METEOROLOGY AT THE UNIVERSITY OF ABERDEEN OVER THE CENTURIES

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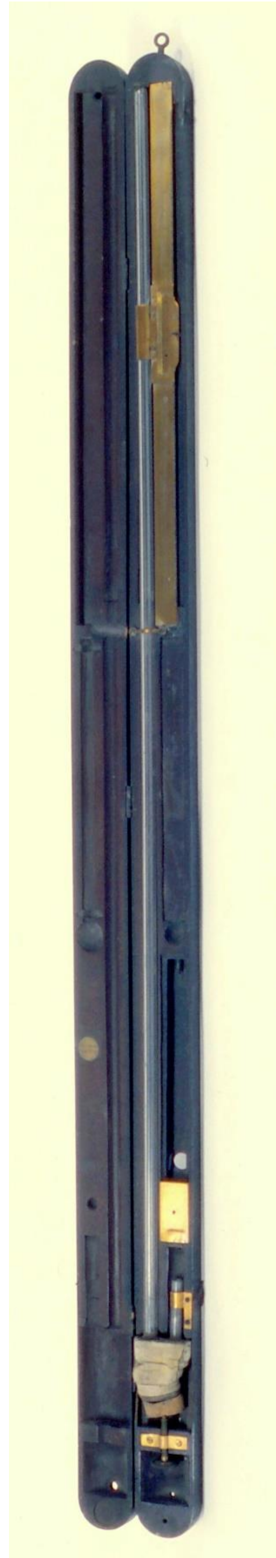
No doubt people have been trying to understand the weather since prehistoric times. As every geography student learns, weather and climate depend on where you are in the world. Generalisations are hard to come by. The weather is a complex physical system and prior to having the right tools to make progress there was little more than superstition, astrological references and folk sayings to go by[1]. At their best they were attempted summaries of experience. Some sayings are a marginal improvement on predicting that tomorrow's weather will be similar to today's but, in short, the accuracy of forecasts was a matter of chance rather than understanding. The tools needed to understand the weather are first and foremost accurate measurements of what constitutes the weather: temperature, pressure, precipitation, sunshine, wind, humidity, visibility. Secondly an understanding of how the physical state of the atmosphere gives rise to the gamut of weather we experience. Get all that right and you have the science of meteorology.

The Tower of the Winds in the Roman forum in Athens dating from 50 BC or earlier. It may have been primarily a water clock but with a wind vane it showed the direction of the winds in relation to the compass directions. Photo JSR

Wind direction was probably the first element that could be measured well, relating it to the compass points. That goes back millennia. Rainfall may have been measured on occasions, but as far as I know no useful records from classical times survive. Of course we can deduce aspects of weather in ancient times from natural proxies, even the clothes that people wore in everyday life, and especially extreme weather from accounts of droughts and floods. All that said, the science of meteorology had no chance of starting until the components of weather could be measured reasonably well. Accurate barometers came in the 17th century, pioneered by Torricelli. Accurate thermometers with a means of calibration were developed in the early 18th century by Celsius, Fahrenheit and others. It's not surprising then that we find the first evidence of meteorology in the University of Aberdeen in the 18th century. In the inventory of the instruments of Professor Copland who taught Natural Philosophy (Physics) we find in his observatory a 'pluviameter' (a rain gauge) and mountain barometers, one of which we still have (made by Miller of Edinburgh around 1800 and shown on the next page: Ref ABDNP:200035a). In the classroom he showed De Luc's

[1] A collection of some of the better sayings can be found in John S. Reid *Weather Lore* Scots Magazine, vol. 107, pp 148 - 153 (1979)

hygrometer (measuring humidity) and of course thermometers. Students were at least seeing basic meteorological tools. Weather and climate were talked about in Natural History lectures. So - was meteorology Natural History (a second-year subject) or Natural Philosophy (a third-year subject)? It seems that measurement was Natural Philosophy, weather Natural History.



