# Introduction

Participants consisted of representatives from ECMWF and from a wide range of industry and public service sectors.

Presentations were made by ECMWF on the scientific basis for seasonal prediction, and on the forecast system developed at ECMWF. The importance of sea surface temperatures anomalies in influencing climate on seasonal timescales was emphasised and the need for coupled ocean atmosphere models to predict sea surface temperatures was stressed. The role of chaos in limiting deterministic forecasts was explained with the consequence that forecasts were of a probabilistic nature. The difficulties in validating such forecasts on the short climate record available was discussed as well as the potential value of such forecasts to different users, depending on the relative cost of acting on a forecast to the loss incurred if action was not taken.

A description of the coupled model used at ECMWF and the method by which ensembles were generated and probability information displayed was given. Examples of forecasts were presented in the form of predicted probabilities of rainfall and temperature being above or below average and of the degree to which the ensemble mean differed from climatology. Some results for the 97/98 El Nino were given to show the generally good predictions in the tropics. Forecasts for the last eight years for the northern hemisphere extratropics illustrated the larger ensemble spread and reduced skill in non-ENSO years.

Presentations from potential users covering a wide range of applications followed:

- hydro-electric services
- natural gas services
- water resource management
- insurance industry
- agro-meteorology (crop yield research)
- medical services and disease preparedness
- health epidemics (malaria)
- weather derivatives industry.

The limitations of seasonal forecasting at this stage were generally understood by the users. Nevertheless, there is an expanding market in Europe for a wide range of seasonal forecast applications. The probabilistic nature of seasonal forecasting is accepted by many end-users, some of whom can utilise the predicted probability density estimates (PDE) of weather events. The PDF is an essential input to risk models and risk evaluation, as for example in the insurance industry.

The workshop participants noted that the reliability of the forecast was an important issue and that the seasonal forecasts need to be provided with verification statistics and quality evaluations based on validations and past performance assessments.

The issues addressed at the workshop were reviewed and discussed further at a subsequent Seasonal Forecasting Users Meeting with representatives from Member States and Co-operating States. The following list of product requirements and recommendations from the workshop was suggested.

(i) Three monthly forecasts of temperature at 2m, maximum and minimum temperature, precipitation, snowfall and wind at 10m. The predictions of the mean and the anomalies are needed. If at all possible information about the evolution of these parameters at shorter intervals, months down to weeks are required.

(ii) Integrated quantities such as predictions of heating days, degree days, etc. are required.

(iii) PDE of the occurrence of weather or seasonal events such as the onset of the rainy season, the snow melt or extreme events, such as gales or the occurrence of tropical cyclones should be provided.

It was recommended that more information on NWP based seasonal forecast should be provided to the user community through additional documentation and enhanced information on the web in association with the forecast products.