Australian Meteorological Association Inc

Monana

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October 2020

From the President's Pen

"Share your knowledge.
It is a way to achieve immortality.."

— Dalai Lama XIV

Given the current increasing control of the COVID-19 pandemic in South Australia, your Committee has decided that it is time to return to physical meetings (in compliance with the COVID regulations in place at the time of the meeting).

It is perhaps fitting that the return to physical meetings will be the first meeting of 2021 - a fresh start to a new, and hopefully more promising, year. The meeting will also be the delayed 2020 AGM (Annual General Meeting). We were given 6-month's grace because of the issues with COVID earlier this year. Although this is not an election year, there is a vacancy for a Treasurer - this will be an easy job until at least the following AGM, as membership fees have been waived for the 2020-2021 membership year.

Amongst other notable facts is that this meeting will the first meeting away from the Bureau of Meteorology (BOM) building (due to COVID-19 restrictions). The downside of losing access to their meeting room is that the AMetA will likely need to pay for meeting rooms from now on and the location may not be as central as it was. I think it is unlikely that we will be allowed back into the BOM area any time in the near future, and who could blame them for being cautious as they are an essential service?

Modern personal weather stations increasingly include inexpensive air quality sensors. Although the Environmental Protection Authority (EPA) carries out the air quality monitoring in South Australia, the BOM reports air quality information such as smoke haze in its forecasts when it is expected to have a significant impact. For those without air quality capable weather stations, it is relatively simple and fairly inexpensive to make your own. From previous conversations with the EPA, they may be interested in gathering air quality readings from home weather stations, so if air quality interests you, this is not a meeting to miss.

I have spoken with the Port Adelaide Enfield Council who are currently looking at providing access to an area with things like test equipment and 3D-printers that can be used by people to make their own projects. Access to the area is currently planned to be free, but I assume that people will need to pay for any materials that they use.

This would be ideal for AMetA members who are interested in making sensors to extend their weather stations, or to make their own weather stations—the Council is intending to make weather stations that will be located at their libraries. I will keep you informed as things progress.

Keep Happy, Keep Safe.

Mark Little

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Fifteen Years of Detective Work: SA's Climate Record Uncovered

In August AMETA Mac Benoy AMetA Citizen Science Team Leader presented our first webinar as a result of COVID 19 using ZOOM.

The AMetA volunteer citizen science team is involved in the rescue of 19th C weather data. This involves searching for and locating SA-based paper collections of weather observations, then converting them to images and finally digitising them.

It took over 2 years to image and another 2yrs to digitise the 1st collection which was the ***Todd Weather Folios***, a bound collection of 64 books containing 18,000 pages covering the period of 1878 to 1909. The team discovered that the Folios continued all the way up to the 1990's, so continued the photographic work up to 1957 resulting in another 60,000 images. Even more historical collections of 19th C weather observations for Adelaide and South Australia were found in the National Archives and the local office of the Bureau of Meteorology. These were imaged and partially digitised. In total, approximately 600,000 data points were rescued. This is a very small fraction of the total data contained in the 100,000+ pages imaged to date.

To ensure the data the images contained remained visible for future researchers, a commercial grade image portal to host these images and a demonstration portal that contains 7 collections from McGill University in Montreal were created.

Images can be found at https://www.met-acre.net/MERIT/AMETA.html. ***Please note that reproduction of images in this article leaves much to be desired. To really appreciate the information please either go to the website or click on the image link***.

Mac's first topic was development of ***Synoptic Maps***. Charles Todd, well known as the architect of the Overland Telegraph, in 1855 became the first government-appointed meteorologist in Colonial South Australia. He left a rich legacy of historical data, some of it contained in the Todd Weather Folios.

These illustrate how the weather statistics of the day were gradually expressed graphically as Synoptic maps (charts connecting places with the same mean sea level atmospheric pressure).

As early as 1816, experimental synoptic maps were created in Europe and America. However, the development of the telegraph in the 1850s allowed observers to send their data to a central point almost instantly, enabling the production of meaningful daily synoptic maps.

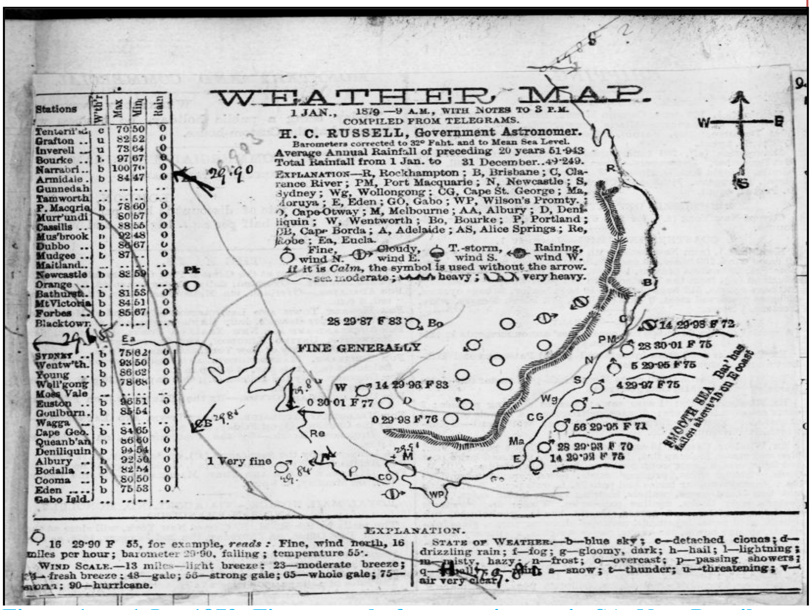


Figure 1: 1 Jan 1879 -First record of a synoptic map in SA. Note Pencil marks on SE States

Figure 2: First use of the Overland Telegraph Line - 15 June 1879

By the mid 1870's international standards were available and weather authorities started producing maps for public display.

In the Todd journals we see the first tentative steps to draw synoptic maps. It took 4 years before this experimental activity became a normal way of analysing and communicating daily weather activity in SA. Some of these maps are reproduced in figures 1 to 3. In them we can see the progress made over time.

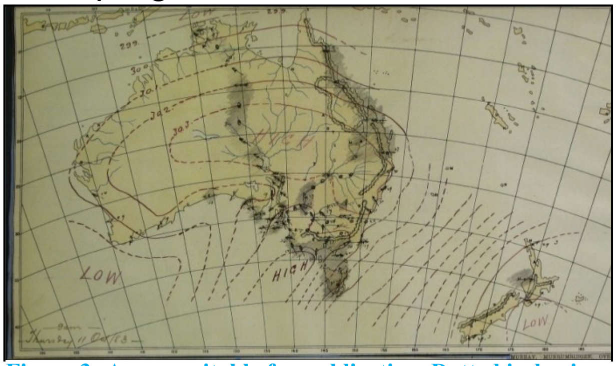


Figure 3: A map suitable for publication. Dotted isobaric lines - 11 October 1883

The collection also shows the development of ***forecasting*** in SA.

Early meteorologists spent many years examining and mapping weather phenomenon before developing the confidence to issue any "forecast" - AFTER the events had occurred. Mac recounted how the State Manager of the Bureau was astonished to find out that Todd never issued a precise next day temperature forecast in his 60 years. Figures 4 to 5 use the Todd Journals to show how the forecasting timeline played out publicly in South Australia in the 1880's. The first next - day Temperature forecast was not issued until the Royal Visit of 30 March 1954.

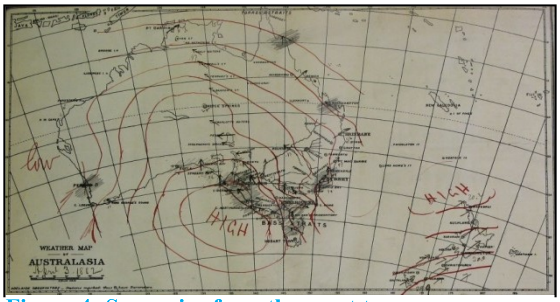
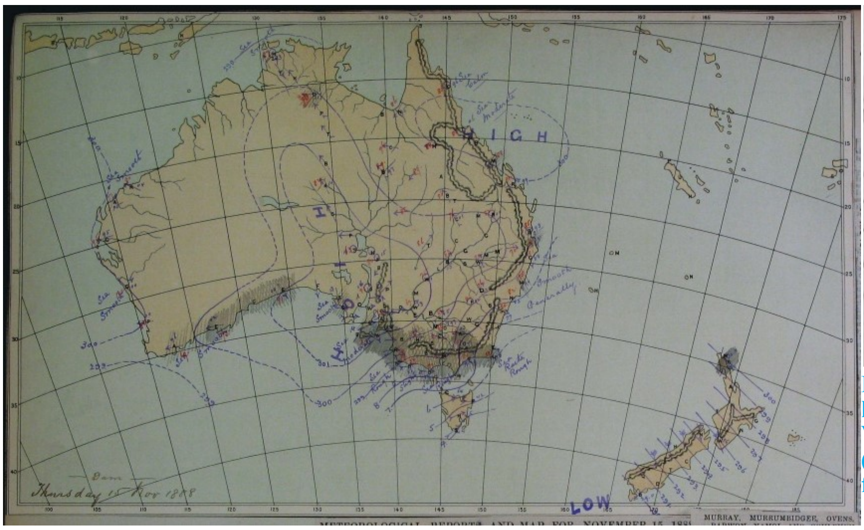
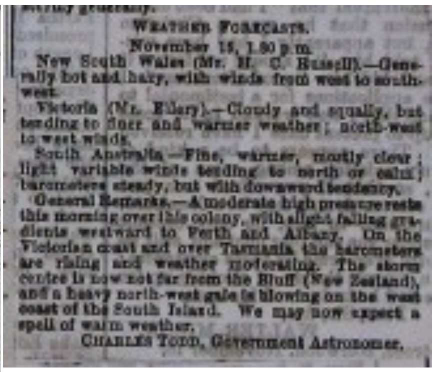


Figure 4: Synopsis of weather sent to newspapers – data from around Australia - 3 April 1882. Note: no formal forecast.

