

15 MAY 2002 : SYMONS MEMORIAL LECTURE

Professor John Pyle, Cambridge University - Atmospheric chemistry and climate: a coupled system (John.Pyle@atm.ch.cam.ac.uk)

I will discuss two examples of global change issues in which there are important chemistry/climate interactions. The first example will consider middle latitude ozone trends where our modelling studies suggest that an important fraction of the observed trend is due to decadal time-scale changes in atmospheric dynamics. The second example concerns the changing oxidizing capacity of the troposphere (as measured by, for example, the tropospheric ozone burden) where a number of climate/chemistry interactions, in both troposphere and lower stratosphere play a role.

Professor John Burrows, University of Bremen - Observations of the chemical environment from space (burrows@iup.physik.uni-bremen.de)

The atmosphere and earth form a system, which determine the nature and behaviour of the environment, experienced by mankind and the biosphere. Prior to the industrial revolution, the global impact of anthropogenic activity on the environment was negligibly small. However the growth in population and associated living standards in the past two centuries has been such that pollution is now a global issue; well known examples being the tropospheric release of chlorofluorocarbon compounds and the consequent depletion of stratospheric ozone, the reduction in air quality and the increase in tropospheric ozone, the release of greenhouse gases etc.

The origin and consequences of both natural and anthropogenically induced changes in atmospheric composition have become a matter of public concern and scientific debate.

In the past decade, it has been demonstrated that tropospheric measurements of important trace gases and aerosol can be made from space. This talk will discuss the needs and the current capability of passive remote sensing of atmospheric trace constituents, using examples from instrumentation aboard low earth orbit platforms (e.g. ERS-1 and ENVISAT) and the potential from geostationary platforms.

Dr Henk Eskes, Royal Netherlands Met Institute - Ozone assimilation and forecasting (eskes@knmi.nl)

The technique of data assimilation combines the latest measurements available with a model description of e.g. the winds, temperature, pressure and composition of the atmosphere. This combination provides the most realistic description of the three-dimensional state of the atmosphere. In numerical

weather prediction, data assimilation is well established and is essential for high-quality medium-range forecasts.

In contrast, the application of data assimilation to the chemical composition of the atmosphere is very new. In recent years, several research centres have developed data assimilation schemes to analyse ozone observations provided by satellite instruments. This work on ozone is a first step towards a more comprehensive integrated meteorological and chemical weather forecasting system. In my talk I will provide a brief overview of the ozone assimilation efforts, and I will describe the benefits for both atmospheric chemistry modelling and numerical weather prediction. The potential of chemical weather forecasting will be illustrated with the results of the ozone forecasting system developed at the KNMI.

Dr Guy Brasseur, Max Planck Institut, Germany - From chemical weather to global atmospheric changes: natural and human-induced variations
(brasseur@dkrz.de)

Changes in the chemical composition of the atmosphere can be of natural origin or produced as a result of human activities (fossil fuel consumption, biomass burning, agricultural practices, etc.). They affect air quality with adverse health impacts, produce climate forcing, and lead to ecosystem damage (including crop growth reduction).

Natural changes in tropospheric composition are directly linked to atmospheric dynamics, stratospheric ozone variability and changes in the strength of chemical sources/sinks. 'Chemical weather' is not only determined by local processes, but also by long-range influences. The prediction of regional air quality must therefore account for global transport effects. The presentation will highlight the need for developing an integrated prediction system for chemical weather. Such system requires appropriate observations provided by different platforms integrated into a coherent framework, a data assimilation capability, a global prediction model with regional high-resolution windows, and eventually a world-wide organization to coordinate such effort.

Long-term trends of the chemical composition will also be discussed. Model simulations of the changes in the abundance of ozone and its precursors since the pre-industrial era will be presented. Impact on climate forcing will be assessed.