HISTORY GROUP NEWSLETTER

RMetS
Royal Meteorological Society

News, views and a miscellany published by the Royal Meteorological Society's Special Interest Group for the History of Meteorology and Physical Oceanography

Issue No.3, 2014

CONTENTS

FORTHCOMING MEETINGS

☐ MARINE CLIMATIC CHANGE AND VARIABILITY

Much has been written in recent years about climate change and variability over land. Much less has been written about such change and variability over the sea. Given that the oceans cover more than 70% of the earth's surface, our knowledge and understanding of global climate change and variability would be far from complete without marine observations.

On WEDNESDAY 15 APRIL 2015, from 11.00am to 5.30pm, there will be a special one-day seminar to focus on marine climatic change and variability. It will be a National Meeting of the Royal Meteorological Society and will take place at the NATIONAL MARITIME MUSEUM PARK ROW, GREENWICH, LONDON SE10 9NF.

The title of the meeting is:
MARINE CLIMATE CHANGE AND VARIABILITY: THE OBSERVATIONAL LEGACY OF MATTHEW FONTAINE MAURY

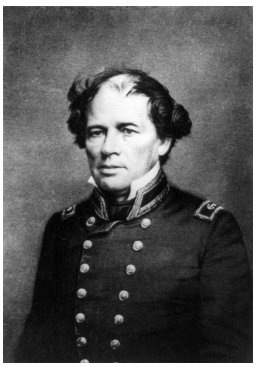
The organizer of the meeting is Chris Folland.

This special seminar will celebrate US Navy Captain Matthew Fontaine Maury (1806-1873) as the instigator of the global marine, surface and subsurface, observing system and as a marine climate scientist. This includes publications such as his *Physical Geography of the Sea* and *Explanations and Sailing Directions to Accompany the Wind and Current Charts*, as well as the outcomes for the marine observing system arising from the landmark Brussels Maritime Conference of 1853. A particular legacy of Maury's work is the ICOADS marine data set developed in the USA which forms the basis of many contemporary data sets.[1] Many more instrumental data from the last two centuries are being uncovered and digitized, which will further enhance this and other data sets. It is important to look back before Maury's time to support studies of climate change and the slower modes of natural variability. In this context, many old data and weather descriptions, particularly in ships' logbooks, have been digitized and analyzed in recent years, though much remains to be done. The meeting will also look forward to new developments taking place in marine instrumentation and data analyses. All the topics will be tied together by one of the overarching applications of marine data, drawing conclusions about the character and magnitude of climate change and variability.

PROGRAMME FOR THE MEETING OVERLEAF

[1] ICOADS = (International Comprehensive Ocean-Atmosphere Data Set)

PROGRAMME



Captain Maury

10:45-11:15 Coffee and tea

11:15-11:25 Introduction

11:25-11:55 *Matthew Fontaine Maury: Pathfinder of the Sea.* Malcolm Walker (Chairman, History Group, Royal Meteorological Society)

11:55-12:20 *Sailors, storms and science: what have ships' logbooks ever done for us?* Dennis Wheeler (formerly Sunderland University)

12:20-12:45 *New Atlantic atmospheric circulation indices derived from ships' logbook observations* Ricardo Garcia-Herrera (Universidad Complutense de Madrid, Spain)

12:45-13:45 Lunch

13:45-14:10 *Instrumental and scientific observing at sea before Maury (c. 1700-1850)*. Clive Wilkinson (University of East Anglia)

14:10-14:40 *Maury's observational legacy and ICOADS*. Scott Woodruff (or Steve Worley), NOAA, USA

14:40-15:05 *oldWeather.org – recovering historical weather through citizen science.* Philip Brohan (Met Office)

15:05-15:30 *The ACRE project – old marine data and applications to reanalyses.* Rob Allan (Met Office)

15:30-15:50 Afternoon coffee and tea

15:50-16:15 *Influences of changing measurement methods on marine data and their uncertainties* Elizabeth Kent (National Oceanography Centre)

16:15-16:40 *Creating global marine data sets and understanding their uncertainties* John Kennedy (Met Office)

16:40-17:05 *Maury's legacy in the 21st Century: novel and remote observations*. Chris Merchant (University of Reading)

17:05-17:30 *What have we learned about climate change and variability from marine data ?* David Parker (Met Office)

17:30 Finish

★ **Pre-registration for the meeting is required, via the Royal Meteorological Society (0118 956 8500). Online registration will be available soon.**

☐ OXFORD WEATHER OBSERVATIONS, 1815-2015

On **FRIDAY 15 MAY 2015**, a meeting in Oxford is planned to commemorate the 200th anniversary of weather records at the Radcliffe Observatory. The meeting is being arranged through the South East Centre of the Royal Meteorological Society but is open to all members of the History Group. However, venue capacity limits will apply, and pre-registration will be required.

Details of the programme are still subject to confirmation, but it is hoped to include a visit to the Radcliffe Observatory weather station site, where meteorological observations began in 1767 and have been made continuously since 1815, forming the longest continuous meteorological record in the British Isles. It is also planned that there will be a small display of significant historical manuscripts from the collection of the Bodleian Library. Other visits are planned.

Please make a note of the date in your diary. More details and booking / registration details will appear in the first newsletter of 2015. They will also be sent to you well in advance of the meeting.

☐ SPECIAL FIFTIETH ANNIVERSARY MEETING ON WEDNESDAY 18 NOVEMBER 2015 AT EXETER

The Met Office first used numerical weather prediction operationally on Monday 2 November 1965 and on the same day conducted its first ever press conference.

Full details of this National Meeting of the Royal Meteorological Society will appear in the newsletter in due course.

☐ THE DYNAMICS OF JET STREAMS

Provisionally from 2.00 to 5.00pm on Wednesday 9 December 2015 at Imperial College, London

This will be a National Meeting of the Royal Meteorological Society organized by the History Group. It will be the 'Classic Papers' meeting for 2015 and will include papers on the various kinds of jet streams (not just subtropical and polar front jets but also sting jets, boundary-layer jets, polar jets and other types of jet stream). The opening paper, on the history of jet streams to 1966 will be given by two members of the History Group's committee.

MEETING REPORT

HISTORY OF THE GREENHOUSE EFFECT
Wednesday 15 October 2014, 2.00 to 5.00pm
Imperial College, South Kensington, London
A National Meeting of the Royal Meteorological Society organized by the History Group.

This 'Classic Papers' meeting marked the 50th anniversary of the death of Guy Callendar, one of the pioneers of greenhouse effect studies. The meeting brought out the significance of his work and also focused upon other papers which have contributed fundamentally to the development of this exciting and topical subject. Different angles were covered – particularly radiation forcing, climate models and laboratory models – and the meeting included a lecture by John Harries, winner of the Society's Mason Medal for 2013. He gave the Mason Lecture on observations of Earth's greenhouse effect from space.

After the introduction by Professor Jo Haigh (Imperial College), who chaired the meeting, **Ed Hawkins (University of Reading)** presented *A brief history of climate science: from Fourier to Callendar*, in which he reviewed contributions to climate science made by Joseph Fourier (1768-1830), Guy Callendar (1898-1964), Louis Agassiz (1807-1873), Horace-Bénédict de Saussure (1740-1799), Claude Pouillet (1791-1868), John Tyndall (1820-1893), James Croll (1821-1890), Svante Arrhenius (1859-1927), Thomas Chamberlin (1843-1923), and Nils Ekholm (1848-1923).

Fourier and Agassiz had wondered why the earth was not a ball of ice and why earth's temperature varied so much. They had reasoned that solar energy was not enough to maintain our planet's temperature above freezing point. Pouillet had invented the pyrheliometer and with it estimated the solar constant, concluding that outer space was too cold to provide the necessary heat to warm the earth. Tyndall had realised the importance of atmospheric gases and presented his ideas in a classic paper published in September 1861 (in the *Journal of Science*, 4th Series, Volume 22). Croll had tried to explain ice ages in terms of eccentricities of the earth's orbit and Arrhenius had shown the importance of atmospheric carbon dioxide. Chamberlin combined the orbital and carbon dioxide theories to explain ice ages and could be considered the first Earth System Scientist.

Ed drew attention to a paper by George Nicolas Ifft, published in the *Monthly Weather Review* in November 1922, which opened with the statement "The Arctic seems to be warming up", and he went on to mention a paper published by J B Kincer in the *Monthly Weather Review* in September 1933, entitled 'Is Our Climate Changing? A Study of Long-Time Temperature Trends'.

Callendar published a classic paper in the *Quarterly Journal of the Royal Meteorological Society* in 1938 (Vol.64, pp.223-237), entitled 'The artificial production of carbon dioxide and its influence on temperature'. He was a steam engineer whose work on CO_2 was carried out in his spare time, and his calculations were all made by hand! Ed mentioned that he and Phil Jones had revisited Callendar's paper in the 2013 volume of the *Quarterly Journal* (Vol.139, pp.1961-1963) in a paper 'On increasing global temperatures: 75 years after Callendar' and shown that his global land temperature estimates agreed remarkably well with more recent analyses.

The next speaker was also from the University of Reading, **Keith Shine**, whose talk was on *The dawn of modern climate modelling – early one-dimensional studies.* In this, he considered first a classic paper by Suki Manabe and Dick Wetherald published in the *Journal of the Atmospheric Sciences* in 1967 (Vol.24, No.3, pp.241-259), which concluded that "doubling the existing CO_2 content of the atmosphere had the effect of increasing the surface temperature by about 2.3°C for the atmosphere with the realistic distribution of relative humidity and by about 1.3°C for that with the realistic distribution of absolute humidity". He went on to refer to classic papers by Ram Ramanathan and James Hansen in *Science* and the *Journal of the Atmospheric Sciences* which explored radiative forcing, the rôle of ocean-atmosphere interactions in a CO_2 climate model, and a range of forcing mechanisms including not only CO_2 but also CFCs and CH_4.

Keith showed that the pioneering one-dimensional radiative-convective models of Manabe and his colleagues had firmly established many of our fundamental theoretical understandings of how carbon dioxide causes climate change – and much else besides! It was remarkable, he said, how these models had withstood the test of time, and even now can act as a source of inspiration He felt there was still more to come yet from one-dimensional models.

The next speaker was **John Mitchell (Met Office)**, on *The dawn of modern climate modelling – early three-dimensional studies*. He too focused on the work of

Manabe and Wetherald, but in his case on the first three dimensional climate change modelling experiments carried out by these workers in the mid-1970s. First, though, John pointed out, it was necessary to acknowledge the work of Norman Phillips two decades earlier, most notably his classic paper entitled 'The general circulation of the atmosphere: a numerical experiment', published in the *Quarterly Journal* in 1956 (Vol.82, pp.123-164). In this, Phillips had reproduced the basic dynamics of the general atmospheric circulation.

In their work published in the *Journal of the Atmospheric Sciences* in 1975 (Vol.32, pp.3-15), Manabe and Wetherald had focused on physical understanding, including what they considered all of the important processes and not putting in more detail than could be justified. In later studies, they had refined their model and succeeded in reproducing many basic characteristics of the atmosphere. Their analyses of their results had shown in an exemplary way how to use models to understand the physical basis of climate and climate change, and their main findings were still valid almost forty years on.

After the tea break, **Clive Rodgers (University of Oxford)** spoke about *Calculating radiation, with and without computers*, starting with radiation charts and describing the various approximations that were used – and then dropped – as computers became more capable. For an understanding of the greenhouse effect, Clive said, radiation calculations were fundamental. The story had begun, he explained, with the Beer-Lambert-Bouguer Law of 1729, which related the attenuation of light to the properties of the material through which the light was travelling The Schwarzschild equation, which incorporated this Law, was the basis of modern understanding of radiative transfer, i.e. the passage of radiation from the surface of the earth to space. However, the equation, which was published by Schwarzschild in 1906, was not then new, for it can be found on page 57 of a book by Siméon-Denis Poisson, *Théorie Mathématique de la Chaleur*, published in 1835. This must give new meaning to there being nothing new under the sun!

