

NORTH AMERICAN ENSEMBLE FORECAST SYSTEM

Project Description

Summary. The North American Ensemble Forecast System (NAEFS) combines state of the art weather forecast tools, called ensemble forecasts, developed at the Meteorological Service of Canada (MSC), and at the US National Weather Service (NWS). When combined, these tools (a) provide weather forecast guidance for the 1-14 day period that is of higher quality than the currently available operational guidance based on either of the two sets of tools separately; and (b) make a set of forecasts that are seamless across the national boundaries over North America, between Mexico and the US, and between the US and Canada. Since both the research/development and the operational costs of the NAEFS system are shared by the participants, each weather service can produce higher quality and more extensive weather forecast guidance than what they could, working separately on their own.

Ensemble forecasting. The NAEFS utilizes a relatively new tool, ensemble forecasting, where a numerical representation of the atmosphere, called a Numerical Weather Prediction (NWP) model is run, with slight perturbations in the initial conditions and the model formulation, multiple times. The purpose of this approach is to capture all possible weather scenarios. Such an approach can support a probabilistic forecast suite, allowing users to better prepare for extreme weather events by providing early warnings.

Improved forecast quality and utility. For the generation of ensemble forecasts, MSC and NWS use different but equally plausible methods (data assimilation, NWP modeling, and ensemble perturbation). When forecasts from the two centers are combined, the joint ensemble is expected to better capture the uncertainty in the forecast, leading to enhanced quality. Probabilistic forecast products based on the joint ensemble will in turn have more value for the users of the forecasts in the participating countries, including Mexico.

Applications. The NAEFS forecast suite will contain a common set of probabilistic weather forecast products, to be used at all three participating meteorological services. These will include the probability of extreme weather events, including heavy precipitation, damaging winds, etc. Some of the products will serve synoptic forecasters as intermediate users at NWS Weather Forecast Offices (WFOs), NCEP Service Centers, and at NMSM. Others will be tailored for end users, both in the private sector and the public in general in Canada and the other countries. All three participating weather services are expected to contribute to the design of these products, and will naturally benefit in their daily routine work from the operational generation of the products by the NAEFS system.

Accelerated research and development. By sharing the research and development tasks among the participating countries, more new methods can be tested, and at an accelerated pace. This will increase the rate of improvements both in the area of ensemble forecasting, and the generation and use of weather forecast products.

Cost savings. NWP forecasting involves extensive use of computer resources. One of the computationally most demanding tasks is the generation of an ensemble of forecasts. By combining ensembles from different centers, the participating weather services can produce potentially higher quality forecasts at a fraction of the cost compared to generating all forecasts themselves.

Initial Operational Capability. As a first step in the development of the NAEFS system, the two ensemble generating centers, the Canadian Meteorological Center (CMC) of MSC, and the National Centers for Environmental Prediction (NCEP) of the NWS, started exchanging their ensemble forecast data on an operational basis in September 2004. At each center, routinely generated forecast products are made based on both sets of ensembles, but not yet on a combined ensemble.

Next implementation. In the next phase of NAEFS development expected to be completed by February 2006, forecast products will be generated based on the joint ensemble. Before combining the forecasts from the two centers, each set of forecasts will undergo a statistical post-processing procedure, reducing their systematic errors. A common set of new products will be developed and prepared operationally at each ensemble generating center, providing also a backup functionality for the other center.

International connections. The Met Office of the United Kingdom plans to join the NAEFS system after their ensemble forecast system becomes operational, possibly in year 2006. The NAEFS system will also serve as a prototype for an ensemble forecast system as part of an even broader international research collaboration, under the auspices of World Meteorological Organization (WMO) sponsored Global Atmospheric Research Program, called THORPEX.

Historical background. Discussions about joint ensemble forecasting development efforts were initiated at a meeting of high level officials from MSC and the NWS in February 2003. A workshop was convened in May 2003, with experts from the MSC and NWS, where planning for the research, development, and operational implementation work for the NAEFS system began. Basic planning activities were completed by October 2003 with the completion of the NAEFS Plan, after which intensive work for the Initial Operational Capability (IOC) implementation began. The IOC phase of the NAEFS was successfully implemented on schedule in September 2004. The National Meteorological Service of Mexico (NMSM) became involved with the NAEFS system in October 2004.

Further information. For further information, see:
<http://wwwt.emc.ncep.noaa.gov/gmb/ens/NAens-wshop-2004.html>
and links therein.