Short Range Ensemble Forecasting at Météo-France : a preliminary study

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Over the past few years ensemble prediction has come to the fore as a major element in the operational weather forecasting. After being exploited in the medium-range prediction, ensembles begin to be used in the short-range frame (Tracton et al, 1998). We are presenting here the description of an experimental ensemble developped at Météo-France in the PEACE[1] project. This ensemble is devoted to detect rare severe events such as storms in the short range (24-48h). Emphasis is placed on assessing skill of predicting strong wind speed probabilities.

Because of heavy computational cost, the ensemble is limited to 11 members (10 perturbed + 1 control). It is based on the global spectral ARPEGE model (Courtier et al, 1991) with a nominal truncature of T199 and a stretching coefficient of 3.5 (which corresponds to an equivalent grid mesh of about 20 km over France). Initial perturbations used in the ensemble are generated by the singular vectors technics. One particular feature is the vectors optimization over a limited area (fig. 1) including the Western Europe as it was done in Hersbach (2000). By this way, we insure that pertubations will be efficient in the area of interest. Different areas and optimization times are under test. No physics (apart a simplified physics including diffusion) is used in singular vectors computation. Total energy norm is used both at initial and final time with T63 linearized and adjoint versions of the model.

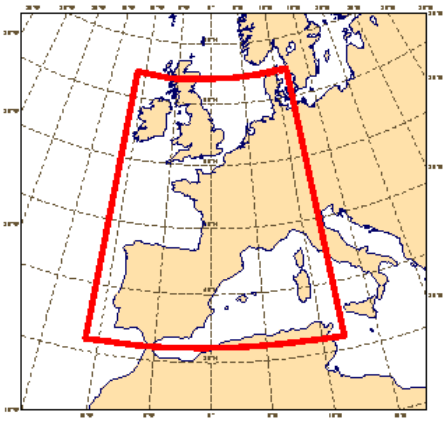
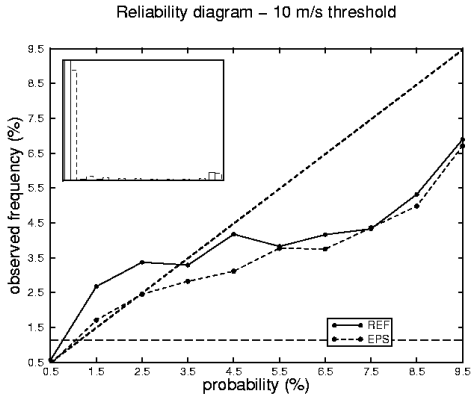


fig.1 Targetting area

The experimental ensemble was tested and compared to ECMWF Ensemble Prediction System over a sample of 61 cases of observed or/and forecast storms between Winter 1998 and Spring 2001. The ensemble distribution statistical consistancy was checked and probabilty scores were computed for different wind speed thresholds.

Results show a usefull information in the skill prediction especially for the mean sea level pressure and most of the time an improvement in the ensemble mean RMS score compared to the control. Concerning the probabilistic score on the 10 m Wind speed, allthough the EPS gets (fig. 2) a better reliability (which can be explained by the higher number of members and can be improved by the way of calibration), the experimental ensemble (named “REF” on the figures) seems to be more skillfull in terms of resolution (fig. 3). This is an encouraging point because resolution represents an intrinsic quality of the ensemble and quantify the informative skill of the ensemble.

[1] PEACE : Prévision d’Ensemble A Courte Echéance



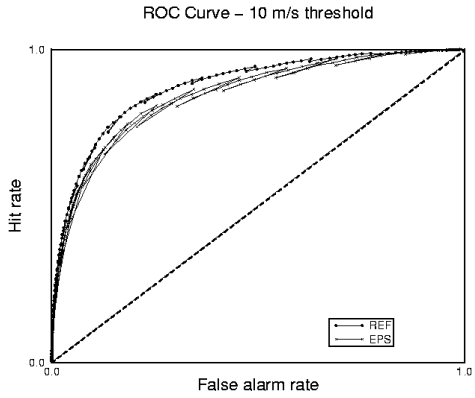


fig. 2 reliability diagram 10m Wind Speed – 10 m/s threshold

fig.3 ROC curve 10m Wind Speed – 10 m/s threshold

The development of this short range ensemble is in its first stage. Improvements will be necessary in different ways :

- Inclusion of past errors in the initial state uncertainties sampling. Different methods will be tested :
    - evolved singular vectors
    - hessian norm in the SV computation (including analysis error statistics)
    - blending-breeding cycle. This last method uses a breeding cycle, but instead of re-scaling the perturbations, the large scales/low waves are kept from the control analysis at each assimilation cycle step (every 6 hours) while the the small scales/short waves come from the perturbed guess. The selection is done by means of the digital filter technics.
- Enhancement of model perturbations by tunning physical parametrizations.

References :

Courtier, P., C. Freydier, J.-F. Geleyn, F. Rabier, and M. Rochas, 1991 : The ARPEGE Project at Météo-France. *ECMWF Seminar Proc., September 1991*, Reading, United Kingdom, ECMWF, 193-232.

Hersbach, H., R. Mureau, J. D. Opsteegh, J. Barkmeijer, 2000: A Short-Range to Early-Medium-Range Ensemble Prediction System for the European Area. *Monthly Weather Review*: Vol. **128**, No. 10, pp. 3501-3519.

Tracton, S., J. Du, Z. Toth, and H. Juang, 1998: Short-range ensemble forecasting (SREF) at NCEP/EMC. *Preprints, 12th Conf. on Numerical Weather Prediction*, Phoenix, AZ, Amer. Meteor. Soc., 269-272.