To understand the weather, careful measurements need to be made over a period of years to cover the range of variation. There is no evidence that this happened in Aberdeen prior to the early 19th century. William Knight included meteorology in his Natural History lectures in 1810 but he later succeeded Copland in Natural Philosophy and from 1825-1836 regular records of rainfall, pressure and temperature were made. Dipping into his notes of the 1840s one can find him talking to his class about meteorological processes involving evaporation, dew, mist, clouds, rain, snow and hail, air temperature and wind speed. This strongly linked the constituents of weather to physics. The Professor of Mathematics, John Cruickshank kept a log for many years of visibility up the Dee valley. These efforts were more a sign of interest in meteorology as a developing science than the groundwork for future understanding. Pressure to make advances in meteorology was stronger from professions whose lives depended on the weather, such as those whose business was at sea.

In 1867, the Meteorological Committee, which had taken over the Meteorological Department from the Board of Trade, decided to set up a national network of observing stations that would report back to headquarters at Kew, by telegraph. It was originally planned to have eight observatories but owing to the lack of funds it was decided to reduce the number to six, Aberdeen being one of the two omitted. However, Aberdeen considered it had a very strong claim because of its position in the country and the facilities it offered. Professor David Thomson at King's College was a keen supporter. He corresponded with Balfour Stewart, Secretary of the Meteorological Committee at Kew. Stewart asked, among other things, *will the instruments be perfectly safe from attacks of boys or mischievous persons?* Having been assured, it was agreed in October 1867 that Aberdeen would be one of the national stations. Mention was made of an anemometer for wind speed and direction, a recording thermograph and barograph. A grant of £250 per year would cover all costs, including that of an observer. The station was established in 1868 at the top of the Cromwell Tower. Thomson assured Balfour Stewart that in the observer's absence he would take the readings and send the results to Kew. In fact in October 1868 he had to tell the Senate that *he was compelled to leave Aberdeen without delay, and to spend the winter in a better* *climate*. The observatory survived. Aberdeen became one of the seven observatories in our first national meteorological network. Indeed, it was one of the first national networks in the world.

View of the top of the Cromwell Tower showing the conical domes of the astronomical observatory and the anemometer behind on a small tower. Photo JSR circa 2013.

The observatory at King's College would remain of national importance for some 80 years. AEM Geddes[2] has given some details of the early history and I have drawn on his account in places. The observatory supplied photographic records of pressure and temperature, the cistern of the barometer being approximately 87 ft above mean sea level. Anemograms were obtained from a Robinson cup-anemometer which, as the Meteorological Report of 1870 records, '*was erected on the roof of the building at a height of 72 ft from the ground, and well exposed on all sides*'. Continuous records of rainfall were obtained by means of the Met Office standard Beckley raingauge situated near the building at ground level. Later, in 1907, a Dines pressure-tube anemometer was added to the establishment. At first, it too was erected on the top of the building, but later a more open site was obtained in the vicinity of the College.

For many years the work at the observatory was carried out entirely by one observer. The first was Mr. William Boswell, who held the appointment from 1868 until the end of 1902, with Professor David Thomson officially as Superintendent until 1880, and then under Professor Charles Niven who succeeded Professor Thomson in the Chair of Natural Philosophy. The Natural Philosophy involvement was simply to administer the funds that kept the observatory operational and to provide any other liaison needed for the use and maintenance of facilities on University premises. In January 1903 Mr. George Aubourne Clarke[3], who had received training

[2] AEM Geddes *The Development of the Study and Practice of Meteorology at Aberdeen* in *Weather* vol X, No. 11, pp 285 - 289

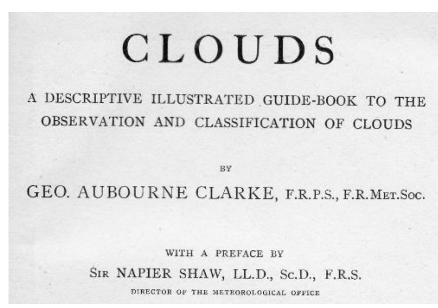
[3] For more on Aubourne Clarke see my piece at https://homepages.abdn.ac.uk/npmuseum/Scitour/CTGAC.pdf

under the Meteorological Office was appointed observer. Clarke would put Aberdeen's name prominently on the world stage of Meteorology.

