Meteorological Observing Systems
Special Interest Group

Newsletter Issue 25

Spring 2008
Introduction

This edition of your Newsletter features two new, regular columns, Research News and News from the Manufacturers. As well as using this publication to keep you informed of the business of the Group and advertise our upcoming meetings, I am keen that it should be a forum for providing information about new instrumentation and applications that would, perhaps, struggle to find an outlet elsewhere—after all, that is the point of setting up a specialist Group like ours. E-mailshots were sent out to likely members some time ago to encourage contributions and my thanks are extended to those who sent material. If you are involved in research or produce equipment, please send some details to me if you would like to be featured in the Newsletter. The benefits to manufacturers are obvious, but those involved in research stand to gain by increased awareness of what is available, as well as provoking contacts from manufacturers and/or other researchers interested in becoming involved with their work.

Malcolm Walker has kindly provided an interesting article dealing with aspects of RMetS's MetLinkInternational project which are highly topical at this time. The Society is looking to expand MetLink in the near future to encourage more observations from individuals and your Committee has been asked to input to this process—more details can be found in the Minutes of our recent meeting. Malcolm's experiences with quality control of data are highly pertinent in light of our recent work on raising awareness of data quality issues with 'amateur' data and we are keen to see RMetS leading the community in this area.

Andy Overton, Newsletter Editor

Group Website

Members are encouraged to regularly check the Group's pages on the RMetS website at http://www.rmets.org/groups/SIG/detail.php?ID=10 for details of meetings and booking information,
including on-line registration for meetings. Whilst every effort is made to publicise meetings via the inserts in Weather magazine and the Newsletter the website is the quickest medium of communicating with you.

**Have Your Say**

This is your Group and your Officers are always happy to receive feedback about what is being done on your behalf. If you have any comments or suggestions on matters relating to the Group and our activities please do not hesitate to get in touch with any Officer. Contact details are shown on the last page of the Newsletter. Suggestions for future meetings and speakers are always very welcome.

**Material For Publication**

Written material must be in electronic format, preferably in MS Word or Excel, although PDF format can be accepted. Short news items as email are acceptable. Material can be sent as email attachments to andrewkovertcon@tiscali.co.uk on floppy disk, CD or DVD. Please note that large email attachments (>1MB) cannot be accepted and should be sent on disk to 58 Zetland Road, Town Moor, Doncaster, South Yorkshire DN2 5EJ. Please say if you would like disks returning. In all cases please include your name, address and email or telephone number with submissions. **Publication deadlines** are 1st March for Spring Newsletters and 1st September for Autumn Newsletters.

Whilst every effort is taken to ensure accuracy, responsibility for the accuracy of material published and opinions expressed lies with individual authors. The Editor is always pleased to receive correspondence on published items which provides correction, clarification or additional detail. This may be included in future editions of the Newsletter.

The copyright of photographs and written contributions in this Newsletter remains with individual authors and no reproduction by any means, including electronically, is allowed without permission.

*Front Cover Photo*- Halo Photonics 1.5 micron Doppler LIDAR installed in Mercedes Sprinter van. See Professor Chris Collier's item in *Research News*, in this edition, for more details. *Photo © Prof. Chris Collier.*

**Group E-mail List**

Following a review of the Group E-mail list at the Spring Committee Meeting (see Minutes in this edition) the decision has been taken to discontinue this initiative. Only a handful of members had registered to use this facility (four of whom were Committee members) and no expressions of interest were forthcoming following a request for feedback on the facility in the last Newsletter.

The Group Committee do feel that there could be occasions when contact with members by email would be advantageous to all parties, e.g. to advise of details of a forthcoming meeting which has missed the deadline for inclusion in our Newsletter or the *Weather* insert. We do have email addresses for most members but not everyone. It would be very much appreciated if members could let the Membership Secretary know their current email address- please forward yours to mike.brettle@vaisala.com if we don't already have it. You will NOT be bombarded with emails, this method of communication will only be used exceptionally where deadlines are tight, and 'blind copying' will be used with multiple recipients to maintain privacy.
Membership of RMetS

While acknowledging that the Bylaws governing the running of our Group do not require members to hold membership of RMetS, the Group Committee would like to encourage all members to consider becoming RMetS members. RMetS provide the Group with invaluable support at no cost to us, which includes, but is not limited to:

- The hosting of the Group's website on the RMetS website
- Advertising of Group meetings on the RMetS website and through the RMetS journal, *Weather*
- Online credit/debit card booking facilities for Group meetings via the RMetS website
- Administrative support for meeting organisers
- Public liability insurance for committee members
- VAT registration
- Funding of major meeting rooms when a Group Meeting is also a RMetS Saturday Meeting
- Ultimate liability if the Group were to find itself unable to meet its expenses
- The provision of a meeting room and catering at RMetS HQ in Reading for our biannual committee meetings

Your committee wish to record their grateful thanks to RMetS for the support they give us to pursue our activities, recognising that it would be very difficult, if not impossible, to continue what we do outside of the RMetS structure- at least not without a major increase in Group membership fees.

Details of how to join RMetS can be found at [http://www.rmets.org/membership/index.php](http://www.rmets.org/membership/index.php) where you will find a full description of the additional benefits of RMetS membership.

Forthcoming Meetings

**Location, Location, Location - how can users and providers of observations assure fitness for purpose?**

**Wednesday 14th May 2008 at Imperial College, London**

This meeting is intended to give an insight into issues relating to quality control of meteorological observations. It is intended to reflect concerns among both users and providers of meteorological data regarding quality control and standards for meteorological observations. To help address these concerns, the Society has produced guidance on the installation and operation of sensors and this will be presented.