The MERIT collections show the tremendous amount of ***weather data*** collected in an era that didn't have the tools to make use of it – even the earliest observers knew that the ultimate aim of weather science was to create accurate forecasts. Todd and his contemporaries collected huge amounts of data faithfully recorded by hand by 19th C weather observers. The sheer scale implies that these meteorologists knew it would eventually prove its value in weather analysis and forecasting. One hundred and fifty years later this great effort is being used to help benchmark climate change analysis.





WEATHER FORECASTS.

November 15, 1.30 p.m.

New South Wales (Mr. H. C. Russell).—Generally hot and hazy, with winds from west to south-west.

Victoria (Mr. Ellery).—Cloudy and squally, but tending to finer and warmer weather; north-west to west winds.

South Australia.—Fine, warmer, mostly clear; light variable winds tending to north or calm; barometers steady, but with downward tendency.

General Remarks.—A moderate high pressure rests this morning over this colony, with slight falling gradients westward to Perth and Albany. On the Victorian coast and over Tasmania the barometers are rising and weather moderating. The storm centre is now not far from the Bluff (New Zealand), and a heavy north-west gale is blowing on the west coast of the South Island. We may now expect a spell of warm weather.

CHARLES TODD, Government Astronomer.

Figure 5: Formal Forecast section, with his intercolonial colleagues in NSW and Vic
(Still generalities but no temperature forecast) - 15 Nov 1888

Plainly evident in the journals of the 1880's are the **Newsprint Data Tables**. Figure 6 is an example of one.

Not only do we have hard data in these journals but we also have lengthy descriptions of Australia's significant weather events and their impact on its citizens. For example, on 1 Feb 1893, according to the newspapers, the Armageddon arrived in Brisbane.

Even relatively common events like a summer heatwave in Adelaide gets serious coverage on 30 Dec 1897, right down to its effects on the animals in the zoo. You have to wonder if the European settlers were transfixed by Australia's distinctly un-British weather.

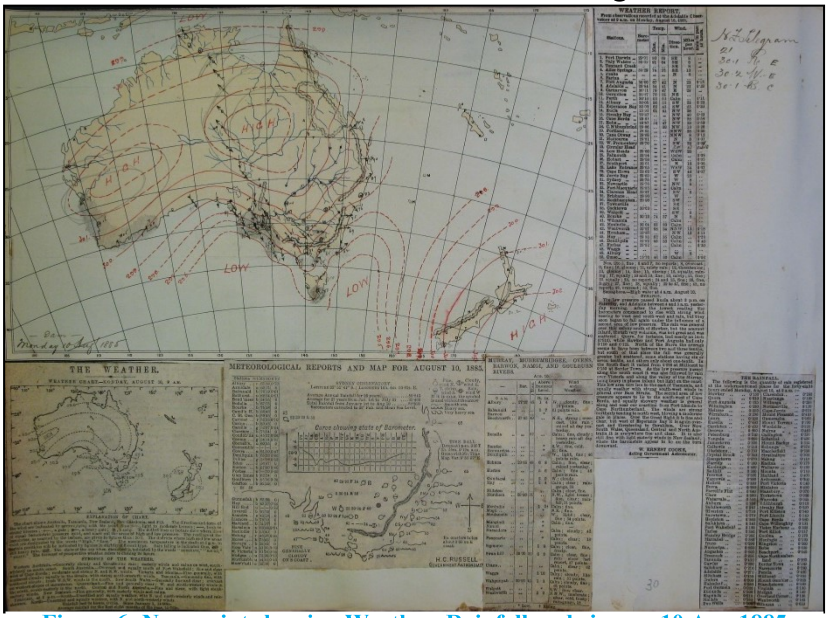


Figure 6: Newsprint showing Weather, Rainfall and rivers - 10 Aug 1885

So these journals mix the hard weather data with the soft descriptions of the effects of the weather

Observations of Southern Ocean weather are especially important as the Ocean is a major nursery for global weather activity. As 19th C marine based observations are scarce, the next best thing are the weather observations recorded at ***lighthouses***. Included are 6 collections of 19th C observations taken in South Australia. The key one is Cape Borda at the west end of Kangaroo Island (see figures 7 and 8). The combination of digitised data records from three lighthouses, Cape Borda (47 yrs), Point Lowly (9 yrs) and Tipara Reef (24 years), allows researchers to gauge the speed and depth of weather systems of Southern Ocean approaching the mainland.

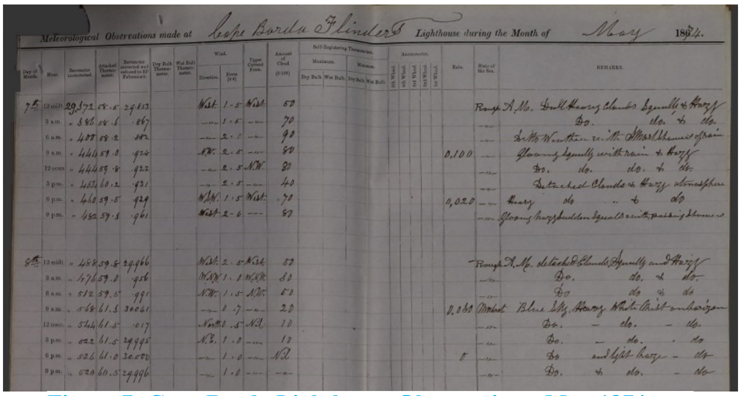


Figure 7: Cape Borda Lighthouse Observations, May 1874

The discovery of the ***Register of Adelaide Weather* 1843-1856** in the National Archives provides the earliest comprehensive record found so far. It was kept by the Royal Engineers of the Survey Department,

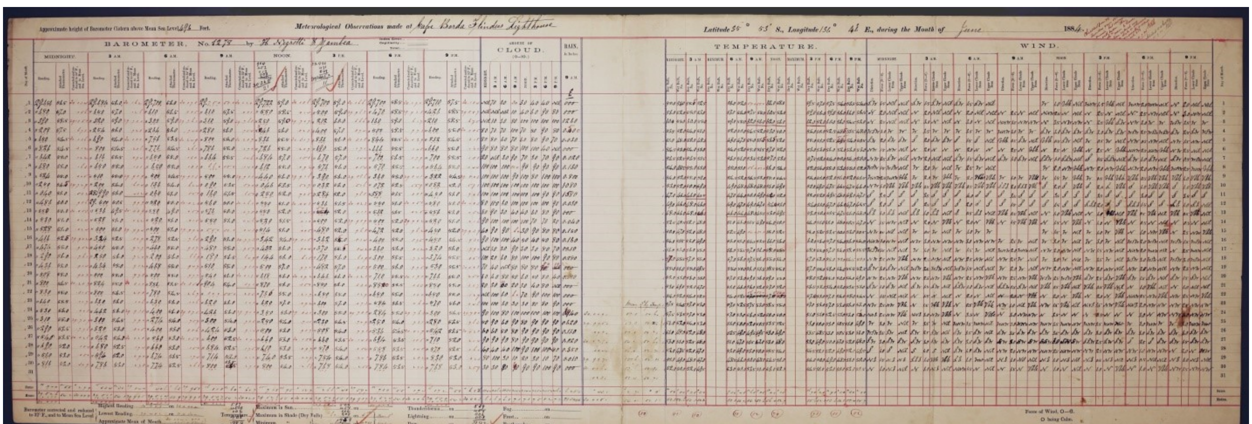


Figure 8: Cape Borda June 1884 – changes to a much more dense record, with more weather phenomena

typically some of the first arrivals in British Colonies. They were essential in creating the basic infrastructure to get the Colonies going. Many of the early colonial weather records in the Caribbean, Africa, Asia and the Pacific exist because of their work. An example is found in figure 9.

