

REQUEST FOR A SPECIAL PROJECT 2013–2015

MEMBER STATE: ITALY

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Project Title:
Multi Model Monthly Ensemble

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|---|------------------------------|--|
| If this is a continuation of an existing project, please state the computer project account assigned previously. | SPIT-SPIA | |
| Starting year: (Each project will have a well defined duration, up to a maximum of 3 years, agreed at the beginning of the project.) | 2012 | |
| Would you accept support for 1 year only, if necessary? | YES <input type="checkbox"/> | NO <input checked="" type="checkbox"/> |

| Computer resources required for 2013-2015: (The maximum project duration is 3 years, therefore a continuation project cannot request resources for 2015.) | 2013 | 2014 | 2015 |
|---|--------|--------|------|
| High Performance Computing Facility (units) | 490000 | 490000 | |
| Data storage capacity (total archive volume) (gigabytes) | 100 | 100 | |

An electronic copy of this form **must be sent** via e-mail to: *special_projects@ecmwf.int*

Electronic copy of the form sent on (please specify date): 27-04-2012

Continue overleaf

¹ The Principal Investigator will act as contact person for this Special Project and, in particular, will be asked to register the project, provide an annual progress report of the project's activities, etc.

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Extended abstract

Monthly ensemble predictions over Europe are produced operationally at several International Weather Services. Their skill, although still not comparable to that of operational medium range predictions, is considered sufficient to justify their use by several end-user. However, while model predictions are normally useful in the first two weeks of the forecast period, in the second half of the month (that is after the limit of deterministic predictability) the skill drops substantially.

Although several single model ensemble monthly predictions are available, no multi-model ensemble system has yet been proposed for operational use. The present project aims at evaluating if the forecast skill can be improved, especially over the last two weeks of forecast, by using a (small) multi-model ensemble system instead of a single-model ensemble system.

Here we propose to use the outputs of two model systems, namely the ECMWF operational ensemble monthly predictions data-set and the GLOBO model system predictions of the ISAC-CNR Institute of Bologna (Malguzzi et al, 2011). The GLOBO model is a grid-point based AGCM with a slab ocean model to infer Sea Surface Temperature (SST) evolution. It is currently used at ISAC-CNR to produce 6-day global forecasts (see www.isac.cnr.it/dinamica/projects/forecasts/globo.html) and monthly forecasts (see www.isac.cnr.it/dinamica/projects/forecast_dpc/month_en.htm).

One of the recent applications of the GLOBO model at the ISAC Institute is the monthly probabilistic forecasting of temperature and precipitation anomalies over Italy, promoted by the Italian Civil Protection Agency. The monthly forecasting is based on recalibrated ensemble forecasts, with initial conditions derived from unperturbed and perturbed analyses of NOAA-NCEP, with prescribed SST anomaly (corresponding to the observed anomaly at the initial time) superimposed on the seasonal SST cycle. The GLOBO model is presently employed in this ensemble mode with a resolution of 1.0 x 0.75 degrees, and with 50 vertical levels (Mastrangelo et al, 2012).

Within this project, it is planned to carry out monthly ensemble forecasts for a couple of case studies, selected as representative of winter and summer periods characterized by important climatological anomalies. Each case-study starting date will be chosen in order to evaluate the predictability of observed climate anomalies over Italy. Particular attention will be paid to summer heat waves and draught, and winter cold anomalies. In order to gain a better dynamical understanding of model errors and predictability limitations, a new diagnostic tool, based on Rossby wave-packet detection (Grazzini and Lucarini, 2011), will also be used.

Finally, the possibility of improving the multi-model ensemble prediction skill by calibrating the forecasts over Italy will be explored and evaluated. More specifically, the possibility to calibrate the monthly mean forecast anomaly as well as weekly anomalies will be considered. In the first case, it will be possible to use calibration techniques similar to those currently used to calibrate seasonal forecasts over Italy developed within the Italian Special Project SPIT-SPIA. These techniques are based on the construction of a MOS calibration scheme between upper air large-scale model predictions and local surface observed anomalies. In the latter case, it will be necessary to build a different method, possibly still based on a MOS scheme, but accepting as input synoptic scale transient anomalies.

References

Malguzzi, P., A. Buzzi and O. Drofa, 2011: The meteorological global model GLOBO at the ISAC-CNR of Italy: Assessment of 1.5 years of experimental use for medium range weather forecast. *Weather Forecast.*, 26, 1045–1055.

Mastrangelo, D., Malguzzi, P., Rendina, C., Drofa, O., and Buzzi, A., 2012: First outcomes from the CNR-ISAC monthly forecasting system, *Adv. Sci. Res.*, 8, 77-82.

Grazzini, F., V. Lucarini, 2011: Climatology of extratropical atmospheric wave packets in the Northern Hemisphere. Submitted