**Programme:**

11.00 - 11.45 Coffee/Registration

11.45 – 12.00 Introduction, Society announcements - *Mike Brettle, meeting organiser*

12.00 - 12.30 Royal Meteorological Society Guidance - *Jonathan Shanklin, Chairman, RMetS Special Interest Group on Meteorological Observing Systems*

12.30 - 13.00 The New COL station grading system - *Stephen Burt, Climatological Observers Link*

13.00 - 14.00 Lunch
14.00 - 14.30  Meteorological Observations at Aerodromes: A Regulator's Perspective - Colin Hord, CAA


15.00 - 15.30  Tea

15.30 - 16.00  Wind measurements at chemical storage sites - Mike Brettle, Chartered Meteorologist

16.00 - 16.30  How much can you trust weather observations? - John Greetham, Forensic Meteorologist

16.30 - 17.00  Open Forum

Registration is £5 for members of the Special Interest Group on Meteorological Observing Systems or Royal Meteorological Society or students of Imperial College and £10 for others and includes coffee at reception, a buffet lunch and mid-afternoon refreshments.

The meeting will be held in Blackett Lecture Theatre 1 Imperial College, London. For directions see http://www3.imperial.ac.uk/campusinfo/southkensington

Registration forms may be obtained from the Royal Meteorological Society at 104, Oxford Road, Reading, Berks. RG1 7LL, Tel: 0118 956 8500, Email susan.drew@rmets.org, or you can download a form from the Observing Systems Group website http://www.rmets.org/groups/SIG/detail.php?ID=10. On-line registration is also available via the RMetS website www.rmets.org

Further information about the meeting can be obtained from the Meeting Organiser, Mike Brettle, 01638 576203, Email: mike.brettle@vaisala.com

**Group Summer Visit 2008 and AGM - Wednesday, 2nd July, Chilbolton Observatory**

This year's Summer Visit and AGM will take place at Chilbolton Observatory, home to the largest steerable meteorological radar in the world. This site, around 5 miles south of Andover, is not normally accessible to public visits and so this offers a rare opportunity to members. The Group AGM will be held from 1130-1230hrs at the Observatory, followed by lunch in a local pub, with the site tour beginning at 1430hrs.

The Royal Meteorological Society are also joining us for the afternoon visit, making the tour their own Summer Visit. Numbers allowed to tour the site are strictly limited and a priority booking period has been extended to Obs SIG members, ahead of RMetS members, until 30th April 2008. If you wish to come along please contact the meeting organiser, Jonathan Shanklin (Tel: 01223-221482, Email: jdsh@bas.ac.uk) as soon as possible to reserve your place. From 1st May 2008 onwards, once booking opens through RMetS, please register through the Society's website or by requesting a registration form from Susan Drew (Tel: 0118 956 8500, Email: susan.drew@rmets.org). The visit itself is free but you will have to pay for your own pub-lunch!

Full details of how to get to the Observatory and arrangements for the day will be sent out to attendees in due course. The nearest railway station is Andover and public transport to Chilbolton itself is difficult, making it most likely that you will need to come by car.
Autumn 2008 Group Meeting

Details of the Autumn 2008 Group Meeting had yet to be finalised as this Newsletter went to press. Two options are being investigated: a workshop on data display software to be held at the British Antarctic Survey (BAS) in Cambridge, and a joint meeting with the Data Assimilation SIG (location TBA). Information will be posted on the Group website and detailed in the Meetings Notice included with Weather as soon as it is available. Please keep a check on these over the next few months.

Although the timing has yet to be decided, the workshop on data display at BAS is definitely on our future meetings programme. We would like to hear from potential attendees what they would like to see at this meeting in order for the programme to be as attractive as possible. Please contact Jonathan Shanklin with your thoughts (Tel: 01223-221482, Email: jdsh@bas.ac.uk)

Research News

From Professor Chris Collier, Research Institute of the Built and Human Environment, University of Salford

Members may have seen a paper by Bozier et al, *Doppler lidar observations of Russian forest fire plumes over Helsinki*, which was published in *Weather* in August 2007. This paper describes measurements made in Helsinki using a 1.5 micron Doppler LIDAR system built by Halo Photonics, and outlines the system. Since this experiment the Doppler LIDAR has been installed in a Mercedes Sprinter van and is now capable of scanning 1-180 deg in the vertical (RHIs) and 0-360 deg in the horizontal (PPIs). The system was deployed during last summer at Achern in Germany as a contribution to the international Convective Orographically-induced Precipitation Study (COPS).

A photograph (below) shows the vehicle with, in the foreground, our 14 channel scanning microwave radiometer, used to measure vertical profiles of temperature and humidity. The LIDAR and scanning mechanism within the vehicle is shown on the front cover of this Newsletter.

Photo © Prof. Chris Collier
The analysis of COPS data has only just begun and the project is due to last three years. The Doppler LIDAR has been deployed recently at Cardington for a study of stratocumulus with the Met Office, and has been installed in central London for a short deployment in the DAPPLE II experiment investigating the impact of street canyons on the dispersion of air pollution. In 2008 the LIDAR will hopefully be installed at the Danum Research Station in Sabah, Malaysia on the island of Borneo as part of a large UK project aimed at investigating energy exchanges through the tropical rain forest canopy.

Our equipment is part of the NERC-funded National Centre for Atmospheric Science (NCAS) Universities Facility for Atmospheric Measurement (UFAM) whose Director is Professor Alan Blyth of the University of Leeds. Our scientific team comprises myself, Dr Fay Davies, NERC Instrument Scientist, Dr Guy Pearson, Dr Jenny Davis and Andrew Barkwith.