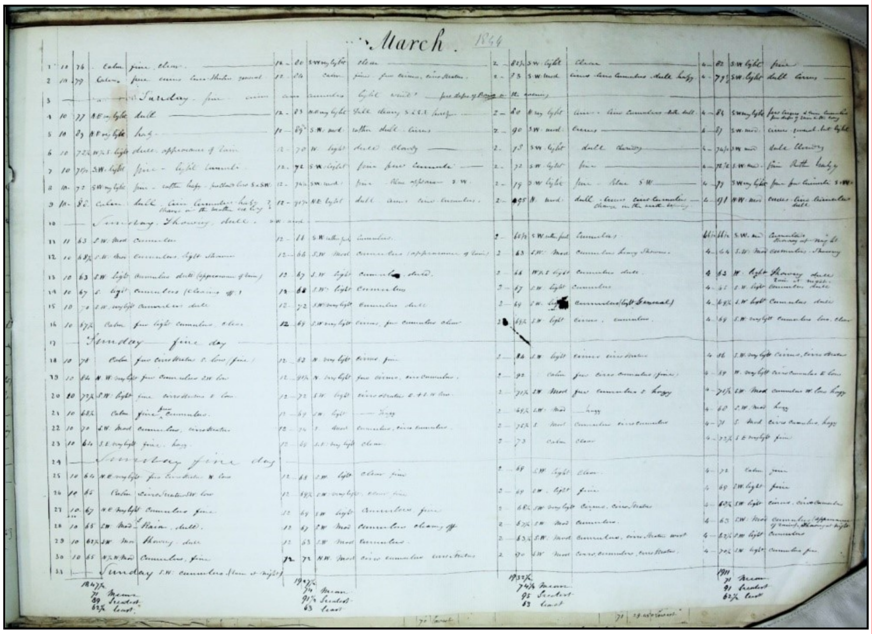


Figure 9: Register of Adelaide Weather March 1844, Royal Engineers

Todd's first official record of weather observations at the newly built West Terrace Observatory are found in the ***Adelaide Observatory Record 1858-1867***. At the beginning, the observations were simple but they got more complex as time went on (see Figures 10 and 11)

The data is lodged with international data repositories as part of Project ACRE, a weather data rescue program run out of the British Met Office. ACRE, in turn, is allied with the US National Centre for Atmospheric Research which has a reanalysis model called 20th CR.

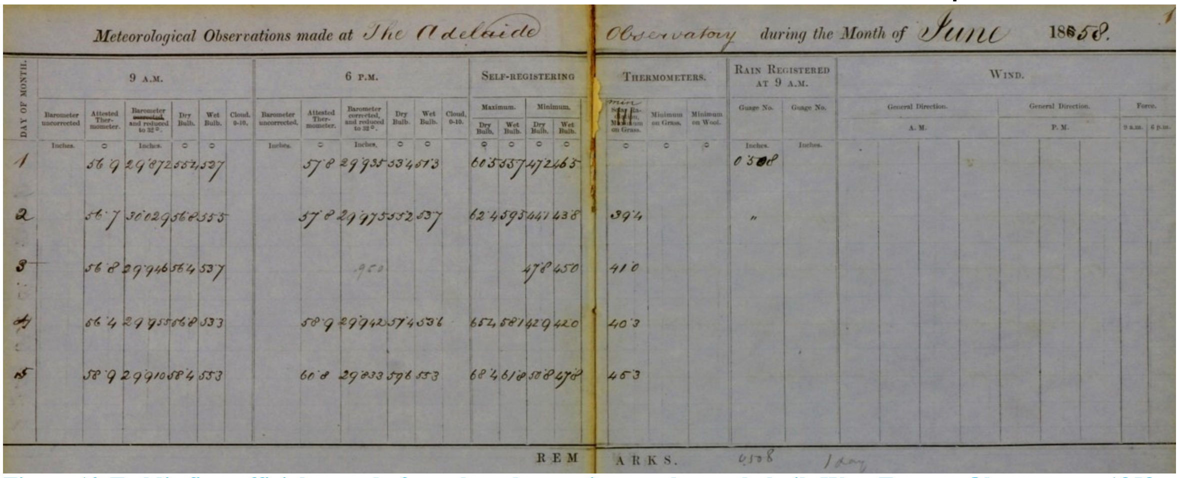


Figure 10:Todd's first official record of weather observations at the newly built West Terrace Observatory, 1858

"Re-analysis" is the term used taking a weather forecasting model, turning it around and making it a hindcasting (or backcasting) model, and then progressively recreating local and global weather patterns going back in time. This model is the only one that can stretch back into the 19th C, and is now accurately hindcasting weather as far back as 1815 in western Europe where there are sufficient pressure readings to make the reanalysis work.

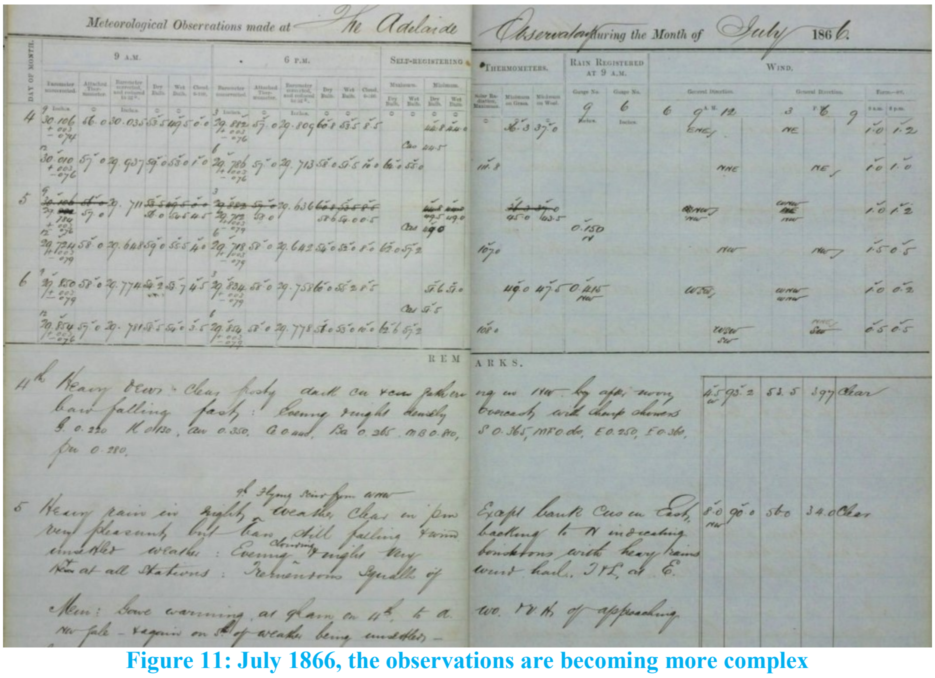


Figure 11: July 1866, the observations are becoming more complex

It's our data that has enabled

20CR's recreation of Australian weather for the last 25 years of the 19th C.

MERIT images can be used to highlight the issue of ***homogenising data records*** and the importance of the globally significant ***Adelaide Temperature Record 1857-1963***. Examples of this record are given in figure 12.

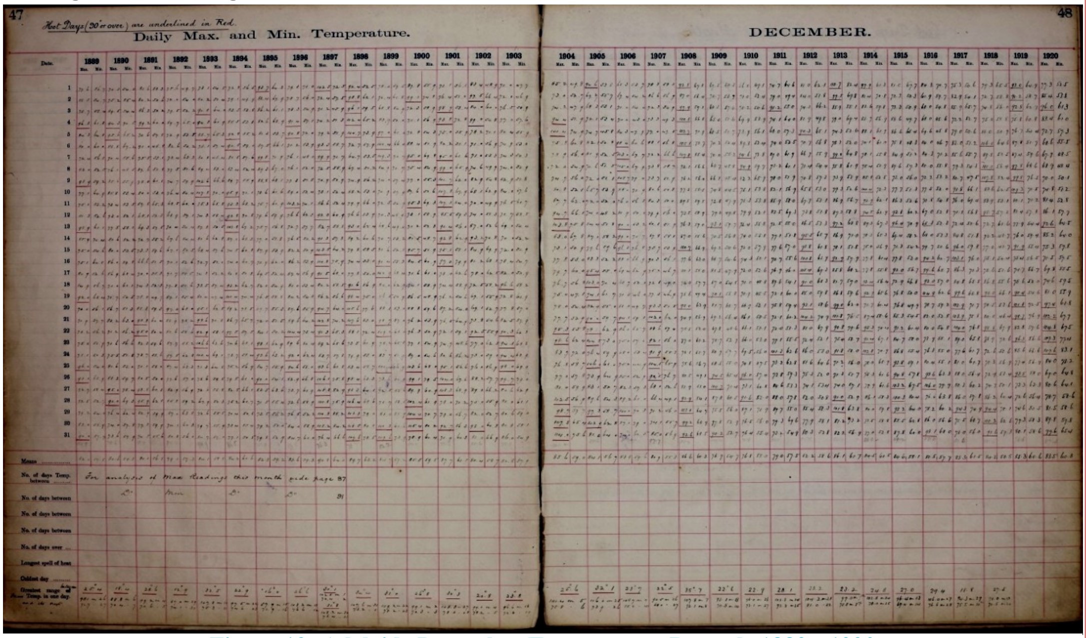


Figure 12: Adelaide December Temperature Records 1889 - 1920

A change in how Temperatures were recorded occurred in the late 1880's when the housing used to hold thermometers moved from a Glaisher (or Greenwich stand) to a Stevenson Screen. The Glaisher screen is more open resulting in temperature recordings that are influenced by factors such as reflected heat from the ground. As a result Glaisher temperature recordings during heat waves tend to be higher than those recorded in Stevenson Screens. (see figure 13).

Figure 13: Stevenson Screen on left, thermometer house in middle and Glaisher Screen on right, Adelaide Observatory circa 1900.- BOM

The Glaisher/Stevenson screen homogenisation has become controversial in the climate change debate with claims that meteorologists are falsely reducing Glaisher maximums to show that our climate is getting hotter. The Adelaide record is significant because Todd and his successors kept a record from 1887 to 1947. Globally, this is by far the longest parallel record and has been used to further support the claims of meteorologists that we are warmer now than we were in the 19th century.

Another more detailed data collection also includes the temperature records. This is the **Adelaide Meteorological Journal 1938-48**. Each page has 60 columns detailing 1,800 observations. As an example see Figures 14 and 15, in which Adelaide's most (in?) famous temperature reading, the Greenwich (Glaisher) reading of 117.7^{0}F on 12th January 1939 is recorded.