Clive drew attention to others who had made classic contributions to the subject of his talk, mentioning:

- Chaim Leib Pekeris, who for his Massachusetts Institute of Technology ScD degree, awarded in 1933, had written a dissertation on 'The development and present status of the theory of the heat balance in the atmosphere';
- Ernest Gold, who had published in Volume 82 of the *Proceedings of the Royal Society* in 1909 (pp.43-70) a paper entitled 'The isothermal layer of the atmosphere and atmospheric radiation';
- George Simpson, who had published two classic papers in *Memoirs of the Royal Meteorological Society*, one on 'Some studies in terrestrial radiation' (1927, Vol.2, No.16, pp.69-95), the other on 'Further studies in terrestrial radiation' (1928, Vol.3, No.21, pp.1-26);
- Guy Callendar, who, as mentioned earlier, had published in the *Quarterly Journal of the Royal Meteorological Society* in 1938 (Vol.64, pp.223-237) 'The artificial production of carbon dioxide and its influence on temperature'.

Finally, Clive turned his attention to radiation charts, mentioning particularly the Kew Chart developed by G.D.Robinson, Yamamoto's Flux Chart and Elsasser's Chart. He also mentioned Elsasser's ingenious Mechanical Computing Device, which can compute a function of a function.

The last speaker was **John Harries (Imperial College)**, who spoke on *Observations of the Earth's greenhouse effect from space* and, in so doing, described some key observations from highly sophisticated satellite instruments of recent decades, including the Infrared Interferometer Spectrometer on Nimbus 4, the Interferometric Monitor for Greenhouse Gases on the Advanced Earth Observing Satellite, the Atmospheric Infrared Sensor on NASA's Aqua satellite, the Tropospheric Emission Spectrometer on NASA's Aura satellite, the Infrared Atmospheric Sounding Interferometer on the Metop-A satellite, and the Climate Absolute Radiance and Refractivity Observatory satellite mission. As he showed, we now know a lot about the spectrum of infra-red radiation that cools the Earth to space, and also how the integrated long-wave and short-wave energy fluxes vary with time. He also touched on the nature of the energy balance of the planet: if the energy balance is de-stabilized, e.g. by a volcanic eruption, how long does it take to restore equilibrium? In John's talk, the audience was taken on a very exciting journey to the very frontiers of knowledge of our planet.

The meeting as a whole was very successful, with a very good set of talks and a very considerable emphasis on classic papers and developments from them. The audience numbered just over 100.

THE BALLAD OF THE STRATOSPHERE
by Ernest Gold (1881-1976)

Published in *Symons's Meteorological Magazine* in December 1914 (Vol.49, No.587, p.195). This is Gold's reply to a toast at a meeting of the British Association for the Advancement of Science held in Australia in August 1914.

I am the rolling stratosphere,
I long to perturbate;
So I tickle the top of the troposphere
To make him undulate.

My temp'rature is two fifteen,
On Kelvin's abs'lute scale,
Though it's never been taken in a louvred screen,
It has in a comet's tail.

I rule the air beneath my feet,
I'm in a stable state,
When the sun is shining through a cirrus sheet
My base I elevate.

I was discovered, most agree,
by Teisserenc de Bort;
From Trappes his balloons he sent floating free
Through my 'Great Inversion' floor.

In England Dines has found me out
With instrument so light;
And my secrets he's sought with courage devout,
And correlation might.

But no correlation ratio,
For kilometres nine,
Can explain to me why a small shallow low
Brings rain from the land of wine.

Where Simpson made a dash for me
Antarctic east wind blows;
So he tried calm days when (see Adm'ral B.),
Smoke vertically rose.

I am the rolling stratosphere,
I keep, need I relate,
By the radiation of the atmosphere
In a thermal steady state.

For a summary of the meteorology discussed at the British Association meeting in August 1914, see the November 1914 issue of *Symons's Meteorological Magazine* (Vol.49, No.586, pp.173-175). That summary was written by Gold.

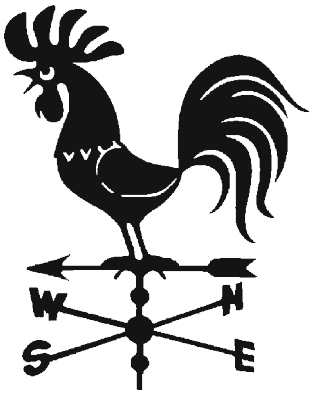
THE WEATHER COCK
also by Ernest Gold (1881-1976)

Published in the *Meteorological Magazine* in December 1939 (Vol.74, No.887, pp.282-283).

Many people, both meteorologists and others, must have asked themselves from time to time what a cock had to do with meteorology. Sir Napier Shaw recently drew my attention to a note by Gwyneth Pennethorne in a local magazine which may explain the origin of the connexion.

The note was to the effect that in the ninth century the reigning Pope Nicholas I, much concerned at the prevalence of lying and prevarication, directed that cocks should be placed at the tops of spires and towers of churches so that the people might have continually before them a reminder of the denial of Peter and the lesson which it taught, and might thereby become more truthful. The Pope was in fact a propagandist and the cocks propaganda of the higher type.

It seems likely that when the cocks were first placed on churches in obedience to this wise order they were fixed cocks, and when strong winds arose they were blown down. The obvious remedy was adopted, namely, to make the cocks rotate with the wind and so present a smaller surface to its force. In this way they not only maintained their lofty situation when the storms arose and beat upon them, but they also became indicators of the direction of the wind and there by qualified as meteorological instruments: not only warners against lying, but purveyors of truth. Indeed, their original deterrent negative purpose has been forgotten, and their secondary instructive positive purpose now alone remains: but even that was perverted by the ignorance of those who called them weather-cocks, not wind-cocks as they should have been called when they lost their significance as 'Peter-cocks'. Perhaps it is time they regained it.



THE DAY THE WHOLE WORLD TREMBLED
by Alan Heasman

Perhaps this article will whet your appetite for the History Group meeting at Whitby in May 2016 (for information about this meeting, see page 7).

On Monday 27 August 1883, at 10.02am local time, on Sumatra (one of the largest islands in the archipelago which is now modern Indonesia), the 2600-foot high volcanic island of Krakatoa, in the straits between Sumatra and Java, blasted itself into the history books in one of the largest natural explosions known to mankind. After several weeks of eruptions of increasing intensity, the mountain finally succumbed in a cataclysmic detonation. All through the preceding 24 hours, enormous explosions had wracked the island. These blasts were clearly attributed to the eruption by those unfortunate to live close by. However, the sounds were also heard hundreds of miles away out of sight of the volcano's plume and were variously attributed to thunder or cannon fire from unknown sources. The final detonation shot 6 cubic miles of rock, gas and debris into the atmosphere as high as 120,000 feet (40 kilometres), possibly 160,000 feet (50 kilometres), well into the stratosphere and possibly into the ozonosphere. The audible sound of the blast was heard 3000 miles (nearly 5000 kilometres) away on the east coast of Africa and over most of the Far East. In the immediate vicinity there was widespread devastation, mainly from tsunamis.

Later that week, as scores of people around the world came to change their weekly barogram, the keen-eyed observers noticed several sudden and (at that time) inexplicable 'kicks' on the trace early in the week. Although telegraphic reports of the Krakatoan eruption were filtering through to newspaper offices, most people were still completely unaware of the enormity of events in the Far East and so did not link them to the unusual barographic traces. However, over the following weeks, more and more information reached the scientific world. The barograms were again closely studied and a pattern began to emerge. There was evidence of several 'kicks' over many hours on barograms *worldwide* . Once the time differences between Sumatra and the location of the barographs were taken into account, the truth began to dawn. The atmospheric 'shock' wave appeared to have travelled back and forth around most of the world *several* times!

One of the first to investigate the barometric records in detail was Robert Scott, Secretary to the (UK) Meteorological Council. He collaborated with other far-flung observatories and, together with General Richard Strachey, the distinguished engineer, he wrote and presented a paper to the Royal Society in December 1883 entitled 'Notes on a Series of Barometrical Disturbances which passed over Europe between 27th and 31st August 1883'. It caused a sensation. For the first time, Victorians had to think 'globally' and consider that a natural event could have *immediate worldwide* effects. Although not occurring on British territory, nevertheless the British scientific authorities led the wider investigation under the auspices of the Royal Society. Thus steps forward George James Symons.

As many readers will know, Symons is best remembered as the 'father' of the British Rainfall Organization (BRO) in the second half of the 19th century and early 20th century. In addition, as Malcolm Walker highlighted in his article 'The Man Behind the BRO' (*Weather*, **65**, May 2010), Symons was not only very active in meteorology but also 'diversified' into several other disciplines including an interest in 'earthquakes'. Consequently, it is perhaps not surprising that it was Symons's name which appeared in an 'advertisement' in the form of a letter from the Royal Society to the Editor of *The Times* published on 12 February 1884, as follows:

"Sir, The Council of the Royal Society has appointed a committee for the purpose of collecting the various accounts of the volcanic eruption at Krakatoa and attendant phenomena in such form as shall best provide for their preservation and promote their usefulness. The committee invite the communication of authenticated facts respecting the fall of pumice and dust, the position and extent of floating pumice, the date of exceptional quantities of pumice reaching various shores, observations of unusual disturbances of barometric pressure and of sea level, the presence of sulphurous vapours, the distances at which the explosions were heard and the exceptional effects of light and colour in the atmosphere."

The letter concluded by asking correspondents to be very particular about giving the date and time (Greenwich or Local) of facts. All the information was to be sent to 'G.J.Symons, Chairman, Krakatoa Committee, Royal Society, Burlington House, London'. So Symons was at the very forefront of the Society's investigation, chairing the 13 strong committee. It took five years for the report to be

published, by which time it ran to some 494 pages, with countless diagrams, maps, graphs and detailed coloured prints in true Victorian style.

The painstaking report confirmed that the main initial atmospheric shock wave from the explosion at 10.02am, 'radiated' outwards like ripples on a pond at between 674 and 726 miles per hour, expanding then contracting to reach the antipodean point in the Pacific off Colombia some 19 hours later. The 'wave' then returned back to Krakatoa and then repeated the sequence back and forth around the globe, being faithfully recorded on the world's barographs. For example, the Royal Observatory at Greenwich noted seven distinct 'passes' of the shock wave until it became too faint to be recorded on the equipment then in use. The information on the transmission of the pressure wave was very important to meteorology and global physics and laid the foundation for the measurement and analysis of similar shock waves from the often secret atomic tests some 70 years later during the 'Cold War'.

As is widely known, most of the approximately 36,000 local deaths from Krakatoa were the result of several major tsunamis. Again, 'echoes' of these swept the globe with, for example, the tide gauge 11,000 miles from Krakatoa at Socoa , near Biarritz on the French coast registering distinct fluctuations. There were even some less distinct fluctuations recorded along the south coast of England.

The report devoted quite a lot of detail to the reports of ash and pumice, much of which fell and floated on the surface of the Indian Ocean. The other major effect of the eruption was , of course, the extensive and prolonged veil of dust which spread around many parts of the world, giving rise to spectacular coloured skies and other optical phenomena. In fact, about two thirds of the Society's report was devoted to detailed descriptions of these effects. Meteorology benefitted by getting indications of the high level wind structure of the atmosphere etc. The veil of dust persisted well into 1884 before gravity slowly drew most of the particles back to earth. In the immediate vicinity of Krakatoa the dust was so thick as to produce a noticeable reduction in air temperature. Farther afield, this was not so obvious and perhaps for this reason the Royal Society's report apparently did not consider the effects of the veil in affecting global air temperatures. It was not until 1913 and as late as 1982 before it was confirmed that globally the air temperatures had fallen by about one degree Fahrenheit after Krakatoa. The effects of volcanic eruptions on global temperatures is now widely recognized, especially in the cases of the Hekla eruption of 1783 and the Tambora eruption of 1815 and others in pre-history.

As mentioned, George James Symons led the Krakatoa Committee, and it may be for this reason that he also took a particular interest in the 'great earthquake' which affected the county of Essex in England on 22 April 1884. Again Symons invited observations to be sent to him, which he compiled into an eight-page report which subsequently was published, including in his *Meteorological Magazine* in May 1884 (note the speed of publication!).

