weather parameters. There was general consensus about the usefulness of generating re-forecast data for medium-range, monthly and seasonal ensemble forecasts. It was pointed out that unresolved issues on the choice of optimal methodologies, re-forecast versus ensemble size, and the actual increase of forecast skill could only be addressed by carrying out research on extensive sets of re-forecasts.

Downscaling issues were mostly discussed in the context of seasonal forecasts, an area where the advantages (and disadvantages) of dynamical versus statistical methods are still to be properly evaluated. The working group agreed that, so far, evidence to justify the additional complexity and computing requirements of dynamical downscaling is limited. However, results presented at the workshop on a reduction of false-alarm rates in downscaled simulations with a regional climate model warrant further investigation. The degradation of results arising from the use of boundary conditions at 12-hour versus 6-hour frequency in dynamical downscaling was also pointed out.

Verification and application of Ensemble Prediction Systems

The third working group focused its discussions on the verification and application of Ensemble Prediction Systems. The topics discussed included the most appropriate choice of verification measures, statistical significance of results, accounting for the uncertainty of verification data, avoidance of false skill, verification of rare/extreme events, and communication of probabilistic forecasts.

The working group made some recommendations concerning the design and testing of forecast systems, stating that, based on predictability theory, medium-range and later-range forecasts should be issued in probabilistic form. Therefore, the prime aim of ECMWF should be to provide the tools to predict a reliable and sharp probability density function (PDF) of the atmospheric state rather than just a single deterministic high-resolution forecast. The PDF should be based on all available information, i.e. the EPS and the high-resolution deterministic forecast. Consequently, the EPS should be given the same level of attention as the deterministic forecast system.

It was recommended that research on how to best combine high-resolution deterministic forecast and EPS should be continued at ECMWF. It was, however, also stated that a user/application-specific combination may be superior to a generic combination. In such cases, the production of an optimally combined PDF would fall into the responsibility of Member States or individual end-users.

Key message

The workshop closed with a plenary discussion during which the key conclusions of the three working groups were analyzed by all participants. The key message that can be drawn from the plenary meeting is that many groups are working to improve the current ensemble prediction systems, and that work is progressing towards the development of a complete probabilistic approach to the data assimilation and forecasting problem.

A wealth of ocean data makes its appearance on the public web at ECMWF

ALBERTO TROCCOLI,
FRANCISCO J. DOBLAS-REYES

IN *ECMWF Newsletter No. 113* (page 4) there was a news item about ENSEMBLES public data dissemination in which it was reported that ocean data would be available in the near future. Rather quicker than expected a wealth of ocean data has now been made available on the OPeNDAP server installed at ECMWF under the EU project ENSEMBLES (ensembles.ecmwf.int/thredds/catalog.html). In fact, limited amounts of ocean data were made publicly available on the ECMWF OPeNDAP server under the FP5 EU project ENACT (www.ecmwf.int/research/EU_projects/ENACT/), but a greatly expanded data set is now available which may trigger the interest of more people. This is the first time that such an extensive dataset with homogeneous NetCDF Climate and Forecast (CF) Metadata conventions for either atmospheric or ocean variables has been created and made available to the public.

The ENSEMBLES ocean data are from two sources.

- *Data assimilation analyses* covering the 48-year period 1959–2006 – currently the longest period for publicly available ocean analyses.
- *Retrospective forecasts* (or *hindcasts*) – from three experiments, two covering the period 1991–2001 and one covering the period 1960– 2006.

The analyses are available both in a regular grid to allow an easier intercomparison between different models and in the original model grid (more information about the ocean analyses is in the article in *ECMWF Newsletter No. 113*, pages 8–16). At present these data are available for the ECMWF model but within the framework of ENSEMBLES, results from other models should be available soon.

