16 OCTOBER 2002 : METEOROLOGY AND HYDROLOGY - TOWARDS CLOSER COLLABORATION

Ken Mylne ken.mylne@metoffice.com: Recent advances in probabilistic forecasting, particularly in rainfall uncertainty

The need for probabilistic forecasting will be introduced, and demonstrated through reference to the Lorenz model for a simple chaotic system. The development and application of ensemble prediction systems to address issues of predictability will be described, and some illustrations given of how they can be applied to provide probability forecasts, with particular reference to rainfall. Results will be illustrated from a Met Office system designed to provide early warnings of severe weather from the ECMWF ensemble, and it will be shown that calibration can often improve the quality of probability forecasts. Some results will also be shown from an Italian system designed to provide added detail in probability prediction of catchment-scale rainfall. Future plans for higher resolution systems aiming to provide more detail of rainfall uncertainty will also be outlined.

Ken Mylne joined the Met Office in 1984 after doing a degree in Physics with Atmospheric Physics at Oxford. He spent the first few years conducting field experiments in the turbulent dispersion of pollution. He then trained as a weather forecaster and spent 6 years as an operational forecaster in the National Meteorological Centre in Bracknell, preparing the shipping forecast and various types of forecasts for civil aviation. During this time he developed a particular interest in uncertainty and predictability, so took the opportunity to return to research in the Ensemble Forecasting Research group which he has been leading since 1999.

James Dent jed@hrwallingford.co.uk: Forecasting precipitation from the flood hydrologists perspective – an environment agency view

The Environment Agency in England and Wales has a standard of service to provide a warning lead -time of 2 hours for all property flooding. The flood warning process is 4-staged, from an initial Flood Watch, through Warning and Severe Warning to All-clear. At present, the Agency Regions receive a customised forecast service from the Met Office, through a Daily Weather Forecast and Heavy Rainfall Warnings. These have relevance to various stages of the flood forecasting and warning process. This presentation looks at the assistance precipitation forecasts currently afford, and some of the issues surrounding future development.

James Dent is a Technical Director of HR Wallingford, with particular responsibility for Hydrology and Hydrometeorology. Mr Dent has had an extensive career in the UK and overseas, working with consultants, international agencies and government departments. He spent 4 years in Papua New Guinea, his final post being Director of Water Resources: during a long association with Bangladesh, he was for 2 years seconded to the WMO as Chief Technical Advisor to the national Flood Forecasting and Warning Centre. This project saw the combination of radar, satellite imagery, real-time river

modelling and information dissemination into an effective, full-time forecasting and warning service. He has recently completed a long secondment to the National Flood Warning Centre of the Environment Agency, where as Weather Services Co-ordinator, he was responsible for implementing and developing the Weather Services Agreement between the Met Office and the Environment Agency.

Bob Moore rm@ceh.ac.uk: Advances in flood modelling and the need for improved and spatial rainfall data

Advances in flood modelling have been constrained by the difficulty of estimating rainfall continuously over space, for catchment, national and continental-scale areas. This has had a concomitant impact on the choice of appropriate model formulations for given flood modelling applications. Whilst weather radar used in combination with rain gauges – and extending to utilise satellite remote-sensing and numerical weather prediction models – have offered the prospect of progress, there have been significant problems to overcome. The challenges of improved rainfall estimation and flood model formulation will be discussed against a background of greater access to spatial datasets on terrain, soils, geology, land cover and weather variables. Representing the effective runoff production and translation process operating at a given grid or catchment scale may prove key to improved flood simulations, and robust application to ungauged basins through physically-based linkages with these spatial datasets. Flood modelling for both real-time forecasting and off-line continuous simulation design and planning applications will be considered. The need to embrace uncertainty and decision-making in advancing storm and flood modelling practice is seen as a major challenge for the future.

Bob Moore serves as the Head of the Hydrological Modelling & Forecasting Group at CEH Wallingford specialising in the development of mathematical modelling techniques for hydrological and water resource applications. He is also CEH head of the Met Office/CEH Joint Centre for Hydro-Meteorological Research at Wallingford.

Robert Gurney rjg@mail.nerc.essc.ac.uk: New techniques in land atmosphere interactions:

Upscaling and downscaling land surface processes are difficult problems that can be aided by remote sensing techniques. Several will be illustrated, including the use of passive microwave observations in soil-vegetation-atmosphere transfer (SVAT) models and the use of airborne LiDAR altimetry to initialise flood models. The importance of good temporal sampling will also be discussed, and the necessity of making observations at the scale of the surface processes being modelled will be illustrated.

After a BSc at King's College, University of London and a PhD at Bristol University, Robert Gurney worked at the Institute of Hydrology, Wallingford for five years. He then spent 9 years at the Hydrological Sciences Branch, NASA Goddard Space Flight Centre, with the last five as Branch Head. Since 1990 he has been Director of the NERC Environmental Systems Science Centre, and a Professor at Reading University. He is

interested in the use of remote sensing in helping to diagnose models of land surface processes.

Roderick Smith roderick.smith@metoffice.com: Developments in real-time soil moisture and surface hydrology diagnosis

A soil state diagnosis model has been implemented as part of the Met Office's Nimrod nowcasting system. Nimrod's analyses of precipitation, snow probability, cloud cover, near-surface temperature, humidity and wind are input to the model which then calculates runoff, evaporation and other surface hydrological variables and updates soil moisture hourly. High resolution land cover and soil type data are used by the model. All quantities are calculated on Nimrod's 5km resolution grid. The model is based on the Met Office Surface Exchanges Scheme (MOSES) but modified to include the Probability Distributed Moisture (PDM) model developed at CEH Wallingford. The PDM enables MOSES to represent soil heterogeneity and thereby calculate more realistic runoff. A comparison of key outputs with those from an older model (MORECS) is underway to support customers' migration to the new products. A simple runoff routing scheme has been incorporated to enable comparison with archived daily river flow measurements for a number of catchments as an additional verification and monitoring tool. Future development will include the use of real-time satellite observations of land cover and leaf area index.

Roderick Smith leads the Met Office hydro-meteorological R&D group at the Joint Centre for Hydro-Meteorological Research (JCHMR), Wallingford. His previous work in the Met Office has been developing physical parametrizations for NWP and climate models. His group at the JCHMR is developing systems for producing short-range forecasts and products which enable new and improved hydrometeorological services to government agencies, commercial enterprises and the public. Met Office staff at the JCHMR work with scientists at the Centre for Ecology and Hydrology, Wallingford.

Peter Clark peter.a.clark@metoffice.com: Prospects for convective scale numerical weather prediction in rainfall forecasting; engineering or pipe dream:

The only technology currently available to predict rainfall quantitatively on the very small scales needed to give adequate warning of flooding of small catchments and sub-catchments is based on advection and expert rule based modification of measured rainfall patterns. This approach has severe limitations, especially in the most extreme cases of organised severe convection. Current Numerical Weather Prediction (NWP) models add useful information to these systems, but generally only about the broad environment. Advances both in modelling capability and, in particular, computer power, hold the promise of applying full NWP techniques to very short range forecasting of convective systems. This talk will discuss the prospects for achieving this goal, how, and when, it will be achievable, and some of the changes in the way we use very short range forecasts that may be needed as a result.

Peter Clark is a Theoretical Physics Graduate from the University of Cambridge. The first half of his research career was spent in the (then public) electricity industry studying long range transport and transformation of air pollutants through modelling and field measurements. He joined the Met Office in 1992, and has spent most of his time since developing mesoscale and local NWP forecast models. He currently leads the Mesoscale Modelling Group at the JCMM, Reading.