The controversy over reducing the Glaisher temperature readings isn't just recent. We can trace it's origin in **Newsclipping journals** created by the receptionist at SARO that cover 1957 to the late 1990's. Instances have been found in

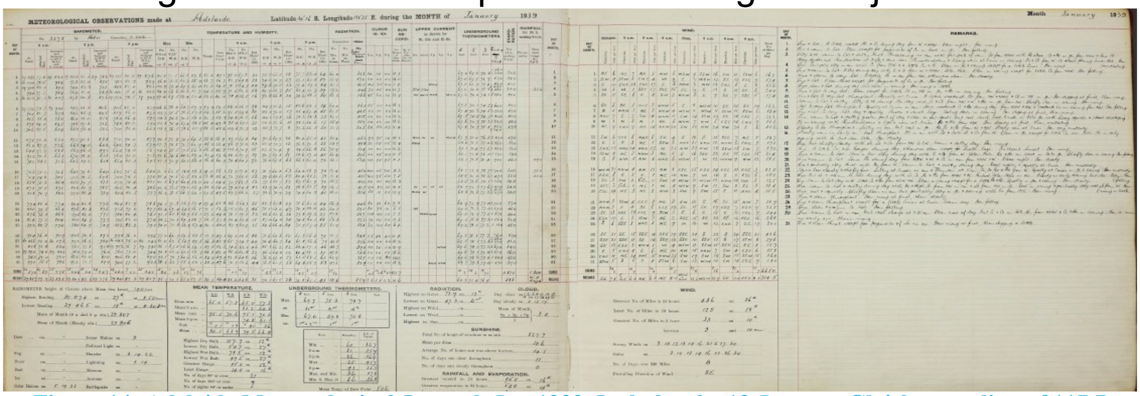
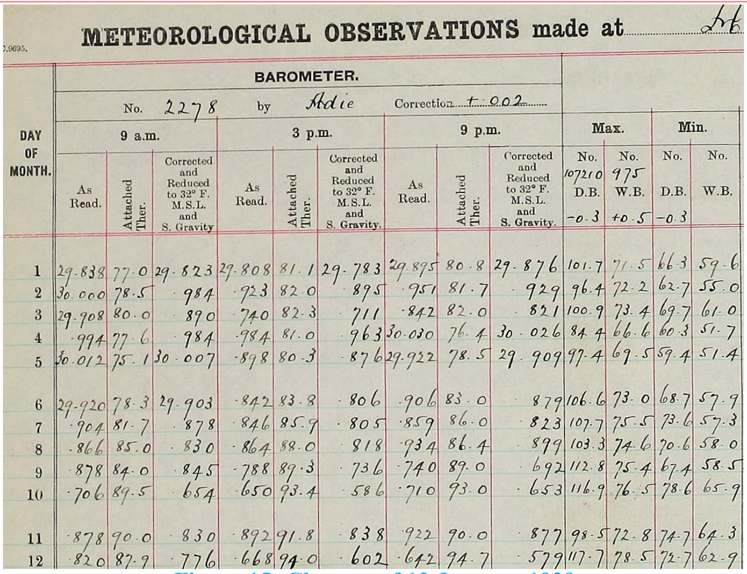


Figure 14: Adelaide Meteorological Journal, Jan 1939. Includes the 12 January Glaisher reading of 117.7

letters to the editor on 15 Dec 1959 and an explanation by "Doc" Hogan on 4th January 1961. This anomaly was actually recognised well before this – by Todd (1897 Met Obs Report)

In summary, the 15 years of weather data rescue has been an interesting journey. Putting all these collections together you can begin to see the intersection of hard data-based science and soft weather narrative giving us a perspective on not only what happened in history but on what is happening now.


METEOROLOGICAL OBSERVATIONS made at

BAROMETER. No. 2278 by Adie Correction +.002

DAY OF MONTH.	9 a.m. As Read.	9 a.m. Attached Ther.	9 a.m. Corrected and Reduced to 32° F. M.S.L. and S. Gravity	3 p.m. As Read.	3 p.m. Attached Ther.	3 p.m. Corrected and Reduced to 32° F. M.S.L. and S. Gravity.	9 p.m. As Read.	9 p.m. Attached Ther.	9 p.m. Corrected and Reduced to 32° F. M.S.L. and S. Gravity.	Max. No. 107210 D.B. -0.3	Max. No. 975 W.B. +0.5	Min. No. D.B. -0.3	Min. No. W.B.
1	29.838	77.0	29.823	29.808	81.1	29.783	29.895	80.8	29.876	101.7	71.5	66.3	59.6
2	30.000	78.5	.984	.923	82.0	.895	.951	81.7	.929	96.4	72.2	62.7	55.0
3	29.908	80.0	.890	.740	82.3	.711	.842	82.0	.821	100.9	73.4	69.7	61.0
4	.994	77.6	.984	.984	81.0	.963	30.030	76.4	30.026	84.4	66.6	60.3	51.7
5	30.012	75.1	30.007	.898	80.3	.876	29.922	78.5	29.909	97.4	69.5	59.4	51.4
6	29.920	78.3	29.903	.842	83.8	.806	.906	83.0	.879	106.6	73.0	68.7	57.9
7	.904	81.7	.878	.846	85.9	.805	.859	86.0	.823	107.7	75.5	73.6	57.3
8	.866	85.0	.830	.864	88.0	.818	.934	86.4	.899	103.3	74.6	70.6	58.0
9	.878	84.0	.845	.788	89.3	.736	.740	89.0	.692	112.8	75.4	67.4	58.5
10	.706	89.5	.654	.650	93.4	.586	.710	93.0	.653	116.9	76.5	78.6	65.9
11	.878	90.0	.830	.892	91.8	.838	.922	90.0	.877	98.5	72.8	74.7	64.3
12	.820	87.9	.776	.668	94.0	.602	.642	94.7	.579	117.7	78.5	72.7	62.9

Figure 15: Close up of 12 January 1939

Call for citizen scientists to help researchers understand climate change

ANU Zooniverse Citizen Science event focussed on Adelaide

The Climate History Australia Team at the Australian National University (ANU) has launched an online citizen science event to digitise Adelaide's climate history between 1843 -1856. Using images of Adelaide's earliest official collection of weather observations taken at Victoria Square, a call has gone out for volunteers to transcribe the data they see on their computer screens. The digitising project uses the Zooniverse platform, specifically designed to engage citizen scientists with the needs of researchers.

The collection was discovered in the National Archives and imaged by Lesley Wyndram of the Australian Meteorological Association (AMetA). It was recorded by the Royal Engineers at the Colonial Government Building, at what is now the Medina Hotel, opposite the GPO. It started a series of observations that were continued by Charles Todd at the West Terrace Observatory. With a virtually unbroken series of weather observations to the present day, Adelaide has a globally significant climate record.

Even the Weather Bureau does not have this data, so this truly is an opportunity for us to contribute to our climate record. The transcribed data will be stored in global repositories for access by climate researchers making this project a unique example of connecting our history with modern science 177 years later; the work of our ancestors will improve our understanding of Australia's 21st century climate.

How to contribute, 3 easy steps

1. Click here to Get Started. You may want to **REGISTER** as a user (top right corner of screen). Signing in allows you to participate in discussions, allows the science team to give you credit for your work, and helps the team make the best use of the data you provide.
2. Click **CLASSIFY** (top right of screen) and then click the **TUTORIAL** tab (right side of screen) Continue through the 4 guidance points then press **LET'S GO.**
3. Start entering data and contribute to our climate history!

The Weather and its Impact on History. Part 3 *by Dianne Davis*

As a child were you told of the glorious victory of Sir Francis Drake and his fleet over the Spanish Armada in 1588? While it is true that the Armada was defeated, not everybody realises that the weather played a vital part in the success of the English - not just once, but in fact on four separate occasions.

Fig 1: Phillip II of Spain

Phillip 11 of Spain assembled the Spanish Armada for several reasons. He was a Roman Catholic who had been married to Mary Tudor, (step-sister of Elizabeth 1 of England) and wanted to reclaim England for Catholicism. In addition, he wanted to stop English privateers from attacking Spanish ships and to bring an end to what he saw as English interference in the Netherlands, which at that time was under Spanish control

Fig 2: The "Armada" portrait of Elizabeth I

Consequently he assembled a fleet of 129 ships with the strategy of first controlling the English Channel. Next the ships would sail to Calais in France to gather some 16,000 Spanish troops coming from the Netherlands who would then be landed near Margate in Kent, move to London and overthrow the government.

On May19th 1588 the fleet carrying some 8,000 sailors and 18,000 soldiers left Lisbon. (The number of ships and men varies with different accounts. I have used the most commonly quoted ones.) Soon, however, the convoy was stopped by bad weather. Severe squalls in the Bay of Biscay forced four galleys and one galleon to turn back, and other ships had to put in for repairs, leaving only about 120 ships to advance into the English Channel.

The armada re-assembled and left the Spanish port of Corunna (now called A Coruña) on the 15th July 1588. Four days later it was sighted by the English off Cornwall and the English contingent of 200 ships pursued it up the English Channel. Both fleets had a variety of craft, but the Spanish always spearheaded their attack with galleons. These were slow, heavy, cumbersome, and rode high in the water providing large targets to fire at. Spanish tactics were to close on ships, use grappling irons and board.