So we have much to thank Symons for in ensuring that the great Krakatoa event was studied and recorded in detail as soon as practically possible after the event. Learned institutions will still hold copies of the original report, but an 'on line' version is available via the internet under its title of 'The Eruption of Krakatoa & Subsequent Phenomena' (1888). Many books have been written about Krakatoa. Despite its somewhat exaggerated title, I commend to readers Simon Winchester's 2003 publication *Krakatoa – The Day the World Exploded*, as well as the now somewhat dated *Krakatoa*, by Rupert Furneaux, published in 1965.

THE 'YEAR WITHOUT A SUMMER', 1816

As announced in Newsletter No.1, 2014, there will be a meeting on a Saturday in May 2016 to mark the bicentenary of the so-called 'Year without a Summer'. The venue for this meeting will be the Whitby Museum.

To repeat what was said in the aforementioned newsletter, summer climate abnormalities in 1816 were such that average global temperatures decreased by 0.4-0.7°C, resulting in major food shortages across the northern hemisphere. It is believed that the anomaly was caused by a combination of an historic low in solar activity coupled with a succession of major volcanic eruptions, capped in April 1815 by the eruption of Mount Tambora, in the Dutch East Indies (Indonesia), the largest known eruption in over 1,300 years and possibly 10,000 years.

CONTINUED ON NEXT PAGE

We are delighted to say that several talks have been promised, as follows:

- Tambora, the event and its immediate consequences;
- European climate in the summer of 1816;
- the Dalton Solar Minimum of the early nineteenth century;
- post-Tambora sunsets in art;
- the explorer and scientist William Scoresby Junior, whose papers, log books, instruments and botanical specimens were left to the Whitby Museum;
- whaling logbooks and Arctic climate in the early nineteenth century;
- weather in the Gothic novel.

In addition, it is planned that there will be a short talk on Frank Meadows Sutcliffe, a distinguished Whitby photographer of the late 19th Century and early 20th.

The meeting will begin with a dinner on the Friday evening. We hope to be able to announce in the next newsletter exactly when this meeting will take place.

EARLY METEOROLOGICAL PHOTOGRAPHS IN THE EASTMAN COLLECTION
by Howard Oliver

'George Eastman House' in New York is one of the world's premier institutions for the study, exhibition and preservation on photography. It was opened in 1949 in the home of George Eastman, founder of the Eastman Kodak Company. The 766-page book on the collection *A History of Photography from 1839 to the Present* was first published in 1999 by *Taschen* at a very economical price and is readily available.

It contains some early photographs of relevance to the history of meteorology. Unfortunately, the images cannot be included in this article due to the copyright costs that are levied, but they can easily be located via the George Eastman House web site or a search engine.

The amateur photographer William N Jennings (1860-1946), living in Philadelphia but born in England, made reputedly the earliest images of lightning. The collection contains a series of his gelatin silver prints mounted on cards, annotated and signed by him. They are entitled "first photograph of lightning", "ribbon lightning", "lightning behind clouds" and "vertical discharge with dark branches". These images defined the paths taken through the sky and undeniably refuted the commonly used straight 'zigzag' form that artists had often employed. Jennings later also photographed artificial spark discharges which later led to flash photography.

One of the leading early photographers in France was Gustave Le Gray (1820-1882), who in his career of only a dozen years became one of the most influential of its practitioners of the 19th century and is the founder on the first photographic association. His book *A Practical Treatise on Photography* was published in both Europe and the USA.

Around 1855, Le Gray began photographing on the Mediterranean coast, and two of his famous albumen prints are held in the collection. Both of these, 'Seascape' and 'The Great Wave', show cloud formations in great detail. He had found that as the chemicals used were more sensitive to the blue end of the spectrum this meant that seascapes produced a washed-out grey sky effect. To remedy this, he took two images with different exposures and combined them afterwards to obtain a correctly exposed picture of the sea and clouds. In a similar way to Constable and Turner with their painted landscapes, he sometimes used his sky half images on other unrelated photographs. Le Gray became a skilled cloud photographer and a range of his images can easily be located via a computer search of his name.

'Philosophical Instruments' were an important part of the displays at the Crystal Palace Exhibition of 1851, and a lavish photographic record was made. One salted paper print held in the Eastman collection is entitled 'Metallic Barometers'. It is attributed to Claude-Marie Ferrier and shows a metal case with over twenty vertical display dials on it, the largest clearly being a circular barometric pressure display of the general form still used today. Across the top are the words "EUG BOURDON ING MECANICIEN" and horizontally along the base are a series of further electrical displays and controls. Can any reader shed any more light on this impressive piece of apparatus?

DARWIN AND FITZROY PLAY

From Monday 8 to Saturday 13 September 2014, this play was performed at the Progress Theatre, The Mount, Christchurch Road, Reading.

As advertised in Newsletter No.2, 2014, each performance of the play was preceded by a special talk or musical event:

Monday – Gordon Tripp spoke about 'Admiral FitzRoy, Founder of the Met Office'

Tuesday – Professor Tony Rice spoke on 'Science at sea and under sail'

Wednesday – Pierrette Thomet and Briony Cox-Williams gave a recital called 'Sea Fever'

Thursday – Dr Philip Brohan spoke on 'oldWeather – New Science'

Friday – Professor Brian Golding spoke about 'Faith and Science'

Saturday – there was a 'Sea Fever Gala Night'

Malcolm Walker was in the audience on the Wednesday evening. Here is the review he wrote for the newsletter of the Royal Meteorological Society's 'Weather, Arts and Music' Special Interest Group.

TWO LIVES ON THE OCEAN WAVE

For a week in September 2014, the high seas came to Reading in the form of Juliet Aykroyd's play about relations between the pioneer meteorologist who gave us the term 'weather forecast' and a naturalist and geologist who achieved fame for his theory of evolution. The meteorologist was Robert FitzRoy, who was Meteorological Statist to the Board of Trade from 1854 to 1865 (and would now be called Chief Executive of the Met Office). The naturalist and geologist was Charles Darwin, who from 1831 to 1836 sailed around the world aboard HMS *Beagle* with FitzRoy in command and in 1859 published his seminal work *On the origin of species*.

The play focuses on the sometimes stormy interactions between the two men during the voyage and on the final years of Fitzroy's life as he struggled with depression and subsequently committed suicide (on 30 April 1865). In particular, it brings out the torment suffered by FitzRoy when his originally friendly but often authoritarian relationship with Darwin tuned sour, a consequence of the latter's ideas on evolution challenging his own fundamental beliefs about the literal truth of the story of creation as told in the Biblical Book of Genesis. We may smile now at FitzRoy's belief that there were no dinosaurs aboard Noah's Ark because the doors were not wide enough, but to him this was an obvious explanation, and anything to the contrary was heretical and deeply offensive.

Each evening before the play was performed, there was a scene-setting talk or recital, arranged by the 'Weather, Arts and Music' Special Interest Group of the Royal Meteorological Society. On the Wednesday evening, 10 September, the ninety of us who filled the auditorium of the Progress Theatre were treated to an excellent and most enjoyable recital of nautical songs. This did not include the rolling foam bass aria from Haydn's *Creation* which would have been appropriate, given the anguish FitzRoy harboured from the day in 1829 on a previous *Beagle* voyage when he lost two men overboard in a storm off Uruguay and evermore thereafter blamed himself for taking insufficient heed of a rapid fall in barometric pressure. But the aria's omission was entirely understandable, for the singer was a mezzo-soprano, Pierrette Thomet, who steered a middle course between the deep Cs and the high Cs!

For most of her recital, Pierrette was accompanied sympathetically and expertly by Briony Cox-Williams on a keyboard. The programme ranged over a variety of musical styles, beginning with Franz Schubert's *An die Musik* and ending with Gershwin's *Lorelei*. In between, the audience were treated to *Sea Fever* and *The Bells of San Marie* by John Ireland, *L'invitation au voyage* by Henri Duparc, *O Waly, Waly* by Benjamin Britten, *Meeres Stille* and *Schäfers Klaglied* by Schubert, the Welsh traditional song *Ar lan y môr*, and the sea shanty *Lowlands Away*. Two other items featured Briony on instruments other than keyboard, these being a tambourine in the French traditional *Quand la Boiteuse va-t-au marché* and an Irish bodhran drum in the German traditional *Jub-hei-di, jub-hei-da*! The songs in Welsh and other languages showed Pierrette's considerable linguistic talent.

The play was superbly performed (and a great credit to the producer, Kate Shaw), with powerful performances from Christopher Hoult, Michael Beakhouse, Steve Havercan and Jim McClure as, respectively, young FitzRoy, young Darwin, old FitzRoy and old Darwin. The play was commissioned by Lord (Julian) Hunt of Chesterton in the 1990s and has since been updated, now including, for example, a reference to the Shipping Forecast Area called FitzRoy (introduced in 2002). The only significant

historical fact that has been omitted is that FitzRoy married again after his first wife died. They had a daughter, Laura, who was seven when her father died. It is said that she discovered him after he cut his throat.

If you have never seen this play, do take the next opportunity that comes your way. It tells very vividly a story that ought to be much better known, and, in so doing, dispels the popular notion that the voyage of the *Beagle* was Darwin's. It was not. It was FitzRoy's. It was a voyage whose primary purpose was hydrographic surveying, and FitzRoy was in charge. Darwin was a supernumerary, and not even first choice in that rôle. Moreover, he was lucky to survive the voyage. Without FitzRoy's consummate skill as a mariner and meteorologist, the ship might have been lost in one of the tempests encountered. There could so easily have been no theory of evolution (at least not the one formulated by Darwin).

The devout FitzRoy was buried in unconsecrated ground, as was then customary for those who had committed suicide. He lies near his local Anglican church at Upper Norwood, South London. In contrast, the man who was destined to become a clergyman when the *Beagle* voyage began but increasingly questioned conventional religious beliefs and died an agnostic lies in the hallowed ground of Westminster Abbey. What irony!

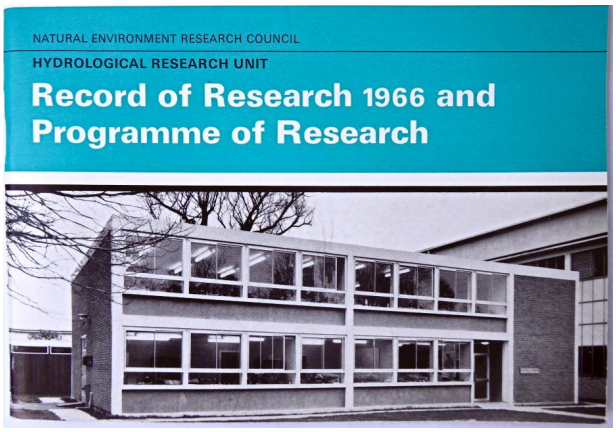
JIM MCCULLOCH
METEOROLOGICAL RESEARCH ENABLER
by Howard Oliver

A large congregation, including four members of his early Hydrometeorology Section, gathered at Dorchester Abbey on 29 September 2014 to mark the passing of the Institute of Hydrology's first director, Dr James (Jim) Samuel Gordon McCulloch, at the age of 86.

Jim was born in Edinburgh in 1928 and brought up on a farm near Nairn. Through exceptionally hard work he was able to obtain a physics and mathematics first degree at Edinburgh University, a meteorology MSc from Imperial College and a PhD. He first worked at Rothamsted Experimental Station under Howard Penman studying water movement in soil. After a break for national service on secret work for the forerunner of the Atomic Energy Authority, he joined the Colonial Service in 1955 to work for the East African Agriculture and Forestry Research Organization in Kenya. 1965 saw him return to the UK as head of the Hydraulics Research Station's Hydrological Research Unit (HRU) in Wallingford.

The first annual report of the HRU shows a team of 26 with research sections including Applied and Mathematical Hydrology, Catchment Research and Soil Physics. Most importantly for this article is the Hydrometeorology Section staffed by meteorologists John Stewart (on secondment from the Met Office) and Malcolm Walker. The unit later evolved into the internationally respected NERC Institute of Hydrology (IoH).

