History of Meteorology and Physical Oceanography Special Interest Group

Newsletter 3, 2009

A VIEW FROM THE CHAIR

In the February 2004 issue of *Physics World* (pp.14-15), Werner Marx and Manuel Cardona (of the Max Planck Institute for Solid State Research, Stuttgart) asked why scientists were so obsessed with recent publications, often at the expense of older work.

They suggested a possible explanation was that the number of papers published every year in the natural sciences had increased by a factor of between two and four since 1974. Thus, there were many more new papers to read now and there was even less time than before to re-read older papers. The Web, they pointed out, had also increased the pace of the publishing process and the volume of material published. It was obviously important, they agreed, to stay up to date with the latest research, but not at the expense of all the papers that had gone before.

They began their article with a question: How can the significance or usefulness of a scientific paper be measured? One way to do this was, of course, they said, to count the number of times a given paper had been included in the reference lists of other papers. However, they went on, the number of citations cannot easily be equated with the overall significance or usefulness of a paper, something that was true for recent papers (the long-term significance of which may not yet be clear) and also for many older papers (that were not now cited because their results were so well known that their results appeared in textbooks). It would be easy to theorize and speculate about these matters, they said, but there was a much more satisfactory way to proceed: as was always the case in physics, the best way to make progress was to collect and analyse data.

Marx and Cardona looked at papers from the time of Newton to the present day, focusing on the pre-1900 and pre-1930 periods but also exploring more recent trends. Since 1974, they found, only about 0.5% of the references in papers in all fields of science had been to articles published before 1900, and about 4% had been to papers published before 1950. When the 'age distribution' of the references to all the papers published in a particular year was plotted, the peak tended to be three years previously. The research of Marx and Cardona showed considerable variation between subjects, with engineers much less likely to cite older papers than geoscientists.

In physics, Marx and Cardona found, the first authors of pre-1900 papers cited most since 1974 were Lord Rayleigh (with 2,163 citations) and James Clerk Maxwell (with 1,345). The first author of pre-1930 papers cited most since 1990 was Albert Einstein, with 3,025 citations, nearly twice the next most cited author, Peter Debye (1,592). Lord Rayleigh was still high up the list, in fifth place, with 1,503 citations.

Which old papers have been cited most in meteorology and physical oceanography in recent times? Here's a project for someone. Would anyone care to undertake it? If so, please get in touch with me and I shall send you a copy of the article by Marx and Cardona. Would Hadley's classic of 1735 come top of the list? And where in the list would the papers of the Bergen School of Meteorology on the polar front theory of depressions come?

Malcolm Walker, History Group chairman

CONTENTS

CONCERN OVER CLIMATE CHANGE!

We can see from a book published in 1866 that concern over climate change is nothing new. The book was compiled by Andrew Steinmetz and called *A Manual of Weathercasts: comprising prognostics on land and sea; with an explanation of the method in use at the Meteorological Office* (George Routledge and Sons, London and New York, 208 pages). We find the following on pages 129-132:

Clouds – rain clouds – are attracted to certain localities more than others; and probably Nature's conductors are the points of the leaves of all vegetation, particularly trees; and hence, to the cutting down of trees in civilized countries may be traced their ultimate sterility – such as the present sterility of the once most fertile but now desert regions of Syria, Chaldea, and Barbary. The famed "oases of the desert" are due to the circumstance of a few trees being accidentally suffered to grow on them. Such are the errors of selfish ignorance in depriving a country of its trees, and such are the advantages which may result from taking a hint from Nature in the principles of her philosophy, so as to make amends for interfering with her provisions. Should we not be able to prevent those disastrous droughts with which we have been of late years so often visited by erecting metallic conductors over the country, which would even be more effective than trees? Placed on elevated surfaces, a sufficient number of such conductors would arrest the clouds and produce sufficient rain to sustain vegetation, and refill the almost exhausted rivers in the most barren regions.

If we consider what railway cuttings, embankments, &c., may have effected in this way, certain physical phenomena of common experience may find their explanation. The network of railways in England intersects it in almost every direction, in many cases, as in certain parts of the metropolis, opening out dens of vice, poverty and pestilence; in others, forming the most effective mode of drainage; and certainly everywhere permitting a greater permeation of the air laterally or sideways through the soil – thus promoting its fertility by securing one of the essential conditions of the latter. Water, however, may be got rid of too completely; and, judging from the late successive droughts, it is by no means superabundant in Britain.

The positive amount of heat or caloric must have been very largely increased by railroads. Several times every day and every night the glowing fire of the steam-engine, like huge warming pans, is passed through the sheet of air along the surface. We have thus out-of-door fires perpetually kept up, warming the country at large; and the resulting increase of temperature must be something very considerable. … That we no longer experience winters so severe as formerly, in fact, that mild winters like the last, and hot summers like the last, are the rule, is a matter of notoriety. Habitually we pass through "the cold zone" of the earth's orbit without much inconvenience. Is it an error to ascribe this change to the influence of our network of railways and their constant fires?

Moreover, the railways may be considered huge winnowing machines, perpetually fanning and agitating the air with prodigious power throughout the length and breadth of the land – ploughing the air, as it were, causing waves of vast extent, which, invisibly enlarging, like the waves of the ocean, probably meet each other, clash, and produce modified effects as resultants from adverse motions. From all these causes it is not improbable that the mean annual temperature of England has increased, and that our railroads have changed or modified the climate. Physical causes must produce physical effects. The space actually subjected to this continual influence of heat and rapid agitation of air in all directions to and fro is not much less than fifty-three millions of miles!

At this point, Steinmetz added a footnote:

Since writing the above, we find that Mr.Glaisher has announced the positive increase of the mean annual temperature of England in the last hundred years as 2°F – there being an increase also during the last twenty-five years to 1863 – that is, we may observe, during our increased railway expansion. According to Mr.Glaisher, it is especially our winter months that have had their temperature raised; and this fact forcibly indicates the change of our climate, for it is on the winter of a country that its climatic characteristics depend. Mr.Glaisher has proved this increase of temperature to be progressive – as we inferred, and we ascribe it mainly to the causes we have mentioned – the vast increase of heat by railways, to which we must add that of the manufactories, so immensely expanding on all sides. Old England, far from being chilled, is getting warmer with age!

These ideas may seem curious to us now but we should not scoff at the misconceptions of our meteorological forebears. How many of our currently-cherished concepts will meteorologists of the future consider curious?

JEHUDA NEUMANN PRIZE 2009

This year's Jehuda Neumann Memorial Prize was awarded to Dr Dennis Wheeler of the University of Sunderland's Geography Department. As is clear from the citation, he was a very worthy winner of the prize:

> *Over the past quarter of a century, Dennis has established an international reputation as a meteorological historian.*
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> *He has published in* Weather*,* Climatic Change*,* Marine Observer*,* Meteorological Magazine*, the* International Journal of Climatology*, the* Journal of Meteorology*, the* Scottish Geographical Magazine *and* Ocean Challenge *numerous papers concerned with the history of meteorology. Some of them have mirrored a style of paper very much favoured by Jehuda Neumann himself, that is to say detailed analyses of the significance of the weather in historical events. They include Dennis's studies of weather influences on the Waterloo campaign and the Battle of Trafalgar.*
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> *Dennis is especially well known for his work on meteorological observations in the logbooks of sailing ships and the importance of these observations in respect of climatic variability and climatic change, with particular reference to the production of the* Climatological Database for the World's Oceans, 1750-1850 *(CLIWOC), an EU-funded project in which he was a leading participant. He has also advanced knowledge and understanding of the antecedents of the Beaufort Scale of Wind Force and written about lesser-known meteorologists and weather observers of the past, such as Thomas Backhouse and Margaret MacKenzie.*
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> *In addition, Dennis has spoken at meetings of the Royal Meteorological Society's Special Interest Group for the History of Meteorology and Physical Oceanography and is currently a member of the Group's committee. He has long led the North-East Centre of the Royal Meteorological Society and spoken at meetings of the Centre on topics concerned with meteorological history. He is also a member of the Editorial Board of* Weather*.*

The prize was presented by Professor Julia Slingo OBE, President of the Royal Meteorological Society, and Malcolm Walker, Chairman of the History Group, at the Royal Meteorological Society's Awards Dinner held at Mapledurham near Reading on 1 July 2009.

Previous winners of the Neumann Prize have been:

1995 – Robert Marc Friedman
1997 – Dick Ogden
1999 – John Kington
2001 – Malcolm Walker
2003 – Jane Insley
2005 – Anita McConnell
2007 – Oliver Ashford

Dennis Wheeler with
Julia Slingo and Malcolm Walker

NEW OCCASIONAL PAPER

Occasional Paper No.9 was added to the website of the Royal Meteorological Society in August 2009. Called *'An experimental measure' – The first meteorological office at South Farnborough and the Meteorological Office Radio Station, Aldershot, January 1911 to December 1918*, it was written by Brian Booth.

The paper is available online only. See:

http://www.rmets.org/pdf/hist09.pdf

If, however, you do not have internet access and would like a copy of the paper, please contact Malcolm Walker, 2 Eastwick Barton, Nomansland, Tiverton, Devon, EX16 8PP.

A FORGOTTEN JOURNAL OF THE ROYAL METEOROLOGICAL SOCIETY?

Come clean! How many of you can understand papers published in the *Quarterly Journal of the Royal Meteorological Society* these days? For most of us, the papers have over the years become more and more abstruse; and that is true too of other meteorological journals that publish state-of-the-art contributions to our subject. Fortunately, our Society publishes *Weather* to help redress the balance; and other popular magazines are published around the world (for example, *Weatherwise*).

The problem of the Society's premier journal being beyond most members of the Society is not a new one. This is what C.J.P.Cave had to say in his 1925 Presidential Address (for the 75th anniversary of the Society), delivered on 21 January 1925 and published in the *QJRMetS* (1925, Vol.51, pp.67-76):

> *In glancing through the papers read before the Society in those days [1900], which seem not so long ago to the older of us, but of a different age to the younger, one is struck by the fact that many of the papers deal with climatology or descriptions of outstanding phenomena; physics and mathematics had not taken possession of our science as they have today; it was still the science of FitzRoy, and by the more exacting it was hinted, and more than hinted, that it was no science at all, and indeed it may almost be said that forecasting retains some of the characteristics of an art to this day. The real beginning of modern meteorology was upper air research, which in its turn necessitated dynamical meteorology. … Meteorology, originally a pleasant pursuit for people of leisure living in the country, has been completely changed by the advent of dynamical meteorology. …*
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> *We have to rely on a large number of amateurs to recruit our membership. In former times the amateur formed the backbone of all learned societies, but for most of such nowadays the position is reversed. … The amateur of today has not the training to enjoy a great number of the papers which he comes across in the journal of his society – I speak feelingly – and there is thus a tendency for him to drop out and leave the society to his more advanced brethren. In other societies this does not so much matter; the more advanced are there in abundance. In our Society it matters a great deal, for we have perforce to rely on the amateur for the bulk of our membership.*
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> *We cannot go back and make the* Journal *merely a pleasant account of meteorological phenomena; we must keep abreast of the subject, and more and more must advanced mathematics and physics find a place in its pages. But we must at the same time see that the* Journal *contains a great deal of attractive reading for the less advanced members. We must solve the difficulty somehow if we are to retain our present membership, and the solution ought not to be unattainable.*