George Aubourne Clarke portrait[4] from 1930s

Clarke's remit was to keep the instruments in good order and report readings for a range of weather parameters several times a day. The Aberdeen Observatory was one of the seven 'first-order stations' of the British meteorological network. It was an important job. Clarke didn't contribute to University teaching and had no obligation to engage in research but he developed a hands-on interest in cloud photography. Maybe he was spurred by the location, for Aberdeen's climate is not only typically cloudy but we enjoy a wide variety of cloud types and cloudscapes. Clarke obtained an official nephoscope for measuring the direction and speed of clouds and supplied his own camera. Bringing out the fine detail of clouds was a challenge with the black-and-white photographic plates of early 20th century. What started as a hobby became a front-line subject in Word War I with the advent of aerial combat and reconnaissance. Aviators needed to know their clouds. It was a matter of life and death. A passing reference at the end of the war mentions that Clarke provided valuable advice to front-line staff on the technical detail of creating good cloud pictures. He also prepared the Naval Meteorological Service Cloud Atlas during the war.

By 1919 Clarke had an expanding library of several hundred cloud photographs of all types of clouds taken from the Cromwell tower observatory or its near surroundings. A selection of over 80 formed the heart of his book *Clouds: a descriptive illustrated guide-book to the observation and classification of clouds* that was published by Constable & Co. in 1920. The leading meteorologist of the day, Napier Shaw, director of the Meteorological Office, wrote the preface. By then Clarke



CLOUDS

A DESCRIPTIVE ILLUSTRATED GUIDE-BOOK TO THE OBSERVATION AND CLASSIFICATION OF CLOUDS

BY

GEO. AUBOURNE CLARKE, F.R.P.S., F.R.MET.SOC.

WITH A PREFACE BY

SIR NAPIER SHAW, LL.D., Sc.D., F.R.S.

DIRECTOR OF THE METEOROLOGICAL OFFICE

My copy of 'Clouds'

[4] This portrait, along with other memorabilia of G A Clarke were donated to the author from his estate. They will be donated to the University's Natural Philosophy Collection in due course.

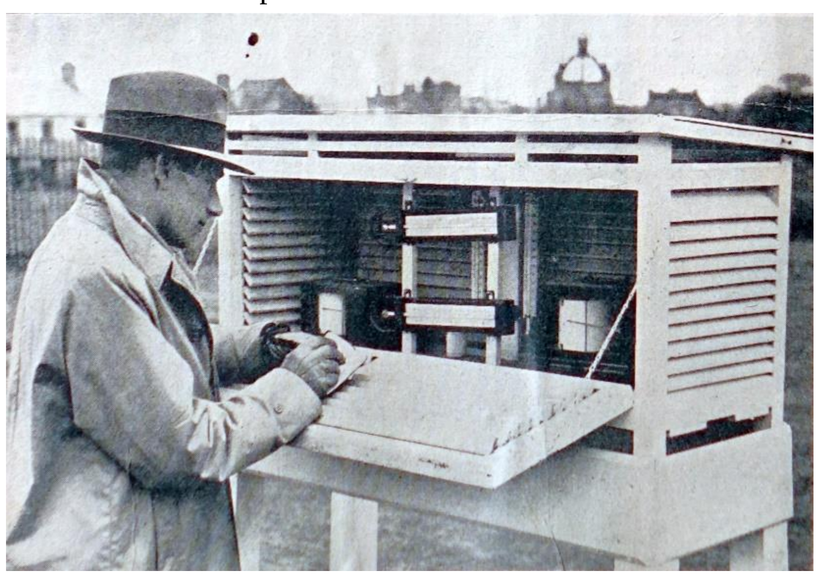
was an Air Ministry employee and it is no surprise that the Air Ministry used Clarke's pictures in their manuals and training information. The Admiralty did too and of course the Met. Office.

One side of an Air Ministry information board for observers. The majority of the 36 cloud illustrations on the board are those of G A Clarke

Clarke's pictures, some of which contain distinctive Aberdeen skylines, became world-wide reference material. They were clearly superior to those in the current Cloud Atlas and would replace these in future editions. Napier Shaw's own book *The drama of Weather* published over a decade later was enhanced by Clarke's photographs, as indeed were other books for weather watchers. *Clouds* included not only photographs but explanatory figures drawn by Clarke, some colour illustrations and a section associating cloud forms to weather types.