Dr J S G McCulloch (1928-2014)



A main mission of the research was to understand the mechanisms controlling the differential water balances of various vegetation covers, and in particular the vexed question of the hydrological impact of afforestation versus grassland. To this end, forested and grassed catchment studies had been set up in Wales to obtain long-term average results. However, to understand fully what was going on, it was also necessary to measure detailed water and energy balances on time scales of hours rather than months.

Jim showed the foresight and ability to obtain funding support for the important Thetford forest programme, which used meteorological energy balance and aerodynamic methods to investigate fully all aspects of the detailed water and energy exchange processes. His management expertise, linked to his real understanding of the physics involved, led to the project becoming a world leader in such research. This included the use of novel, and very expensive, on-line computer data acquisition and analysis systems for deployment in the field.

By the time of the 1970-71 report of the Institute of Hydrology, the staff numbers had risen to almost a hundred, with the four members of the hydrometeorology team attending the funeral (John Gash, Colin Lloyd, Howard and Sylvia Oliver) in post. Jim successfully by-passed possible competitive antagonisms from other organizations by the involvement of specialist staff and consultants from Imperial College and Edinburgh University.

His enthusiasm, and his ability to insulate his scientists from the increasing financial and administrative worries of research, meant that his teams were able to concentrate entirely on the work in hand. Some of the papers coming out of these early studies have stood the test of time as being of real scientific significance for advancing hydrometeorology in the areas of land surface interactions and hydrological impacts of vegetation.

Under the directorship of Jim McCulloch, meteorological research expanded rapidly and grew to include the programmes using state-of-the-art techniques in such diverse parts of the world as the Sahel and Brazilian rainforest. These studies have advanced understanding of water and energy balance processes for incorporation into a range of climate models.

During his later career, he carried out an international rôle for the NERC and was managing editor of *Journal of Hydrology* and founder of the journal *Hydrology and Earth System Sciences* for the European Geophysical Society.

Jim published many hydrology-related papers in his own right during his long career, but it is as an 'enabler' he will be most remembered. Without the knowledgeable support and encouragement together with the determined leadership of Jim McCulloch, the high international reputation of the Institute of Hydrology and the major advances in hydro-meteorological and other areas of hydrology would not have come to pass. He was a one-off and the impressive evidence of his efforts live on after him.

A history of the Institute of Hydrology, *Progress in Modern Hydrology – Past, Present and Future*, edited by John Rodda and Mark Robinson, published by Wiley-Blackwell will be available in 2015 to mark IoH's fiftieth anniversary.

A VALUABLE LONDON WEATHER RECORD FROM THE 1860S AND 1870S by Peter Rogers

These days, there is a plethora (perhaps even a surfeit) of weather information from most countries around the world, enabling weather observers to record conditions in 'real time' and for very specific locations.

However, this is a very recent development, so that it is much more difficult to track the day-to-day weather during last century, and earlier, thus making records that survive particularly valuable.

For that reason, I was delighted when a friend, clearing out his grandfather's belongings, gave me a rather battered book, containing weather information recorded by his grandfather at his house on Clapham Common between January 1861 and April 1877.

With a few exceptions for the earlier years, when the figures seem to have been recorded three times each day, the book contains the temperature (in degrees F) and the pressure (in the 'old style', e.g. 30.15 inches) for each day. The times of the observations are not given, but it is clear that they were morning and evening figures, and almost certainly at the same times each day.

The wind direction and current weather are accorded a single word, such as 'windy', or 'freezing'. Unfortunately, there are no rainfall figures, presumably because the observer did not possess a rain-gauge. In addition, the strength of the wind does not appear.

All this might suggest that the figures, detailed though they are, and meticulously recorded, are of very limited value to a modern-day meteorological observer, but I would suggest that this is not so. The reason is that the observer's site is fairly close to both Greenwich and Kew, where detailed records are available that cover the entire period, and these records are conveniently accessible in the

invaluable, but now sadly out-of-print, book, *London Weather*, by J H Brazell and published in 1968.

Accordingly, I have carried out some comparative research, which indicates a very good correlation between the data from the Clapham Common site and the corresponding figures for Kew or Greenwich.

The best example is for the summer of 1868. As is well-recorded, that was a particularly hot summer, which set a new maximum temperature record in July for the UK, which has only relatively recently been discarded because the figures were recorded in a Glaisher screen (which because it was not protected from the heat of the ground by panelling, allowed reflected heat from the ground to distort the figures).

Nevertheless, the comparative figures are extremely close. Thus, Brazell records that Greenwich recorded its highest temperature as 96.6°F on 22 July, and the Clapham observer records a figure of 94°F for the same day, with the comment "Exceptionally hot".

The same close correlation can be seen from two overnight minima, recorded a year earlier in 1867. Brazell records that the month's lowest reading at Greenwich in January that year was 6.6°F on 5 January, while at Clapham the minimum for the same day was recorded as 8°F!

I have carried out a number of similar comparisons, obviously using examples where the official figures from Greenwich/Kew are records for the month in question, and, in every case, the corresponding Clapham figures are exceptional for the same day in that month.

This strongly suggests to me that the Clapham observer has accurately recorded his data, which, accordingly, are of increased value, and that the Clapham site has great similarities to those at Greenwich/Kew. It would have been even more valuable if the Clapham observer had recorded rainfall figures, so that similar comparisons with Kew/Greenwich could have been drawn.

Nevertheless, I have found the book to be of great interest and value for the periods in question, and I believe indicate how important it is such books are not thrown away, but if possible kept and interesting conclusions drawn. It was only because my friend knew of my interest in the subject that he gave me the book, rather than discarding it.

As many readers will know, Philip Eden is only too happy to receive weather diaries and other weather data from COL readers, and I would encourage other observers to do what I have done, and to leave such valuable data as they may have accumulated to his trust in their wills. If this not done, there must be a considerable risk that valuable weather records are destroyed, simply because their intrinsic value is not appreciated.

PLEASE TAKE CARE OF OUR RECORDS! by David Pedgley

War can lead to the destruction of much valuable meteorological equipment as well as irreplaceable records that had been gathered laboriously over many years. But sometimes the outcome is less traumatic. An example comes from World War II in former Abyssinia. Following the country's rapid liberation in 1941, Dr R C Rainey (entomologist with the Empire Cotton Growing Corporation, but then serving in the newly-formed meteorological section of the South African Air Force) reached Addis Ababa, where things were chaotic – but not wholly so, as the following extracts from his account reveal.

"The aerodrome bore witness to the SAAF attack a day or two previously, which had pretty well put paid to what was left of the Regia Aeronautica [Italian Air Force] in East Africa. The Italian meteorological equipment was, however, still in operation; we moved in and duly changed the charts of the recording instruments at the end of the week. We met our predecessors of the Servicio Meteorologica in one of the vast and almost autonomous PoW camps in town, and managed to arrange to take over the records of the climatological work of their service, amounting to some thousands of volumes of routine observations made at stations throughout Italian East Africa.

"Addis soon proved to be packed with technical equipment of every description, and SAAF meteorological stations from Port Elizabeth to Benghazi thus came to be equipped with the instruments and even the humidity tables of the Regia Aeronutica – equipment which at this stage of the war was virtually unobtainable from Allied sources. And the city … could even assist with our other acute problem – shortage of meteorological personnel. For at the civil meteorological observatory were the normal peace-time staff, pensioners of the 1935-36 war, who were only too happy to find a niche in the new scheme of things. Like the rest of the Italian Civil Service in the capital, they had even received three or four months'

advance of pay from their departing administration, to tide them over until the Africa Korps should restore the status quo! They were soon busy on a new analysis of local vapour-pressure data, in addition to maintaining their so far uninterrupted routine observations. They were later joined by their former chief ... readily loaned by an over-worked PoW camp commandant.

"The meteorological service in the Italian territories had been organized on a lavish scale, and the climatological summaries completed by our hard-working Italian staff in Addis during 1941 remain in the archives of the British East African Meteorological Service as the last one tangible product of Mussolini's African empire."

(From: 'Further outlook unsettled' (1945), *The Empire Cotton Growing Review* **23**: 172-181.)

CAN YOU ESCAPE YOUR HISTORY?
by Maurice Crewe

In July 2014, I visited the Royal Gunpowder Mills near Waltham Abbey and in the rocket exhibition noticed a SKUA rocket. The guide said they knew nothing about it, and I admitted I could find some information. So a couple of articles from the National Meteorological Library were sent to the Mills.

A few weeks later I received the following email:

"Dear Maurice,

"Thank you for your e-mail to the Royal Gunpowder Mills.

"I was sorry I was not able to be present at the Gunpowder Mills when you visited us a month or so ago. You may remember we met during the 1980s when I was at the Ordnance Board developing NATO STANAG 2895 on Worldwide Environmental Conditions. You provided assistance particularly on wind conditions but also on other climatic parameters. Subsequently Keith Grant made further additions to it. When it was eventually published it became the most requested STANAG in NATO, quite a record!"

Plus a few other comments.

"I am the chairman of the Friends of the Gunpowder Mills.

"Kind regards
John Wright"

We exchanged one or two emails and it seems John Wright has, as he says, a memory good in parts and he remembered how helpful the Met Office was when he was working on NATO standards.

(I'm glad someone can remember the good bits)

RAINBAND SPECTROSCOPY
by Paul Fuller

This article forms part of a paper on 'The Life and Times of John Rand Capron (1829-1888)' published by Paul Fuller in the April 2014 issue of *The Antiquarian Astronomer* (The Journal of the Society for the History of Astronomy, Vol.8, pp.21-45). It is reproduced here by kind permission of that Society.

Today rainband spectroscopy is all but forgotten, but for a brief period in the 1870s and 1880s it was enthusiastically proposed by two well-known astronomers, Charles Piazzi Smyth (1819-1900) and John Rand Capron (1829-1888). Piazzi Smyth began his astronomical career as a computer at the Royal Observatory, Cape of Good Hope. He later triangulated the districts of Southern Africa, enjoyed landscape painting and took possibly the first ever photograph on the continent of Africa. In 1856, he founded the first high-altitude observatory on Tenerife to demonstrate the benefits of using a high-altitude location. Smyth also pioneered infra-red astronomy, when he estimated the amount of heat radiation received from the moon. Later, Smyth returned to Britain to take up the post of Astronomer Royal for Scotland (1846-1888), based in Edinburgh.

John Rand Capron was a 'grand amateur', who was interested in a wide variety of natural and atmospheric phenomena. He was a fellow of both the Royal Astronomical Society and the Meteorological Society.[2] He lived in Guildford, Surrey, and was a solicitor by trade. He was most well-known to the general public for his auroral research, and he contributed more than 100 letters and articles to the science books and journals of the 1870s and 1880s. He wrote three books: *Photographed Spectra* (1877), *Aurorae: their characters and spectra* (1879) and *A Plea for the Rainband and The Rainband Vindicated* (1886). The highlights of his scientific work were probably his analysis of the 'auroral beam' observations of 1882

[2] Capron was elected a fellow of the Meteorological (later Royal Meteorological) Society on 15 February 1882.

and his lecture to the British Association on Professor Lemström's auroral experiments in Lapland in 1883.

Capron and Piazzi Smyth shared a series of intellectual interests which were under-pinned by an intensive visual culture. These included photography, astronomy, spectroscopy, the aurora and meteorology. Both men enjoyed collecting reams of scientific data, both delighted in producing water-colour illustrations of what they had observed. and both were committed Christians. There is an unconfirmed story that Capron and Smyth astonished passengers on the London to Edinburgh train by pointing their pocket spectroscopes out of the window to examine the spectra of clouds.

Smyth was a Fellow of the Royal Society, but his scientific career was marred by eccentricity, outspokenness and his confrontational letters to *Nature*. In 1864, Smyth wrote the first of three highly popular accounts of the Great Pyramid at Gizeh (Giza), a man-made object which Smyth was convinced held deeply mystical – almost divine – mathematical properties.

In 1871, Piazzi Smyth accused the Royal Society of having a 'secret committee' which had engaged in 'despotic dispatches' to ensure that his paper on the alleged relationship between the frequency of sun spots and earth temperature would never see the light of day. On another occasion, Piazzi Smyth attacked the respected spectroscopist Marshall Watts, author of an important work *Index of Spectra,* in the pages of the *Philosophical Magazine.* This time, he accused the Royal Astronomical Society of having a secret anti-Smyth-like committee. In 1874, he resigned his membership of the Royal Society because of their refusal to publish his paper on the (alleged) mathematical properties of the Great Pyramid at Giza.