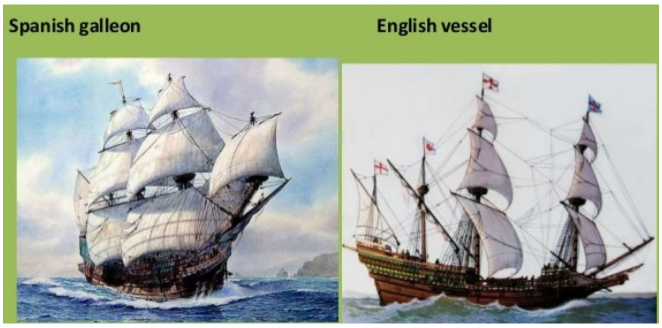


Fig 3: Comparison of Spanish and English ships

The English ships were lighter and more manoeuvrable, and thus were able to tack upwind outside of boarding range. In addition, the English guns, although smaller, had a greater range and could be reloaded much faster. Furthermore, as the ships were smaller and closer to the water-line, they provided a more difficult target for cannon than the towering Spanish galleons.

There were two indecisive engagements in the English Channel: firstly off Eddystone Rocks and then off Portland. Little damage was done to any ships and neither side gained any advantage.

By July 27th the Armada was anchored off Calais in a tightly packed crescent formation. Due to

Fig 4: Map of Amada Sailings

communication and supply problems, the troops from the Netherlands had not arrived

At midnight on 28th July, the English sent eight fire-ships (ships filled with pitch, brimstone, gunpowder and tar, which were then set alight) into Calais. The prevailing strong August westerly wind at Calais pushed these towards the closely anchored vessels of the Armada. Two fire ships were intercepted and towed away, but the remainder kept going towards the fleet. No Spanish ships were actually burnt, but the defensive crescent formation was broken as ships' captains in panic cut their mooring ropes to escape.

The wind then swung to the south west, and the Spanish fleet found itself too scattered and too far north east of Calais to return and collect any troops that may have arrived.

At Gravelines (a small port just to the south of Dunkirk) the English harried the Spanish fleet but were unable to destroy them due to a shortage of gunpowder and shot. The Spanish Admiral Medina Sidonia tried to re-gather his fleet. He realised he could not sail east due to the risk of the strong wind blowing his ships onto the shoals that littered the coast. They could not go south because the English held the Channel. Medina Sidonia ordered his ships back to the open sea and any chance of an invasion was gone.

From the 30th of July the Spanish ships tried to escape and return to Spain by sailing into the North Sea and eventually around the north of Scotland and the west of Ireland. Even here the weather conspired against them with incredibly fierce storms damaging many ships. The late 16th century, and especially 1588, was marked by unusually strong North Atlantic storms.

More ships and sailors were lost to cold and stormy weather than in direct combat. About 5,000 men died by drowning, starvation and slaughter by local inhabitants after their ships were driven ashore on the west coasts of Scotland and Ireland. Only 67 ships and fewer than 10,000 men arrived back in Spain.

It is not only in retrospect that the weather is seen as a vital factor in the failure of the Spanish Armada. It was reported that when Philip II learned of the result of the expedition, he declared, "I sent the Armada against men, not God's winds and waves" .The English called it "The Protestant Wind" and a medal was struck (see fig 5) with the inscription in Latin *"Flavit Jehovah et Dissipati Sunt",* which translates as "Jehovah blew with His winds, and they were scattered*".*

Fig 5:Armada Medal

Once more we see that while countries can wage war and win battles, if they also have to fight the weather, their efforts are often in vain.

REFERENCES AND FURTHER READING ON THE SUBJECT.

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MICROBURSTS - UNSEEN KILLERS by Bruce Davis

The last major airline accident in Australia occurred at 6.22 pm on 31st May 1974 when an East-West Airlines Fokker F-27 Friendship (VH-EWL) impacted with the ground on approach to Bathurst, NSW. Fortunately all passengers survived with only minor injuries recorded. At the time this accident was attributed to wind shear (a change in wind direction and/or speed over a vertical or horizontal distance). Many now believe the wind shear was caused by an at the time unknown phenomena, a microburst.

Figure 1: VH-EWL at Bathurst. Source: ATSB

Microbursts are severe downbursts associated with altocumulus, cumulus or cumulonimbus clouds. A downburst is a concentrated cold downdraft, typically lasting five to fifteen minutes, and is of a speed high enough to be able to cause damage on, or near, the ground. The term microburst is used to describe a downburst which causes damage over an area with horizontal dimensions of less than four kilometres. Downdraft speeds are typically of the order of 4000 ft/minute (40 kts) but can reach up to 6000 fpm (60 kts). On reaching the ground the microburst spreads out in all directions, bounces back and forms a vortex ring (see Fig 2). Horizontal outflows (surface winds) are typically between 45 and 100 knots, resulting in a possible horizontal wind shear of from 90 to 200 knots. The surface outflow may be symmetric or asymmetric.

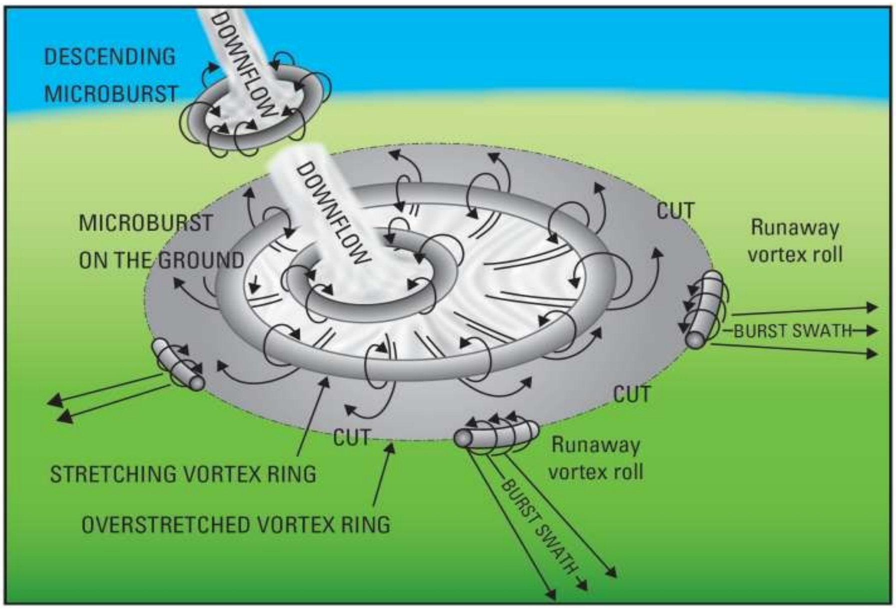


Figure 2 : Microburst Structure. Source: FAA

Microbursts can be characterised as wet or dry. Wet microbursts are accompanied by significant precipitation reaching the ground and are usually associated with thunderstorms. In a dry microburst, precipitation at the ground is either very light or does not occur at all, although virga (precipitation falling from a cloud but evaporating before reaching the ground) may be present. High-based cumulus and altocumulus also have been observed to produce damaging dry microbursts. A wet microburst may be quite readily seen (e.g. figure 3) but not so a dry microburst. When there is

Figure 3: Wet Microburst Source: FAA

little or no precipitation at the surface, a ring of blowing dust if apparent may be the only visual clue of its existence.

In this article I do not propose to go into the meteorological causes of a microburst as many of you are probably more qualified than I to describe this (see for example the following article co-authored by Warwick Grace, https://journals.sfu.ca/ts/index.php/ts/article/viewFile/802/760), but to concentrate on the effects on aircraft. For those interested in obtaining more information, Figures 4 & 5, plus the following websites may be of assistance

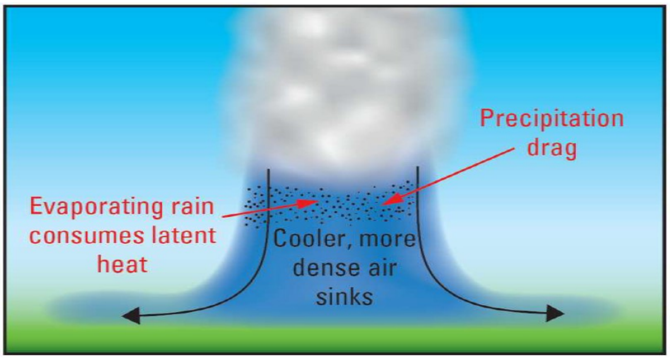


Figure 4: Downburst Formation Source: FAA

http://www.bom.gov.au/aviation/data/education/thunderstorms.pdf,

http://www.bom.gov.au/aviation/data/education/wind-shear.pdf,

http://www.bom.gov.au/aviation/data/education/flying-tropics.pdf,

http://www.bom.gov.au/storm_spotters/handbook/observing_thunderstorms.shtml

The existence of downbursts and microbursts was first proposed by Japanese-American meteorologist Ted Fujita. This arose after he was asked to help investigate the crash, on 24 June 1975, of Eastern Airlines Flight 66 at New York killing 112 and injuring 12 people.