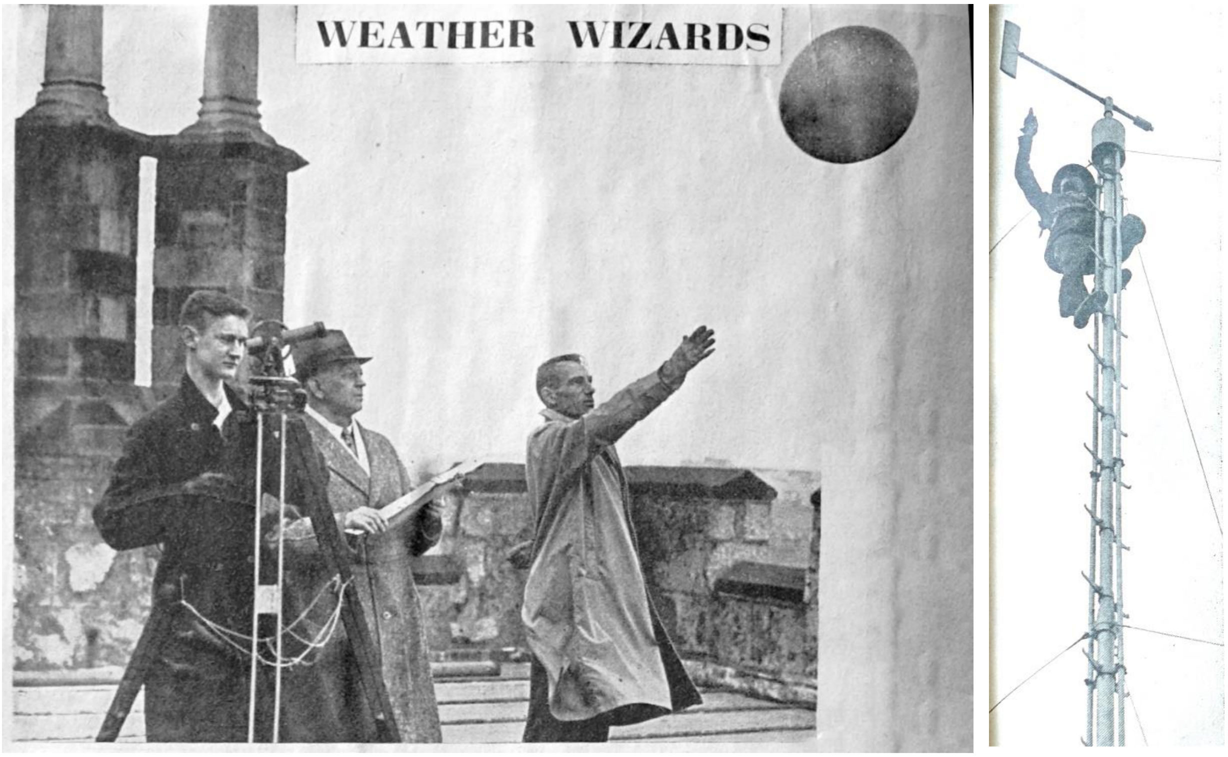
By the time *Clouds* appeared, Clarke had become a Fellow of the Royal Meteorological Society and a Fellow of the Royal Photographic Society. *Clouds* was widely praised in reviews and spurred D'Arcy Thompson to write a whole article in Country Life[5]. His photographs were appreciated not just for their technical clarity but for their artistry. Clarke displayed his cloud pictures in open photographic exhibitions. His autochromes shown in 1923 at the RPS earned him a medal and he would collect other medals over the next decade and a half. Locally, Clarke became a senior figure in the Aberdeen Photographic Association that was founded in 1891and he would become their President from 1931 to 1934. His outreach lectures on both cloud photography and astronomy topics brought the Aberdeen Observatory to an audience much wider than professional meteorology.

It was likely Clarke's outreach popularity that attracted a visit from the Aberdeen Bon-Accord & Northern Pictorial in 1938. Their readers were treated to a description of the Aberdeen Observatory, the only one I know of, illustrated with photographs. The correspondent described how Clarke occupied a converted classroom at the top of the Cromwell Tower *with his two assistants, a maze of instruments, piles of statistics, and accuracy which could not be bettered*. I know the room well. It's now a classroom again. *At 6.30 every morning readings are taken from the various instruments – pressure, temperature, rainfall, sunshine, wind force and direction, humidity, types of clouds and direction, degree of visibility and earth temperature.* The information was coded for brevity and sent by telegram to the Meteorological Office of the Air Ministry where it was merged into the data stream that underpinned the forecasts broadcast at regular times by the BBC. A Campbell-Stokes sunshine



Clarke at the ground level Stevenson screen that contains a thermograph, a recording barometer and thermometers

[5] D'Arcy Wentworth Thomson *Clouds*, Country Life, pp 274 – 277, March 5th 1921.