The Rainband

It was Piazzi Smyth's work on spectroscopy which led to Capron's misjudged acceptance and promotion of the so-called 'rainband'. Piazzi Smyth first noticed this alleged phenomenon at noon on 24 March 1872 at Palermo in Sicily. Using a pocket spectroscope only a few inches in length, he observed 'striking variations' in the solar spectrum near the double D (sodium) lines. His diagram shows that the following day at noon many of the spectroscopic lines had disappeared, but he noted that it had rained the previous afternoon at 4pm.

In July 1875, *Nature* published a major article by Piazzi Smyth which described how using his barometer Le Verrier had predicted a period of fine weather, but then for a whole week Paris and London were struck by 'deluges' of rain. Smyth claimed that whilst travelling through London his pocket spectroscope displayed "a broad dark band on the less refrangible side of D, and partly in place of it". However, by the time Smyth reached York the rain had ceased, the dark spectral band decreased and fine weather prevailed. His pocket spectroscope once again revealed the double D lines and by the time he reached Edinburgh the weather had returned with a "glorious blue sky, transparent atmosphere, delicious temperature, and light N.E. wind".

Smyth discovered that whenever there was rain, a band of dark lines appeared in his spectroscope, but as soon as the rain disappeared, this band was absent. Almost accidentally, Piazzi Smyth had initiated a whole new area of scientific study which quickly attracted both its supporters and detractors. In May 1876, during a trip to the south of France, Smyth again predicted heavy downpours "to the surprise of the natives" who had only consulted their barometers. He followed up this work with a major publication 'Meteorological Spectroscopy in the small and rough' which set out the scientific case for his discovery of the 'rain band.'

Capron was obviously interested in Piazzi Smyth's work and soon began his own data collection using a McLean's star spectroscope. He found that he too could identify the rainband. For two periods in 1880 and 1881 he recorded both the strength of the rainband – on a scale from 1 to 5 – and the amount of rain which fell in the 24 hours following the rainband reading. His charts (see Fig. 1 – next page) seem to show a strong positive association between the two data sets, but when these data are correctly combined onto a scatter gram (Fig 2 – see next page) the linear correlation coefficient is only + 0.26. Unfortunately, the statistical technique of correlation was not available to Capron and Piazzi Smyth in the 1880s. Had it been so they would surely have understood the weakness of their case.

In 1881, Capron published his first 'rainband' article, 'A Plea for the Rainband'. As a leading spectroscopist, his claims were taken seriously by many people. In 1883, Capron's rainband appeared in colour in the second edition of John Browning's popular handbook *How to work with the*

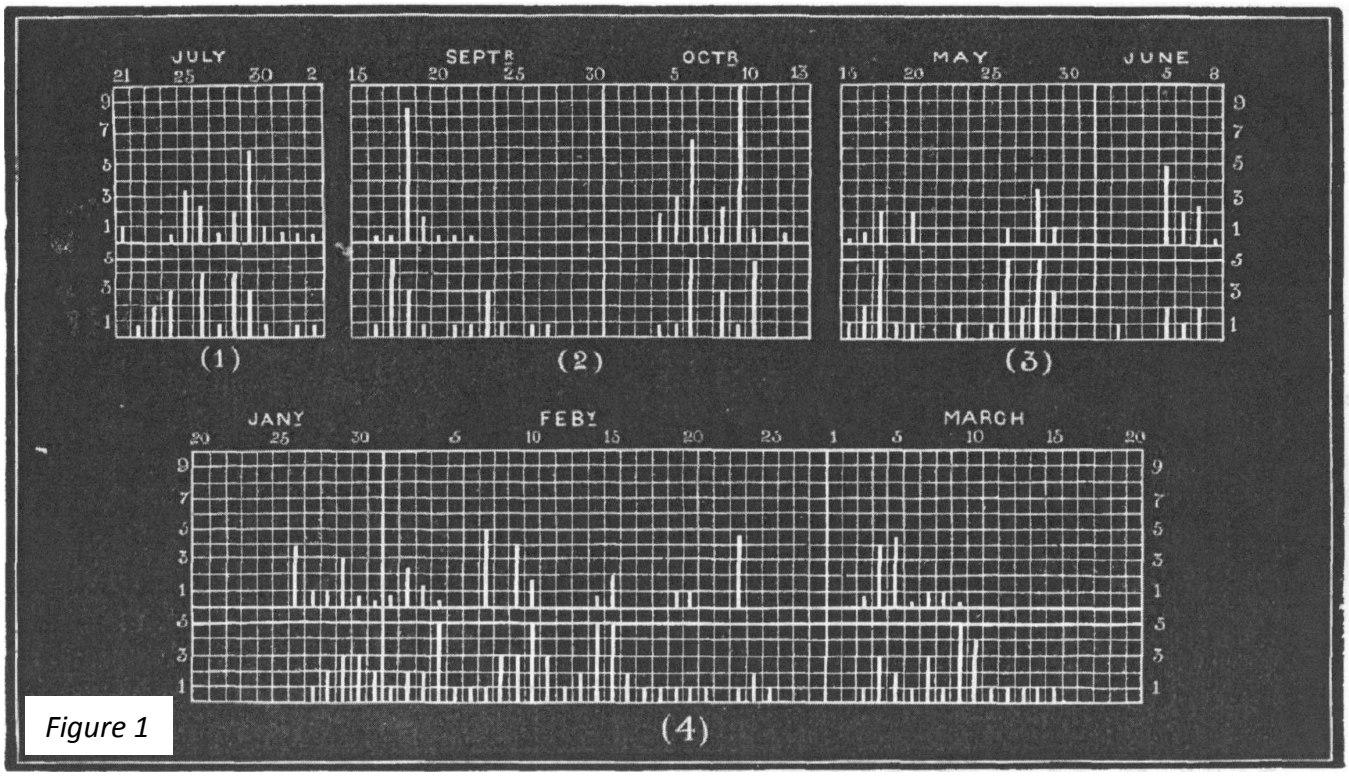

JULY
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Figure 1

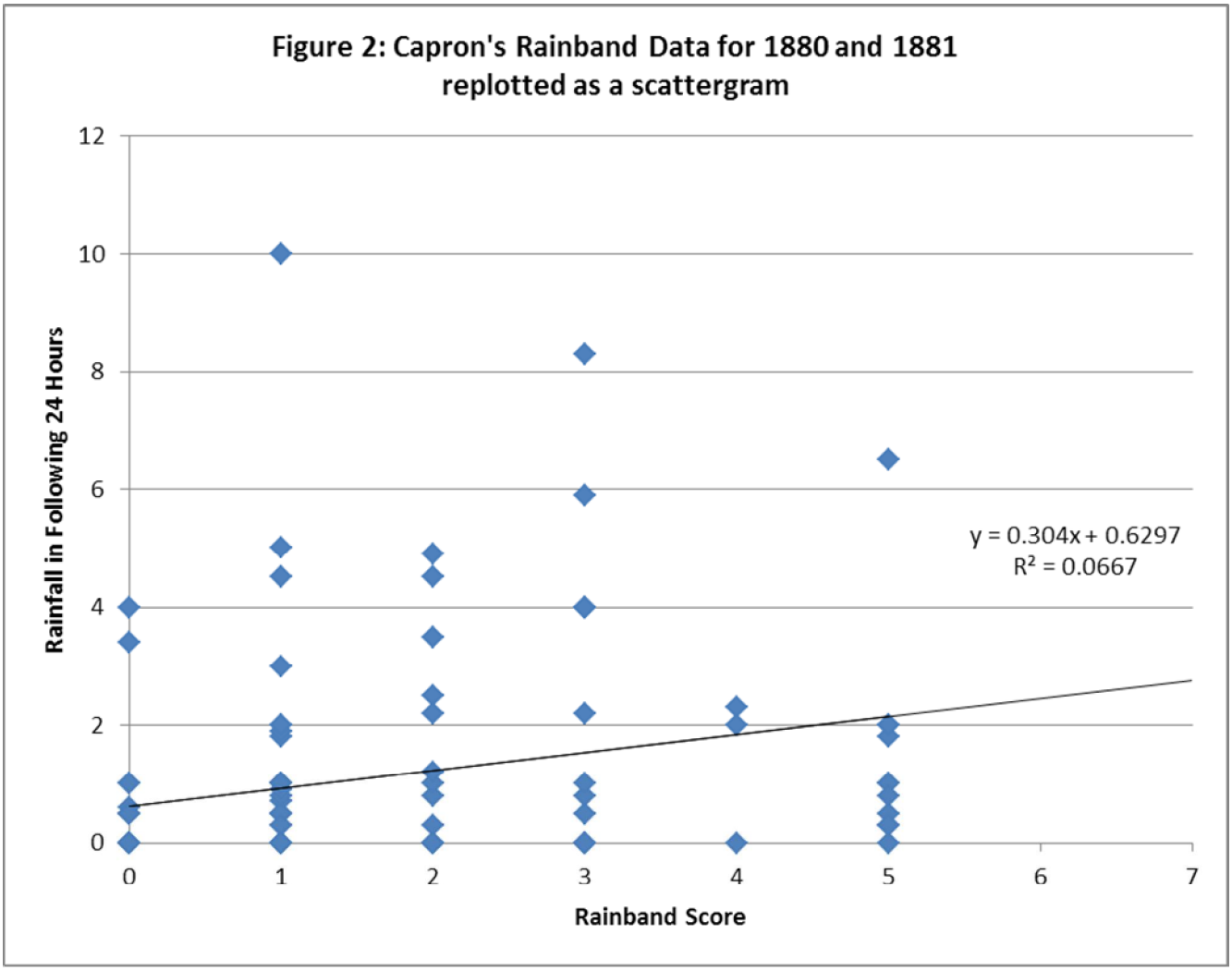
Figure 2: Capron's Rainband Data for 1880 and 1881
replotted as a scattergram
Rainfall in Following 24 Hours
Rainband Score
y = 0.304x + 0.6297
R² = 0.0667
0
2
4
6
8
10
12
0
1
2
3
4
5
6
7

Spectroscope. The realisation that, for the first time, it might be possible to predict rainfall scientifically made for big news, and both John Browning and his rival Adam Hilger quickly issued a variety of pocket spectroscopes and pamphlets which explained how to use them.

Despite the enthusiasm of Capron and Smyth for their subject, many people had problems actually seeing the rainband. This debate even took to the pages of *The Times*, when both the Honourable Ralph Abercrombie of the Meteorological Society and the Duke of Argyll (FRS) wrote in to say that they could see no value in the technique. Capron himself admitted that the rainband did not claim 'absolute infallibility', but Capron and Piazzi Smyth never really understood that their method relied on subjective estimates of the state of the bands to the left of the D lines. Neither did they understand that variations in viewing conditions introduced a further subjectivity into what was seen and how the lines should be interpreted. Capron even admitted that there were "discrepancies and irregularities" in the relationship between the strength of the rainband and the amount of rainfall. However, he attempted to explain this away as being caused by changes of intensity in the rainband between the three daily readings. Unfortunately, he never presented any data to demonstrate such an effect.

In 1886, Capron re-published 'A Plea for the Rainband' alongside a new article 'The Rainband Vindicated', but by now interest was dying away and the problems with the technique were becoming obvious. Piazzi Smyth continued to mount a vigorous rearguard action against criticisms raised by American scientists and both men continued with their fallacious claim that they could identify atmospheric water vapour with such tiny instruments before it had even begun falling!

A leading spectroscopic historian, Klaus Hentschel, has criticized Capron's role in the promotion of the rainband and the quality of the photographs in *Photographed Spectra. A*side from the subjective nature of the observations:

The user of Capron's manual had the task of deciding which among the several printed samples [rainband photographs] was most similar to the real spectrum observed in his rainband spectroscope, that is, to match his visual field against a whole array of categories provided by the manual's author.