In his 1925 Address, Cave did not put forward a solution to the problem of the *Quarterly Journal* becoming too technical. But all was revealed in his 1926 Address (*QJRMetS*, 1926, Vol.52, pp.127-130):

> *Perhaps the most important thing that has occurred in the Society in the past year is the reorganization of the* Journal*. As I mentioned in my last year's address the question of the* Journal *is a difficult one. We have to keep up to date in our publications, and in consequence we have to publish a good many papers which are rather hard for the average Fellow to understand. I am not casting any aspersion on the average Fellow; I admit frankly that many of the papers that have been published in the* Journal *are not of a kind that I can understand, even with the most careful reading. We should rejoice that this is so; it shows that we have a number of Fellows who are able mathematicians, and that our* Journal *has such a high standard that they are glad to put forward their views in our pages. But there is another side to the question; the majority of our Fellows, many of whom live far from London, and some far from England, find, as I do, that the* Journal *is sometimes rather stiff reading, and the* Journal *is all they get in return for their support of the Society.*
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> *Well, I hope that all these difficulties have been overcome. We have had a gift from several Fellows of the Society, which is to be continued for five years, towards the expenses of the* Journal*, in order to make it more interesting to the average Fellow. We have had also a grant of £150 through the Royal Society from the Government Publication Grant to assist us in the publication of papers of a highly technical nature, and have been able in consequence to arrange that the Society should have two separate publications: firstly, the* Quarterly Journal*, which we hope may become of far greater interest than it has been to Fellows who cannot follow advanced*

mathematics; and secondly, a series of Memoirs *which will contain papers of a highly technical nature. A copy of the first published memoirs will be sent to all fellows, but afterwards they will only be sent to those fellows who ask for them.*

In the *Report of the [Society's] Council for the Year 1925* (*QJRMetS*, 1926, Vol.52, p.178), it was recorded that a Committee had been appointed by the Council in 1924 "to consider what steps should be taken in order to widen the appeal of the Journal among the Fellows of the Society". This Committee had reported in 1925 and, as a result, Mr R.G.K.Lempfert had been appointed Honorary Editor. The £150 mentioned by Cave had "enabled the Council to provide additional assistance in the preparation of the Journal", and the 1925 *QJRMetS* had been "the largest ever issued", 442 pages, exclusive of the *Bibliography of Meteorological Literature*, which had been published separately. Arrangements were now being made for the publication of the more technical papers in a series to be known as *Memoirs of the Royal Meteorological Society*.

In the *Report of the Council for the Year 1926* (*QJRMetS*, 1927, Vol.53, p.152), it was stated that in spite of the publication of five important scientific papers as *Memoirs*, the *Quarterly Journal* for 1926 had been the largest on record. Moreover, as it was put in the *Report*:

The Council are indebted to three Fellows who have for the second time placed at their disposal a sum of £150 in aid of the publication of the Journal*. The Council made application again this year to the Royal Society for a second sum of £150 from the Government Publication Grant, and are glad to report that the request has been granted. Two amounts of £150 each, for 1925 and 1926, have now been received, and are both shown in this year's accounts.*

It was noted in the *Report of the Council for the Year 1927* (*QJRMetS*, 1928, Vol.54, p.111) that the policy of making the *Quarterly Journal* more attractive to the general body of Fellows and publishing the more technical papers in the *Memoirs* had met with widespread approval. A further sum of £125 had been received from two generous Fellows and another £150 had been granted by the Royal Society.

Concern over the technical difficulty of papers in the *Quarterly Journal* was not new in 1924. It had been expressed at a Council meeting as early as 20 October 1920 and the importance of retaining both professional and non-professional members then stressed. Subsequent to that Council meeting, R.H.Hooker, President for the years 1920 and 1921, set out at great length in a discussion paper for Council the Society's financial position and indicated that the increasing technical difficulty of the *Quarterly Journal* was a threat to the Society through its detrimental effect on retaining members. The minutes of the Special Journal Committee shed more light on the deliberations which led to the introduction of the *Memoirs*. These minutes are in the National Meteorological Archive, along with a copy of Hooker's paper.

In all, forty papers were published in the *Memoirs*, in four volumes, each containing ten papers. The first paper was published in early 1926. By L.F.Richardson and D.Proctor, on "Diffusion over distances ranging from 3 km to 86 km", it ran to eight pages, plus fifteen diagrams. The last paper, on "Correlations between monthly rainfall at eleven stations in the British Isles", was published in 1939, by D.A.Boyd of the Rothamsted Experimental Station's Statistical Department. It was accompanied by a note which read as follows:

The present Memoir*, No.40, concludes the series of* Memoirs*. It appears to be more useful for reference if all papers published by the Society are included in the* Quarterly Journal*, and this practice will be followed in future.*

After World War II, the Royal Meteorological Society introduced the magazine *Weather* to cater for the needs of weather hobbyists, amateurs, non-professional meteorologists, call them what you will. For the story of how *Weather* began, see the 2009, No.2 issue of this newsletter. As the years have gone by, the *Quarterly Journal* has become more and more technical and, at the same time, ever more respected as a meteorological journal at the cutting edge of the subject.

The *Memoirs the Royal Meteorological Society* are now largely forgotten. However, they contain important papers by the foremost meteorologists of the day: L.F.Richardson, Sir Napier Shaw, Sir Gilbert Walker, Sir George Simpson, C.K.M.Douglas, Sir David Brunt, C.E.P.Brooks, V.W.Ekman, S.Chapman and G.I.Taylor. To read some of these classic meteorological papers, see:

http://www.rmets.org/about/history/classics.php

STORM WARNINGS FOR SEAFARERS
by Malcolm Walker

A violent storm in October 1859 changed the course of meteorological history.

The Meteorological Department of the Board of Trade came into being on 1 August 1854, with Captain (later Admiral) FitzRoy at the helm.

Before long, weather observations from ships at sea and places on the coast and inland were flowing into the Department, and FitzRoy made use of them to construct synoptic charts. These enabled him to study weather patterns and thus show, by intelligent interpretation of the atmospheric conditions occurring at places upstream, that changes in the weather at any given station could be foretold (or, as he preferred to call it, 'forecast'). Soon he was making weather forecasts, which he shared with the staff of his Department.

The next stage in the development of the Department was obvious to FitzRoy. If warnings of storms were issued to seafarers, the heavy loss of life in shipwrecks around the coasts of the British Isles might be reduced. But it was not within FitzRoy's brief to issue such warnings. The Meteorological Department's *raison d'être* was officially to improve ocean climatology and thereby help seafarers operate their ships more safely and efficiently. The Department's function was largely commercial.

In France, daily weather bulletins for seafarers had been produced at Paris Observatory since July 1856 by the distinguished astronomer Urbain Jean Joseph Le Verrier and his staff, though forecasting of the weather had not been attempted. And in The Netherlands, Christoph Buys Ballot was by the late 1850s exploring ways and means of publishing telegraphic weather reports and issuing storm warnings to seafarers.

FitzRoy decided that an operational storm warning service for shipping ought to be provided by his Department, making use of the electric telegraph to gather observations from weather stations and communicate warnings to ports and harbours. To this end, he enjoyed some support from the scientific community, notably from Sir John Herschel, whom he consulted over the soundness of his idea. In September 1859, moreover, at the Annual Meeting of the British Association, held at Aberdeen, the Association's Council passed a resolution "praying the Board of Trade to consider the possibility of watching the rise, force and direction of storms and the means for sending, in case of sudden danger, a series of storm warnings along the coast". [1]

Tragically, attention was soon to be focused upon the need for such warnings.

In the early hours of Wednesday 26 October 1859, the auxiliary steam clipper *Royal Charter*, 58 days out from Melbourne and bound for Liverpool, was driven ashore by winds of almost hurricane force and totally destroyed on the north-east coast of Anglesey, near Moelfre. Only 39 of the almost 500 on board survived.[2]

The enquiry could establish no particular cause for the disaster. The *Royal Charter* was a well-found iron ship, launched in 1855. There were excellent instruments on board, including three barometers. Her engines were running when

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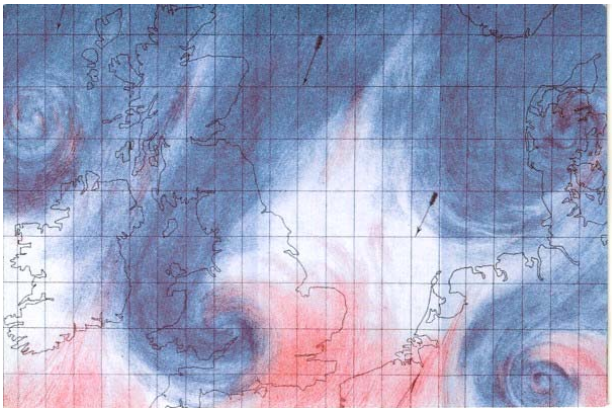
[1] *William Marsden (the 'Marsden Squares' man) appears to have been the first to conceive the idea of storm warnings, in the first decade of the 19th century. His project failed, however, for lack of support. In the 1830s, Captain Alexander Bridport Becher (not to be confused with Beechey) tried to introduce a system whereby storm warnings were issued to shipping and advice given to seafarers. His initiative came to nothing, too, for lack of means. The Netherlands was the first country in Europe to operate a weather forecast and storm-warning service. Buys Ballot first published telegraphic weather reports in 1859 and first issued storm warnings on 1 June 1860, basing them on observations made at Helder, Groningen, Flushing and Maestricht. He commented that "it was unfortunate that those telegraphic warnings were not introduced four days sooner, for in that case the first communication would have been a first warning against the fearful storm of May 28, 1860, called the 'Finster-storm'". By 1863, observations were also received from Paris, Havre and Brest in France and from Hartlepool, Yarmouth, Portsmouth and Plymouth in England. However, as Buys Ballot noted, they generally arrived too late to be of much use in forecasting.*

[2] *The exact number on board is not known, as the passenger list was lost in the wreck. When she arrived at Queenstown (now Cóbh), southern Ireland, on 24 October, the* Royal Charter *had on board 112 crew and about 390 passengers. Of the passengers, fourteen disembarked, their destination Ireland. In addition, a man went ashore to conduct some business and the ship left without him. Off Bardsey Island, eleven riggers in search of a speedy return passage to Liverpool were taken aboard from a tug. Thus, the number on board* Royal Charter *was probably 498. For a vivid account of the* Royal Charter *disaster, see* The Golden Wreck *by Alexander McKee (London: Souvenir Press, 1961, 221 pp.).*

she ran aground, and there appeared to be nothing wrong with her sails. True, there were many other wrecks that night, but ships which were much less seaworthy than the *Royal Charter* weathered the storm. It is possible the captain wrongly anticipated changes in wind direction and force and sought shelter from a shore which he thought would be to windward but, in the event, proved to be to leeward.