**News from the Manufacturers**

**Biral - Micro Rain Radar (MRR)**

![Micro Rain Radar (MRR)](image)

Photo © Biral

Although many meteorological parameters are now being measured with a very good degree of accuracy, the detection and measurement of precipitation remains far more challenging. The scientific community is working hard to understand the factors which affect the formation, life cycle and measurement of precipitation as well as how precipitation affects other meteorological processes.

In the past there have been many approaches to measuring precipitation including the use of catchment, optical and electro-mechanical devices, as well as other technologies such as RADAR and satellite. Each type of instrument has its own benefits and disadvantages (which are beyond the scope of this article) and the Micro Rain Radar (MRR) is the latest addition to the wide range of instrumentation available and is priced around £13,000 per system.
The MRR is a vertically pointing RADAR unit which is very small, portable and easy to install and use. It is typically installed on a mast or post on a field, building or other appropriate structure. The RADAR dish is the largest component of the unit and is the same size as a typical home satellite dish. Attached is a small electronics box that houses the entire transmitter and receiver electronics and does some very basic processing on the received data. The processed signal is passed through the power and data cable, which can be up to 25 m, allowing the RADAR to be positioned a short distance away from where the data will be collected, processed and visualised.

The MRR RADAR dish acts as both transmitter and receiver using a Frequency Modulated Continuous Wave (FMCW) to transmit and receive continuously into the atmosphere. The MRR measures a sample volume above the unit in an expanding cone as it goes up in the atmosphere and due to the continuous transmission of the device it can determine a great deal of statistical information on the drop size distribution from the precipitation that is falling through the sample volume using some very intelligent processing. The measurements are not affected by wind, which can be a major factor for many optical or catchment devices, and allows the MRR to produce much more accurate drop size distributions than were previously possible.

Although most RADAR units measure reflectivity and then produce precipitation amounts from this data using the well known Z R ratio, the amounts may or may not be accurate due to the ratio that is being used, which is dependant on the type of weather producing the precipitation as well as the type of air mass and season that the precipitation is occurring in. The MRR does not have these issues as it is inherently measuring the precipitation size and from this the terminal fall velocity can be exploited from the drop size diameter. Once this relationship has been established the accumulation rates, drop size distributions, liquid water content amounts, among other derived parameters can be found. The MRR is able to produce 30 range heights for measurements with a spacing of between 30 m and 200 m, giving a range potential of roughly 1 km using a 30 m resolution and up to 6 km using a 200m resolution.

The data output by the MRR is ASCII human readable data (ASCII data in serial format). It can be saved as 'raw data' for later reprocessing as well as processed data with and without averaging. The data files can either be visualised using a program of the user's choice or with the software package that is included with the MRR. Using the MRR visualisation software the data can be viewed from 1 hour periods to 1 month periods or more. The software allows the user to set colour schemes, view several different types of data plots including drop size distributions, reflectivity, and times series accumulations among others.

The operating software is a separate program and is quite simple to use and allows the user to specify the parameters that should be measured or calculated from the raw data as well as to specify whether the PC should save data all of the time or only when it is raining.

The MRR is allowing scientists, industry and other organisations to not only better understand the evolution of precipitation as it passes over a site but also allows users to gain an understanding of the development of the freezing layer or so called 'bright band’. This is particularly useful in situations where it is not only important to know the height of the freezing layer but how quickly it is moving up or down and to what extent the precipitation itself is affecting this movement.

Several National Weather Services (NWS) are now looking at the bright band in more detail to improve forecasting and warning systems. Notably the United States NWS are using several MRR units on the US east coast to study this in great detail allowing them to modify forecasts in real time and to aid quality control of software forecasting models used for that region.

There are other uses of the MRR which are less ‘normal’ but equally fascinating, such as forecasting when precipitation will reach the surface during a Formula 1 race so tyres can be changed, giving a team
a competitive advantage over others. The MRR has also been deployed on ships carrying material which is sensitive to the elements thus allowing the merchandise to be covered before it can be damaged by rain.

As knowledge and interest in the MRR increases, more and more applications and product developments will become reality bringing benefits to the instrument community and its users. Should you wish to find out more about the Micro Rain Radar or its applications please contact Richard McKay at Biral:

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Also Available from Biral - New User Interface Software for Metek Ultrasonic Anemometers and HSS Visibility Sensors

Biral are developing graphical user interface software for both the Metek ultrasonic anemometers and the digital HSS visibility sensors and beta versions are now available. These software programs allow communication between a PC (running Windows XP) and the sensors via an RS232 connection. They offer date/time stamp logging and archiving functions as well as graphical displays of the data with easy to use interfaces for the most important commands.

For more information on BiralView software for Metek ultrasonic anemometers (all models - USA-1, USA-2, Wind Horizon, Wind Professional and Wind Research) see www.biral.com/met/wind/biralview.htm
For more information on HSSView software for HSS VPF-700 digital sensors (VPF-710 and VPF-730) see www.biral.com/met/fog/hssview.htm

Campbell Scientific - Datalogger Memory Increased

Several Campbell Scientific loggers have undergone improvements in serial flash memory capacity with the CR200, CR800, CR850, CR1000 and CR3000 all having capacity quadrupled from 128Kb to 512Kb. This upgrade allows larger and more complex programs to be stored in the datalogger. At the same time the standard SRAM memory on the CR1000, CR800 and CR850 loggers has been increased from 2Mb to 4Mb, allowing greater data storage capacity. For more details see www.campbellsci.eu

Members may also be interested to learn that Campbell Scientific Ltd. acquired the Aberdeen based Muir Mathieson Ltd., manufacturer of weather monitoring systems for airport and offshore oil and gas applications, in November 2007.

