

WORLD METEOROLOGICAL ORGANIZATION

DPFS/CBS/ET-EPS/Doc. 4.1

**COMMISSION FOR BASIC SYSTEMS
OPAG on DPFS**

(28.10.2011)

**MEETING THE CBS EXPERT TEAM ON
ENSEMBLE PREDICTION SYSTEMS (ET-EPS)**

Agenda item : 4.1

Geneva, Switzerland, 14-18 November 2011

ENGLISH ONLY

PROGRESS OF EPS IMPLEMENTATIONS

(Submitted by Yuejian Zhu)

Summary and purpose of document

This document is updating NCEP Global Ensemble Forecast System (GEFS) and its post products for past two years. It is good for ET-EPS final report

Action Proposed

It is not necessary to review the details in the meeting for these changes from a tight agenda.

Annex(es): Table 1: The changes of NCEP Global Ensemble Forecast System (GEFS)

4.1 Global EPS: NCEP Global Ensemble Forecast System (GEFS) (Report by Yuejian Zhu)

4.1.1 Historic Review

NCEP's Global Ensemble Forecast System (GEFS) has been in operation since December 1992, using the NCEP Global Forecast System (GFS) model for integration and Breeding Vector (BV) technique to generate perturbations in the initial conditions. After the Aug. 25, 2005 implementation, GEFS runs four times per day (0000, 0600, 1200 and 1800 GMT) out to 16 days. At each time, 10 (5 pairs) perturbed members are initialized using BV method with 6 hours cycling. Meanwhile, a "relocation" technique is applied in the initial condition of each run to adjust the initial central location of tropical storms to the actual location (see: Liu and et al., 2006). Since 2006, extended BV method with Ensemble Transform and Rescaling (BV-ETR; Wei and et al., 2008) was applied in operation. In early 2010, GEFS was upgraded by introducing model uncertainty which names "Stochastic Total Tendency Perturbation (STTP)" (see: Hou and et al., 2011)

4.1.2 Recent Changes in Configuration (Feb. 2010, Feb. 2012)

See details of implementation log:

http://www.emc.ncep.noaa.gov/gmb/ens/ens_imp_news.html

1) *Horizontal and Vertical Resolutions:*

In the coming implementation to be finished in Feb 2012, the horizontal resolution will be increased to T254 (about 55km on equator) for 0-192 hours and the same for 192-384 hours (T190), the vertical resolution will be increased to 42 hybrid levels from 28 levels.

2) *Membership:*

The number of perturbed members was the same as before (20 members), and ensemble control forecast for all four forecast cycles.

3) *Generation of the Initial Perturbations:*

Breeding Vector (BV) technique is modified by applying Ensemble Transformation (ET) to the ensemble perturbations in 6-hr forecasts. The resulted initial perturbations are then rescaled, leading to ET with Rescaling (ETR) method. ETR was introduced to the Breeding Vector technique (BV-ETR) in May 2006 (see: Wei and et al., 2008).

4) *Representation of Model Related Uncertainty:*

In Feb. 2010, a Stochastic Total Tendency Perturbation (STTP) scheme was implemented to represent uncertainties associated with the NWP model used for the integration. STTP is based on the hypothesis that tendencies of the ensemble perturbations provide a representative sample of the random total model errors (see: Hou and et al. 2011).

4.1.3 Post Products

1) *Global products at 1*1 degree resolution:*

A set of probabilistic forecasts of 10%, 50%, 90%, ensemble mean, mode and spread have been generated daily for 48 bias corrected variables.

2) *CONUS products at 5*5km resolution*

A set of probabilistic forecast of 10%, 50%, 90%, ensemble mean, mode and spread have been generated daily for 4 surface variables.

3) *Alaska Region products at 6*6km resolution*

A set of probabilistic forecast of 10%, 50%, 90%, ensemble mean, mode and spread have been generated daily for 8 surface variables.

Annex: Table 1: The changes of NCEP Global Ensemble Forecast System (GEFS)

| Date | Initial Uncertainty | TS Relocation | Model Uncertainty | Resolution | Fcst length | Ensemble members | Daily Frequency | |
|---------|---|---------------|---|----------------------------------|-------------|-----------------------|-----------------|--|
| 1992.12 | Breeding vector (BV) | | | T62L18 | 12 | 2 | 00UTC | |
| 1994.3 | | | | T62L28 | 16 | 10(00UTC) 4(12UTC) | 00, 12UTC | |
| 2000.6 | | | | T126L28(0-2.5) T62L28(2.5-16) | | 10 | | |
| 2001.1 | | | | T126L28(0-3.5) T62L28(3.5-16) | | | | |
| 2004.3 | | | | T126L28(0-7.5) T62L28(7.5-16) | | 14 | | |
| 2005.8 | | Relocation | | | | | | |
| 2006.5 | BV + Ensemble transform with rescaling (BV-ETR) | | T126L28 | 20 | | 00, 06, 12, 18UTC | | |
| 2007.3 | | | | | | | | |
| 2010.2 | | | Stochastic total tendency perturbation (STTP) | T190L28 | | | | |

Reference(s):

Hou, D., Z. Toth, Y. Zhu, W. Yang and R. Wobus, 2011: ["A Stochastic Total Tendency Perturbation Scheme Representing Model- Related Uncertainties in the NCEP Global Ensemble Forecast System"](#) Submitted to Tellus-A (Dec. 2010))

Cui, B., Z. Toth, Y. Zhu and D. Hou, 2011: ["Bias Correction For Global Ensemble Forecast"](#) Weather and Forecasting (in press)

Wei, M., Z. Toth, R. Wobus, and Y. Zhu, 2008: ["Initial Perturbations Based on the Ensemble Transform \(ET\) Technique in the NCEP Global Operational Forecast System"](#) Tellus 59A, 62-79

Liu, Q., S. J. Lord, N. Surgi, Y. Zhu, R. Wobus, Z. Toth and T. Marchok, 2006: ["Hurricane Relocation in Global Ensemble Forecast System"](#) Preprints, 27th Conf. on Hurricanes and Tropical Meteorology, Monterey, CA, Amer. Meteor. Soc., P5.13.