The main difficulty in making the data available, once they have been produced, is to ensure that the NetCDF files destined for the OPeNDAP server follow well defined standards. Extensive work has been undertaken for the atmospheric data also, as discussed in the news item mentioned above. However, new conventions have been introduced for the ocean data in order to make them CF-compliant. This process, together with the actual preparation of the CF-

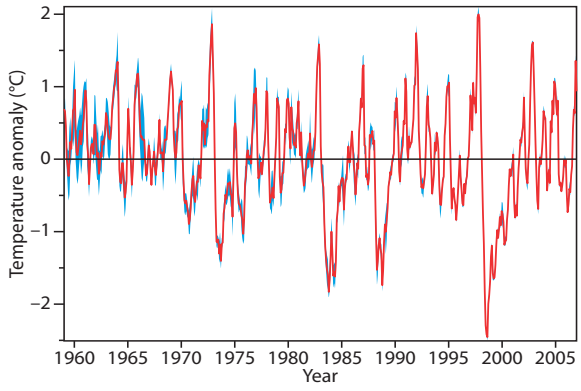
Examples of data retrieval

An example of how data can be retrieved using free software such as *nco* (nco.sourceforge.net) is given here. In this example the *nco* command (ncks) is requesting the temperature (the three-dimensional *thetao* field) along the equator (-d latitude,0) for the upper 1000 m (-d level), for the 1959–2006 period (-d time for the 576 months) and for the five ensemble members (-d ensemble):

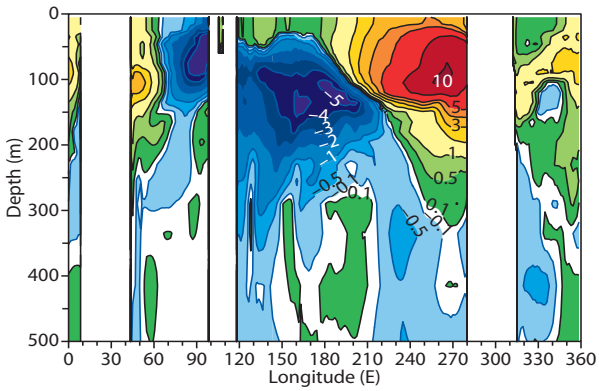
```
ncks -a -h -v thetao,time_bnd -d latitude,0. -d level,0.,1000. -d
time,0,575,1 -d ensemble,0,4,1 -O -o fileout.nc -p
http://ensembles.ecmwf.int/thredds/dodsC/ocean/ecmwf/eg thetao
```

By applying this command to programming/visual languages such as IDL one can analyse these data in a relatively easy way. For instance, the figures illustrated here were produced using a simple code which is available on request or at: www.ecmwf.int/research/EU_projects/ENSEMBLES/data/data_dissemination.html.

In both cases illustrated here, the results change only marginally when fields are taken on the regular grid rather than on the original grid.



Time series of the temperature anomaly of the ocean analysis on the regular grid averaged over the top 300 m and over the Niño3.4 region. The blue envelope represents the full spread of the five members. The absence of spread, as in the present period, indicates that observations are numerous and provide a strong constraint to the analyses.



The equatorial section of the analysed temperature anomaly for the ensemble mean for the month of December 1997 (close to the peak of the 1997/98 El Niño event).

compliant NetCDF, is one that has required intensive work, involving others at ECMWF and elsewhere.

The main advantage of the OPeNDAP server (www.opendap.org) is the targeted remote data access. This means that only portions of data (e.g. equatorial cross-sections) need to be physically retrieved (the *targeted* part) and this operation can be carried out without visiting directly the web page where the server and the data reside (the *remote* part). As a consequence, computer codes can be written that access targeted data from more than one OPeNDAP servers, even at different locations.

More sophisticated data analyses than those illustrated here are certainly possible and we would like to encourage all those interested in using historical oceanic data as well as long hindcasts to start exploiting our targeted remote data access facility.

Signing of the Co-operation Agreement between ECMWF and Montenegro

MANFRED KLÖPPEL

ON 5 November 2007, Predrag Nenezic, Minister of Tourism and Environment of Montenegro, and Dominique Marbouty, Director of ECMWF, signed a co-operation agreement in Podgorica, Montenegro. Luka Mitrovic, Director of the Hydrometeorological Institute of Montenegro, attended the signing ceremony.

Predrag Nenezic stated: "The European Centre for Medium-Range Weather Forecasts is the world leader in its area of numerical weather prediction and we are proud of having concluded this co-operation agreement with this organisation. Its products will greatly assist the Hydrometeorological Institute of Montenegro in fulfilling its mission, in particular with regard to the protection of life and property. I am confident that both ECMWF and the Hydrometeorological Institute of Montenegro will benefit to a great extent from their close co-operation in meteorology."

Dominique Marbouty said: "ECMWF's worldwide leadership in the field of numerical weather prediction is based on close collaboration with the meteorological community. Governments recognise the necessity of improving the quality and accuracy of numerical weather