Capron and Smyth assumed that their pocket spectroscopes were capable of identifying reliably all the main lines in the solar spectrum, but these tiny instruments were barely capable of identifying more than about 100 of the 50,000+ solar lines.

The promotion of Smyth's rainband by Capron seems like an example of cronyism on Capron's part but we are still left with the term 'rainband' in today's weather forecasting, albeit used in a non-spectroscopic sense.

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Shaking the atmosphere ..... by Alan Heasman

Apart from an abiding interest in meteorology, what is the (rather tenuous) link between Malcolm Walker (History Group Chairman) and Admiral Robert FitzRoy (pioneer of British meteorology)?

Well, as some of you may know, Malcolm is an experienced church organist, playing regularly at his local church in Tiverton, Devon. He has just written a book about the history of Exeter Cathedral's organs and organists. One of the pioneers and great innovators of organs was Robert Hope-Jones, born in February 1859 on the Wirral in Cheshire, England. He took an engineering apprenticeship at Lairds Shipbuilders in Birkenhead and in 1881 moved into the (then) developing world of telephony at the Lancashire & Cheshire Telephone Company. However, he also had an interest in organ music and applied his knowledge of electricity to developing an electro-pneumatic action for organ pipes. By 1892, he had founded his own 'Hope-Jones Electric Organ Company' in Birkenhead, Cheshire. Over the years, he took out 45 patents associated with the organ.

One of his ground-breaking inventions was the 32-foot organ 'stop' or pipe known as the Diaphone, a special type of pipe much used on later theatre organs. However, the Diaphone's particular feature was its very deep tone. Previously in the 1850, Scots-born Robert Foulis , a surgeon and engineer, had developed the earliest form of foghorn after noticing how low tones carried the farthest. Hope-Jones realised that his Diaphone could be adapted for the same purpose. In 1896, he patented his new electric foghorn and for almost 100 years the 'Hope-Jones' foghorns were used throughout the world, issuing warnings to sailors and saving many thousands of lives. An American newspaper article at the time described the diaphone as "the most clamorous fog signal in the world. It has a roar like the advancing tornado, opens with a bellow like a bull moose and winding up with a grunt that shakes the atmosphere".

Over the years, Hope-Jones built over 240 organs, some for churches but mainly for theatres. He has become known as 'the inventor of the theatre organ'. In 1911, he moved to the USA and subsequently collaborated with the Wurlitzer Company to produce other famous organs. However, he became disillusioned with the business venture and committed suicide in 1914, aged just 55.

In England, one of the church organs he developed was installed in All Saints Church, Upper Norwood, SE London. This was another of his innovative installations and it remained *in situ* for many years and has only recently been dismantled. Parts of it are now on display elsewhere.

It was fitting that Hope-Jones should be associated with All Saints Church, because in its churchyard is the grave of Admiral Robert FitzRoy, another whose pioneering work in the early 1860s on storm warnings to seafarers helped save many thousands of lives. However public criticism of his forecasting work (associated with a depressive family disorder) led him, like Hope-Jones , to take his own life – in April 1865 at his house just a couple of hundred yards away along Church Road in Upper Norwood.

So there we have it. From Malcolm Walker via the great organ innovator Robert Hope-Jones and his life-saving 'Diaphone' foghorn to Robert FitzRoy and his life-saving 'storm warnings'. I did say that it was a tenuous link!

My thanks to Paul Simons for his recent 'Times' newspaper article about Hope-Jones and to Wikipedia and the All Saints Church website for additional details.

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From Malcolm Walker
Thank you very much for your article, Alan.
There are sixteen large Contra Violone organ pipes in the south transept of Exeter Cathedral. The speaking length of the largest is 32 feet. The frequency of the note played by this pipe is 16.4 cycles per second. As the speed of sound at a temperature of 20°C is 343 metres per second, the length of the wave produced by that pipe is 343 divided by 16.4, i.e. 20.9 metres (68.6 feet). Visitors to the cathedral often ask if the notes produced by the large pipes are deafening to people who are close to the pipes when they are played. In fact, they are not. The noise one hears is a rather low 'grumble'. To hear the whole of the sound wave produced by the 32-ft pipe, the listener has to be at least 20.9 metres away. The Contra Violone pipes are loudest at the west end of the cathedral (about three wavelengths away). But they do not sound like foghorns. They are flue pipes, whereas the Diaphone is a sort of reed pipe in which a spring-loaded pallet vibrates, rather than a reed, to create the basic sound (which is then reinforced by means of a resonator).

METEOROLOGICAL EDUCATION AND TRAINING

The Met Office College celebrated its 75th anniversary in 2014. The following was written by Malcolm Walker and has been taken from his *History of the Meteorological Office*, (Cambridge University Press, 2012, pp.256-261 and 273).

The Meteorological Office's annual report for the year ending 31 March 1936 stated that the year in question had been memorable because it had seen the introduction of revised scales of pay on the lines recommended by the 'Committee on the Staffs of Government Scientific Establishments' chaired by Harold Carpenter. New scales had been introduced as from 1 April 1935, along with the various grades of Technical Officer and Assistant which Carpenter had proposed. The new employment arrangements stipulated that recruitment for the Technical Officer class would normally be from university graduates who held honours degrees in mathematics or physics, while the level of education required for the Assistant class would be that of the Intermediate Bachelor of Science degree. The Carpenter Committee had, in fact, reported as long ago as 1930, but the Office had not been able to implement its recommendations any earlier because of financial difficulties arising from the Great Depression of the early 1930s.

One of the main recommendations of the Carpenter Committee was that rates of pay should not be improved in any establishment until that establishment had scrutinized its working arrangements. The purpose of the scrutiny was to bring to light any work currently performed by Technical Officers which could be carried out satisfactorily by staff of lower grades. In this respect, the Office's forecasting work was considered carefully and a modification of Carpenter's recommendations found necessary. Under the system which had been in operation for fifteen years, forecasting was entirely in the hands of professional staff who had been recruited from universities, the underlying reason being that weather forecasting was a branch of meteorological science which demanded the high degree of scientific training provided by an honours degree.

At the same time, though, the Meteorological Committee [of the Air Ministry, which controlled the work of the Office] recognized that experience played an important part in the more routine aspects of forecasting. They agreed that Assistants who had acquired such experience in the course of long service to the Office should continue to be utilized to the full. Accordingly, Assistants who had gained this experience would be employed on forecasting duties provided steps were taken to give them adequate training in the scientific principles on which the practice of forecasting was based. Assistants who had been trained in this way could be assigned to forecasting posts under the supervision of higher grades, while Assistants who had previously been trained would be allowed to carry out forecasting without such supervision.

Further consideration of Carpenter's recommendations led the Meteorological Committee to the conclusion that all new entrants to the Office needed to be given appropriate training; and the Committee also concluded that existing members of staff needed to be trained when undertaking new responsibilities on transfer from one division of the Office to another. To this end, in the autumn of 1935, a Technical Officer who had been relieved of his ordinary duties to become an instructor gave a course on the theory of forecasting to six Assistants who had all in the course of long service gained a great deal of practical experience in the Forecast Division. The course, given in the Office at South Kensington, lasted four months, after which the Assistants were given posts which required them to prepare forecasts as part of their regular duty. But whilst staff were being trained, they were not available to carry out their normal work. As a result, shortages of staff occurred in some divisions of the Office. The reorganization of the Office which followed the Carpenter Committee, though necessary, did therefore create some temporary inconvenience.

The arrangement with the Imperial College of Science and Technology whereby the Office provided accommodation, facilities and lecturers [for courses in meteorology] did not continue beyond 1924, when Sir Napier Shaw retired as professor. By then, the Office could no longer spare the space or staff; and after Shaw's retirement very few members of the Office's staff pursued courses at the College anyway. On 1 October 1934, the Superintendent of the Office's Army Services Division, David Brunt, became Professor of Meteorology. He believed the department should be a training ground for the graduates in physics and mathematics who were recruited by the Office and, as part of his endeavours to bring this about, pressed for the appointment of additional staff. He was soon to be joined by another member of the

Office's staff, Percival Albert Sheppard, who was appointed Reader in May 1939.[3]

Plans for the development of the department had to be suspended when the Second World War broke out. Brunt and Sheppard were released immediately by Imperial College and seconded to the Air Ministry to open a Meteorological Office Training School, at Berkeley Square House, London. Their responsibility was to train all forecasters for the Office, service and civilian. For the war that had seemed inevitable for some time, the Office had made provision for the recruitment or secondment of a large number of scientists to it. A Meteorological Section of the RAF Volunteer Reserve had been formed in May 1939 and the recruitment of officers and airmen had begun. Airmen were posted in small groups to RAF stations, where the staff of local meteorological offices provided their training. Officers were trained by Brunt and Sheppard. **Their work began on 15 September 1939, which is an important date historically, for it marks the official opening of the Office's Training School.**

Before the autumn of 1935, there was no systematic centralized training of staff in the Office. Any training that was given was *ad hoc* in nature. Recruits were posted to the places where they were required to serve and considered to be under training until declared competent in their respective grades by their officers in charge. They read recommended textbooks but otherwise learned by watching their colleagues at work. Then, in February 1936, at Croydon Airport, the Office set up a Training and Special Investigations Section of the Overseas Division, with S P Peters in charge, assisted by two trained forecasters, D F Bowering and E S Tunstall.[4] The *primum mobile* of this development was that the rate of recruitment to the Office had increased suddenly in the latter part of 1935. A number of Technical Officers had been appointed in a short space of time. They needed to be trained.

The principal reason for the increase in strength was that the Office had been warned in 1935 that forecasts would be required for an experimental transatlantic flying-boat service which was scheduled to start in the spring of 1937. It would be experimental because the idea of regular commercial flights across the North Atlantic Ocean was at best bold, some would say foolhardy. Pioneering flights across the Atlantic had excited the public, but there had also been tragic failures. Many aircraft and crew had disappeared when attempting to cross the ocean, and the weather had been blamed for these failures. Little was known about flying conditions over the Atlantic, which meant that the old pattern of staff training would no longer suffice. There was no experience to be drawn upon. Research and investigation needed to be carried out. However, existing staff of the Office were fully committed. None could be spared. Forecasters could not be redeployed to undertake the work.

To address the matter, the Meteorological Committee took the advice of Simpson.[5] He was given permission to recruit mathematics and physics graduates direct from the universities to be trained as forecasters and carry out investigations of Atlantic weather. Under Peters, they were introduced to theoretical meteorology through a course of lectures supplemented by private study and, in parallel, taught to make weather observations, carry out pilot-balloon ascents and plot weather charts.[6] One of the team, David Arthur Davies, then studied the weather over the Atlantic at first hand by means of visual, instrumental and pilot-balloon observations.[7] In all, he made sixteen crossings of the Atlantic on a cargo ship, the *Manchester Port*, the first in November 1936, the last in October 1937.

Others of the team contributed to an intensive examination of the weather that might be

[3] Sheppard joined the Office in 1929 and was employed first at Kew Observatory, as a Junior Professional Assistant. He later worked at Porton Down for some years, one of his colleagues there being Oliver Graham Sutton, a future Director of the Meteorological Office.

[4] Peters, a physicist, joined the Office in 1923 after working with C J P Cave privately. His first posting was to RAF Cranwell in Lincolnshire, as a Junior Professional Assistant, and he moved to Cardington in 1925 on promotion to Senior Professional Assistant. After the R.101 disaster, he served at RAF Worthy Down in Hampshire for a number of years and became an instructor in the summer of 1935.

[5] He was now Sir George Simpson, having been knighted in June 1935.

[6] Recollections of the first such training course have been provided by Patrick Meade in 'Transatlantic civil aviation – the first training course for scientists in the Meteorological Office', published in 1986 in the *Meteorological Magazine* (Vol.115, pp.193-199).

[7] Davies was from 1955 to 1979 Secretary-General of the World (formerly International) Meteorological Organization. He was knighted in June 1980, thus becoming Sir Arthur Davies.

encountered over the Atlantic Ocean.[8] They prepared a daily sequence of Atlantic weather charts for a complete year, using a *post facto* dataset, and from these, along with a set of working charts for a period of ten years obtained from the Office's Forecast and Aviation Services Division, compiled climatological charts from which optimum routes were established and flight times estimated. Peters also trained a member of the Iraqi Meteorological Service, two graduates engaged by the Colonial Office for service in Singapore and the Sudan, and a number of graduate recruits to the Meteorological Office, some of whom were to serve at new RAF stations, others to undertake gunnery and sound-ranging duties with the Royal Artillery.

