Institute *of* **Physics**

LONDON AND SOUTH EASTERN BRANCH REMS SECTION

&

Royal Meteorological Society

HISTORY OF METEOROLOGY AND PHYSICAL OCEANOGRAPHY SPECIAL INTEREST GROUP

At Home Thursday 15 January 2009
IOP HQ 76 Portland Place London W1B 1NT

This at home has been organised by Malcolm Walker & David Pick

THE DEVELOPMENT OF METEOROLOGICAL OBSERVATIONS

10.30	Arrival and Coffee
11.00	Welcome REMS Notices and Introduction: David Pick
11.05	Welcome on behalf of RMetSoc SIG: Malcolm Walker
11.10	A Short History of Upper Air Measurements: Richard Pettifer
11.50	Ground Based Remote Sensing of the Atmosphere: Geraint Vaughan
12.45- 14.00	Lunch
14.00	The Cairngorm Automatic Weather Station: Gordon Peckham
14.20	Weather Radar: Keith Browning
15.10	Development of Satellite Observations: David Pick
16.00	Tea and disperse

The meeting will be at the IOP HQ 76 Portland Place. The cost per person including lunch and refreshments is £23 (£5 without lunch). IOP members can sign up in the usual way, others should contact the REMS Visit Secretary; Reinalt Vaughan-Williams, telephone: 020 8946 3399, e-mail: reinalt@physics.org. The REMS web site can be accessed by going to http://london.iop.org and clicking on "Retired Members".

Abstracts and Biographical Details

A Short History of Upper Air Measurements: A Brief Look at the Technology

Richard Pettifer

Until the middle of the 17th Century, very little was known about the physical characteristics of the atmosphere above the earth's surface. Hannibal knew that it got colder with height but not until the invention of the barometer and the thermometer was it possible to make any measurements. Even then, measurements could only be made on the surface and measurements in the free air had to wait until the development of instrumented kites in the 18th century.

The invention of the (manned) free flying balloon marked a further major step forward and the intrepid scientists of the 19th century began , at great personal risk, systematically to acquire information about the characteristics of the atmosphere to heights of over 20,000 ft!

Kites and later unmanned balloons required the development of small, lightweight and entirely mechanical recording instruments and some of these "meteographs" remained in use until almost the middle of the 20th century.

But early in that century, the invention of radio telegraphy and the development of useable batteries led to the development of the radiosonde and for almost 80 years now, these devices in a variety of forms have been used operationally to measure the atmosphere with ever increasing accuracy. Although both ground based and space based remote sensing have appeared in the past twenty years or so, radiosonde measurements are still the most fundamental and important data source for both weather forecasting and climate studies.

Richard Pettifer joined the Met Office as a weather observer on leaving school in 1958. After a spell as a supervisor at an operational radiosonde station, he won a government scholarship to the Queen's University of Belfast where he gained a 1st in Physics. Returning to the Met Office, he began research into the use of high powered lasers as probes of the high atmosphere, work for which he gained a PhD in 1975. He then became the Head of Upper Air Instrument Development and the project manager for the introduction of the MkIII radiosonde system for the Met Office. He subsequently became the Head of Surface Instrumentation and then Assistant Director of Operational Instrumentation. In 1985 he left the Met Office to become the Managing Director of Vaisala (UK) Ltd where he spent 13 years and was responsible for providing the next generation radiosonde systems for both the Met Office and the UK Army and for the development of automatic observing systems for many surface applications. He retired from industry in 1998 and became the Executive Director of the Royal Meteorological Society, a post he held until 2006. He is now the General Secretary of PRIMET. He is a Fellow of the Royal Meteorological Society, a Chartered Meteorologist, a Chartered Environmentalist and was awarded the MBE in 2008 for services to Science and the Community.

Ground Based Remote Sensing of the Atmosphere

Geraint Vaughan

The technique of active remote sensing of the atmosphere at optical wavelengths began soon after the Second World War with the use of searchlights to measure cloud base. Very soon after the invention of the laser, it was realised that this was a perfect light source for upper atmospheric measurement, and indeed the first lidar paper (Fiocco and Smullin 1963) reported measurements from 60 - 140 km altitude! The eruption of Mt Agung in 1963 provided an easily-observed stratospheric aerosol layer which stimulated the development and application of the technique. A brief resume of developments to date will be given. In a similar way radar vertical profiling developed from wartime technology, specifically the observations of mysterious 'angels' or clear-air echoes on radar screens. Observations of the upper atmosphere were again first to be developed, becasue of the strong interest in ionospheric physics for radio communication. THe most widespread application of radar profiling today however is in the use of UHF to measure the boundary layer.

