J1.4 Advances in Short Range Ensemble Forecasting (SREF) at NCEP

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1. INTRODUCTION

Over the past several years, NCEP's Environmental Modeling Center (EMC) also been developing a **S**hort-**R**ange (0-3 days) **E**nsemble **F**orecasting (**SREF**) system based on regional models. The principal motivation has been and remains to provide quantitative estimates of the inevitable uncertainties in weather forecasts. It is widely agreed that ensemble based probabilities and/or measures of confidence hold the best potential for enhancing the ability to make user dependent informed decisions. Vision 2005, the National Weather Service Strategic Plan, recognizes this fact by committing the NWS to "provide weather, water, and climate forecasts in probabilistic terms by 2005." Early studies (Hamill and Colucci, 1997 and 1998;Eckel and Walters,1998; Tracton and Du, 1998; Du and Tracton, 1999; Hou and Kalnay, 2001) provided valuable insights on some of the key scientific and strategic issues in constructing an ensemble system, such as tradeoffs between resolution and ensemble size, the influence of lateral boundary conditions, single versus multi-model ensembles, and methodology for generating perturbations to initial conditions. Moreover, the studies strongly suggested that SREF can provide operationally relevant and useful guidance on the probability distribution of weather elements and events, including quantitative precipitation (QPF).

2. STATUS

The current operational SREF configuration (beginning June 2001) consists of 10 members running from both 09 GMT and 21 GMT to 63 hours. In the context of the cuurent NCEP IBM computer suite, this is the only approach that enables completion of runs about the same time as the operational Eta model runs (22 km) from 12 and 00 GMT. The SREF system consists of a control Eta model forecast plus 4 Eta perturbed runs and a control Regional Spectral Model (RSM) run plus 4 perturbed RSM forecasts. All forecasts are with 48 km resolution versions of the models over the operational Eta domain. Lateral boundary conditions are provided by the 9-hour forecasts from the respective members of the MRF global model ensemble. Initial state perturbations are genrated by independent "breeding" cycles, as for the NCEP global ensemble system, but in the context of the respective regional models.

SREF is currently run in what's referred to as a Real Time Test and Evaluation (RTT&E) mode leading (hopefully) to official NWS sanction as operational by September, 2002. The RTT&E designation means SREF is running in the production side of the NCEP IBM with NCEP/NCO production standards and support. However, products are not yet sanctioned nor distributed by the NWS as operational. They are available beyond NCEP on the SREF website[2] and in GRIB format from an NCEP server. SREF based products include maps from of ensemble mean and spread, "spaghetti" diagrams showing forecast diversity, and probability charts for precipitation, stability indices, etc. Recent additions include the ensemble based predominant precipitation type (rain, snow, freezing rain) and relative liklihood of each using the Baldwin et al.(1994) precipitation type algorithm.

Integral components of the RTT&E include education and training in the concepts and applications of SREF and assessing the performance and value of the SREF system. Education and training can be addressed, for example, by site visits and web based tutorials[3] and a COMET computer-based training module (under construction). The system performance and value will be evaluated objectively (e.g., RMS errors, ranked probability scores, reliability diagrams) and subjectively on the basis of user feedback from NCEP Service Centers and selected ("Beta" site) NWS field offices. Unofficially, input is welcome from all quarters!!

Essentialy the same SREF system as above had been running in a delayed mode (~ 8-10hr delay) from 12 and 00 GMT for about 14 months prior to June, 2001. Case studies (e.g., the January 2000 east coast snowstorm, Tracton and Du, 2001), preliminary objective diagnostics, and anecdotal evidence based on these runs

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[2] See: http://lnx48.wwb.noaa.gov/SREF/SREF.html (SREF products are also available at http://eyewall.met.psu.edu/SREF/index.html)

[3] See: http://www.hpc.ncep.noaa.gov/ensembletraining/

unquestionably reinforced the proposition that SREF could be very valuable for operational forecasting applications. And this was supported unanimously by the SOOs of NCEP service centers (HPC, SPC, AWC, TPC, MPC).

3. PLANS

Following the initial start of the RTT&E, we will continue to investigate in a parallel mode possible modifications and upgrades of the SREF system and weigh the relative benefits and necessary tradeoffs with regard to, for example, perturbing and/or alternative physics parameterizations, additional members, higher resolution, and extension to 87 hours. Also considered will be adding models (e.g., the RUC) to the mix.

Also, we will explore adding products in the context of user needs and requirements. In particular SREF based guidance of the sort depicted in Fig.1 will be provided on an experimental basis to assist HPC and selected Eastern Region WSOs in issuance of winter storm watches and warnings. Beyond the products generated centrally, NCEP Service Centers and other users have the opportunity to develop their own user specific products from GRIB files of the individual ensemble members.

The target for full NWS sanctioned operational implementation is during the middle of 2002. Toward this end NCEP will work with NWS Headquarters on a NWS wide evaluation, critical issues (e.g., communications, product availability on AWIPS), and on NWS wide education and training.

4. REFERENCES

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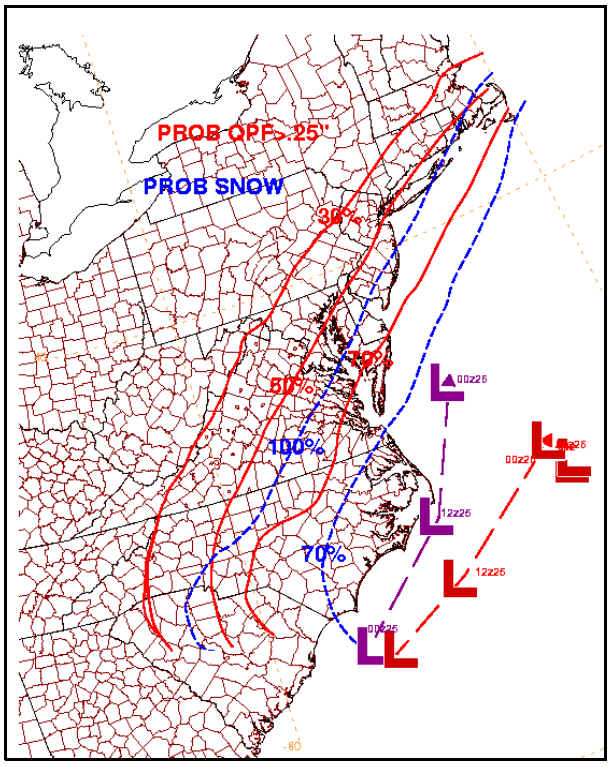

Fig. 1: Example of probabilistic snow product generated from the SREF: PQPF for melted precip >.25", Prob of precip being snow, and envelope of storm tracks.