Skye Instruments - DataHog3 Multi-Channel Datalogger

DataHog3 is the latest addition to Skye Instruments' range of multi-channel dataloggers. The logger is supplied ready configured and features a waterproof housing, with a choice of sockets or terminal blocks. There are more channels than previously available, including 32 SDI-12 and 3 RS-485, with 128Mb of memory, which can be further expanded with a USB memory stick. Communications options comprise
ethernet, RS232/RS485, modems and autosend via email or FTP. For more details see www.skyeinstruments.com/datahog3.htm

Kipp & Zonen Ltd - SOLYS 2 Suntracker

SOLYS 2 is a completely new sun tracker from Kipp & Zonen. It has Baseline Surface Radiation Network (BSRN) levels of performance and reliability. It brings to the sun tracker market distinctive design, innovative features, performance, quality and unprecedented ease of use.

Interest in high quality solar radiation monitoring is increasing in the fields of climate change, meteorology, solar energy and atmospheric physics. This requires the use of a sun tracker to measure the direct irradiance component and (if desired) the diffuse component, that complies with the WMO-GAW BSRN-requirements. The Kipp & Zonen 2AP sun tracker is widely used for this purpose because of its capabilities in extreme conditions around the world. However, for a number of users the 2AP is over-specified. The new SOLYS 2 sun tracker from Kipp & Zonen provides BSRN level performance but is much easier to install and operate than any other tracker on the market.

The key function of a sun tracker is to follow the movement of the sun. This ensures that the pyrheliometer mounted on the side of the SOLYS 2 is always pointing optimally to measure the direct irradiance from the sun. This depends upon accurate location and time information. SOLYS 2 is unique in obtaining this information automatically using an integrated GPS receiver. After installation and levelling of the SOLYS 2, the power is connected and the GPS automatically configures the location and time data. The tracker will move to the calculated sun position and simple mechanical adjustments are made to optimise the alignment. SOLYS 2 is the only fully automatic sun tracker available that does not require a computer and software for setup. With the optional top mounting plate and shading assembly SOLYS 2 can be configured as a complete solar monitoring station with up to three ventilated Kipp & Zonen radiometers. The operating temperature range is - 40 °C to + 50 °C.

The SOLYS 2 was launched at the Annual Meeting of the European Meteorological Society in San Lorenzo de El Escorial in October 2007 and has been enthusiastically received. More information about the innovative features of the SOLYS 2 is available at www.kippzonen.com
Vaisala - New C-Band Weather Radar

Vaisala have two new C-band weather radars available: WRM100 and WRM200. The WRM100 is a single polarization magnetron Doppler weather radar which can be upgraded to dual polarization. The WRM200 is a dual polarization Doppler weather radar with magnetron transmitter and can be used with Vaisala's HydroClass™ software - the world’s first real-time automatic hydrometeor classification software package suitable for operational use - providing operational hydrometeor classification in real-time, utilising polarization measurements for classifying targets into categories like rain, hail, graupel, snow, etc..

The new antenna-pedestal design in a semi-yoke significantly reduces the momentum of inertia required for antenna movement, with resultant speed and accuracy benefits in antenna positioning. The total weight of the antenna with pedestal is 1.5 tonnes. For more details see www.vaisala.com

QUALITY CONTROL AND AN ONLINE WEATHER OBSERVATION PROJECT
by Malcolm Walker

The Royal Meteorological Society launched its online weather observation project ‘MetLinkInternational’ in January 1998 (http://www.metlink.org). The project was originally for groups of schoolchildren aged 7 to 19 but individuals of any age have been encouraged to take part since 2003. The number of participants grew from 12 schools in 6 countries in 1998 to more than 300 schools and individuals in more than 50 countries in 2005. Since then, the number of participants has fallen, though not greatly, for the project still attracts more than 200 schools and individuals each year. Apart from GLOBE (http://www.globe.gov), which many believe is a comparable project but in fact has a much wider environmental scope than MetLink and, moreover, different aims, objectives and methodology, there is no weather observation project for schools as comprehensive as MetLinkInternational.

An essential feature of MetLink is its online database (http://metlink.org/data/observe.php), in which provision is made for the following to be entered: current temperature; maximum and minimum temperature; relative humidity; barometric pressure and tendency; wind strength and direction; 24-hour precipitation amount; current precipitation type and intensity; and current cloud type and amount. A box for comments is also provided, and so is a facility for uploading photographs. Only two measurements are compulsory: current temperature and wind strength. Without them, the database will not accept an observation.

The MetLink website contains many resources, among them exercises for the classroom (http://metlink.org/resources/ews/ews.html) and links to sites from which weather maps and observations, satellite images, weather webcams, climatic data and educational material can be obtained (http://www.metlink.org/data/reslinks.php). It also contains guidance and advice on observational best practice and the setting up and use of weather stations (http://www.metlink.org/before.php and http://www.metlink.org/help.php).

The observations of most participants are commendably accurate when compared with those made at nearby official weather stations. However, despite the best efforts of those who run MetLink, and despite the guidance and advice on the project’s website, the observations of some participants are questionable (“some” being around one in twenty).

More than a third of the schools in MetLink are in the primary sector, with some of the participating children as young as 7 but most in the age range 9 to 11. One might perhaps expect the reliability of observations made in these schools to be fairly low because quality instruments generally cannot be afforded and most teachers in primary schools have received comparatively little scientific training. It is certainly the case that errors are found in observations from primary schools, but they result more often
from carelessness and poor supervision of pupils than from insufficient scientific training and the use of cheap instruments. In fact, many observations made in primary schools compare well with those made at nearby official weather stations. Errors are not found only in primary schools; they are found, too, in observations from secondary schools and individual participants. About a quarter of MetLink’s participants are individuals, most of them dedicated, competent and conscientious amateur weather observers. On the whole, their observations are reliable, but typos and other careless mistakes do sometimes occur. It’s human to err!