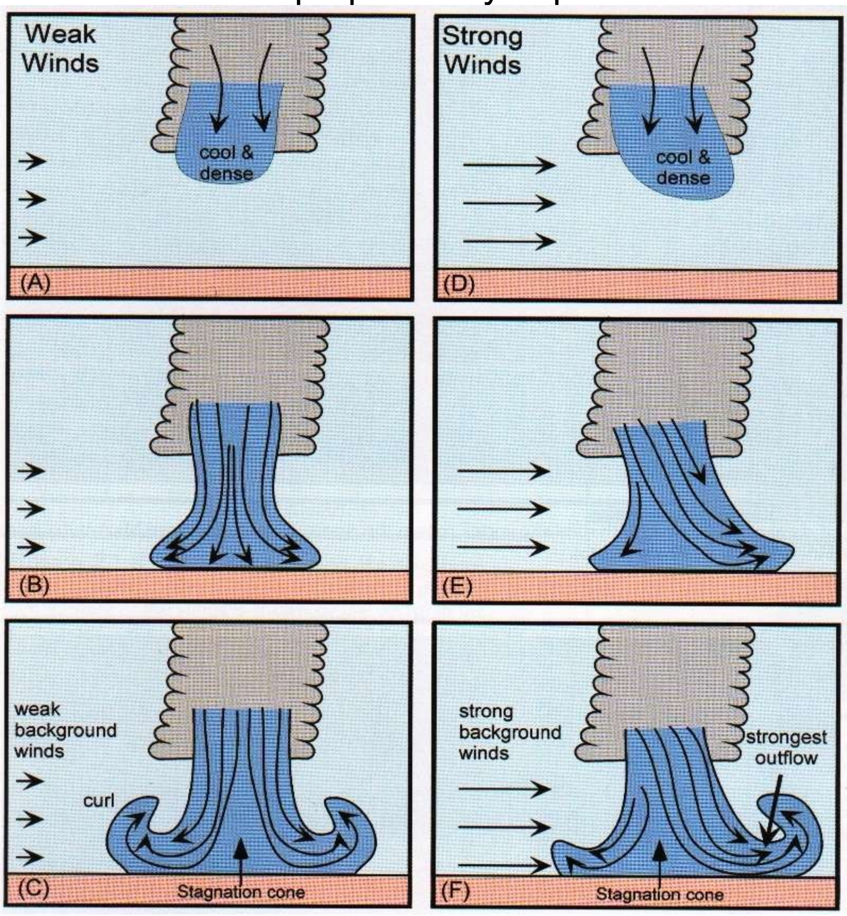


Figure 5: Downburst Structure & Formation Source: FAA

That led to a 1977 paper by Fujita and Horace Byers, describing a previously unknown weather phenomenon they called a downburst which, they believed, contributed to the crash of Flight 66. Other meteorologists were sceptical as no one had seen or recorded such a thing. Fujita persevered in his research and further subdivided downbursts into microbursts and macrobursts according to their scale of damaging winds. His ideas also prompted interest from bodies such as the US Federal Aviation Administration and NASA who supported further research into downbursts and microbursts; and their specific hazard to aviation. As the research proceeded, evidence of the existence of downbursts and microbursts mounted.

The final proof for many came with a fatal accident involving Delta Air Lines Flight 191 at Dallas/Fort Worth International Airport in August 1985. You may have seen this dramatised in an episode of the TV series "Air Crash Investigations". Flight 191, a Lockheed L-1011 Tri-Star, was on final approach when it encountered the microburst, The resulting wind shear resulted in the aeroplane touching down short of the runway, bouncing, touching down three more times and skidding into a large water storage tank where the jet's fuel ignited.137 people were killed (including all 3 flight crew) and 28 injured out of a total of 163 on board. Once again, Fujita was invited to investigate the accident.

Subsequently, based around Fujita's research, much progress was made in mitigating the danger from microbursts and wind shear. These improvements included detection equipment, forecasting and pilot training. As a result of this, microburst conditions are now more readily forecast, observed, avoided and coped with. They still, however, represent great danger.

One device for detecting turbulence is weather radar - both ground based and airborne. Weather radar indicates the intensity of the precipitation as a function of droplet size, composition and quantity (for example, a water particle is five times more reflective than an ice particle of the same size). In airborne weather radar this is presented to the pilot as a coloured display - from green to red. The theory being that the more intense the precipitation, the greater the turbulence. As can be inferred from above, dry microbursts, often the most dangerous, will probably not "paint". In some earlier experiments it was found using traditional weather radar, that the safest indicated flight path was in fact the most dangerous! Detection is improved by the use of Doppler Radar which also measures the speed of movement of the reflecting particle. Generally as precipitation falls it moves with the wind, so the Doppler radar can measure this movement and provide wind information as well as rainfall intensity. The BOM weather radar at Buckland Park is one such device. Some airborne weather radars are now also of this type. However, a minimum amount of precipitation is still needed for a return.

Some other detection methods used are Low-level Wind Shear Alert System (LLWAS) and Lidar. LLWAS consists of a number of anemometers strategically placed around an aerodrome. LIDAR works in a similar way to radar but uses laser or infra-red radiation reflected by tiny particles in the air.

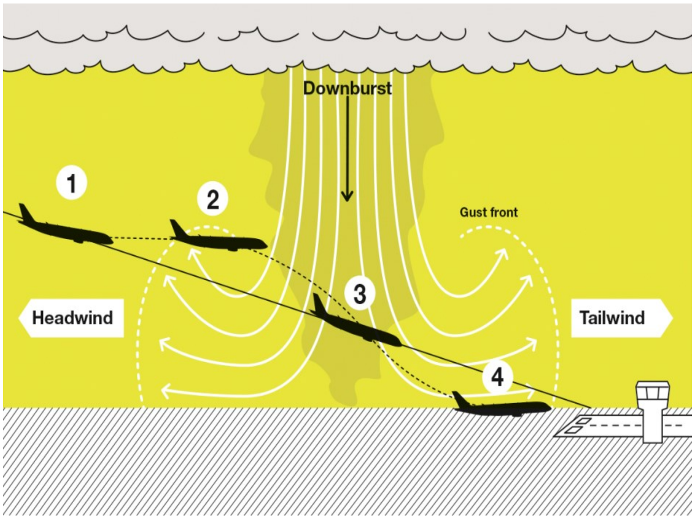


Figure 6: Effect of Microburst on Descent (Source: Airbus)

Why then are microbursts so dangerous? Consider the approach given in Figure 6. The straight line from 1 to 4 describes the desired flight path and the dotted line the probable with its disastrous outcomes.

At point 2 the aeroplane encounters an updraft and the rate of descent will decrease. The pilot's instinctive reaction is to reduce power and push the nose down. The aeroplane then very quickly encounters a rapid increase in headwind component resulting in a sudden increase of airspeed and lift which encourages a further reduction of power and pushing the nose down. Soon however the aeroplane moves to 3 at the heart of the downdraft with a consequence large increase in rate of descent. The pilot now rapidly tries to increase power and raise the nose. If this works the aeroplane will survive and move into a region of rapidly increased tailwind component resulting in a sudden loss of airspeed and lift. This, coupled with the high nose attitude, means at worst an aerodynamic stall or at best a further increase in the rate of descent. If the pilot is unlucky the likely outcome is scenario 4. If the pilot is lucky the aeroplane will move into a region of updraft (described above) and survive. Whatever happens, it is an experience best avoided.

So, what to do about microbursts? First, they should be avoided if at all possible. Second, if an aeroplane is caught in one, guidelines are now provided as to how best cope with the situation For airline operations, companies are required to provide procedures and pilots are required to take microburst and wind-shear training courses, and practice manoeuvres in flight simulators. The general rule however is full power immediately and raise the nose to a climb attitude or more, until the stall warning sounds but ensuring a stall is avoided. Then ride out the turbulence. Do not chase airspeed.

So, how to finish? There is good news and bad news. The bad news is that microbursts exist, they are extremely dangerous and have resulted in over 10000 deaths in aviation accidents. The good news is that now they are recognised, forecast and (hopefully) coped with. Accidents are rare. For example, from 1986 to 2008, the number of microburst fatalities in the United States was 37, a decrease of 93 percent over the previous period, despite a near doubling of airline flights during this time.

Article Competition - Great Prizes - See Back Page (Click to Follow Link)

Members are encouraged to submit weather related photos to monana@ameta.org.au for publication in *Monana.*

All the detail you could possibly want and more is available on the BoM website.

Visit http://www.bom.gov.au/climate and wander through the various archived climate reports and summaries which are available in text and graphical forms.

Another useful website is https://www.theweatherclub.org.uk/index.php/

Many of you will remember Terry Keen, a dedicated and long time member of AMETA; and a passionate aviator who sadly passed away in April last year. You may also recall hearing of Terry's astounding experience of a propeller breaking off just after take-off at night. Before he passed away, Terry dictated his story to his wife Marjorie who has provided it for publication in this newsletter.

Propeller Breaks during take-off at night.

In June 1967, I was the single pilot in a Piper Cherokee, 180 PYJ, doing practice for a Class IV Instrument Rating (now called a NGT VFR Rating). At the time, Night Flying was also part of the Commercial Pilot Licence Requirements.

The pre-flight checks were OK so I taxied and took off using a power setting of 2500rpm. I was doing circuit flying, the climb was normal and I began the circuit.

