17 OCTOBER 2001 : THE SCIENCE OF CLIMATE CHANGE: THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE -THIRD ASSESSMENT REPORT

Dr D Griggs, Hadley Centre - The IPCC Third Assessment Report - dave.griggs@metoffice.com

A brief introduction to the purpose and structure of IPCC will be given and the process of the production of the IPCC Working Group I Third Assessment Report will be described. The agreed confidence scale used in the report will be briefly explained.

Dr C Folland, Hadley Centre - Observed Climate Variability and Change - chris.folland@metoffice.com

The Observed Climate Variability and Change chapter provides a wide-ranging review of observations of climate change and climate variability important to the policy debate on greenhouse gases. It considers a wider range of climate variables than previous reports. Global temperature change calculations are provided with objective estimates of uncertainty for the first time. New analyses indicate that the magnitude of Northern Hemisphere warming over the twentieth century is likely to have been the largest of any century of the past millennium. A number of cryospheric indicators support appreciable twentieth century warming. Many hydrological indicators are also consistent with warming, though not all e.g. there is no convincing evidence for increases in hurricanes or severe extratropical storms. However, there is new evidence for changing climate extremes, particularly a widespread rapid warming of daily temperature minima, and emerging evidence for increases in heavy precipitation. Summarising, the chapter provides increasingly clear evidence of a warming world.

Dr M Allen, University of Oxford - Detection of Climate Change and Attribution of Causes - m.allen1@physics.ox.ac.uk

Key pieces of evidence supporting the IPCC-TAR's "punchline" attribution statement that "most of the warming observed over the past 50 years is attributable to human activities" are reviewed, along with an informal discussion of the problem of arriving at consensus wording for such conclusions. The role of detection and attribution in future scientific assessments in discussed, and I will argue that the need to exploit the emerging signal to constrain climate forecasts will necessitate changes in traditional demarcation of observation and prediction in the IPCC reporting structure. Finally, we will discuss the prospects for and potential implications of meaningful attribution statements regarding more socially-relevant climatic phenomena, such as the UK floods of 2000.

Dr D Derwent, Met Office - Atmospheric Chemistry and Greenhouse Gases - dick.derwent@metoffice.com

Dick Derwent will present some of the key findings of the IPCC Third Assessment Report as they address the major trace gases that contribute to global warming. During the 1990s, the global burdens of all of the major greenhouse gases each reached their highest concentrations in their respective measurement records under the influence of human activities. For the key greenhouse gases their increasing trends are likely to be continued into the foreseeable future.

Prof. J Haigh, Imperial College - Radiative Forcing of Climate Change - j.haigh@ic.ac.uk

Radiative forcing provides a convenient first-order measure of the relative climatic importance of different agents on a global, annual mean. The strengths and limitations of the radiative forcing concept will be discussed as its applies to agents with marked vertical, geographical and temporal variation. Radiative forcing estimates for well-mixed greenhouse gases, stratospheric and tropospheric ozone, aerosols, land-use and solar variability will be presented and uncertainties discussed.

Dr C Senior, Hadley Centre - Projections of Future Climate Change - cath.senior@metoffice.com

The IPCC TAR had available to it results from many more AOGCM projections of future climate change using a range of scenarios than was the case for any previous assessment. For the first time this allows quantification of a mean climate response along with a range to give some estimate of model uncertainty. New results from such an analysis will be described as well as those that corroborate or challenge earlier findings. Factors that contribute to the responses of the models, such as climate sensitivity and ocean heat uptake will be discussed and quantified by a number of measures of climate response. Changes in the thermohaline circulation, variability and extreme events in global models will also be described. A simple model, calibrated to a number of the AOGCMs has been used to extend the global projections to cover the full range of 35 SRES scenarios. This gives a rise in global average surface temperature from 1990 to 2100 of 1.4 to 5.8 degrees C

Dr J Gregory, Hadley Centre - Changes in Sea Level - jonathan.gregory@metoffice.com

Geological evidence suggests that over the past 3000 years global-average sea-level has risen by 0.1--0.2 mm/yr on average. However, analyses of tide-gauge data yield an average of 1.0--2.0 mm/yr for the 20th century, while the few long records indicate that the rate was smaller in the 19th century. This points towards a recent increase in the rate of sea-level rise, which would be expected as a result of anthropogenic climate change causing thermal expansion of sea-water and loss of mass from glaciers and ice-caps. Observations of interior ocean temperatures during recent decades give estimates of thermal expansion of a similar size to those obtained from simulations by coupled atmosphere--ocean general circulation models (AOGCMs). Observed and modelled land-ice changes are also in reasonable agreement. However, large uncertainties in these and other components mean that it is not possible to give a fully satisfactory explanation for the observed 20th-century rate of sea-level rise. Climate models have been used to project contributions to sea-level from thermal expansion and land-ice changes during the 21st century. For the set of IPCC SRES scenarios, the results lie in a range of about 0.1-0.9 m for 1990--2100, with thermal expansion being the largest contribution. AOGCMs indicate pronounced regional variation in projected sea level change, with some areas experiencing twice the global-average thermal expansion and others practically zero, but there is little agreement about the patterns. As a consequence of mean sea-level rise, existing extreme high water levels will occur more often, and their frequency may be further increased if storms become more frequent or severe. Over the next 1000 years, with a sustained elevated CO2 concentration in the atmosphere, loss of mass from the Greenland ice sheet could become the dominant term in sea level rise, eventually contributing several metres.