Whatever the truth of the matter, FitzRoy was certain that a suitable warning system could have prevented the disaster, and he produced charts to show that the storm, which he called a 'complete horizontal cyclone', could easily have been tracked and its path predicted had the means existed.[3]



FitzRoy's analysis of the Royal Charter *storm (from his* Weather Book*, 1863). See also Booth, B.J., 1970,* Weather*, Vol.25, pp.550-553.*

FitzRoy's arguments in favour of barometers, storm warnings, better understanding of weather systems by seafarers and effective use of the electric telegraph received support from many quarters. For example, soon after the *Royal Charter* catastrophe, a correspondent (simply identified as E.G.R.) wrote as follows in *The Athenæum* (31 December 1859):

> *Many disasters at sea might be prevented if every vessel carried a marine barometer. Had the Commander of the* Royal Charter *attended to the warnings of the barometers on board, and struck yards, &c., and made all snug aloft, it is possible that that most fearful loss might have been avoided. Yet no coaster or fishing vessel ever carries a barometer! Ought it not to be made compulsory on all vessels to provide themselves with these instruments; and ought not the Board of Trade examinations of captains, mates, &c. to include a knowledge of their indications in various climates? Till this be done, I would suggest that barometers should be erected in public situations on shore, and a signal be devised (to be hoisted as required), signifying that the barometer indicated foul weather. This should be done at the various coastguard stations; and even our vessels of war, especially when in the Channel, should keep it flying, as a signal to craft in sight of them. These barometers should not be entirely donations. Part of the expense should be borne by the Board of Trade, - the other raised by small (say shilling) subscriptions among the class to be principally benefited and their employers. I believe that the sure way to render any movement unsuccessful is to make it wholly eleemosynary. Beachmen, fishermen, &c. who had contributed to the erection of a barometer would be interested in its preservation, and observant of its indications. A cheap book, explaining its construction and its indications in plain Saxon English, that could be understood by such people, should be published and sold to them.*

In his capacity as President of the British Association for the session 1859-60, the Prince Consort took a close interest in the matter, and so, too, did the Astronomer-Royal, Sir George Airy. In a letter dated 19 December 1859, from the Board of Trade to the Council of the British Association, and forwarded to Airy, the Board of Trade instructed FitzRoy to report on the use of the electric telegraph to warn ports of approaching storms and asked the Association to forward any suggestions to FitzRoy direct.

FitzRoy duly put forward proposals, and these were approved by the Association's Council at a meeting held at Buckingham Palace on 25 February 1860, the Prince Consort in the chair. FitzRoy proposed that Great Britain and Ireland be divided into three 'weather districts'. One of these, called 'North', would include all of Scotland, while 'East' would include the east coast of England as far as the Dover Strait. 'South-West' would include the southern and western coasts of England, as well as the southern and western coasts of Ireland. In each of these three districts, officers would be selected, instructed and provided with instruments. There would be three or four officers in each district, required to send "such

[3] *It is widely accepted that the Royal Charter Gale was the most violent storm of the century and probably comparable in intensity to the tempest of 26-27 November 1703 (6-7 December New Style), the most devastating storm to visit the British Isles in recorded history. For an account of the tempest and its effects, see* The Storm, 1703 *by Daniel Defoe (published in 1704).*

telegraphic messages to London *occasionally* as their instructions specify". The messages would be posted at Lloyd's and transmitted to other selected stations, where they would "likewise be conspicuously posted".

Justifying his proposal, FitzRoy explained to the Council that storms generally did not arrive unannounced. At Valentia, south-west Ireland, for example, gales were typically preceded by rough seas. Because the weather systems responsible for these seas advanced in particular directions, the time of arrival of gales at other places could be predicted.

As regards the cost of telegrams, FitzRoy pointed out that agency fees and the cost of supplying instruments to ships by his Department had been reduced. Accordingly, he suggested, the sum of £700 which had been saved from the amount voted for his Department could be used to defray the cost of telegrams. This was approved by the Board of Trade, and the rôle of the Meteorological Department as a storm-warning centre was officially authorized by the President of the Board of Trade under a minute dated 6 June 1860.

FitzRoy was not granted permission to issue weather forecasts, however. Authority was given for the existence of storms at one place to be announced by telegraph to other places, nothing more. The Board of Trade and the Council of the British Association were not in favour of attempting to foretell anything except the approach of storms known to exist elsewhere; and this was the position of Le Verrier too.

The Board of Trade was not convinced FitzRoy was able to forecast the weather correctly, as communications from the Board's Assistant Secretary, Mr T H Farrer, to FitzRoy show. As Farrer put it: "official timidity prompts us to question whether ... it might not be better ... to confine ourselves to registering and publishing facts, and leave foretelling the weather for a subsequent stage".

In reply, FitzRoy defended his forecasts, saying that "six months' trial would prove their character". "It had been found", he said, "from simultaneous observation that similar atmospheric pressure, temperature and weather prevailed over a much wider area than was usually supposed and that, by inter-comparison, changes and conditions might be foretold approximately". "It had been ascertained", he went on, "that atmospheric changes on an extensive scale were not sudden, and that premonitions were more than a day in advance, sometimes several days". "When a storm occurred", he added, "it was its own herald". To avoid compromising those in authority over him, he offered to initial the weather forecasts that he proposed to issue to *The Times* and the *Shipping Gazette*.

The President of the Board of Trade remained sceptical. He declined to authorize the issue of weather forecasts and wrote as follows to FitzRoy: "I don't see any objection to the collection of facts as to weather, posting them at Lloyd's and transmitting them to various ports and to Paris, but it appears to me that the Government cannot take the responsibility of drawing conclusions and foretelling the weather for the practical guidance of merchant shipping".

In a letter to FitzRoy dated 6 June 1860, Farrer asked if the warnings of storms he wished to give might not be provided through the medium of, or as a member of, the Council of the British Association. FitzRoy's reply, dated 9 June, suggests that the Council's views on the matter tended to mirror those of the Board of Trade. The Treasury took a different view, showing approval for FitzRoy's scheme by adding £500 to the estimate of the Meteorological Department for the year 1861-62!

The collection of weather reports by means of the electric telegraph began on 1 September 1860, with reports of shade temperature, wet-bulb temperature, wind force and direction, barometric pressure and state of the weather transmitted from thirteen coastal stations, these being at Aberdeen, Berwick, Hull, Yarmouth, Dover, Portsmouth, Jersey, Plymouth, Penzance, Queenstown (Cóbh), Galway, Portrush and Greenock. Observations were made once a day, at about 09:00 hours, and transmitted to the Meteorological Department in London, with the telegraph companies charging only for the cost of the telegrams and furthermore rebating them by one-third.

Telegraph clerks made the observations, making them as part of their regular duties. Though the observers were given no more by way of training than a printed list of instructions, and observing stations were apparently not inspected on any systematic basis, the reporting arrangements worked satisfactorily from the outset. The same arrangements worked satisfactorily in France, too, where telegraph clerks had made weather observations since 1856. Both FitzRoy and Le Verrier believed that the prompt and regular despatch of telegrams which resulted from the use of telegraph clerks

to make the observations was an advantage that outweighed any lack of meteorological knowledge on the part of the observers.

In America, where the electric telegraph had been used since the mid-1840s to send weather messages, it had been used since 1854 to supply weather reports each morning to the Smithsonian Institution. The reports were used by the Director, Joseph Henry, in collaboration with James Pollard Espy, to make predictions of the weather, and the first weather forecast in America appeared in the *Washington Evening Star* on 7 May 1857.

In early 1860, through the French Ministry of Marine and later in a letter to Airy, Le Verrier proposed an exchange of weather observations with the British. In return for observations from five stations in the British Isles, the French offered reports from any five places on the Continent. FitzRoy sought permission from the Board of Trade to accept the offer and this was granted, the expense of the telegrams to be covered by the £700 which had been approved.

Negotiations for the transmission of data from France began in April 1860 and the first exchange of weather reports took place five months later. On 14 September, as *The Daily Weather Report* for the day shows, reports were received from the original thirteen stations and also from Liverpool, London and Kew, which had by then been added to the British list. Reports were also received that day from Copenhagen, Helder, Brest, Bayonne and Lisbon. Two more British stations were added on 8 October 1860, these being at Valentia and Nairn, though several days elapsed before reports were received from the latter.

For a while, FitzRoy contented himself with merely receiving observations and passing them to the principal newspapers, which published them daily. Then, on 6 February 1861, he issued the first of his storm warnings to shipping, or, as he called them, 'cautionary signals'.

The warning for the Tyne was disregarded, with disastrous consequences. Many ships were wrecked and considerable loss of life occurred. However, greater heed was taken of the eight further warnings which he issued in the period 6 February to 19 March 1861. And in the fourth *Report of the Meteorological Department of the Board of Trade*, published in 1862, he claimed in justification of the warnings that very few ships had been wrecked on the coasts of the British Isles "during the notoriously tempestuous weather" of February and March 1861.

Warnings were sent by telegram to the place (or places) likely to experience inclement weather, each message containing a list of coastal stations affected, together with advice on the warning signal (or signals) to be displayed.

Near each of the telegraph stations in receipt of a warning, at a conspicuous point on the coast, a cone or drum or combination of the two was hoisted on a staff, the cones and drums being about three feet in height and made with hoops and canvas, the latter painted black. A cone with its point upwards warned of gale-force winds expected from the north, whereas a cone with its point downwards warned of a gale from a southerly direction. A drum alone showed that stormy winds from more than one quarter could be expected. A drum and cone together warned of dangerous winds, the point of the cone showing the direction of the wind expected to occur first.

South cone, St Anne's Head, Pembrokeshire, 17 September 1965

In the words of FitzRoy, each signal "will be repeated along part of the coast by the Coast Guard, at such of their stations as may be authorized (at most of their stations flagstaffs are visible to coasters)". At night, signal lanterns were hoisted, the equivalent of a cone being represented by a triangle formed by three lanterns, the equivalent of a drum being represented by a square formed by four. The lanterns were hung at least three feet apart. FitzRoy was careful not to use a spherical shape, to avoid confusion with time-balls.

So effective were the storm-warning signals that the system of hoisting cones and drums or the equivalent in lights was used at coastal stations for over a century. Only comparatively recently was the system superseded by electronic means of communicating storm warnings (on 1 June 1984 in the United Kingdom).

The British storm-warning service was suspended on 7 December 1866, but that is another story, which will be told in the next issue of this newsletter.

RIGHT FOR THE WRONG REASON? – A NEW LOOK AT THE D-DAY FORECAST by Anders Persson

If you wish to dispute anything in this article or comment in any way, please write to Malcolm Walker (address on the last page of this newsletter.

As a young meteorologist in the early 1970s, one of my heroes was Sverre Petterssen, the Norwegian-American meteorologist. In 1974 I had read his newly-published autobiography *Kuling fra nord* (Gale from the North) and was particularly thrilled by the chapters about the forecasting for D-Day.

About 25 years later, while researching the life of Carl Gustaf Rossby, I happened to find in the London telephone directory the entry "S.Petterssen". I dialled the number and got in touch with Sverre's English widow, Grace. An outcome of this contact, together with a lot of detective work by Norman A.Phillips and James R.Fleming, was that Petterssen's autobiography at last reached non-Scandinavian readers in 2001 (with the title *Weathering the storm: Sverre Petterssen, the D-Day forecast, and the rise of modern meteorology)*.

By then, I had started to doubt if Petterssen's account of the D-day forecast was the final and only version. Stagg's had presented a slightly different story and of course the American Irving Krick had quite the opposite view: the Americans had, thanks to their analogue technique, got it right almost a week or so in advance. During my Rossby research I got a letter from Krick in which he forcefully argued his version of the D-Day forecast and offered to pay if I phoned him up in California. For diplomatic reasons (I worked at ECMWF at the time), I never took advantage of the generous offer.