Geraint Vaughan joined, the Met Office in 1976, initially working on rocket-borne experiments to study the mesosphere which led to a DPhil at Oxford in 1983. On leaving the Met Office in 1984 to take up a post at the University of Wales, Aberystwyth, he developed an interest in building and using lidars, and in exploiting radar vertical profiling of the atmosphere. He is Professor of Atmospheric Physics at Manchester since 2005, and Director of Weather Research at the National Centre for Atmospheric Science since 2007. He recently completed his term as president of R Met S and is currently a Vice President of the Society.

The Cairngorm Automatic Weather Station

Gordon Peckham

For more than 30 years, Heriot-Watt University Physics Department (now part of the School of Engineering and Physical Sciences) has operated an automatic weather station (AWS) on the summit of Cairn Gorm. When Desmond Smith proposed the project in 1976, there had been few continuous sets of mountain weather observations since the closure of the Ben Nevis observatory in 1904. The Cairn Gorm provides a particularly

difficult environment because of severe riming due to freezing fog. To combat this, the instruments are housed in a heated cylinder, only being exposed to sample the weather for three minutes every half hour. Data are uploaded to the internet several times daily using the mobile phone network. I will describe the history of the project and outline some of the recorded data.

Gordon Peckham studied physics at Cambridge and was awarded a PhD for work on neutron scattering. He then changed fields to work with Desmond Smith at Reading on satellite instrumentation for atmospheric research. He continued this interest at Heriot-Watt University and was involved in developing instruments for Nimbus 4, Nimbus 5 and the Upper Atmosphere Research Satellites. As a lecturer in electronics, he designed an early control system for the Cairn Gorm AWS, and was involved in its installation on the mountain.

Weather radar

Keith Browning

Radar has been used to observe and advance the understanding of a wide range of weather phenomena ranging from thunderstorms and frontal rain and wind systems to clear air turbulence. It has also been developed for use as an operational tool for mapping the extent and movement of rain.

Keith Browning has used radar in all these areas, starting with a PhD on thunderstorms at Imperial College in 1962, followed by some years in the United States. He then spent a long time with a Met Office unit at what was then the Royal Radar Establishment, when the early development of the National Weather Radar Network was carried out and a giant ex-astronomy dish was available for CAT detection work. He later became Director of Research at the Met Office before becoming Professor in the Department of Meteorology at the University of Reading. He is now studying thunderstorms with the University of Leeds. As well as being an Honorary Member and Past President of the Royal Meteorological Society, Keith Browning is a Fellow of the Royal Society, Member of Academiae Europaeae and Foreign Associate of the US National Academy of Engineering.

Development of Satellite Observations

David Pick

The practical demonstration of the capabilities of routinely measuring temperature, humidity and composition of the earth's atmosphere started in 1964 with the launch of the NIMBUS series of Spacecraft by NASA. The technique relies on the ability to measure accurately the outgoing radiation from the earth's atmosphere from the visible through the infrared and microwave spectral regions. To be of practical use to the meteorological user this has to be done globally and the data made available within hours to the global forecasting community. A rather selective (UK) overview of the developments over the last 44 years will be presented.

David Pick went to Oxford University in 1960 and after graduating in Physics in 1963, spent the next 3 years building a small balloon borne radiometer to measure stratospheric water vapour. He then went as a post-doctoral researcher to Saskatoon University to fly a bigger balloon. On return to Oxford he was involved in testing radiometers developed at Oxford for the NASA NIMBUS spacecraft. He then joined the Met Office to set up the test facility and be part of the team providing the stratospheric temperature sounder for the NOAA operational meteorological spacecraft. He was then responsible for the development of a 183 GHz radiometer to measure water in the atmosphere again from a satellite; this has been flying on the NOAA spacecraft. He then moved to EUMETSAT to coordinate the user requirements for the new European polar orbiting spacecraft and conduct the initial feasibility studies for the spacecraft and ground segment. He ended his career in the Met Office as Assistant Director of remote sensing and retired in 1999.