The observations which are entered in the database are checked regularly by a member of the MetLink team (a job which can be very time-consuming), and those entered on 17 March 2004 during an enterprise known as the ‘Great UK Weather Watch’ were assessed by Roger Brugge of Reading University (see http://www.metlink.org/images/pics/mi040513132957.pdf).

Many errant observations stem from the use of electronic instruments and automatic weather stations. Not only do the exposures of such instruments and the locations of such weather stations sometimes leave much to be desired but also the idea of checking and calibrating instruments and weather stations has come as a surprise to a number of MetLink participants. I remember having drummed into me in school science lessons half a century ago the need to check the accuracy of equipment and the importance of ascertaining errors of observation. Many MetLink participants today have no idea how to check or calibrate instruments and seem surprised that they should need to do so.

I may at this point recount an experience of mine. Some years ago, I bought an electronic thermometer which provided two measurements of temperature, one from a sensor inside the device, the other from a sensor on the end of a cable two metres long. The idea was that I could dangle the sensor on the cable out of a window and thus measure the outdoor temperature, while the other sensor showed the indoor temperature. When I placed the two sensors close to each other, I found a discrepancy of 2°C, so I went back to the shop where I bought the device and thereupon encountered an attitude problem. The assistant who sold me the device did not see there was any problem until I pointed out that I worked for the Royal Meteorological Society across the road! He then took me seriously and together we checked five of these thermometers. Four showed the same discrepancy and I replaced the device I had bought earlier with the one that did not show any discrepancy at all. I then went back to my office and checked this device against several mercury-in-glass thermometers that I just happened to have to hand. I found it was reliable, and it still is. I should add, though, that there is no way of adjusting the device. If the readings it gives are wrong, there is no option but to go back to the supplier, and this is true of a number of electronic meteorological instruments. But if a MetLink participant does not check an electronic instrument, he or she may remain blissfully unaware of any problem until a member of the MetLink team draws it to his or her attention.

Carelessness over the use of automatic weather stations accounts for many of the errors that are found in MetLink reports of rainfall amount and maximum and minimum temperature. It is, as I said before, human to err, but some observers regularly forget to reset their observing equipment each day, and some go to the opposite extreme, resetting it several times each day. Another problem which can occur with electronic instrumentation is that some of the cheaper automatic observing equipment does not provide sufficiently reliable exposure when compared to a standard Stevenson screen. This can cause remarkable diurnal temperature ranges! And measurements of maximum and minimum temperature made at schools which have no Stevenson screen sometimes make interesting reading, too, indicating exposure of thermometers to sunlight by day and excessive cooling by night.

Another manifestation of carelessness is the reporting of wind speed rather than wind strength. For some years, MetLink participants were expected to enter wind speed in kilometres per hour (kph), this being the unit schoolteachers in the UK and a number of other countries said they preferred. Despite agreement that kph would be used, however, a mishmash of wind speeds appeared in the database, with some in kph, others in knots, a few in mph and one or two in metres per second. In an attempt to resolve this issue, the reporting of wind speed was dropped in October 2004 in favour of wind strength. Since then, participants have used a drop-down which shows all the points on the Beaufort Scale from 0 to 12 and, conspicuously
in red alongside the drop-down, the reminder “Please make sure you use the Beaufort Scale”. Moreover, a link is provided to a web page that lists the Beaufort Scale criteria which are used on land. Nevertheless, and exasperatingly, it is not uncommon for MetLink participants to choose from the 0-12 drop-down the number which corresponds to the wind speed shown by their anemometer. Accordingly, it is not uncommon to find that a wind speed of, for example, 8 or 9 kph or mph has been reported as Force 8 or 9 (sometimes with an accompanying weather report in the Comments box along the lines of “a very pleasant day with a refreshing breeze”).

Probably the most intractable of all MetLink problems is that of barometric pressure measurement. Many participants do not seem to have any idea how to set a barometer. To be sure, they know there is a screw in the back of an aneroid barometer for adjusting the instrument’s pressure reading, but whether pressure has to be increased or decreased to ‘correct’ it to sea level is a step too far for a not inconsiderable number of participants; and all too many participants persistently report pressure values that are way out, even after they have been advised, and told how, to compare their barometer’s reading with the pressure shown on a current weather map or reported by a nearby official weather station (as given by, for example, http://weather.noaa.gov/international.html). Clear guidance on how a barometer is set and why it needs to be set has been provided on the MetLink website, but, as we all know, you can lead a horse to water …!

Why, indeed, do so many meteorologists attach so much importance to sea-level pressure? Most of the MetLink stations in Africa and northern India and a few in France and North America lie hundreds of metres above sea level. Patterns of sea-level isobars over high ground can be very misleading, as I pointed out in an article published long ago (Weather, 1967, 22, pp.296-297). I plead guilty that I did not in my years as MetLink director make enough of the pressure tendency readings which were entered in the database.

We know that some schoolteachers and their students make use of MetLink observations in coursework, but we do not know how many; and we know that some who use them are not, in fact, MetLink participants. There are, therefore, compelling educational reasons why quality control of MetLink data is necessary, but how does one overcome carelessness and the other factors that reduce the value of the observations which are entered in the MetLink database? We know that teachers are busy people, but surely not so busy that they do not make good use of the resources provided for them on the project’s website to improve their knowledge and understanding and thus benefit fully from the project which they have, after all, chosen to take part in. Do they not owe it to their pupils? This said, though, MetLink has proved itself a very successful project in all sorts of ways and has certainly aroused interest in meteorology in a considerable number of children. If only we could iron out the quality control issues…!