Among the many Veterans who supported my research into the history of meteorology was Adrian Gordon in Australia. By letters and later email we discussed everything from the best way to depict geostrophic adjustment to the D-Day forecast. According to Adrian, also stated in his auto-biography *Skywonkie* (1996), the D-Day forecast was "right for the wrong reason". I came to the same conclusion when I started to read the 22 June 1944 Memorandum on "Meteorological Implications in the selection of the Day for the Allied invasion of France June 1944" issued by J.M.Stagg and reprinted both in an American Meteorological Society publication ("Some meteorological aspects of the D-Day invasion of Europe 6 June 1944", *Proceedings of a symposium, 19 May 1984*) and in Stan Cornford's excellent 1994 booklet (*With wind and sword: the story of meteorology and D-Day, 6 June 1944*).

An appendix to the Memorandum contains a detailed documentation of the discussions between the three forecasting groups: Widewing (the Americans), Dunstable and Navy. From this and a confidential Air Ministry 1954 document AP1134 about the meteorological contributions to D-Day (declassified in 1989), it is possible to reconstruct the forecast maps with pressure centres and fronts as they were envisaged in June 1944. My *preliminary* conclusion, after having done this, is not only that Adrian Gordon might have been right and Petterssen and his group not quite right but that Krick and his group might not have been more in error than the others!

Five questions regarding the D-day forecast:

1. The forecast of the large-scale flow:

Throughout the discussions, Petterssen's group was rather devoted to the Bergen School model advocating frontal systems moving in a west-south-westerly flow. Their argument for delaying D-Day from 5 to 6 June was not, as it turned out, the strong north-westerly winds in a cool air mass, but the risk of low clouds and low visibility due to winds between west and south-west in an approaching warm sector. There was never any mention of the cool north-westerlies. The attention late in their outlook was towards an approaching warm front that was predicted to pass on the 7th of June but did not pass until the 9th (see chart on page 11). The risk of fresh north-westerly winds did not figure in the D-Day forecasts, rather winds between SW and W.

The change in weather type from mainly zonal flow to blocked flow around 4-5 June could not be forecast by the Bergen school linear concepts. As we know today, such highly non-linear events can be well forecasted only by computer models. Re-runs by Karl R. Johannessen ("Hindcasting weather for the Normandy invasion 40 years later", in "Some meteorological aspects of the D-Day invasion") with a barotropic model showed that the transition from zonal to blocked flow was partly a barotropic event, probably influenced by the upstream development of a strong cyclone ("down-stream development").

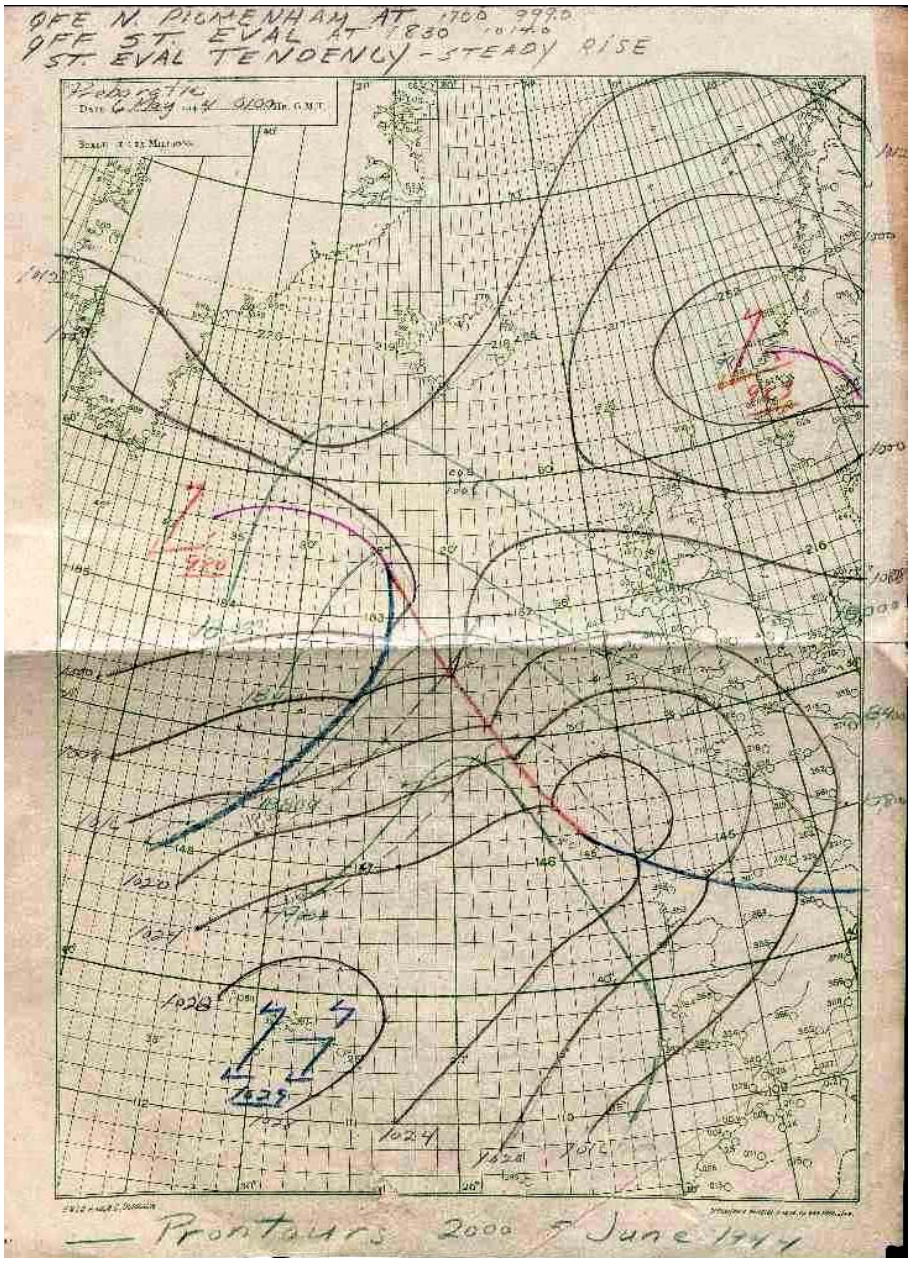
The non-linear transition could, however, to some extent emerge from an analogue system like Krick's. His technique did not provide the perfect forecasts he always claimed, but it indicated at an early stage that the high pressure system over the Azores might extend northwards and block the advance of further Atlantic depressions. What his group failed to notice was that this would also make the Low over Scotland stagnate in the "lee" of this ridge.

2. The forecast for D-Day

As far as I know, all the maps shown in the different accounts from D-Day are *analysed* weather maps. Shown right is a British forecast map I found in the National Meteorological Archive in Exeter, in the C.K.M.Douglas archive. It is valid on 6 June 1944 at 01:00 GMT[4], just a few hours before the Allied troops set their feet on the Normandy beaches. Its exact background is unknown, but since it is accompanied by forecasts of cloud conditions on a route from SW England to the south-west (not shown), it was obviously used for a briefing for one of the weather reconnaissance flights and obviously based on the agreed view at Dunstable. From the map, it is clear that the north-westerly winds over the English Channel are not expected to last long and might soon be replaced by increasing westerly winds, lowering cloud ceiling and worsening visibility, in line with the official D-Day forecast. The ridge from the Azores which here is assumed to extend to France actually bounced northward, blocking the approach of the frontal system, more or less as envisaged by Krick's analogue system.

3. The pocket of warm and moist air

In the early weather discussions there was talk about a pocket of unusually warm and moist air moving in the west-south-westerly flow over the Atlantic. It was this air that was feared to cause low clouds and bad visibility on 5 June. When the landing took place, this air had left the area, being sucked into the Low near Scotland. But, perhaps as a result of extra latent heat energy from this warm and moist air, the Scottish Low deepened even more, to become one of the deepest ever recorded over the British Isles in June.



[4] *It is misdated in the upper left as valid on 6 May at 01:00 GMT, a not too unusual error at the beginning of a month. The weather situation on 5 May was quite different, with a small Low over southern England.*

4. Was there an erroneous SHIP observation?

In the accounts by Stagg, Petterssen and the 26 June Memorandum there is mention of a sequence of erroneous reports from one of the weather ships south of Iceland on 4 June. I have not been able to identify these SHIP reports, nor do the contemporary real-time analyses by the UK Met Office, both in the National Archive and as depicted in the Daily Weather Report, which are quite skilful, indicate any problems of this kind.

5. The German weather analyses

Something that all previous accounts seem to have overlooked is the surprisingly high quality of the weather analyses made by the German meteorologists. For the period 2-6 June, the 00:00 GMT (2 Uhr) analyses in their daily *Tägliche Wetterbericht* provide rather accurate and day-to-day consistent mean sea-level pressure analyses all the way from Europe to Greenland and Canada (where the chart ends). There are no fronts, but kinks in the isobars indicate their assumed locations. The only exception is the 00:00 GMT analysis for 4 June, which looks as if it was based on no or scant observations, or even pure guesswork.

I said "surprisingly high quality" because the image we have of the working conditions of the German meteorologists is that they were cut-off from all weather information over the British Isles and in particular the North Atlantic (apart from some reconnaissance flights and occasional weather reports from their U-boats)[5]. But these analyses cannot have been made only from their own reconnaissance flights or U-boats. The Germans must have had access to decoded Allied weather information, not necessarily weather observations and upper-air soundings, but at least the Allied's meteorological overviews, in particular coded analyses and forecast maps. These might have been transmitted in relatively simple code that was easily breakable. *We know all about how the Allied cracked the German codes, but I am surprised that nobody has looked into how much the Germans cracked Allied codes.*

Outlook to the 2014 seventy year D-day celebration

For the next D-Day celebration in 2014 it would be nice to have a good re-analysis and re-forecast, including ensemble forecasts for the crucial days. There are upper-air observations archived from the USA all the way over the North Atlantic to the USSR and even (I think) China and definitely Japan. In the absence of upper-air information, modern analysis techniques have shown their skill in reconstructing upper air flow from surface observations. The main question to answer is the reason for the abrupt change in the flow pattern the days before the landing: was it due to the warm and moist air vitalising the Scottish low or the arrival up energy from the upstream cyclogenesis south of Greenland – or both?

[5] *Synoptic weather maps in the archive of the Swedish Meteorological and Hydrological Institute in Norrköping show that the Swedes frequently managed to decode German weather reports. For May and June 1944, the period I was able to look at during a very brief stay on 25 May 2009, Allied weather reports had not been decoded. However, on the maps there are observations from London probably supplied by the Swedish Embassy. The German Embassy in Dublin must have done the same!*

A CENTURY AGO
by Malcolm Walker

In this newsletter, we usually turn to the pages of the *Quarterly Journal of the Royal Meteorological Society* to find out what was happening in the world of meteorology one hundred years ago. This time, let us turn to the pages of *Symons's Meteorological Magazine*.

In the September 1909 issue (Vol.44, No.524, pp.141-144), we find an article by Carle Salter entitled "Mediæval Meteorology", in which he quoted extracts from Trevisa's translation of *De Proprietatibus Rerum* by Bartholomew Anglicus, a work first published about the middle of the thirteenth century. Here, for example, is an extract concerning rain.

> *Fumosities that are drawn out of the waters and off the earth by strength of heat of heaven are drawn to the nethermost part of the middle space of the air, and there by coldness of the place they are made thick, and then by heat dissolving and departing the moisture thereof and not wasting all, these fumosities are resolved and fall and turn into rain and showers.*

Mr Salter said that the extracts he quoted gave "some idea of the vague conceptions which held place in the esteem of our forefathers as the high-water mark of learning". However, as he commented, this piece about rain "appears to be moderately sound meteorology". Thus, he

contradicted himself to some extent, for in his first paragraph he had written: “The savant of the middle ages was wont to allow his imagination, and with it his pen, to run riot in the realms of conjecture, and to take wild plunges into the unplumbed deeps of the ocean of unexplained natural phenomena”.

