17 JANUARY 2001 : WHAT DO SATELLITES OFFER METEOROLOGISTS IN THE FUTURE?

Mr R Reynolds, University of Reading - Do Look Down! Four Decades of Weather Satellites - (r.reynolds@reading.ac.uk)

Meteorological satellites have evolved dramatically since their inception in 1960. The presentation will focus on the major changes that have occurred over the interim, including differing orbits, changing instrumentation and broadening applications. Key times in the development of these aspects will provide a focus to the discussion which will run through to the present day operational systems.

Dr A Hollingsworth, ECMWF - The Use of Satellite Data in Medium-Range and Extended-Range Forecasting - (dia@ecmwf.int)

Operational experience in medium range weather forecasting and in seasonal forecasting has demonstrated that comprehensive models of the Earth-system are needed for successful forecasts, and that comprehensive observing systems and data assimilation systems are needed to provide accurate initial conditions for the forecasts. Satellite data are or will be available as measurements in many different parts of the electromagnetic spectrum:
PASSIVE MEASUREMENTS
Ultra-violet (e.g.UV back scatter to measure ozone)
Visible and Near Infra-red Imagery (e.g. estimates of vegetation properties and TV pictures of cloud motion)
High-spectral-resolution thermal infra red sounding data (e.g for profiles of temperature and water vapour)
Microwave sounding and imagery (sensitive to sea-ice, ocean wind speed, land characteristics, cloud, rain rate, ice scattering from dense cold cirrus)
ACTIVE MEASUREMENTS
Scatterometers, measuring ocean surface wind speed and direction, land surface properties
Altimeters, measuring dynamic anomalies in the ocean surface height, as well as ocean surface waves and surface wind speed
Synthetic aperture radars measuring, inter alia, ocean surface wave spectra and land surface properties.

In the near future we shall see active lidars used for wind-profiling from space.

A key aspect of the 4D-Var assimilation system is that the measurement of the mismatch between observation and expectation, is carried out in terms of the observed quantities measured by many different instruments, including the satellite instruments, described above.

The presentation will illustrate the progress made in variational methods for using satellite data in numerical weather prediction, and will discuss the progress to be

expected from the new generation of satellite instruments which will become available in the next few years.

Dr A Slingo, Hadley Centre, Met Office - The Impact of Future Satellite Instruments on Climate Change Studies - (aslingo@meto.gov.uk)

Satellite observations are of enormous value in climate research, providing global datasets for studies of climate variability and change, as well as for evaluating climate models. While some of these data have come from specially commissioned research satellites, operational weather satellites have also provided important data on the basic climatic variables. Some of these data have been processed through re-analysis projects, which are powerful tools for merging data from disparate observing systems into coherent, long-term products. This talk will briefly review these past successes and some of the plans for new space instrumentation to study the climate system.

Dr D Klaes, EUMETSAT - The EUMETSAT Polar System (EPS) - (klaes@eum.etsat.de)

The mission objectives, expected capabilities and products of the EUMETSAT Polar System (EPS) are presented together with relevant programmatic background information. The EPS Programme covers a series of three identical satellites METOP-1, -2 and -3 and provides the European contribution to the Initial Joint Polar System established in co-operation with the US National Oceanic and Atmospheric Administration (NOAA). The EPS system will provide a service over 14 years, starting in late 2005. Although the mission is entirely justified by requirements from the operational meteorological user community, its capabilities offer a variety of opportunities for research and applications in many other disciplines.

Dr C Hughes, Proudman Oceanographic Laboratory - Improving our Understanding of Ocean Circulation Using Satellite Measurements of Altimetry and the Earth's Geoid - (cwh@pol.ac.uk)

Satellite altimetry has given us measurements of the position of the sea surface to an accuracy of about 2 cm, over almost a decade now. Since slopes in the sea surface relate to currents in much the same way that pressure gradients in the atmosphere relate to winds, this has taught us a great deal about time dependent parts of the ocean circulation. However, in order to learn about the steady part of the circulation, we need to know the shape of the reference surface, or geoid, relative to which slopes are measured.

Two satellite gravity missions are now planned to measure the geoid, the European GOCE mission, which will define the geoid to scales shorter than 100 km, and the US/German GRACE mission which will have coarser spatial resolution, but greater accuracy at long wavelengths. This will enable GRACE to detect the gravitational influence of movements of mass within the oceans, effectively measuring ocean bottom pressure changes from space. This is the only satellite technology which can "see through" the ocean into the abyssal regions. Current estimates project an accuracy

equivalent to millimetres of water, for averages over about 1000 km. Satellite gravity measurements are thus expected to produce important developments in our understanding of ocean circulation, over the next decade.