Meeting Report - Climate Measurements for the Future
Department of Meteorology, University of Reading, 7th November 2007
by John Prior, Met Office

The Meteorology Department at Reading University was the venue for the Group’s meeting “Climate Measurements for the Future” on 7th November 2007. The objective was to examine the impact of new surface observing technology on climate records. Since weather observations were first made, scientific endeavour has meant that the methods used (instruments, exposure, data analysis etc) have improved, albeit relatively slowly. However, the pace of change in observing has quickened in the last 30 years or so with the advent of new technology, affecting sensors, communications, data storage and analysis. Coinciding with these technical opportunities there have been financial pressures on many of the organisations that provide observations, such as the national met services, aviation and maritime authorities. The response to these pressures has included automation and the closure of some long-established observing sites. All these changes have taken place at a time when monitoring the global
climate and the prospect of future climate change have become important issues, and frequently “front page news”.

Six presentations were made on various aspects of the above changes to help assess how well we are coping with them in terms of maintaining homogeneity in climate records.

The meeting opened with “The importance of homogeneity – Global Climate Observing System principles and their application” by Matthew Palmer of the Hadley Centre, Met Office. Changes in how, where and when observations are made can sometimes introduce false signals (biases) in climate records. Data homogenisation is the process by which such biases are quantified and accounted for and Matthew gave examples of the need to correct data biases in ocean, land and upper-air records by assessment against independent data.

For in-situ subsurface ocean temperature records, comparisons were made between state-of-the-art profiling float (Argo) data (ca. 1994 to date), high quality research ship data (Conductivity-Temperature-Depth sensors and bottles) and the less accurate mechanical bathythermograph (MBT) (until ca. 1995) and expendable bathythermograph (XBT) observations. Work was undertaken by Gouretski & Koltermann (2007) to try to detect biases between these types of measurement, which included the production of a graph allowing the percentage of data gathered by different methods to be seen. Wijffels et al found that the fall rates of XBTs had previously been overestimated and that there were some biases in Argo floats due to pressure sensor errors. Folland (2005) found that SSTs also had a cold bias in old records when the change from water collection was changed from wooden to canvas buckets. In all these studies there were definite biases in the data before correction.

Matthew then moved on to discuss radiosondes, pointing out that although a lot of sonde data is available, that which is suitable for climatological work is very northern-hemisphere biased. There have been several changes in instrumentation here which have caused inhomogeneities and multiple datasets are needed to estimate structural uncertainty.

In order to improve our ability to monitor the global climate system, in 1992 the Global Climate Observing System (GCOS) was established under the auspices of the WMO and other international agencies (see http://www.wmo.int/pages/prog/gcos). GCOS advocates 10 climate monitoring principles, summarised as:

- The impact of new systems or changes to existing systems should be assessed prior to implementation
- A suitable period of overlap for old and new observing systems is required
- Metadata (e.g. operating procedures, data processing algorithms) should be documented and treated with the same care as the data themselves
- Quality and homogeneity of data to be regularly assessed
- Needs for climate monitoring products and assessments to be integrated into observing priorities
- Retention of historical stations & systems
- Additional observations to fill in sparse areas or parameters
- Long term requirements should be specified to network designers, operators and manufacturers
- Conversion of research systems to long term operation in carefully planned manner
- Robust data management systems are essential elements of climate monitoring systems

Application of these principles helps provide the accurate climate observations that are vital for monitoring, detecting and attributing climate change.

The second speaker was Mike Molyneux of the surface sensor development section in the Met Office, whose subject was “Men or machines – automation and its effect on data series”. Mike began by explaining that to make observations over an extended period (“24/7”) and in a range of environments it is necessary to automate functions – largely because of cost pressures but also including legislative requirements (the need to phase out mercury) and the opportunities which technology presents. However, he pointed out that every change has to impact on data series, sometimes in clear and controllable ways, but sometimes in less obvious and more difficult to predict ways. As a result, measurements will always be changing, even if only slightly.

In the Met Office observing networks the degree of automation varies – from fully automatic to being aids to the observer. The manual and automatic methods each have their pros and cons, with people being good at on-site spatial variations, quality control, resilience and judgement whilst automatics win for repeatability, frequency, remote places (including the sea), night time observations and cost. Mike went on to look at cloud height, cloud amount, present weather, snow depth, humidity, temperature and visibility as examples of weather elements that, when automated, potentially provide data different to that from an observer. For example:

- Cloud base recorders have a range limit, observers don't
- Cloud amount from instruments can be inaccurate when a sheet is approaching, at a coastal site, with cloud streets, where cloud is too high and with other asymmetric skies; and not everyone knows how the instrument derives its results
- Present weather detectors can differ in readings at low rates of fall or in sleet and they only sample a point, unlike an observer. Manufacturers have different techniques
- Snow depth is read by an observer in three representative places, an instrument measures just one place
- Observing staff have a big influence on humidity measurements through their maintenance of the wet (or ice) bulb. Humidity probes may not work well close to 100% RH and can take a long time to recover when humidity falls, they age and are affected by pollution.
- Temperature sensors can be affected by water ingress into cables and it can be unclear how interfaces age. The opportunity exists at manned stations to undertake quality checks but not so easily at automated sites. Differences exist between wooden and plastic screens.

The GCOS principles become important in these circumstances, e.g. having metadata and flag–setting in data sets. The same holds true of elements that are thought of as easier to automate (such as temperature, humidity and wind speed), care being needed with calibration and data processing so that exact details of the measurement process are known. Mike ended by suggesting that we need to look to the WMO for help with these issues.