Also in the September 1909 issue, on page 149, we find an article by P.P.Pennant called “Weather reports by a fruit tree”, in which he gave the date on which, each year, the first ripe peach was picked from a particular tree (‘River’s Early’) at his home in St Asaph, North Wales.

The October 1909 issue of *Symons’s Meteorological Magazine* (Vol.44, No.525) contains (pp.156-158) an article by Ernest Gold entitled “Meteorology at the British Association”, in which he referred to the “strato-sphere”, thus using a term only recently introduced to meteorology. This meeting of the British Association took place at Winnipeg, Canada.

Also in the October issue (p.169), there was a note which read as follows:

> *A Peeress who has been in the habit of purchasing a copy of* British Rainfall *every year has expressed her regret that, in view of the impending Budget of Mr Lloyd George, she is compelled to retrench by giving up the luxury of subscribing for the annual volume.*

What can we say?!

On page 162 of the October issue, we find a letter from G.L.Dashwood of Shenley, Hertfordshire, seeking explanations of “expressions that we often hear connected with rain:- Mist, Drizzle, Spitting, ‘Cats and Dogs’, Downpour”. A fairly lengthy reply concerning ‘cats and dogs’ was published in the November issue, on pages 182-183, from Basil T.Rowswill of Les Blanches, Guernsey, who had turned to Brewer’s *Dictionary of Phrase and Fable* for enlightenment. Brewer was sceptical of a suggested Greek origin from *cata doxas*, meaning ‘contrary to experience’ and offered the explanation that in Northern mythology the cat was supposed to have great influence on the weather and the dog was a signal of wind. The cat symbolised down-pouring rain and the dog strong gusts of wind, so that a rain of cats and dogs was a heavy rain with wind.

There were two articles about heavy rain in the autumn issues of *Symons’s Meteorological Magazine*. In the October issue (pp.159-161), there was an article on the heavy rainfall of 27-28 September 1909 which produced great floods in Wales. In the November issue (pp.175-179), there was an article about the heavy rainfall of 26-28 October 1909 in southern England, when as much as six inches of rain fell at Ramsgate in the three days and more than five inches fell at a number of places, including Folkestone, Broadstairs and Brighton.

Finally, we may note that there was a two-part article by R.H.Curtis on “The standardization of sunshine recorders”, with the first part published in November (pp.187-191) and the second in December (pp.204-206).

ANNUAL GENERAL MEETINGS

We asked in the last newsletter if you thought the History Group should hold an Annual General Meeting.

There is nothing in the By-Laws or Standing Orders of the Royal Meteorological Society that requires the Group to hold one, nor does Charity Law require one.

- It is sufficient for the Group’s committee to approve accounts prior to forwarding them to the Society for incorporation in the Society’s annual financial statement. A summary of the accounts can be published in the newsletter.
- It is sufficient for the Chairman’s Report to be published in the newsletter.
- So far as committee membership is concerned, it is sufficient for nominations to be invited through the newsletter.
- The Chairman must be either a Fellow or an Associate Fellow of the Royal Meteorological Society and his/her appointment should be approved by the Society’s Council (but approval has not in practice been sought or required in the past).
- Comments/ideas from Group members can be solicited through the newsletter.

No-one has yet responded in favour of an AGM. If you think one should be held, please let us know as soon as possible.

WHO SAID THIS?

Don't knock the weather. If it didn't change once in a while, nine out of ten people couldn't start a conversation.

Answer on page 23.

THE GREAT DEPRESSION OF THE 1930s by Malcolm Walker

In these days of economic recession, we may wonder how the Royal Meteorological Society coped in the Great Depression. To find out, let us turn to the annual reports of the Society and begin with the one for 1930, published in the 1931 volume of the *Quarterly Journal* (Vol.57, pp.182-195).

We find in this report no indication of concern over the Society's finances. Indeed, the debt on the Society's premises was reduced by £300 in 1930[6]; and the number of Fellows rose from 725 to 762 during the year. The lack of concern over the finances may not be surprising, given that economic optimism persisted for some time after the collapse of the US stock market (which occurred on 29 October 1929). The worst of the economic crisis was yet to come.

We find a less than happy story in the report for 1931, which was published in the 1932 volume of the *Quarterly Journal* (Vol.58, pp.179-191). In the very first paragraph, we read:

> *The general financial stringency has been reflected in a smaller number of Candidates seeking election and a larger number of resignations. Many of these latter were definitely caused by enforced economy and the Council hope that when the financial situation is easier Fellowship will be taken up again. All Fellows are strongly urged to interest others in the Society, wherever possible, and to induce them to take up Fellowship.*

The number of Fellows fell from 762 to 722 in 1931 and the accounts show that expenditure exceeded receipts by £332 during the year (in a turnover of £3,015). A particular disappointment was that the Council had been "unable to report a contribution this year towards the cost of publications from the Government Publication Fund, from which valuable assistance has been received in recent years".[7]

We find in the minutes of the Society's Finance Committee further evidence of concern over the financial position; and ways and means of retaining members were sought. At the meeting on 15 April 1931, for example, Mr W.H.Pick put forward the following motions:

- That it was desirable that the Annual Subscription payable by Fellows be reduced to two guineas [from three guineas].
- That the Life Composition Fees payable be also considerably reduced, "due regard being paid to length of Fellowship".

The minutes tell us that "an informal discussion followed on the first of these motions and on a suggestion for the formation of a class of Associate Fellows with an age limit". A decision was deferred "until a concrete scheme should be submitted for consideration"; and discussion of the second motion was also deferred.

The need for economy is also evident in the minutes of the Finance Committee meeting held on 16 December 1931. In Minute 5 we read: "A list of the resignations received since the June meeting was considered. It was recommended that where the resignations were due to financial reasons a letter from the President should be forwarded suggesting the payment of one-third of the subscription in January and the balance in July". And in Minute 6 we find that "owing to the financial position and the urgent need for economy it was agreed to recommend that the part-time services of Miss Dunfield be dispensed with after three-months notice had been given".

In the annual report for 1932 (*QJRMetS*, 1933, Vol.59, pp.166-175), the redundancy of Miss Dunfield was recorded thus: "As a measure of economy it became necessary in April to dispense with the services of the part-time typist, Miss Dunfield, although she had rendered most useful assistance". And she was not the only person made redundant: the employment of Miss E.H.Geake, Assistant Editor, was terminated towards the end of the year. Moreover, a decision was made that a shorthand reporter was no longer needed at meetings.

The number of Fellows further decreased in 1932, from 722 to 678. Only 26 Fellows were elected (compared with 78 in 1930 and 30 in 1931) and four others were reinstated. Thus, there was a gain of 30 in 1932. However, 60 resigned and 14 died, hence the net loss of 44.

Council's financial report for the year 1932 was not, however, wholly unhappy. On the one hand, it stated that "in view of the financial stringency special attention had been directed during the year to the reduction of expenditure wherever

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[6] *The Royal Meteorological Society's home at 49 Cromwell Road, South Kensington, had been purchased in 1921 with the help of debentures which were gradually redeemed over the years.*

[7] *Grants from this Fund helped the Society publish two journals, the* Quarterly Journal *and the* Memoirs of the Royal Meteorological Society*. See, in this newsletter, pp.4-5, "A forgotten journal of the Royal Meteorological Society".*

possible"; and it also noted that cost-cutting had been achieved by reproducing the *Bibliography of Meteorological Literature* by a photographic process instead of by printing from type. But it also noted that all of the outstanding debentures had been paid off, so that the Society's house was now entirely free of debt. This was, the report stated, "partly effected by the sale at a profit of a portion of the Society's holding of Victory Bonds and partly by a gift of the Treasurer of two debentures held by him, of £50 each, which he forwarded for cancellation". It was also reported that the Council had "transferred to a special account the remainder of the holding of Victory Bonds and £100 from the year's balance to form the nucleus of a Staff Pension Fund". Moreover, the sale of the *Collected Papers of William Henry Dines* had been, the 1932 annual report said, "highly satisfactory", and reference was made to a gift from Sir Napier Shaw which had enabled "a number of copies to be sent to certain heads of meteorological services abroad".

At a Special General Meeting of the Society in November 1932, the by-laws were amended to permit the admission of Student Associates, persons between 18 and 24 years of age who had been proposed by at least two Fellows, one of whom could certify personal knowledge of the candidate. The annual subscription for students was set at one guinea without entrance fee, and on election students were to receive the *Quarterly Journal*, notices of meetings and other notices issued by the Society. The annual report expressed the hope that Student Associates would later on become Fellows.

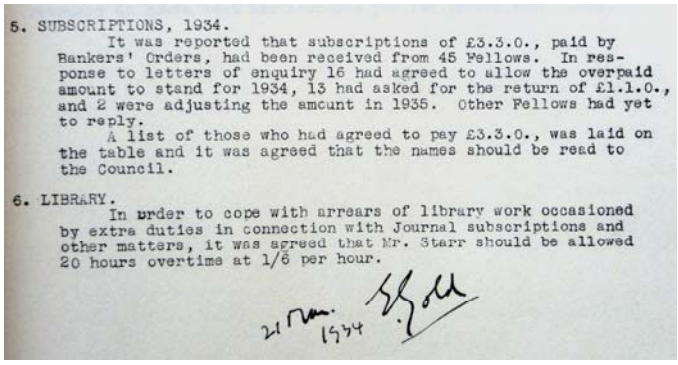
The idea of reducing the Fellows' subscription, suggested in 1931, was put to a Special General Meeting in November 1933 and the following new by-laws were approved:

- That the normal subscription for 1934 and subsequent years be two guineas (a decrease of one guinea).
- That payment of a further entrance fee be waived in the case of those Fellows who had resigned in the years 1929 to 1933 inclusive and were *re-elected* before the end of the year 1934.
- That the subscription payable by members of the Institute of Physics and certain other societies be revised.
- That the scale of composition fees be lowered to correspond with the revised subscription and be fixed in closer relation to the number of annual subscriptions already paid.

There was confusion over the new subscription, as the Finance Committee minute below shows. The minute reads as follows:

5. SUBSCRIPTIONS, 1934
It was reported that subscriptions of £3.3.0, paid by Bankers' Orders, had been received from 45 Fellows. In response to letters of enquiry, 16 had agreed to allow the overpaid amount to stand for 1934, 13 had asked for the return of £1.1.0, and 2 were adjusting the amount in 1935. Other Fellows had yet to reply.

A list of those who had agreed to pay £3.3.0 was laid on the table and it was agreed that the names should be read to the Council.



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6. LIBRARY.
In order to cope with arrears of library work occasioned by extra duties in connection with Journal subscriptions and other matters, it was agreed that Mr. Starr should be allowed 20 hours overtime at 1/6 per hour.

21 Mar. 1934

The meeting in question took place on 21 February 1934 and the minutes were signed by the President, E.Gold, on 21 March 1934. The number of Fellows decreased in 1933 from 678 to 668 and three Student Associates were elected.

