customers. Increased customer feedback will be required to help us tailor an expanded and improved EFS product suite to more closely meet customer needs. We also need to explore broadening the distribution of EFS products for customers who don't or can't routinely access the FNMOC web site.

3.   ACKNOWLEDGMENTS

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4.   REFERENCES

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