The next speaker was Ian Strangeways of Terradata Ltd, who argued the case for a new network for precipitation and temperature data in his presentation “To change or not to change?”. Ian drew upon his extensive knowledge of meteorological and hydrological measurements around the world to illustrate various shortcomings. These relate to a lack of standardisation in the exposure of instruments as well as changing practices. Some examples given were:

- Thermometers being originally read to 1 degF but nowadays estimated to 0.1deg C from instruments graduated in 0.5 degC steps.
- Methods of establishing mean temperatures being different
- The hundreds of different types of raingauges in use throughout the world, not all tested by WMO, and very few in pits
- The problems with lack of calibration of instruments by developing countries
Many sites were said to be good enough for operational meteorology but not for climatology. The issue of GCOS sites was discussed and a failing of the system was seen to be the fact that WMO does not own the sites but just chooses data from them, and the fact that there is no obligation on countries to adhere to GCOS principles. A random survey of 72 GCOS sites showed that 52% were at airports, 22% in towns or cities, with 26% in unclear locations which seemed to be towns or villages.

As well as these issues for land observations, especially in developing countries, urbanisation and a declining numbers of stations are causing further difficulties. Ian pointed out that the dramatic rise in temperature shown by global datasets coincides with the period during which the number of observing stations has declined.

Marine environments present a different set of challenges, amongst which the lack of rainfall and air temperature data is significant, and the fact that drifting buoys move is not helpful for a climate station.

Ian suggested that these issues have made it difficult to detect relatively small trends in records. He therefore advocated a completely new network of instruments over land and sea, to one standard design worldwide, using aspirated thermometer screens and ground-level rain gauges and telemetry of data in real time. Sites should be away from centres of population and unchanging and managed by a new organisation independent of GCOS. For marine observations, more use could be made of small islands as these make ideal sites for climate monitoring. Lively discussion of some of the arguments ensued, continuing into the tea break!


After the break, Matthew Perry from the National Climate Information Centre of the Met Office presented a specific example of coping with instrumental change, “Sunshine – burns to bytes”. The Campbell-Stokes recorder has been used to measure sunshine duration for over 100 years. However, to take advantage of technical developments and to reduce observing costs, in 2000 the Met Office started to replace this with an automatic sensor. The Kipp and Zonen CSD-1 pyranometer, providing durations based upon the WMO direct incidence solar radiation threshold of 120 W/m² is now deployed at about 25% of the 150 stations measuring sunshine. Matthew described work to quantify the relationship between the 2 methods, providing adjustment factors for monthly totals that it is hoped can be varied according to the nature of the weather. This work was possible because of parallel running of the old and new methods – including over 4 years of overlapping data at 5 geographically spread sites.


Stephen Burt provided a further example of parallel running of old and new observing methods with his presentation “Earth temperatures – tubes to thermistors”. Earth temperatures have been measured in the UK for over 120 years and the standard method, exposing sensors in metal tubes to depths of 100cm, has changed little in this time. However, increasingly the ‘tube’ method is being replaced by one involving an electronic sensor buried in a trench. Stephen reported results from his comparison of these 2 methods at 30cm from January 2006 to October 2007. He found that conduction effects along the tube resulted in these temperatures being low in winter and high in summer, compared to the ‘trench’ method, with monthly mean differences typically about -0.5 C in winter and about +1.0 C in summer but as high as +1.7 C in the heat of July 2006. However, the differences will vary with soil type, climate and the weather conditions. Therefore to provide record homogeneity when an instrumentation change is made, a minimum 12 month overlap is recommended.


The final presentation was by Phil Jones, Director of the Climatic Research Unit at the University of East Anglia, who took as his subject “Problems measuring temperature globally”. Phil gave further insight to
some of the issues raised earlier in the meeting and described several of the requirements of GCOS and
the problems the organisation has with participating countries. Changes to the GCOS network must be
agreed by the Atmospheric Panel (AOPC) and the annual change in the number of stations in the GCOS
Surface Network (GSN) has been about 20. Despite these restrictions it is accepted that many countries
do still move stations without agreement and GCOS has had to take data from AWS. GCOS has focussed
the attention of the national met services on the importance of making and exchanging observations and
reduced the decline in the number of observations that was occurring in the early 1990s but some
countries (e.g. Denmark) still refuse to send historic data to the GCOS archive at NCDC, Asheville. The
reasons for non-homogeneity of land temperature data include changes to screen design, observation time,
analysis method and site environment. For sea-surface temperatures, the measurement method has varied.


Strenuous efforts have been made to homogenise the station data used to create the global land and
marine data sets that begin in mid C19. The assessment and statement of uncertainties, e.g. arising from
biases and sampling, is important. Such work to compile lengthy, homogeneous series then allows
statements about climate change to be made and it was Phil's conclusion that if the GCOS network cannot
be made to work then any other attempt to establish a global network will also fail. (Reference: Brohan,
P., Kennedy, J., Harris, I., Tett, S.F.B. and Jones, P.D “Uncertainty estimates in regional and global
observed temperature changes: a new dataset from 1850”. J. Geophys. Res. 111, 2006 and for series see

An interesting meeting, bringing together ‘data suppliers’ and ‘data users’ to assess what has been done to
improve the homogeneity of climate records – and what needs to be done. Our thanks to Reading
University for hosting this meeting, to the 6 speakers for their excellent presentations and to the 30+
people who attended for their questions and a lively debate.


Committee Meeting
held from 12.30 to 16.00 hrs on Monday 10th March 2008
at 104 Oxford Road, Reading.

Minutes of the Meeting

Those present:
Jonathan Shanklin, Chairman (by telephone conference call, 1245-1345) #
Mike Brettle, Treasurer Ian Strangeways
John Prior, Secretary Andrew Overton, Newsletter Editor
# adverse weather prevented attendance in person

Item 1. Apologies
Mike Bennett, Stephen Burt, Dick Saffel, Jonathan Wright

Item 2. Agreement of Agenda
The agenda was agreed.

Item 3. Minutes of last meeting
The minutes of the Committee Meeting held on 17th September 2007 were agreed as being correct.