The annual report of the Society for 1933, published in the *QJRMetS* in 1934 (Vol.60, pp.169-181) painted an optimistic picture, saying that "the finances of the Society now appear to be in a sufficiently strong position to stand the strain of a temporarily diminished income". And the Council were confident that with a reduced subscription the number of Fellows was "likely to increase appreciably, thus widening the general scope of the Society's usefulness". Costs had been reduced wherever possible and the Council had decided that from the end of 1933 the Society would act as its own publisher. After 1 January 1934, the *Quarterly Journal* and all other publications would be obtainable directly from the Offices of the Society, which would "throw more work on the office staff" but would bring about "appreciable economy". The Council desired to acknowledge the services of Messrs. Edward Stanford, Ltd, who had acted for the Society as publishers since 1878.

In 1934 (see *QJRMetS*, 1935, Vol.61, pp.195-209), the turnover of the Society was only £2,415, a considerable decrease since 1930, when the turnover was £3,523. However, the annual report does not indicate any undue concern. The main assets of the Society were its house and investments (the latter valued at about £1,600); and there was rental income from the part of the house not used as offices. The effect of reducing the subscription was reported thus:

> *As a result of changes in the By-laws, the annual subscription became £2 2s. in 1934, after standing at £3 3s. since 1921. This has resulted in a substantial reduction of the income during 1934, although the Council hopes that the smaller subscription will enable many more meteorologists to become Fellows of the Society. The Council desires to place on record the generous action of over thirty Fellows in continuing their subscription at the old rate.* ……. ⇗

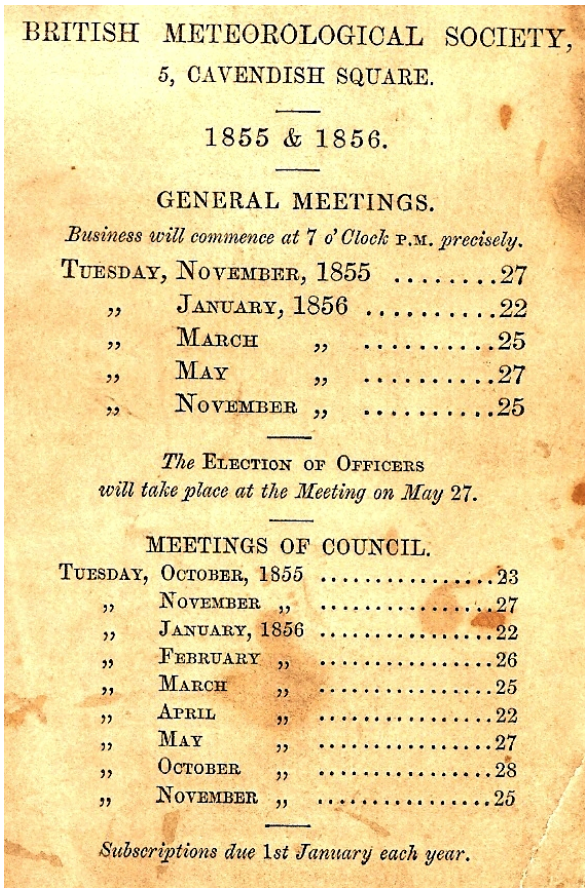
⇗ Moreover, it was reported that the Council had again transferred £100 to the Staff Pension Fund and that even when this sum was included the net receipts for the year had just exceeded net expenditure.

The number of Fellows increased from 668 at the end of 1933 to 688 a year later, 703 at the end of December 1935 and 711 at the end of December 1936, but the new grade of Student Associate did not prove attractive to many people, there being only four Associates at the end of 1936. Turnover decreased again in 1935, to £2,168, but increased a little, to £2,282, in 1936. There was no mention of financial stringency in the annual report for 1935 (see *QJRMetS*, 1936, Vol.62, pp.260-275) or the report for 1936 (see *QJRMetS*, 1937, Vol.63, pp.185-201). Indeed, the latter report has an optimistic air about it and indicates a growing, thriving Society.

The worst of the Great Depression had certainly passed. Belts had been tightened. The storm had been weathered.

MEETINGS OF THE BRITISH METEOROLOGICAL SOCIETY, 1855-1856

The card below was issued to members of the British Meteorological Society to give notice of meetings (on 27 November, 22 January, 25 March, etc). A list of Council members was printed on the reverse of the card.



BRITISH METEOROLOGICAL SOCIETY,

5, CAVENDISH SQUARE.

1855 & 1856.

GENERAL MEETINGS.

Business will commence at 7 o'Clock P.M. *precisely.*

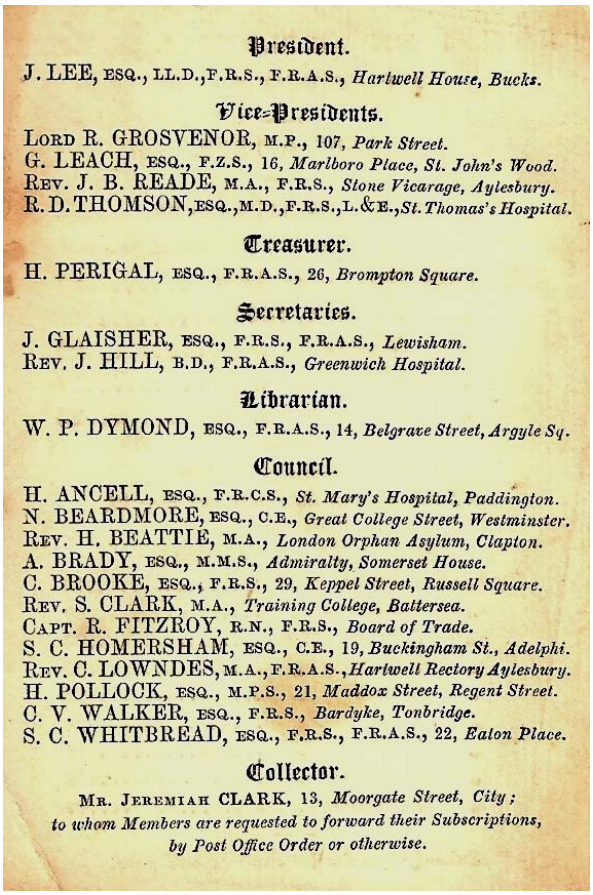
TUESDAY, NOVEMBER, 1855 27
,, JANUARY, 1856 22
,, MARCH ,, ...25
,, MAY ,, ...27
,, NOVEMBER ,, ...25

The ELECTION OF OFFICERS *will take place at the Meeting on May* 27.

MEETINGS OF COUNCIL.

TUESDAY, OCTOBER, 1855 23
,, NOVEMBER ,, ...27
,, JANUARY, 1856 22
,, FEBRUARY ,, ...26
,, MARCH ,, ...25
,, APRIL ,, ...22
,, MAY ,, ...27
,, OCTOBER ,, ...28
,, NOVEMBER ,, ...25

Subscriptions due 1*st January each year.*



President.

J. LEE, ESQ., LL.D., F.R.S., F.R.A.S., *Hartwell House, Bucks.*

Vice-Presidents.

LORD R. GROSVENOR, M.P., 107, *Park Street.*
G. LEACH, ESQ., F.Z.S., 16, *Marlboro Place, St. John's Wood.*
REV. J. B. READE, M.A., F.R.S., *Stone Vicarage, Aylesbury.*
R. D. THOMSON, ESQ., M.D., F.R.S., L. & E., *St. Thomas's Hospital.*

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PICTURES FROM THE PAST

The photographs on this page can be found in *Photographs of Stations, 1884-1886, 1887-1896 and 1896-1906* (three albums), in the Royal Meteorological Society Collection, National Meteorological Archive, Exeter. It is likely that the photographs were taken by William Marriott, Assistant Secretary of the Royal Meteorological Society, during his inspections of the Society's weather stations. The dates on which the photographs were taken match the dates of the inspections given in the *QJRMetS* (in the annual reports of meteorological station inspections).

Scarborough, 15 July 1887

The names of the ladies are not known. The regular observer was Mr W.Robinson. William Marriott recommended that the currant bushes in the garden should be kept away from the screen and also that some grass should be laid down. He also recommended that the screen should be painted.

Berkhamsted, Herts., 29 July 1896

The observer appears to be Edward Mawley, who was President of the Royal Meteorological Society 1896-97. The picture on the right shows his French Screen. For a pen portrait of Mawley, by Anita McConnell, see Weather*, 1998, Vol.53, pp.128-129.*

The Hollies, Hastings, 12 September 1884

The observer was probably Mr A.H.Wood. William Marriott commented that the thermometer screen was overhung by a cherry-apple tree.

Croydon, 19 September 1884

Again the observer was probably Edward Mawley, who was, according to William Marriott, shortly to remove from Croydon. His address in Croydon was Lucknow House, Outram Road, Addiscombe.

Ashburton, Devon 26 August 1884

According to William Marriott, the observer was normally Mr F.Avery. When he visited the station, however, observations were being made by Mr Avery's housekeeper, who is presumably the person pictured.

ICING, BUT NOT ON THE CAKE!
by Richard Gregory

Jet-engined aircraft fly high for reasons of both engine and airframe efficiency, since the power delivered by any single jet engine depends largely on the temperature difference between intake and exhaust, so the greater the better. While at any particular true airspeed, mass flow through the engine remains constant, pressure reduction consequent upon increase in height brings about a lesser flow by weight. In order to keep the proportion of fuel-to-air constant, a barometric pressure control reduces the fuel supply as height increases, resulting in fuel saving for each mile covered. Since aerodynamic drag of the whole aircraft also reduces with height, less fuel per mile is required on this count too, so that even on such a rudimentary aircraft as de Havilland's Vampire, each gallon of kerosene burnt took the aircraft nearly three times further above 30,000 feet than at sea level.

All this meant that training a young pilot to fly jet aircraft in the Royal Air Force involved much flying above cloud before descent and landing, and this procedure was always begun with the minimum fuel state to allow for this, plus possible emergencies. First, the aircraft was directed by radio to overhead the airfield, where the turn was made, in the radio "cone of nil bearing" on to a heading opposite that of the runway in use, on which heading the descent was begun at a constant indicated airspeed, a reduced power setting, and with airbrakes out.

On one occasion, flying solo in the two-seat VampireT11, I was overhead base in cloud and beginning the turn on to the outbound heading, having set 8,700 rpm to give a steady indicated airspeed of 240 knots. Seat lowered, and maintaining the usual instruments scan, I noticed a small drop in the airspeed, and gave the throttle a gentle nudge to increase power slightly. A few seconds later I noticed another small drop in airspeed, requiring yet more power. As the airspeed fell below 200 knots indicated it became evident that something was amiss, but a quick manual check of airbrakes, flaps and undercarriage operating levers confirmed that they were all up and housed, at which point I realised that I should look outside at the leading edge of my port wing, and what I saw was distinctly discomforting. Over three inches of hard glazed ice had built up on the leading edge of the wing, so spoiling its aerodynamic lift. This added greatly to the airframe weight but also steadily closed the engine air intake – exponentially, of course, which was much more serious, with my aircraft not far from becoming a powerless lump of ice, with lessening control available.

In short order, I lowered the nose to increase speed and control, started a turn toward base, and made an emergency radio call to let air traffic control know of my predicament – advising them that I might find it necessary to eject from the aircraft while still in cloud! Then, as the speed built up to 240 knots once more, I put the air brakes out. These took the form of a part of the trailing edge of each wing, which rotated through 90° in order to function, causing a great deal of extra drag, and also some vibration throughout the aircraft, which would – I most fervently hoped – help shake off some of the ice . A few twitches and slight bumps indicated that this might in fact be going on. Having decided to eject at 3,000 feet indicated if my situation had not improved, I took another look at the wing as I approached 4,000 feet and was immensely relieved to see a rather jagged wing with its ice capping separated here and there by clear sections, and decided to carry on. Breaking cloud just below 2,000 feet, I levelled off, immensely relieved, put the air brakes in, and cancelled the emergency, landing quite normally, my pulse rate slowing down, shortly afterward.