Incident:

- I reached 550ft and began turning cross wind when there was sudden violent shaking throughout the aircraft. The vibration was enormous. I felt the hair stand up on the back of my neck! I scanned the instruments at the same time waiting for another aircraft to cease transmissions and throttled right back prior to making a Mayday call.
- Jack Buchan, airport manager was on duty in the tower and asked for "present position". I responded "Just taken off".
- I realised that one plane was taking off behind me and two others were in the circuit and on final approach so I needed to keep off the runway.
- The vibration was still enormously strong. I turned the engine off and turned the aircraft back towards the field.
- At this point I turned off the master switch – so no lights or instruments. (The following pilot must have wondered where I was when my lights went off). I concentrated on trying to judge how fast I was going and my approximate height.
- I remember not turning on my torch as it would spoil my night vision. I remember also taking what seemed like a long look at my actions so far. I remember seeing myself inside the aircraft and was satisfied that I had done all I could.
- I concentrated on the height and speed of the aircraft and aimed to control the speed and height by manipulating the elevators so as to keep the nose up sufficiently to maintain the correct angle of descent and avoid stalling too high.
    - One thing I did not want to occur was the aircraft to stall at too high an altitude!
- I judged the speed as best I could so I could get to a lower altitude. To land without major damage, I needed to be below the height of the hangers.
    - I judged the height of the hangers by the lights on the roofs.
- I needed to keep up speed and stall out just a few feet from the ground.
- I remember forcing myself to maintain my nose attitude until I felt I was near enough to the ground to land. It was important to keep the nose up otherwise if I pushed it down too early it would dive into the ground.
- I remember feeling quite satisfied that I could do no more.
- I maintained the pressure on the back stick and waited until I judged that I was only 2 or 3 feet from the ground to land safely and hardly felt the contact with the ground.

- Then I thought there may be drainage ditches or other obstructions so I braked heavily as soon as I realised the wheels were on the ground.
- It was possibly the best landing I'd ever done!
- Investigations later found that I had contacted the ground with the two main wheels and just nicked a little bit of ground with the touch-down.
- I was very happy with my landing.
- The emergency vehicles took a while to find me because I had landed well off the strip and it was very dark. I waved my torch but they couldn't see it.
- Next came the report to the tower and explanation to Jack.
- The investigation that followed showed metal fatigue which caused the propeller to break. There were 5 inches of propeller missing.
- An appeal was made to Parafield residents to "help find the tip of a propeller which broke off from a light aircraft during a flight on the North-Eastern side of Parafield Airport. " It was never found. I was later given the rest of that half of the propeller.
- For my efforts I received a letter of commendation from the Manager of the Royal Aero Club of SA Inc. G T Alderman

ROYAL AERO CLUB OF S.A. INC.

PARAFIELD, S.A. TELEPHONE: 58 2477 TELEGRAMS: "ADAIRCLUB"

16th June, 1967.

Mr.T.G.Keen,
10 Hill Street,
BURNSIDE. S.A.

Dear Mr.Keen,

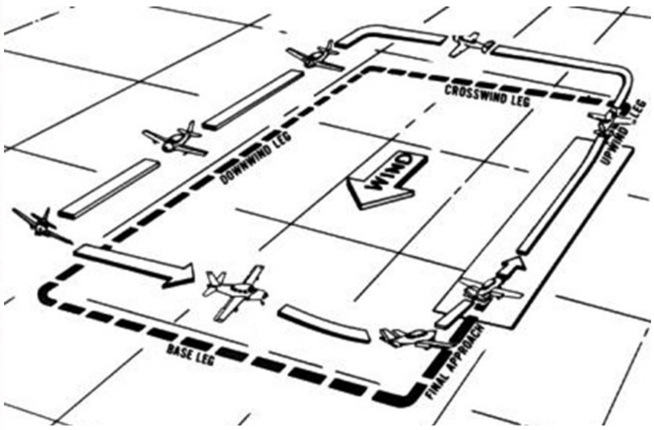
Up and down the hangar line there has been talk about your incident in the Cherokee a few nights ago and we could not let it all pass without letting you know what a tremendous job we think you did.

From all reports, particularly from Mr.Buckham, it appears that your handling of the emergency was in copy book style. Everything was done as it should have been including the "Mayday" call and a difficult landing, with no instruments in the dark.

We take a little pride in the fact that we taught you to fly but take none of the congratulations you deserve for a superb piece of airmanship.

Yours sincerely,

(G.T.Alderman)
MANAGER.



Aerodrome Traffic Pattern

AMETA WEBSITE RE-CONSTRUCTION

The AMETA website (ameta.org.au) is currently under re-construction following an earlier problem. It can be reached by clicking on ameta.org.au or by typing the address into your browser.

Sections of the old website are still available and can be reached by a link on the bottom of the new "Members Area" page.

Comments/suggestions (constructive please) on the new website would be greatly appreciated. They can be sent to webmaster@ameta.org.au.

Greater Adelaide in August 2020: wet in the Hills, cold at times

Rainfall in August was near to or above average in the Adelaide Hills, but monthly totals were generally below average on the Plains. Daytime temperatures were near to or cooler than average across Adelaide and the Hills. Mild nights through the middle and towards the end of the month resulted in close to average mean minimum temperatures, despite record cold temperatures on the 5th.

For more information plus a summary of August's statistics please see:
http://www.bom.gov.au/climate/current/month/sa/archive/202008.adelaide.shtml

Australian Government
Bureau of Meteorology

Adelaide (West Terrace / Ngayirdapira), South Australia
August 2020 Daily Weather Observations

The official site for Adelaide, having reopened in May 2017.

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Sa	10.7	20.2	0			NW	44	13:07	13.6	51		N	11	1023.3	19.8	31		NNW	20	1020.9
2	Su	7.2	20.1	0			NE	22	05:19	13.5	50		NNE	7	1022.8	18.7	43		WNW	11	1020.3
3	Mo	6.2	15.2	0			SSW	28	17:01	11.1	88		NNW	2	1020.0	14.1	59		SW	15	1016.6
4	Tu	5.8	13.9	0			SE	30	10:25	9.4	58		SSE	11	1020.9	12.8	42		SE	20	1019.5
5	We	0.8	14.4	0			ESE	28	23:05	7.7	67			Calm	1021.8	14.0	35		NE	6	1018.6
6	Th	5.5	13.3	0						9.0	55		E	6	1020.3	12.4	43		E	9	1017.3
7	Fr	7.8	10.3	0.2			S	39	18:27	8.9	71		SE	11	1014.7	8.0	76		S	15	1011.8
8	Sa	7.3	13.5	1.4			ESE	30	20:58	10.0	81		SW	9	1011.7	12.6	72		SE	9	1011.6
9	Su	6.9	15.4	0			S	22	13:31	9.4	79		W	4	1020.2	14.0	64		SSE	11	1019.2
10	Mo	5.2	17.3	0			NNE	39	23:04	11.6	68		NE	9	1021.1	16.5	54		N	17	1016.6
11	Tu	11.5	14.3	0						14.2	57		NNE	17	1010.9	11.7	89		NNE	15	1007.0
12	We	11.1	17.2	8.8			NW	39	11:35	12.1	86		N	13	1006.4	16.7	76		NW	20	1005.3
13	Th	11.4	17.2	0			NW	41	14:30	13.2	87		NNW	17	1010.3	16.8	68		NW	19	1008.5
14	Fr	10.4	17.0	0.2			NNW	31	13:22	11.9	86		N	9	1011.6	15.7	66		WNW	17	1010.3
15	Sa	10.4	15.6	2.2			WSW	28	10:40	12.3	86		WSW	9	1016.2	14.7	70		W	13	1015.9
16	Su	8.0	15.7	0.2			W	24	12:57	10.0	99		NNE	7	1019.9	14.5	60		WSW	9	1015.6
17	Mo	9.1	17.5	0			NNW	33	14:20	13.2	54		NE	15	1008.9	14.8	63		N	17	1003.9
18	Tu	8.9	16.2	0.6			NW	44	17:50	11.9	78		N	13	1002.9	15.8	55		NW	26	998.9
19	We	9.5	15.3	9.2			W	48	03:26	12.3	76		WSW	24	998.7	14.2	65		W	28	1001.6
20	Th	9.5	14.7	3.0			WNW	44	12:38	12.5	74		W	13	1010.0	11.8	87		W	15	1008.6
21	Fr	8.9	12.8	5.6			WSW	48	17:16	10.3	81		W	15	1009.4	11.9	64		SW	20	1009.5
22	Sa	7.9	13.7	3.4			SW	50	10:56	10.3	65		WSW	20	1017.1	13.2	56		SW	22	1017.4
23	Su	8.8	13.7	0.4			SW	33	08:50	10.2	75		SW	17	1021.5	13.1	62		WSW	15	1020.6
24	Mo	5.7	13.6	0.2			WNW	28	11:58	9.2	81		N	7	1025.7	12.5	50		SW	6	1024.7
25	Tu	2.3	15.5	0			SW	20	12:51	10.7	63			Calm	1031.9	14.7	53		WSW	9	1029.2
26	We	7.8	20.3	0			N	26	13:10	14.0	46		N	13	1029.7	19.7	42		NNW	13	1025.7
27	Th	10.8	18.2	0			SW	31	15:17	13.7	52		N	11	1026.7	17.4	60		W	17	1025.5
28	Fr	9.9	19.1	0			WSW	20	13:15	13.9	69		NNE	7	1029.6	17.7	55		WSW	9	1026.8
29	Sa	11.0	24.5	0			NNW	46	15:33	19.1	41		NNE	13	1024.0	24.0	25		N	24	1018.3
30	Su	12.5	15.7	0			W	44	12:02	13.1	88		W	15	1020.0	14.0	70		SW	22	1021.2
31	Mo	8.8	15.1	0.4			WSW	24	13:52	11.8	53		S	9	1028.6	13.6	49		WSW	13	1025.6
Statistics for August 2020																					
	Mean	8.3	16.0							11.7	69			10	1018.0	14.9	58			15	1015.9
	Lowest	0.8	10.3							7.7	41			Calm	998.7	8.0	25		#	6	998.9
	Highest	12.5	24.5	9.2			SW	50		19.1	99		WSW	24	1031.9	24.0	89		W	28	1029.2
	Total			35.8																	

