

# RAL

## DESIGN & DISCOVERY

### Open Days July 1990

**RUTHERFORD APPLETON LABORATORY**  
SCIENCE AND ENGINEERING RESEARCH COUNCIL

## GEOPHYSICAL RESEARCH

Recent concern over the condition of the Earth's atmosphere and its effect on the environment in general and the climate in particular has spotlighted the need for a vigorous research programme. RAL is involved in a number of projects aimed at determining the chemical and physical state of the atmosphere from the surface to its upper reaches.

### **ALONG-TRACK SCANNING RADIOMETER (ATSR)**

ATSR is an advanced infrared radiometer designed to measure sea surface temperature from space with high accuracy. This is important in monitoring the changes in the global "greenhouse" effect, caused by the heat-trapping properties of carbon dioxide.

ATSR will be launched in 1991 on ERS-1, ESA's first remote sensing satellite. RAL have developed data processing systems to enable the large volume of data that will be produced by ATSR to be made available quickly to users. It is intended that "quick look" global sea surface temperature will be fed directly to the UK Met Office weather forecasting system.

### **MESOSPHERIC, STRATOSPHERIC AND TROPOSPHERIC (MST) RADAR**

At Capel Dewi, near Aberystwyth there is an impressive antenna farm of 400 15 ft high Yagis, covering 3.5 acres. These are interconnected to form a phased array vertical sounding radar that will be used to study atmospheric dynamics up to heights of 80 km. The project, a collaboration between RAL and Aberystwyth university, is just starting to produce valuable data on wind velocity and direction.

### **UPPER ATMOSPHERE RESEARCH SATELLITE (UARS)**

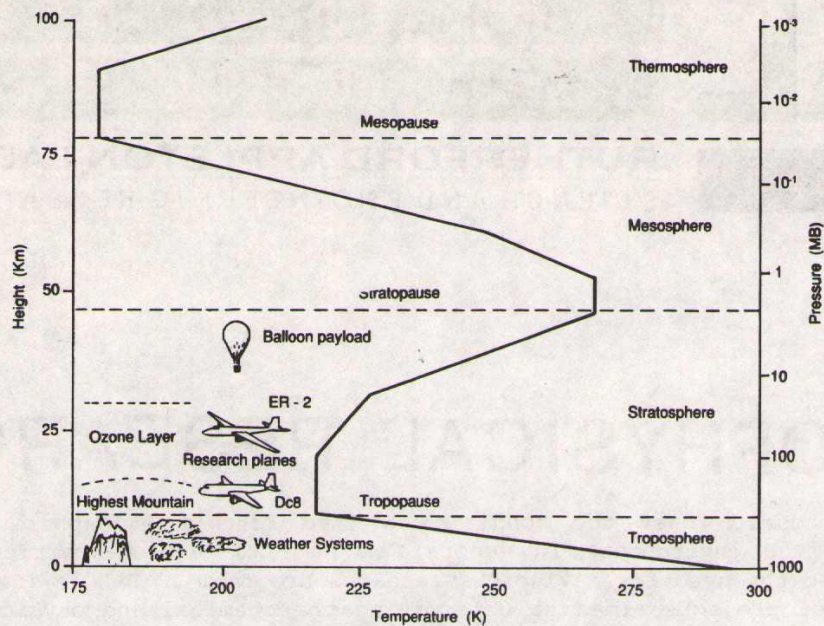
RAL is involved in two instruments on UARS, NASA's Upper Atmosphere Research Satellite, whose goal is the study of the photochemistry, dynamics and energy balance of the atmosphere above the tropopause. The 183 GHz radiometer for the Microwave Limb Sounder (MLS), needed for measurements of ozone and water vapour, has been built by RAL and Heriot-Watt University.

ISAMS, the Improved Stratospheric and Mesospheric Sounder, is a joint project between RAL and Oxford University. ISAMS will measure the concentrations of a variety of upper atmosphere trace gases, including oxides of nitrogen and gases important in the ozone budget.

### **EARTH OBSERVING SYSTEM (EOS)**

There is an international collaboration in Earth sciences to study changes in the systems affecting the Earth's environment. The USA, Japan and ESA are planning to fly a number of polar orbiting satellites over the period 1996-2015 to obtain a 15 year data base and monitor changes. The UK has been successful in having five experiments selected for the definition phase prior to payload selection by NASA and ESA.





### MIDDLE ATMOSPHERE MODELLING

Theoretical models are being used with satellite and balloon data to improve our understanding of the photochemical, dynamical and radiative phenomena which control the middle atmosphere. Successful modelling of the Quasi-Biennial Oscillation in equatorial winds using the Cambridge/RAL two dimensional model has demonstrated substantial inter-annual variation in temperature and trace gas abundances.

Three-dimensional, time dependent global modelling of the atmosphere from the troposphere to the mesosphere is a major task being undertaken by RAL in collaboration with five universities (Universities Global Atmospheric Modelling Project, UGAMP).

### SERC GEOPHYSICAL DATA FACILITY (GDF)

The GDF is being developed to provide access for research workers to a variety of global geophysical datasets.

The datasets now available include data from satellites, eg space plasmas data from the Active Magnetospheric Particle Tracer Experiment and upper atmosphere results from the Stratospheric and Mesospheric Sounder, Limb Infrared Monitor of the Stratosphere, and Stratospheric Sounder Units. There are also outputs from thermospheric and atmospheric models.

### LABORATORY SPECTROSCOPY

The laboratory spectroscopy programme at RAL provides high resolution infrared and visible molecular spectra of gases found in the atmospheres of the Earth and other planets. These measurements quantify the spectral signatures of such gases and are also used to characterise the performance of space experiments designed to measure their abundances (eg ISAMS).

The facilities at RAL include a high resolution Fourier Transform spectrometer with a number of coolable absorption cells having path lengths ranging from 1mm to 500 m. Spectra have been recorded of a number of atmospheric constituents, including photochemically generated radicals.

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