The second occasion on which wing icing affected my aircraft came during the long, bitterly cold winter of 1962-63, and it led to a minor public spectacle. A practice instrument approach leading into a radar controlled talk-down, involved level flight at 1,200 feet and 120 knots, with wheels and flaps down ready for the landing. On the day of the incident this part of the approach took us over the coal-burning power station at Newark upon Trent. Not surprisingly the smoke carried a large number of very small water droplets which, on this particular day, had become supercooled below a low inversion, as we were to discover. In addition, in conditions during which the air temperature at the surface never rose above 0 degrees Celsius for weeks on end, the runway surface was covered with patchy, thin ice, which had been reported during the morning met. briefing, of course. Ordinarily, this would not have caused any serious problem, but this instrument approach was not "ordinary". At all events, while my student, under his visor, concentrated on flying the aircraft on instruments, I maintained the usual visual

search outside, since we were, after all, approaching a busy airfield on which other aircraft in the circuit would be on a different radio frequency. It was not long before I noticed a small accumulation of ice on the wing leading edge. Since we were committed to maintaining 1,200 feet and collecting some more ice, I kept a careful watch on the build-up, and when it approached between 12 and 19mm, I added a few knots to our recommended final approach speed, knowing quite well that the runway icing would reduce the available braking distance, so we crossed the runway end at 105 knots, with myself now in control.

With the main undercarriage wheels firmly on the runway, I gently put the nose wheel in contact and gave the brake lever a slight squeeze. At that instant, the port wheel was running on ice, and with no rolling resistance, it locked, while the starboard wheel, momentarily on a dry patch, continued turning. The locked port wheel slid on to the dry patch and, before I knew what was happening, the friction between the runway surface and the tyre tread built up enormous heat within the tyre, resulting in a bubble between the tread proper and the wire reinforcing, and the tyre burst! The remnants of the ruined tyre luckily kept the wheel rim off the runway but, most unfortunately, applied considerable braking action to the wheel the same time, with the result that my aircraft began turning left, slowly at first until it left the runway for the grass, when we completed a smart turn through 270° and stopped.

When my accident report reached the Wing Commander Flying he could do nothing but exonerate me from any blame, since we had been flying in weather conditions which were outside our limitations – as we both knew!

RECENT PUBLICATIONS

This list of books and articles concerned with the history of meteorology and physical oceanography has been compiled by Malcolm Walker and Anita McConnell.

BAKER, F.W.G., 2009. The first International Polar Year (1882-1883): French measurements of carbon dioxide concentrations in the atmosphere at Bahia Orange, Hoste Island, Tierra del Fuego. *Polar Record*, Vol.45 (No.3), pp.265-268.

BIGNELL, K., Autumn 2008. Meteorology at Imperial College. *Imperial Engineer*, p.23.

BOOTH, B.J., 2009. G.M.B.Dobson during World War I – his barothermograph and 'bomb'. *Weather*, Vol.64 (No.8), pp.212-219.

BRÖNNIMANN, S. and FREI, F., 2008. Defant's work on North Atlantic climate variability revisited. *Meteorologische Zeitschrift*, Vol.17 (No.1), pp.93-102.

CARTWRIGHT, J.H.E. and NAKAMURA, H., 2009. What kind of a wave is Hokusai's 'Great Wave off Kanagawa'? *Notes and Records of the Royal Society*, Vol.63 (No.2), pp.119-135.

Abstract: *The great wave off Kanagawa* by Katsushika Hokusai is probably the most famous image in Japanese art. It depicts three boats in heavy seas on the point of encountering the eponymous wave, while Mount Fuji is glimpsed in the distance. The print is today often reproduced as the artistic depiction of a tsunami. Did Hokusai really have a tsunami in mind when he composed this work? We examine that hypothesis together with the alternatives, by discussing the image itself and the circumstances surrounding its composition, and by evaluating the wave in terms of the fluid dynamics of breaking waves and in particular of the species termed plunging breakers, of which *The great wave* is a member, and conclude that it is more probable that Hokusai intended to depict an exceptionally large storm wave. There is a great deal of scientific interest at present in such abnormally high waves, which are often termed freak or rogue waves.

CREBER, G., 2009. Obituary of Mavis Hinds. *Weather*, Vol.64 (No.10), p.283.

EDEN, P., 2009. Traditional weather observing in the UK: an historical overview. *Weather*, Vol.64 (No.9), pp.239-245.

EGGER, J. and PELKOWSKI, J., 2008. The first mathematical models of dynamic meteorology: the Berlin prize contest of 1746. *Meteorologische Zeitschrift*, Vol.17 (No.1), pp.83-91.

EMEIS, S., 2008. History of the Meteorologische Zeitschrift, *Meteorologische Zeitschrift*, Vol.17 (No.5), pp.685-693.

EMEIS, S. and LÜDECKE, C. (Eds.), 2005. *From Beaufort to Bjerknes and beyond: critical perspectives on observing, analyzing, and predicting weather and climate*, a collection of 19 essays evolving from a conference of the International Commission on History of Meteorology held in the Baroque Library of Kloster Polling, Germany, July 5-10, 2004. This is Volume 52 in Algorismus – Studien zur

Geschichte der Mathematik und der Naturwissenschaften Herausgegeben von Menso Folkerts in the ERV Dr Erwin Rauner Verlag, Augsburg, ISBN 3-936905-13-4.

GURNEY, R., 2009. Obituary of Professor Tony Slingo, University of Reading. *Weather*, Vol.64 (No.7), pp.194-195.

LOVETT, R., 27 June 2009. The calm before the storming of the beach. *New Scientist*, pp.46-47.

During the Second World War, the oceanographer Walter Munk was on military service at the Pentagon, working on the conditions needed for troops making amphibious landings in north-west Africa. This led him to study the behaviour of ocean waves and how their beaching was influenced by distant weather systems. This work was taken up in Britain under a combined Scripps and Admiralty group led by Sir George Deacon, learning how to forecast for Allied landings in various parts of the world. The art of surf forecasting is now big business.

MARNEY, P. and McCONNELL, A., June 2009. Evolution of the Mining or Pit Barometer. *Scientific Instrument Society Bulletin*, No.101, pp.17-18.

MÜLLER, R., 2009. A Brief history of stratospheric ozone research. *Meteorologische Zeitschrift*, Vol.18 (No.1), pp.3-24.

WHEELER, D., *et al*., 2009. Reconstructing the trajectory of the August 1680 hurricane from contemporary records. *Bulletin of the American Meteorological Society*, Vol.90 (No.7), pp.971-978.

WILLIAMS, L. and THOMAS, W., 2009. The epistemologies of non-forecasting simulations. Part II: Climate, chaos, computing style, and the contextual plasticity of error. *Science in context*, Vol.22 (No.2), pp.271-310.

The argument is built around three moments in the history of meteorology and chaos theory, commencing immediately after the Second World War and continuing to the 1980s. There is also a section covering meteorological forecasting 1914-1945.

WINKLER, P., 2009. Revision and necessary correction of the long-term temperature series of Hohenpeissenberg, 1781-2006. *Theoretical and Applied Climatology*, Vol.98, pp.259-268.

WOODS, T., *et al*., 2009. Obituary of Julius London, 1917-2009. *Bulletin of the American Meteorological Society*, Vol.90 (No.7), pp.1029-1030.

DATES FOR YOUR DIARY:

FORTHCOMING MEETINGS

There will be a meeting at the **University of Reading**, in the **Madejski Lecture Theatre,** on **WEDNESDAY 18 NOVEMBER 2009** from **2.00 to 5.30pm**. This will be **The Second Classic Papers Meeting**, in which developments stemming from a classic paper (or classic papers) through to the present day will be discussed. It will be a National Meeting of the Royal Meteorological Society organized by the History Group, as was last November's Classic Papers meeting.

The meeting will consider first the classic contributions of Carl-Gustav Rossby, Jules Charney and others to dynamical meteorology that were crucial to the successful development of Numerical Weather Prediction (NWP) techniques in the 1940s and 1950s and will then focus on the scepticism of some in the UK who argued at that time that improved weather forecasting depended not on numerical methods but on greater understanding of atmospheric processes. Later in the meeting, the reasons why modellers and dynamicists now appear to be talking to each other less and less will be explored, not only in NWP but also in general circulation modelling. Some think understanding of the atmosphere has been sidelined in favour of simulation and wonder to what extent this is detrimental to the progress of modelling or, indeed, meteorology as a whole. How many of today's modellers are really computer engineers who tweak models but do not fully understand the underlying dynamics? If this is the case, how have we reached this state of affairs and how should we remedy it, if, indeed, we need to remedy it? Have we strayed from the pioneering principles of Rossby and Charney? If so, does it much matter now? The last session of the afternoon will be a Panel Discussion, involving all of the day's speakers.

Programme:

14:00 Introduction by the President

14:05 Malcolm Walker (History Group)
Introduction to the meeting and to Rossby, Charney, Sutcliffe and others

14:20 John Methven (University of Reading)
Early theories for extratropical weather system development

14:45 Lennart Bengtsson (University of Reading)
The early days of numerical weather prediction in the UK and USA

15:15 Tea

15:45 Brian Golding (Met Office)
Numerical Weather Prediction since the 1960s: a triumph of numerical analysis or meteorological science?

16:15 Andy White (Met Office)
The role of meteorological dynamics in numerical model construction and appraisal in 2009

16:45 Panel Discussion, chaired by Sir Brian Hoskins (Imperial College and University of Reading)
Looking to the future

On **SATURDAY 17 APRIL 2010**, jointly with the Observing Systems Special Interest Group of the Royal Meteorological Society, there will be a meeting in **London**, in the Zoological Society of London's Huxley Lecture Theatre, Regent's Park, **to mark the 150th anniversary of the formation of what was later called the British Rainfall Organization** (BRO). The founder, George James Symons (1838-1900), was an outstanding figure in meteorology in the late 19th century, not only because of his BRO work, but also as the founder and editor of the *Meteorological Magazine*, leading member of the Royal Meteorological Society and active member of societies abroad with an interest in meteorology. His name lives on in the Royal Meteorological Society through the Symons Gold Medal and Symons Memorial Lecture.

Programme:

10:30 Coffee and registration

11:00 Welcome and introduction by Stephen Burt

11:10 David Pedgley
The history of the British Rainfall Organization

11:40 Malcolm Walker
The man behind the British Rainfall Organization – George James Symons

12:10 Ian Strangeways
The history of the rain-gauge

12:40 Lunch and exhibition of relevant historical artefacts

13:40 Stephen Burt
British Rainfall 1860-1993

14:10 Harvey Rodda
Digitising the British Rainfall Heavy Falls archive 1866 to 1968

14:40 Tim Allott
The British rainfall network in 2010

15:10 Tea/coffee break

15:40 Malcolm Kitchen
Precipitation measurement: towards the next 150 years?

16:25 Stephen Burt
The Symons memorial commemorations, July 2010

16:35 Closing discussion, round-table questions and answers, exhibition viewing

17:00 Close of meeting

There is no charge for the meeting. However, pre-registration is required, through the Royal Meteorological Society, not the History Group. A sandwich lunch will be available at a cost of £5 and this too needs to be ordered in advance.