Item 4. Items arising
The 17th September actions were considered and most could be closed or were to be covered by later
agenda items. The exceptions were:
Many ‘amateur’ stations provide high quality observations, comparable to the official network, and the Met Office should encourage them to submit data. Issue to be kept under review, with 6 monthly progress reports  (Action: John Prior, ongoing)

The next RMetS conference will begin 29 June 2009 at Reading University. The SIG needs to encourage the inclusion of presentations on observations, within operational meteorology, as well as ensuring that the manufacturer’s exhibition arrangements are suitable. Action: John Prior to find out who is chairing the organising committee and offer SIG participation in the planning.

**Item 5. Treasurer’s Report**

Mike Brettle tabled a statement of the SIG’s accounts which showed the net assets to be £4037.31. It was agreed that the SIG would meet any reasonable personal expenses incurred by committee members when attending meetings.

**Item 6. Newsletter**

Andy Overton reported that he had plenty of material for the Spring 08 Newsletter, including several news articles from manufacturers and researchers. There are several items lined up for the Autumn 08 one, including guidance on amateur observations to accompany a report on the May 14th meeting. It was noted that the ownership of the copyright of articles and photographs should be explained (Action: Andy Overton)

**Item 7. Reports of Meetings**

- 7th November 2007 – “Climate measurements for the future” at University of Reading
  Two versions of the meeting report had been prepared – a 2350 word version for the Newsletter and a 425 word one for submission to “Weather” (400 word guide from the Editor). Given the importance of the subject, it was felt that “Weather” Editor should be asked to consider a longer version of the report (Action: John Prior to pursue)

- RMetS meetings committee – the issue of RMetS membership and SIG membership had been raised. For example, should we allow RMetS members free membership of the SIG? It was agreed to put on the agenda for the AGM, (Action: John Prior) after we have determined from RMetS how many SIG members are also RMetS members (Action: Mike Brettle).

**Item 8. Future Meetings**

- Location, Location, Verification – 14th May 2008. Mike Brettle reported that Imperial College London had been secured as the venue and programme of speakers is ready for Spring Newsletter, “Weather” meetings notice and web site. Registration fee to be set shortly (e.g. £5 members, £10 non-members)
- AGM and Summer Visit – 2nd July 2008 at the atmospheric and radio research station at Chilbolton. This will be the only summer visit for the RMetS. The RMetS will handle registrations but there is a limit of ~ 30, so it was proposed that SIG members be given priority until 30 April (advert in Spring Newsletter) then open to all. (Action: Jonathan Shanklin / John Prior to liaise with RMetS)
- Joint meeting with WCSIM – positive response to idea of a joint meeting on trialling instrumentation, probably in 2009 but awaiting WCSIM suggestions on speakers
- Joint meeting Data Assimilation Group – proposal welcomed and Jonathan Shanklin to contact Bruce Ingleby to agree a date (Autumn 2008?) and venue (Reading University or, preferably, ECMWF?) Action: Jonathan Shanklin.
- Joint meeting History Group – at Science Museum, Wroughton near Swindon probably as a summer visits in 2009 Action: Andy Overton to investigate with History Group {PMN - Done (email of 11 March) with March 2010 suggested}. 
- **Observations for transport applications** - Mike Bennett’s offer to organise this at Manchester was welcomed. It was felt that the emphasis should be on road and rail transport (good prospects with several potential speakers and topics) but airport runways and harbours might be included too. Spring or Autumn 2009 seems likely. **Action:** Andy Overton and John Prior to initiate email exchange of ideas for topics and speakers.

- **Data transmission and presentation** – preferably as a workshop, with BAS offered as a venue and autumn 2008 for timing if the joint DA Group meeting isn’t held then.

### Item 9. Amateur Observations

- **Guidance from SIG**
  
The following documentation has been approved by Council

  a) Guidelines for AWS Site Auditors
  b) Guidelines for AWS Site Managers
  c) Distribution list of key organisations who use ‘amateur’ observations
  d) Suggested text to promote the guidance and accreditation arrangements
  e) “A guide for amateur observers to the siting, exposure and calibration of AWS”

  Progress with the issue of material by RMetS needs to be checked (**Action:** Jonathan Shanklin).

- **MetLink**
  
The SIG had been invited to make proposals for the next version of MetLink International. It was believed that the RMetS has ambitions to collect and make available more data (e.g. through involvement with COL members). There were reservations about this, if data QC was not carried out, given our efforts to raise standards and make users aware of data quality. It was felt our role should be limited to a review of the guidance and incorporation of new material as necessary.

  **Actions:** Committee members to review MetLink documentation and Jonathan Shanklin to feedback any suggestions and our reservations about disseminating data of unknown quality.

### Item 10. SIG Email Forum

As this facility hasn’t been used, it was agreed to remove the reference to it from the SIG information on web site (**Action:** John Prior). SIG members to be encouraged to provide an email address to send the Newsletter (**Action:** Andy Overton in Newsletter)

### Item 11. Any other business

- Dick Saffel is working to try to expand the membership, with an article about the SIG in the Spring 2008 issue of Campbell Scientific’s Measurement News, and this was welcomed. [ftp://ftp.campbellsci.co.uk/pub/csl/outgoing/uk/news/newsletter_33.pdf](ftp://ftp.campbellsci.co.uk/pub/csl/outgoing/uk/news/newsletter_33.pdf)

- It was agreed that the tele-conference call arrangements had worked well and so committee members will be able to use this if they are unable to attend a meeting but wish to contribute.

### Item 12. Date of Next Meeting

The next committee meeting will be on a Monday in September or October 2008, with the date being agreed by correspondence, preferably 2-3 weeks before any autumn meeting. (**Action:** John Prior)

The meeting closed at 1600

John Prior, Secretary
19 March 2008
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