Working Group I

Use and Interpretation of Medium and Extended Range Forecast Guidance

User requirements for forecast information

Multi-model systems

- There are good experiences with operational PEPS systems. There is general consensus that the multi-model ensemble approach can give added value to the forecast system.
- Weighting of the elements in a multi-model ensemble is an ongoing issue.
- Objective evaluation of the multi-model ensembles is under development.

Combined Products

- It was commented that the ECMWF EPS clusters are often very similar. Some tuning is therefore necessary. ECMWF tubes are designed to bring out extreme scenarios. The concept of tubing and clustering need to be addressed when applied to multi-model ensembles of 100+ members.
- The NAEFS approach toward combining products was noted i.e.
  - apply bias corrections to the individual runs from different centres.
  - compute the suitable weights for combining products but leave the application of coefficients to the user.
  - provide normalized (anomaly) products
- The interpretation of multi-model products in general should be looked into.

User requirements for forecast information

Forecast consistency

- Inconsistency between consecutive runs and forecasts from different centres is a natural consequence of imperfect predictions. Forecasters tend to use the inconsistency between forecasts as a measure of uncertainty.
- Looking at consecutive ensemble runs separately (rather than combining them) give forecasters a good understanding of the uncertainty in the forecast and the probabilistic forecast evolution.
- A more frequent update of forecasts (e.g. 4x daily) would help forecasters assessing the consistency in the forecast.

Seamless products

- Some preference was expressed for forecast products for separate products for the high-resolution (week 1) and reduced resolution (week 2) parts of the VAREPS forecasts.
- VAREPS resolution change will require adaptations of the Kalman filtering and other PPMs in use in several member states. Any other potential impacts need to be reviewed

User requirements for forecast information

Verification

- The verification provided by ECMWF on the web is found to be useful and should be extended for the monthly forecast.
- Verification over areas (e.g. river basins) would be a useful addition to the standard verification practices.
- Verification statistics should be complemented with information about the atmospheric variability.
- Training in how to use and interpret the verification scores is still needed.
- Verification of severe weather events using corresponding warnings is underway in some countries.
- As a first step to demonstrate the usefulness of the probabilistic information in the EPS some deterministic verification scores can be used (det. model vs. ensemble mean)

Role of forecaster

- Forecasters may be able to add value to numerical models in areas of model weakness.
- Forecasters will continue to play a role in special events (e.g. media, emergencies)
- Amongst forecasters there is still a need for training in how to use probabilistic forecasts.

Value of forecasts

- **Benefits to users (societal, financial)**
  - **The job of the Met Service is to provide the best value to the customers. Some customers require deterministic forecast to be provided by Met Services, even if they know probabilities are available. How should the Met Services respond?**
  - **Be proactive in explaining uncertainty and use of probability information as decision support. There is evidence that users are becoming more open to the use of probabilities**
  - **Work more closely with users to understand their individual needs so it is possible to provide appropriate deterministic guidance from all available information**
  - **There will still be users who want deterministic forecasts but whose risk-sensitivity is not known to the forecasters. There will be a need to provide (generic) “best-estimate” deterministic predictions (based on all available information)**

Value of forecasts

- **performance measures for developers/users**
  - **There are often requests for a single measure to summarise forecast performance (common request from users, management, administrators).**
  - **Traditionally such measures have been based on synoptic upper air flow (e.g. Z500 error). With higher resolution, improvement in these measures may be small while greater impacts may be seen in fields such as precipitation.**
  - **Scientifically, a wide range of parameters and scores need to be considered when evaluating effect of change to forecast system.**
  - **Many users have specific requirements and will only be interested in certain aspects of the forecast (hurricane tracks; T, u for electricity generators). They want verification of relevant parameters with a relevant metric.**
  - **It is not feasible to develop a simple overall measure to satisfy all these needs. A wide (expanding?) range of verification will be required**

Value of forecasts

- **Relative benefit of different system configurations (e.g. ensemble size v. resolution)**
  - **What is the benefit of a high resolution deterministic forecast at day 15? Could the resource be better used to run more (lower-resolution) ensemble members? Should the high-resolution run also reduce resolution in a VAREPS configuration? Is there a need for a high-resolution forecast at all?**
  - **It was noted that doubling ensemble size doubles the cost, while doubling resolution can be closer to a factor of eight times more expensive. A higher resolution run is also useful for development and evaluation potential of future systems.**
  - **Canada and NCEP will to run EPS with the same resolution for days 1-15 (NCEP used to truncate after a few days, but now run constant resolution for 16 days). Is it important to maintain resolution in week 2 if the model is to be used to predict severe weather events?**
  - **Important to consider for which users and for what purposes are more members, or higher resolution, etc. needed. There are likely to be some areas where one option is beneficial, and others where a different configuration is better. There is probably no overall optimal solution**
  - **It was noted that experimentation on the relative benefits of ensemble size and resolution is expensive and cannot be done often. The TIGGE project will provide access to a range of configurations of resolution and ensemble size and will allow significant work to be undertaken**

Value of forecasts

Requirements for re-forecasts

- Re-forecasts (hindcasts) are used (necessary) to calibrate monthly and seasonal forecasts
- The potential use for re-forecast data to calibrate medium-range products (including EPS probabilities) was raised at the Workshop
- At ECMWF, two sets of re-forecasts are being planned
  - Extreme Forecast Index (EFI) climatology: 48-hour forecasts (EPS control) run from ERA-40 reanalyses. Around 900 forecasts will be available to generate the climatology each day. Rolling archive using current model version
  - Ensemble re-forecasts. Plan to investigate benefits for EPS using 15-member ensembles (in VAREPS configuration) run from 20 years of ERA-40 reanalyses
- It was noted that operational use in Member States (especially as a replacement for current post-processing) would involve extensive testing and operational development work. Re-forecast calibration is not an immediate replacement for current post-processing – continuity of current systems (PP, KF) is required for VAREPS. A T255 control is required (for the first 24 hours at least) to enable these systems to continue.
- It was suggested that two control runs (T255 & T399) could be run for full 15 days