In the latter part of 1936, C J Boyden was posted to Croydon to become responsible for training staff at all levels. He was an experienced forecaster who had worked for a year in the Office's London headquarters on Kingsway whilst Jacob Bjerknes was visiting the Office. Bjerknes arrived on 14 December 1935 and stayed for five months, paying particular attention to frontal analysis of northern hemisphere charts, focusing especially on the development and progress of fronts over the Atlantic Ocean. His work was therefore complementary to that of the group at Croydon. At that time, as Boyden said in an article entitled 'Meteorological Office training scheme: the first ten years', published in 1986 in the *Meteorological Magazine* (Vol.115, pp.190-192), British forecasters still varied greatly in their enthusiasm for fronts. Even in 1935, the superintendent of the Forecast and Aviation Services Division, Richard Corless, had sounded unenthusiastic about them when speaking to a Conference of Empire Meteorologists. However, fronts had begun to appear on charts in the *Daily Weather Report* in 1933 and British forecasters had started applying frontal analysis routinely by the time the Croydon group started work.

In his article, Boyden recalled how he came to be posted to Croydon, saying that he found a note waiting for him one evening in 1936 when he reported for night duty. It was from R.G.K.Lempfert [an Assistant Director of the Meteorological Office], and he asked to see Boyden in the morning. Boyden said that he was astonished to be told he was to open a training school. He went on to say that the next few days were hectic, and he realized that the best he could hope for was to prepare lectures for a week or two and trust he could keep ahead of the class for the six months the course was to last. Working from a two-page syllabus by Peters, he said, he set about his task, basing his initial notes largely on the four volumes of Shaw's *Manual of Meteorology* and another book now considered a 'classic', Brunt's *Physical and dynamical meteorology*, published in 1934. These were supplemented later, Boyden said, by *Some problems of modern meteorology*, a compilation of important papers published in the *Quarterly Journal of the Royal Meteorological Society*, and a short book on weather forecasting (*Prévision du temps par l'analyse des cartes météorologiques*) by Jacques Van Mieghem, published in 1936.[9]

In due course, Boyden faced eight students, all veterans, all strangers to him, including one who had joined the Office before he had been born (1908)! At the beginning of the course, he referred to a matter which had caused annoyance in the Office for years. He explained it thus in his article:

In relation to this initial class, it is important to realize that Meteorological Office staff were divided between those who were recruited from the universities and the ordinary assistants, most of whom joined straight from school. Officially, the graduates were the forecasters and the rest were not. Regardless of what happened at outstations, the distinction rankled in the minds of many non-graduates, who, with their years of experience, knew how important they were in the functioning of outstations.

Boyden appealed to the students to maintain an open and friendly relationship with each other, saying that the success of the course depended on it. His words were heeded. The response of the students was, Boyden said, "magnificent". As he pointed out, they were aware their careers depended on their success on the course.

Croydon Airport did not remain the home of the training scheme for long. Aircraft engines were tested for an hour or more almost every day in a nearby hangar, so that lecturing and study were

[8] An account of the work carried out by Davies and other members of the team was published in 1938 by Frank Entwistle, in a paper entitled 'Atlantic flight and its bearing on meteorology', in the *Quarterly Journal of the Royal Meteorological Society* (Vol.64, pp.355-389). When the work was carried out, Entwistle was Superintendent of the Overseas Division.

[9] Professor Van Mieghem, a Belgian meteorologist, founded the World Meteorological Organization's Education and Training Programme in 1965.

impossible. Boyden and his colleagues and students moved in February 1937 to rooms above a Lyons tea-shop close to South Kensington station. Meanwhile, some of the newly-recruited graduates who had formed the Training and Special Investigations Section of the Overseas Division had completed their studies and proceeded to outstations. By and by, in the summer of 1937, Peters and three of the graduates transferred to Foynes in western Ireland and another, Patrick Meade, to the flying-boat base at Hythe near Southampton, these being the places from which Imperial Airways and Pan American Airways intended to operate transatlantic flights. Boyden and his assistants remained in London, continuing to train staff of the Office who were graduates and those who were not.

By the summer of 1937, the Irish Free State had its own meteorological service, established on 1 April that year and directed by Austen Nagle, who had previously been a Technical Officer in the Naval Division of the Meteorological Office. According to the minutes of the Meteorological Committee's meeting on 7 July 1937, however, Valentia Observatory and the transatlantic base at Foynes continued to be run by the Office, on an agency basis, with the salaries of staff recovered from the Irish Free State. Technically, therefore, Peters and his team were seconded to the Irish Meteorological Service.

The Training School remained at Berkeley Square House under Brunt and Sheppard until June 1940 and then, in the autumn of that year, transferred to Barnwood, on the outskirts of Gloucester, with Boyden in charge. Brunt returned to Imperial College and Sheppard remained with the Office, first to take charge of meteorological services concerned with civil defence and later to organize and administer the Office's programme of upper-air observations in the European Theatre and elsewhere. From 1940 onwards, according to Hannah Gay, in *The history of Imperial College London, 1907-2007* (Imperial College Press, 2007, p.247), Brunt "appears to have carried out a number of secret missions, mostly across the Atlantic". Imperial College records show that his salary was paid by the Government for almost the entire duration of the war.

CALL FOR PAPERS
RULING CLIMATE: THE THEORY AND PRACTICE OF ENVIRONMENTAL GOVERNMENTALITY, 1500-1800

'Ruling Climate' aims to explore the relationship between cultural perceptions of the environment and practical attempts at environmental regulation and change between 1500 and 1800. The conference will be held at the **University of Warwick on 16 May 2015**. Submit proposals by 10 December 2014.

In the early modern period, the environment became a privileged locus of scientific debate and governmental action. Discussions spread across Europe and its colonies as to how to improve the land, and possibly even the climate of a given place; practical efforts were made to enhance the healthiness, productivity, and overall pleasantness of the environment (both natural and built) in the belief that environmental 'improvement', as it was then called, would immediately bring about human improvement – a larger, healthier, happier population that would make the country more powerful. Such debates and practices were driven by a persistent belief in the influence that landscape, weather and climate would exert on human beings, both at a physical and a spiritual level. 'Climate theories' – first advanced by ancient authors such as Hippocrates, Plato, Aristotle and Ptolemy – remained a popular explanatory paradigm throughout the early modern period, actively dictating trends in environmental management, social governance, and the administration of both private and public health, as well as shaping colonial attitudes to foreign climates and peoples. Yet the period between 1500 and 1800 was also one of substantial intellectual, scientific, and technological change in which new conceptions of nature, climate, and weather were developed. The human footprint on Earth grew heavier, whilst the first moves towards conservation and sustainable resource management were made. Finally, it was in this period that changing climatic patterns were observed for the first time, partly because of a cooling trend that reached its peak around 1650 (the so-called Little Ice Age).

'Ruling Climate' aims to investigate this complex of problems in an interdisciplinary fashion, focusing particularly on three central research questions:

1) continuities and discrepancies between ancient and early modern climate theories: how were

classical theories of climatic influence received and adjusted to new contexts in the early modern period? How did the understanding of climate itself change over time?

2) climate theories and 'eco-governmentality': how did climatological ideas inspire and sustain governmental efforts of various kinds, at both a domestic and a colonial level? e.g. the displacement of populations, environmental planning in connection to public health issues, engineering works, choice of specific sites for new colonies, etc.

3) governed with climate / governing climate: what is the relationship between theories of climatic influence and the development of strategies to cope with / modify climate and the environment? e.g. through agricultural improvement, increased human settlement, draining of bogs and marshes, deforestation, etc.

We welcome abstracts for 20-minute papers from PhD students and scholars at any stage in their career. Papers from all disciplinary backgrounds are welcome, including environmental history, colonial history, intellectual history, historical geography, history of philosophy, history of medicine, history of science, history of political thought, history of technology. Please send a 200-word abstract (including your name, institutional affiliation and a provisional title) and a one-page CV to rulingclimate@gmail.com. Successful speakers will be notified in January 2015.

CALL FOR PAPERS

CLIMATE IN CULTURE CONFERENCE

University of Prince Edward Island, Canada

As climate change becomes arguably the most pressing issue of our time, with evolving implications for societies in every cultural context, we seek to enhance our understanding of the ways in which culture and climate intersect with and animate one another. Cultural responses to and representations of climate are particularly compelling at a time when catastrophic weather events are becoming more commonly manifest and are inspiring a wide array of cultural and interpretive responses. Paying particular attention to the cultural implications of climate and to cultural, political, and societal responses to climate change, this conference explores how humanities-based scholarship can be brought to bear upon the evolving reality of climate change. Conference events include keynote talks given by internationally-renowned climate and culture scholars, traditional academic papers and presentations, and a variety of interdisciplinary and multimedia performances. We thus invite submissions from scholars from across the humanities, broadly defined, who are dealing with any aspect of climate and climate change in a cultural context. The conference is hosted by the University of Prince Edward Island, home of the Atlantic Climate Lab and the Institute of Island Studies. Prince Edward Island is known for its breath-taking natural beauty and charm, thus making it an especially apt location for a conference on climate change and its human implications. Please submit abstracts of 250-300 words to jmcintyre@upei.ca by January 5, 2015. For more on the conference, visit its website or its Facebook page.

HISTORY GROUP MEETINGS IN 2016

Apart from the meeting at Whitby in May 2016 (see page 7 of this newsletter), three other meetings are planned for that year.

- In March 2016, the first of two meetings on uses of ships for meteorological purposes, which will complement the meeting on Matthew Fontaine Maury which will take place on 15 April 2015 (see page 1 of this newsletter).
- In the autumn of 2016 in Exeter, probably on a Monday in October, a meeting on weather diaries, covering why people kept diaries, what can be gleaned from them and what their importance can be today for studies of, for example, climatic change. Some diaries will be on display.
- A 'Classic Papers' meeting, probably in Reading in November. If you have any suggestions for a topic, please get in touch with Malcolm Walker (whose contact details are on the last page of this newsletter).

IN THE NEXT NEWSLETTER …

… there will be a feature on Admiral FitzRoy, who died on 30 April 1865.

BAROMETER READINGS IN ABSOLUTE UNITS AND THEIR CORRECTION AND REDUCTION

This is the title of a substantial paper published 100 years ago by Ernest Gold, in the July 1914 issue of the *Quarterly Journal of the Royal Meteorological Society* (Vol.40, No.171, pp.185-201).

He began by noting that the decision of the Meteorological Committee [of the Royal Society, which then supervised the work of the Met Office] to use absolute units for the values of pressure published in the *Daily Weather Report*, and for daily charts, had made it necessary to consider the question of the correction and reduction to sea-level of the readings of the barometer.

He pointed out that it had been assumed "in the early days" that "a column of mercury of given length provided a good enough unit of pressure", but only "after many years" had it been realised that "the temperature of the column was an important modifying factor". Still later, he said, it had become apparent that "account must be taken of the variation of gravity over the surface of the earth". And thirdly, actual readings of barometric pressure needed to be reduced to sea-level.

Inches or millimetres as measures of pressure had now been abandoned, Gold said. The new units which had been adopted were multiples of the unit of pressure in the centimetre-gramme-second system, in which the unit of force was the dyne (not so named, he said, in honour of W.H.Dines, as some Fellows of the Society had suggested!). The unit of pressure was defined as unit force per unit area, this being the dyne per square centimetre.

"The dyne per square centimetre was", Gold noted, "a very small pressure, as pressures go". It was, he said, "too small to measure with a mercury barometer". A wind of Force 1 on the Beaufort Scale would, he went on, "produce a pressure equal to about 7 dynes per square centimetre on a plate placed at right angles to it", and "a sensitive observer might be able just to feel a wind giving a pressure of 1 dyne per square centimetre, but probably only if he wet his finger and turned it into a wet-bulb"!