Left: Clarke watches on as one assistant releases a hydrogen filled balloon from the Cromwell Tower roof while the other prepares to track it with a theodolite. Right: checking that the wind vane rotates freely.

Clarke decanting the contents of the rain gauge into a measuring cylinder

An assistant at the recording end of the sensitive Dines pressure tube anemometer recorder was on the roof but, according to the correspondent, *most of the important readings are taken from instruments located in an enclosure in a grass park near the College*.

No illustrations are shown of Clarke's photographic equipment and dark-room but the correspondent comments that *so famous are Mr Clarke's cloud studies that no transatlantic liner is considered completely equipped unless it caries a series of his incomparable cloud pictures for the delectation of passengers who would like to know what cloud formation is associated with the prevailing weather on the voyage.*

Clarke remained in charge until he retired in 1943. The Aberdeen Observatory continued under the Met Office and Air Ministry until 1947 when it was closed, with its work being transferred to Dyce airport. The facility was essentially mothballed until the 1980s. Some of the meteorological instruments are now in the Natural Philosophy historical instrument collection.

Clarke wasn't employed by the University but AEM Geddes who became a well-known meteorologist was for much of Clarke's time and beyond. Geddes began as Natural Philosophy assistant in 1909[6]. He cut his teeth as a meteorologist with a program of his own that investigated the winds in the upper atmosphere by launching pilot balloons from the Cromwell Tower or nearby. These were usually tracked by a pair of observers using theodolites to measure a balloon's altitude and azimuth from which its velocity components could be deduced, and hence the speed and direction of upper atmosphere winds. He made extensive trials from 1912 through to 1914. This was quite an early effort to provide a regular link between science and observation in the third dimension, above the Earth's surface. Geddes was seconded to the Meteorological Office in 1915 and thence to the Royal Flying Corps to act as meteorologist in France and Belgium, not the safest of postings. At the end of the war more than one individual who made his early acquaintance with meteorology at King's College elected to stay on in the service of the Meteorological Office. Geddes himself became a lecturer in Natural Philosophy at Aberdeen with a career that lasted until 1955.

View from the observatory past the all-sky camera of Michael Gadsden; Courtesy MG.

When the degree of BSc (Forestry) was introduced, a course in meteorology was added to the requirements in 1922, though no lecturer was appointed. This was made good with the appointment of Owen F T Roberts in 1924 under the Cruickshank Bequest, mainly for conducting research in meteorology. He also took over the lecturing until he was seconded in WWII to the Met Office when Geddes took over his duties. This course continued in the

[6] For a short biography of Geddes, see https://homepages.abdn.ac.uk/npmuseum/article/Biogs/AEMGeddes.pdf

Foresters' syllabus until about 1970. Geddes mentioned that after the war, meteorology also formed courses on offer to second year Physics students and to Honours Physics students. These fell out of fashion but in the early 1990s, Michael Gadsden (a long-standing Fellow of the Royal Meteorological Society) began a course in Astronomy and Meteorology for first year students that immediately became very popular. After his retirement in 1997 John S. Reid (likewise a Fellow) gave a revised course from 1998 to 2008, a year after his retirement, and as I pen this in 2020 the course is still the most popular Physics course in the University Calendar.

The Cromwell Tower Observatory was re-purposed by Michael Gadsden in the 1980s as an observatory for noctilucent clouds, too high in the atmosphere to affect the weather directly but an indicator of atmospheric changes in the mesosphere. For two winters from 1995 – 1997 the National Physical Laboratory installed equipment to monitor greenhouse gases in the lower atmosphere by measuring their characteristic absorption spectra. Gadsden retired in 1997 and over the next few years the observatory proper, with its astronomical domes, was made more suitable for its original purpose: astronomy.

Image due when Covid-19 restrictions end

The Campbell-Stokes sunshine recorder, now in our historic collection: inv. ABDNP200036a

The rain gauge, now in our historic collection: inv. ABDNP201862a

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