WEDNESDAY 19 May 2004: SYMONS MEMORIAL LECTURE

Mr Sakari Uppala European Centre for Medium-Range Weather forecasts **ERA-40: Strengths and weaknesses**
The comprehensive global multi-decadal datasets generated by reanalysis of past observations using the same data assimilation techniques as applied in numerical weather prediction have become a mainstay of many types of atmospheric research. The first extended ECMWF reanalysis, ERA-15, and the NCEP/NCAR RA-I reanalysis were both carried out in the mid 1990s, and their products quickly found widespread application, including areas where traditionally analyses of a single variable or observations alone had been used. The ERA-40 reanalysis, 1957-2002, completed in 2003 can be considered as the first of a second generation of global reanalyses, the design of which has greatly benefited from the experience of carrying out ERA-15, from development work on the ECMWF forecasting system and from feedback provided by the user community.

Dr Len Shaffrey ,CGAM University of Reading **Bjerknes compensation of atmospheric and oceanic energy transports**
Bjerknes (1964) suggested that if the top of the atmosphere fluxes and the oceanic heat storage did not vary too much, then the total energy transport by the climate system would not vary too much either. This implies that any large anomalies of oceanic and atmospheric energy transport should be equal and opposite. This simple process has become known as Bjerknes compensation.

In a long control run of the UK Hadley Centre's coupled climate model, HadCM3, it was found that decadal anomalies of atmospheric and oceanic energy transports are significantly anticorrelated and their variances have similar magnitudes, which is consistent with the predications of Bjerknes compensation.

Dr Helene Banks ,Met Office, Hadley Centre, **Ocean heat transport and uptake in models and observations**
Ocean heat transport and uptake in Hadley Centre coupled models are compared against observations. Modelled ocean heat transports are in reasonable agreement with direct estimates of ocean heat transport both globally and in individual basins. We discuss modelled estimates of variability in heat transport and the impact of model resolution. Results suggest that ocean heat transport may not be a good indicator of anthropogenic climate change. We compare ocean heat content modelled by HadCM3 against the timeseries derived by Levitus et al. (2000). HadCM3 captures the observed trend but not the variability. We suggest that outside the well-observed upper ocean of the Northern hemisphere, heat content estimates are sensitive to the method used for filling in gaps.

Dr Kevin E Trenberth Climate Analysis Section, National Center for Atmospheric Research (NCAR),USA **Symons Memorial Lecture**

The primary driver of the climate system is the uneven distribution of incoming and outgoing radiation on Earth. The incoming radiant energy is transformed into various forms (internal heat, potential energy, latent energy, and kinetic energy) moved around in various ways primarily by the atmosphere and oceans, stored and sequestered in the ocean, land, and ice components of the climate system, and ultimately radiated back to space as infrared radiation. The requirement for an equilibrium climate mandates a balance between the incoming and outgoing radiation and further mandates that the flows of energy are systematic. These drive the weather systems in the atmosphere, currents in the ocean, and fundamentally determine the climate. In the atmosphere, poleward transports are brought about mainly by large-scale overturning, including the Hadley circulation, in low latitudes, and baroclinic storms in the extratropics, but the seamless nature of the transports indicates a fundamental link between the two rather different mechanisms. The flows of energy can be perturbed, causing climate change. This talk provides an overview of the flows of energy, its transformations, transports, uptake, storage and release and the processes involved.