WEDNESDAY 21 JANUARY 2004: EXTREME WEATHER AND CLIMATE EVENTS

Dr D B Stephenson, University of Reading: **Extremes: what are they and why study them?**
Anthropogenic climate change is expected to lead to noticeable changes in the probability distribution of regional/local weather. In addition to simple shifts in the distribution due to changes in the mean, more complicated changes in the distribution of weather are likely to occur. In particular, the frequency, intensity, and persistence of rare extreme events in the tail of the distribution could change in non-trivial ways that might lead to increased environmental risks in Europe. This talk will start by a discussion of the definition of extreme events and some of the important attributes needed to characterise and interpret such events. Recently developed statistical methods will be presented for analysing and understanding changes in weather and climate extremes.

Prof M Bensiton, University of Fribourg: **The 2003 heatwave in Europe: A shape of things to come?**
The 2003 heat wave that affected much of Europe from June to September bears a close resemblance to what many regional climate models are projecting for summers in the latter part of the 21st century. Model results suggest that under enhanced atmospheric greenhouse-gas concentrations, summer temperatures are likely to increase by over 4°C on average, with a corresponding increase in the frequency of severe heat waves. Statistical features of the 2003 heat wave for the Swiss site of Basel are investigated and compared to both past, 20th century events and possible future extreme temperatures based on model simulations of climatic change. For many purposes, the 2003 event can be used as an analog of future summers in coming decades in climate impacts and policy studies.

Dr F Lalaurette, ECMWF: **Extreme weather events: Could we be warned earlier?**
Forecasting the weather through numerical deterministic techniques has proven to be very successful. The quality of the forecasts has increased very significantly, most notably during the last ten years or so. This has been the result of both improved techniques to estimate the initial state of the forecast based on optimal control theory (4D-var) and on the advent of a wide range of high quality satellite instruments such as scatterometers and interferometers.
Although models are more and more successful at giving a fair representation of severe weather phenomena, their forecasts are traditionally not used by most users beyond day one or two. This can be argued to be the result of too conservative risk management policies. With the advent of dynamical probabilistic forecasting systems (ensembles), and provided that the users have a clear quantitative picture of what is the level of risk they

need to be protected against, it will be argued that early forecasts of severe weather up to three or four days in advance can be of value for severe weather applications.

Dr C Ferro, University of Reading: **Statistical analyses of extremes from a regional climate model**
Statistical methods based on extreme-value theory are valuable tools for summarising the behaviour of climate variables at extreme levels. Estimating the probability distributions of maxima, such as annual maximum temperature at a particular location, is now ubiquitous in
climate extremes research. Other extremal properties are often of interest too, however, and extreme-value theory can also aid their analysis. I shall illustrate some applications with simulated data from a time-slice experiment modelling European climate change in the 21st century.

Dr S Brown, Met Office, Hadley Centre: **Changes and uncertainty in extreme events due to increased CO2 from a large model ensemble**
There are many sources of uncertainty in future predictions of climate. Paradoxically these uncertainties are amplified when considering future changes in extreme events but for some these changes are of greater concern as they potentially have the greatest effect on societies. To begin quantifying these uncertainties, 53 different versions of the Hadley Centre's slab model have been used to produce an ensemble of 1xCO2 and 2xCO2 climate integrations. The different versions are designed to sample the uncertainty arising from the parameterisation of atmospheric physical processes and thus provide a measure of the robustness of the simulated changes. Changes in extreme precipitation and temperature for seasonal and daily time scales will be presented together with their ensemble spread.

Dr N Reynard: Centre for Ecology and Hydrology, Wallingford: **Modelling the impacts of climate change on flood frequency in the UK**
Global warming is predicted to cause significant changes to the world’s climate, but uncertainties remain about the precise nature of these changes. This is particularly true with regard to possible changes at a regional or local level and to changes in the climate extremes that produce catchment flooding. Such changes might include more frequent short-duration, high-intensity rainfall or more frequent periods of long-duration, sustained rainfall of the type responsible for the Autumn 2000 floods. To address the uncertainty surrounding this issue, Defra guidance on flood defence scheme appraisal currently suggests sensitivity allowances for climate change, for example a 20% increase in peak flows over the next 50 years.

The need to further develop this policy and guidance on climate change impacts is being informed by improved modelling capabilities and climate change scenarios. For example, statistical rainfall models and output from regional climate models are being used to drive the hydrological models used to investigate the potential impacts of climate change on flood flows. This presentation describes the continuous flow simulation models, and the suite of climate change scenarios constructed, using a range of techniques, used to investigate the potential changes in flood frequency in the UK. The results, presented for a range of catchments, represent a cross-section of the work done under a project commissioned by Theme 5 of the Defra / EA Flood Management R&D Programme.