Nevertheless, he said, "there were many good reasons in favour of the dyne per square centimetre as the base unit", and as long ago as 1888 a committee of the British Association had proposed the name 'barad' for it. And a congress of physicists in Paris in 1900 had proposed the name 'barye' for one million dynes per square centimetre. More recently, though, "certain chemists" had begun to use the name 'bar' for one dyne per square centimetre.

Rejection of 'bar' for meteorological work, Gold said, was mainly due to two reasons: (i) In upper-air work, pressures were now being expressed in megadynes per square centimetre, and (ii) Vilhelm Bjerknes had "brought out his book on *Dynamic Meteorology* at a critical time and used as his unit for atmospheric and hydrostatic pressure the megadyne per square centimetre, which he called the bar, with its submultiples the microbar, millibar, centibar, and decibar".

"As the question affects physicists, engineers and chemists, as well as meteorologists", Gold advised, "it is one which ought to be decided by some body or congress representative of all these". As the 'bar' defined as a megadyne per square centimetre had already been adopted in meteorology, he thought "it would be a little troublesome to disturb it".

To cut a long story short, the millibar was indeed adopted as the basic unit of barometric pressure in meteorology and has since been superseded by the term 'hectopascal' (with 1hPa = 1mb). The latter honours the name of Blaise Pascal, the pioneer of barometric pressure measurement.

The millibar, Gold said, was "not an academic unit unsuitable for everyday use". Rather, it was a unit in which we could express, "without a long row of noughts, the pressures with which we are daily in contact".

Gold went on in his paper to consider the practicalities of correcting barometers for temperature, altitude and latitude and, in so doing, with reference to the 'baromil' for the length of a column of mercury under standard conditions which would produce a pressure of one millibar, produced a diagram which could be used for reducing barometer readings for temperature, gravity and altitude. He also designed a scale which could be attached to a mercury barometer for making temperature corrections.

The paper is a *tour de force* but not an easy read. Enjoy!

RECENT PUBLICATIONS

BOWKER, D., 2014. 'Ice Saints and the Spring Northerlies'. *Weather*, Vol.69, No.10, pp.272-274.

BRETTSCHNEIDER, B. and TRYPALUK, C., 2014. 'Re-examination of the Alaska 1-day record rainfall'. *Bulletin of the American Meteorological Society*, Vol.95, No.8, pp.1249-1256.

BURNETT, W., HARPER, S., PRELLER, R., JACOBS. G. AND LACROIX, K., 2014. 'Overview of Operational Ocean Forecasting in the US Navy: Past, Present, and Future'. *Oceanography*, Vol.27, No.3, pp.24–31.

CAMUFFO, D. and BERTOLIN, C., 2013. 'The world's earliest instrumental temperature records, from 1632 to 1648, claimed by G. Libri, are reality or myth?'. *Climatic Change*, Vol.119, No.3-4, pp.647-657.

ABSTRACT: *In 1830, Libri announced the finding of a 16-year-long record of daily temperature observed in Florence, Italy, by Father Renieri before the activity of the Medici Network (1654 to 1670) that is usually considered the earliest instrumental series in the world. The Libri announcement was supported by the concurrent finding of a box with the early Little Florentine Thermometers that survived the Inquisition and was confirmed by Schouw, von Humboldt and Maxwell. However, all investigations made to find Renieri's observations were fruitless. This paper clarifies this complex situation differentiating between myth and reality. A careful analysis of the Libri's announcement in the historical context points out that Libri made the announcement while escaping for conspiracy from Florence and needed a scoop to be introduced in the French Academy of Sciences. For this reason he made a deliberate mix of new and old assertions, i.e. he claimed to have made new discoveries but without explaining too much and reporting misleading details about well-known stories concerning the earliest meteorological observations. This induced people to suppose that further, earlier records existed. The consequence of this was that climatologists searched for years the claimed records. This paper shows that the Medici Network almost certainly contains the earliest exploitable instrumental observations. The possibility of finding a short series of observations prior to 1654 is remote.*

CLARK, C., 2014. 'The great flood of 1726 at Bruton, Somerset'. *Weather*, Vol.69, No.9, pp.249-253.

DOMINGUEZ-CASTRO, F., TRIGO, R.M. and VAQUERO, J.M., 2013. 'The first meteorological measurements in the Iberian Peninsula: evaluating the storm of November 1724'. *Climatic Change*, Vol.118, No.2, pp.443-455.

ELSOM, D.M. and WEBB, J.D.C., 2014. 'Deaths and injuries from lightning in the UK, 1988-2012. *Weather*, Vol.69, No.8, pp.221-226.

FERNANDEZ-FERNANDEZ, M.I., GALLEGO, M.C. and DOMINGUEZ-CASTRO, F., 2014. 'The climate in Zafra from 1750 to 1840: history and description of weather observations'. *Climatic Change*, Vol.126, No.1-2, pp.107-118.

HE, M., YANG, B. and DATSENKO, N.M. 2014. 'A six hundred-year annual minimum temperature history for the central Tibetan Plateau derived from tree-ring width series'. *Climate Dynamics*, Vol.43, No.3-4, pp.641-655.

KENWORTHY, J.M., 2014. Albert Walter, OBE (1877-1972) – Meteorologist in the Colonial Service – Part II: First Director of the British East African Meteorological Service; First President, IMO Regional Commission No. I (Africa); Group Captain in the Second World War; and advisor on meteorology to the Groundnut Scheme'. *Occasional Papers in Meteorological History* (No.13, 55 pages) ISBN: 978-0-948090-36-3

LADURIE, E. Le Roy, JAVELLE, J.-P. and ROUSSEAU, D., 2014. 'Sur l'histoire du climate en France: le XIVe siecle'. *La Meteorologie* (8e Serie), No.86, pp.26-28.

PROBERT-JONES, R., 2014. 'The history of the first twenty-five years of radar meteorology in the United Kingdom'. *Occasional Papers in Meteorological History* (No.14, 44 pages). ISBN: 978-0-948090-36-3

ROCHAS, M.J., 2013. 'L'invention de la stratosphere'. *La Meteorologie* (8e Serie), No.82, pp.24-30.

SOUKUPOVA, J., 2013. 'Heavy storms in 1783 in a historical documentary record'. *Meteorologicky Casopis*, Vol.16. No.1, pp.11-18.

TOTH, G. and HILLGER, D., 2013. 'A philatelic history of climate change'. *Weatherwise*, Vol.66, No.4, pp.34-38.

WOODWARD, J., 2014. *The Ice Age: a very short introduction*. Oxford University Press, xvii+163pp. ISBN 978-0-19-958069-9

XU, G., LIU, X., QIN, D. *et al*., 2014. 'Tree-ring delta O-18 evidence for the drought history of eastern Tianshan Mountains, northwest China since 1700 AD'. *International Journal of Climatology*, Vol.34, No.12, pp.3336-3347.

SCANNED MET OFFICE MATERIAL

Increasingly, meteorological material is being scanned and made available online. Visit https://archive.org/details/texts, for example, and enter 'meteorology' as the search term. You will find a huge number of publications, including many 'classics', such as Lempfert's *Meteorology*, Brunt's book with the same title, Simpson's great works on the meteorology of Antarctica, *Meteorology* by Charles Wilkes (published in 1851) and much, much, much else. Indeed, you will find that most books, many pamphlets and a number of journals published before about 1940 have been scanned.

There are so many scanned publications online now that the list produced by searching for 'meteorology' is daunting. It contains hundreds of publications. You need to refine your search. If you search for 'Manual of Meteorology', for example, you will find all four volumes of Sir Napier Shaw's classic work, and if you search for 'Meteorological Glossary', you will find that the Meteorological Office's 1918 edition is available.

You may wonder what 'goodies' are available on the Met Office's website. Here is a list, supplied by History Group committee member Catherine Ross, who is the Archivist of the National Meteorological Archive, Exeter.

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The following are all available from http://www.metoffice.gov.uk/learning/library/publications-archive

- Met Office Synoptic Charts for 4 to 6 June and 18 to 21 June 1944 and their German equivalents from DWD (Deutscher Wetterdienst).
- Monthly Weather Report summary pages (front pages) January 1884 to December 1993.
- British Rainfall 1860 to 1991 (the name being used as a general term for the publication the name of which varied between *English Rainfall*, *Symons's British Rainfall*, *British Rainfall* and *Monthly and Annual Totals of Rainfall*).
- Daily Weather Reports for 1914 to 1918 and 1939 to 1945.
- *Snow Survey of Great Britain,* 1953 to 1992.
- *Forecasters' Reference Book* (M.O.1023), published in 1997.
- *Source Book to Forecasters' Reference Book* (M.O.1024), published in 1997.
- *Observers Handbook* (M.O.1028), Fourth Edition, reprinted 2000.
- *Marine Observer's Handbook* (M.O.1016), Eleventh Edition, published 1995.

The following items are also available online:

Meteorology for Mariners (M.O.895), Third Edition, published 1978: http://www.metoffice.gov.uk/archive/meteorology-for-mariners-3rd-edition

Quarterly Surface Charts of the Southern Pacific Ocean covering the period 1854 to 1952: http://www.metoffice.gov.uk/archive/MO435

M.O.509 Decode for Use of Shipping as 12 editions: http://www.metoffice.gov.uk/archive/decode-for-use-of-shipping

The Gods of War memo and the booklet 'D-Day and the role of the Met Office' are available at: http://www.metoffice.gov.uk/archive/national-meteorological-archive-hidden-treasures-d-day-operation-overlord

Register of Weather observations for British Antarctic Expedition 1911 – log for the Northern Party at Cape Adare for 27 Feb – 30 June 1911 only: http://www.metoffice.gov.uk/archive/british-antarctic-expedition-cape-adare

First published newspaper forecast: http://www.metoffice.gov.uk/archive/first-published-forecast-for-31st-July-1861

First weather chart published in a newspaper: http://www.metoffice.gov.uk/archive/first-weather-chart-for-31st-march-1875

These URLs were all active on 27 October 2014.

DID YOU KNOW …

… that there is a meteorological zoetrope in the Science Museum? Dating from *c.*1905, it shows the motion of air in travelling storms and was made by Dr (from 1915 Sir) Napier Shaw, who was in charge of the Meteorological Office from 1900 to 1920 (with the title of Director from 1905).

The Science Museum also has a sea aneroid barometer with dial designed by Napier Shaw and five models of atmospheric circulation patterns (one damaged) thought to have been constructed by Sir Napier at Cambridge around 1920.

TWO NEW OCCASIONAL PAPERS

Since Newsletter No.2, 2014 was published, two more of the Royal Meteorological Society's Occasional Papers on Meteorological History have appeared, No. 13 in August 2014 and No.14 in October 2014. Here are details. Both are online, via *http://www.rmets.org/publications/occasional-papers*

OCCASIONAL PAPER No.13, 55 pages

ALBERT WALTER, O.B.E. (1877-1972)
Meteorologist in the Colonial Service

Part II
First Director of the British East African Meteorological Service, First President, IMO Regional Commission No. I (Africa), Group Captain in the Second World War and advisor on meteorology to the Groundnut Scheme

by Joan M. Kenworthy

Published by
The Royal Meteorological Society's
History of Meteorology and Physical Oceanography
Special Interest Group

AUGUST 2014
ISBN: 978-0-948090-36-3

OCCASIONAL PAPER No.14, 44 pages

THE HISTORY OF
THE FIRST TWENTY-FIVE YEARS OF
RADAR METEOROLOGY
IN THE UNITED KINGDOM

by Richard Probert-Jones

Published by
The Royal Meteorological Society's
History of Meteorology and Physical Oceanography
Special Interest Group

OCTOBER 2014
ISBN: 978-0-948090-38-7

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THIS IS <u>YOUR</u> NEWSLETTER

Please send comments and contributions to:
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💻 MetSocHistoryGroup@gmail.com

The next newsletter will be published in late February 2015. Please send items for publication to Malcolm Walker by 15 February 2015.

Malcolm would particularly welcome reminiscences of life in the Met Office (at home or abroad) in the 1950s, 1960s and 1970s, also recollections of meteorological activities in universities, research institutes or the services (at home or abroad) in those decades. He would also welcome comments and letters for publication.