FROM THE EVENING OF SUNDAY 18 TO THE EVENING OF TUESDAY 20 JULY 2010, there will be a **Two-Day Summer Meeting**, which will be a Royal Meteorological Society National Meeting organized by the History Group. It will be based in **Exeter**.

In the mornings (before coffee), there will be review-type talks covering a range of meteorological topics. After mid-morning coffee and in the afternoons, there will be visits.

On the Monday, we shall visit the Met Office, the National Meteorological Archive and Barometer World.

On the Tuesday, we shall visit the Norman Lockyer Observatory near Sidmouth.

Overnight accommodation at Exeter University has been booked and talks will be given at the University, which has a most beautiful campus, with extensive views across Exeter and landscaped gardens containing a great many plants and trees.

This will be a mainly informal meeting that we hope will prove attractive to many. Do please note the dates in your diary. Full details of the meeting will be published in the January 2010 issue of this newsletter.

Other meetings are in the pipeline. Please turn to page 22.

OTHER PLANNED MEETINGS OF THE HISTORY GROUP

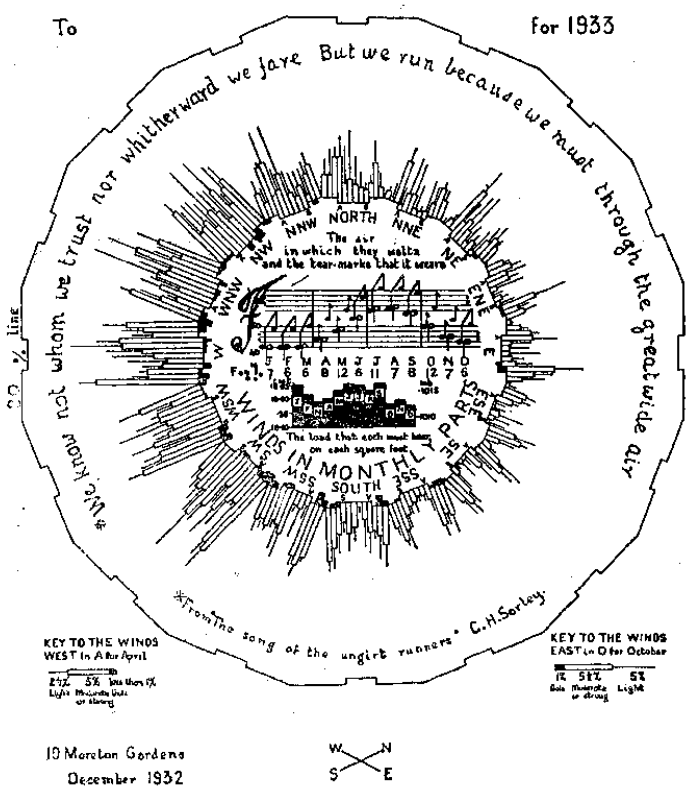
The third Classic Papers meeting, on the subject of **turbulence**, will take place on **Wednesday 17 November 2010**, again probably at the University of Reading.

A Saturday meeting, **possibly in the autumn of 2010**, to mark the **centenary of aircraft first being used for meteorological purposes** is being discussed.

A Saturday meeting at **Cambridge** to mark the **centenary of Scott's 1910-13 expedition to the Antarctic** is planned for April 2011.

Meetings at the **Thames Barrier** and the **Chatham Historic Dockyard** are being considered.

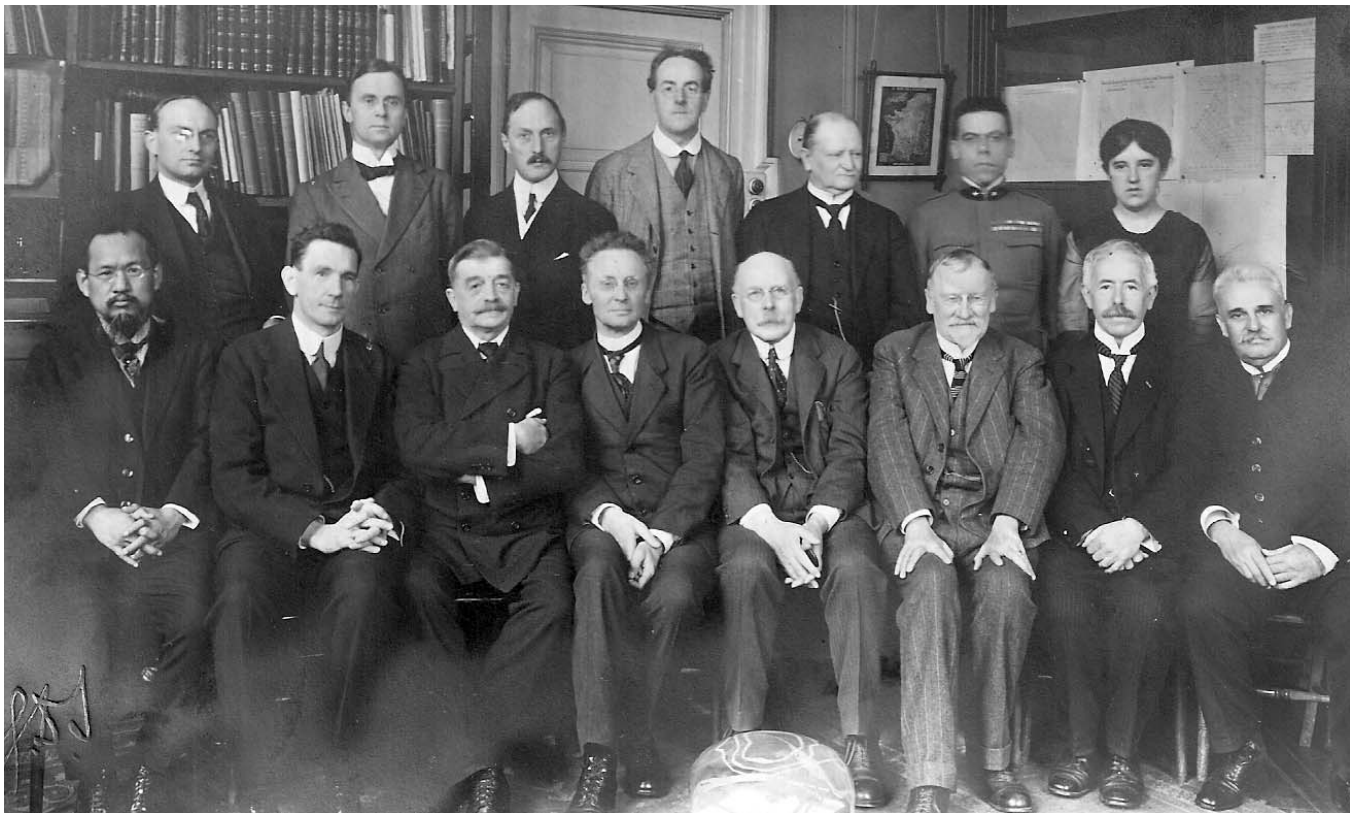
SIR NAPIER SHAW'S CHRISTMAS CARD, DECEMBER 1932



A Christmas Card built on the frequency of winds of different strengths from sixteen points of the compass, each for the twelve months of the year, with the maximum and minimum temperatures of the months set to music with the dew point in the bass.

The lines of the stave of music are set to show the Fahrenheit scale of temperature. Below them are the monthly percentage of observations of wind for which fogs were recorded, and twelve black columns to shew the variation of normal pressure from month to month exhibiting a structure which asks a number of questions such as why the normal pressure is high in September and also in January and yet so low in December.

HISTORIC PHOTOGRAPH



We know the names of all the people in this photograph. They are as follows:
BACK ROW (left to right)
Commandant J.Jaumotte (Belgium), Dr T.Hesselberg (Norway), Dr L.Gorczynski (Poland), Mr L.F.Richardson (Great Britain), Dr G.Melander (Finland), Colonel L.Matteuzzi (Italy), Miss E.E.Austin (Great Britain)
FRONT ROW (left to right)
Dr T.Okada (Japan), Dr G.C.Simpson (Great Britain), Captain C.H.Ryder (Denmark),
Professor V.Bjerknes (Norway), Sir Napier Shaw (Great Britain), Professor J.Maurer (Switzerland),
Professor E. van Everdingen (The Netherlands), Colonel F.A.Chaves (Portugal, Azores).

The picture was taken in London in September 1921, in the Director's Room of the Meteorological Office, South Kensington. It was found in an envelope which has "Met Committee" written on it. The Twelfth Meeting of the International Meteorological Committee was held in London in 1921. However, Gorczynski, Richardson, Bjerknes, Matteuzzi and Miss Austin never served on the International Meteorological Committee. Bjerknes was President of the International Commission for the Investigation of the Upper Air from 1919 to 1921 and Richardson was a member of that Commission from 1921 to 1930. Maurer and Gorczynski were members of the International Commission for Solar Radiation. Matteuzzi had a strong interest in clouds. Miss Austin was Shaw's Secretary. At the 1921 Meeting of the Committee, all attended sessions by invitation (see Meteorological Magazine*, June 1922, Vol.57, No.677, pp.117-120).*

Another photograph of these people appeared as a Frontispiece to Volume 57 of the Meteorological Magazine*.*

What is the object at Shaw's feet? It looks like a model of some sort showing contours or flow patterns.

WHO SAID THIS?

Answer to question on page 13:
American journalist and humorist
Frank McKinney ("Kin") Hubbard (1868-1930).

2009 MEMBERS

Rob Allan (Exeter)
Alberto Ansaloni (Milano Italy)
Oliver Ashford (Didcot)
Graham Bartlett (Slough)
Rodney Blackall (Buckingham)
Brian Booth (Devizes)
Ron Bristow (Maidstone)
Stephen Burt (Stratfield Mortimer)
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Jacqueline Carpine-Lancre (Beausoleil, France)
Nick Chappell (Lancaster)
Mike Collins (Frinton on Sea)
Philip Collins (Merton, Devon)
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A M Hughes (Oxford)
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Arnold Johnson (Maidenhead)
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Julian Mayes (West Molesey)
Anita McConnell (Stowmarket)
Reg Milne (Farnborough)
Alison Morrison-Low (Edinburgh)
John Norris (Gerrards Cross)
Howard Oliver (Swanage)
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Sara Osman (London)
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R W Phillips (Lincoln)
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P R Rogers (Sevenoaks)
James Rothwell (Southwell)
Peter Rowntree (Crowthorne)
Marjory Roy (Edinburgh)
Ann Shirley (Canterbury)
David Simmons (Cambridge)
Hugh Thomas (Hassocks)
Derry Thorburn (London)
Keith Tinkler (Ontario, Canada)
Jack Underwood (Barham)
Bill Wade (Harrogate)
Diane Walker (Tiverton)
Malcolm Walker (Tiverton)
Catharine Ward (Bury St Edmunds)
Dennis Wheeler (Sunderland)
G D White (Truro)
Peter Wickham (Wokingham)
Clive Wilkinson (Diss)
Christopher Wilson (Cullompton)
Mick Wood (Bracknell)

THIS IS YOUR NEWSLETTER

Please send any comments or contributions to:
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MetSocHistoryGroup@gmail.com

The Group's annual subscription is £5 (cheques payable to *Royal Meteorological Society History Group*). A reminder will be sent when your subscription is due.