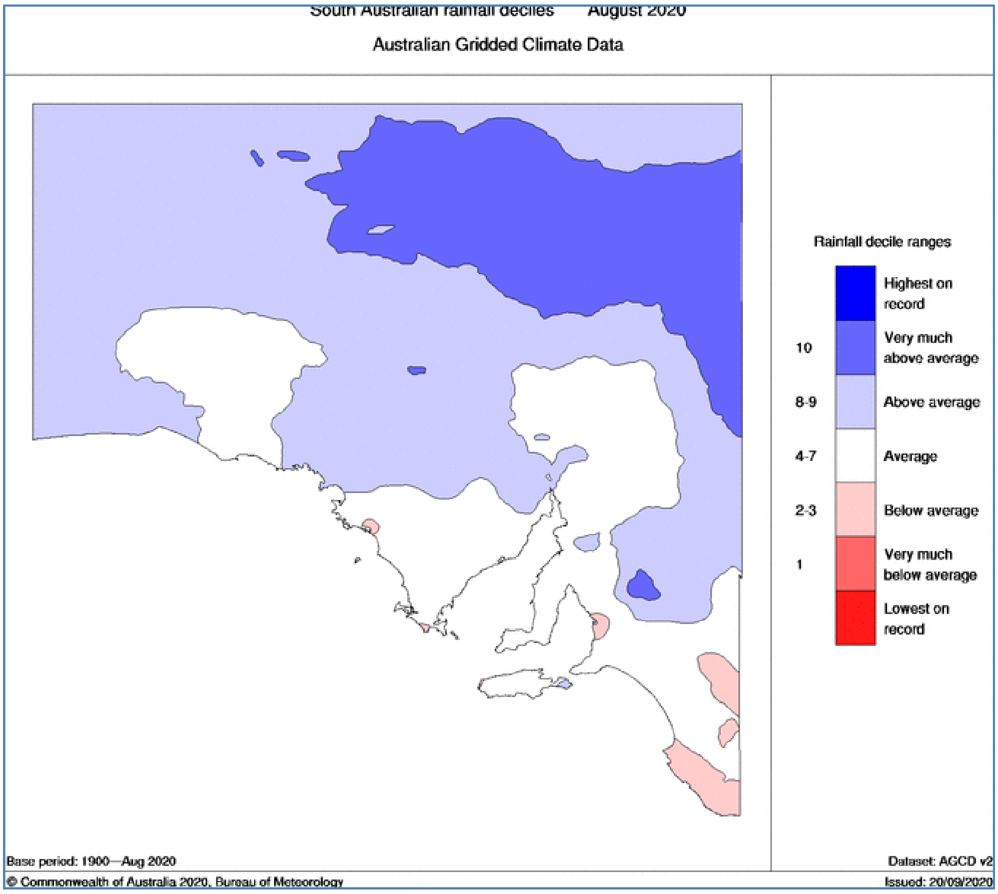
Observations were drawn from Adelaide (West Terrace / Ngayirdapira) {station 023000}
This is the "official" site for Adelaide, having reopened in May 2017. Observations are available from the Kent Town site {station number 023090} up until 31 July 2020.

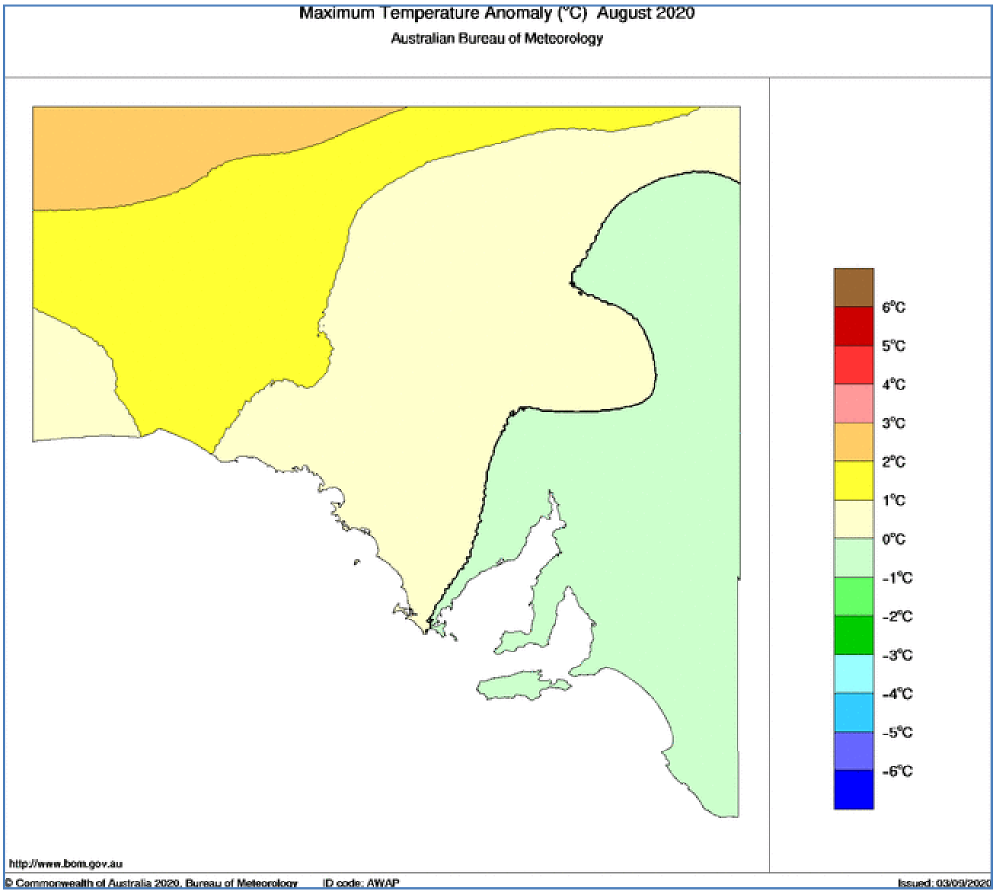
IDCJDW5081.202008 Prepared at 16:02 UTC on 2 Oct 2020

South Australia in August 2020: wet in the north, warm in the west

Rainfall in August was above average in the northern Pastoral districts, but it was a drier than average month for the Eyre Peninsula and South East Agricultural districts. Large areas of the state's west had warmer than average daytime and night-time temperatures, however it was generally cooler than average in the state's south-east, including around Adelaide.

For more information plus a summary of August's statistics please see:
http://www.bom.gov.au/climate/current/month/sa/archive/202008.summary.shtml





Greater Adelaide in winter 2020: drier than average, some cold nights

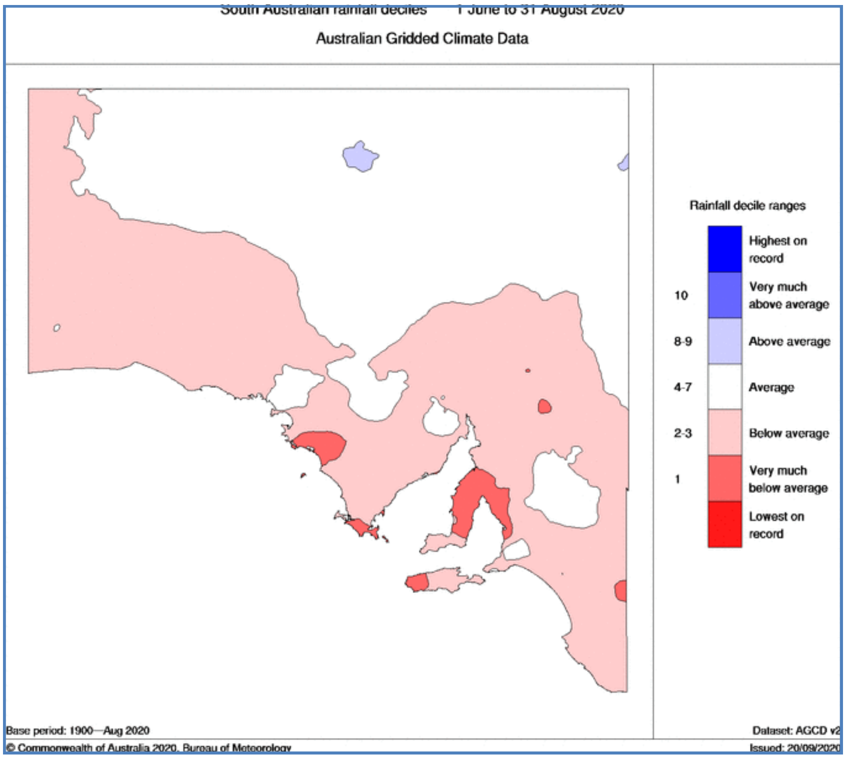
Rainfall for winter was generally below average across Greater Adelaide, but close to average in parts of the Hills and southern suburbs. Daytime temperatures were within one degree of average at all sites across Adelaide and the Hills, but night-time temperatures were cooler than average in most suburbs.

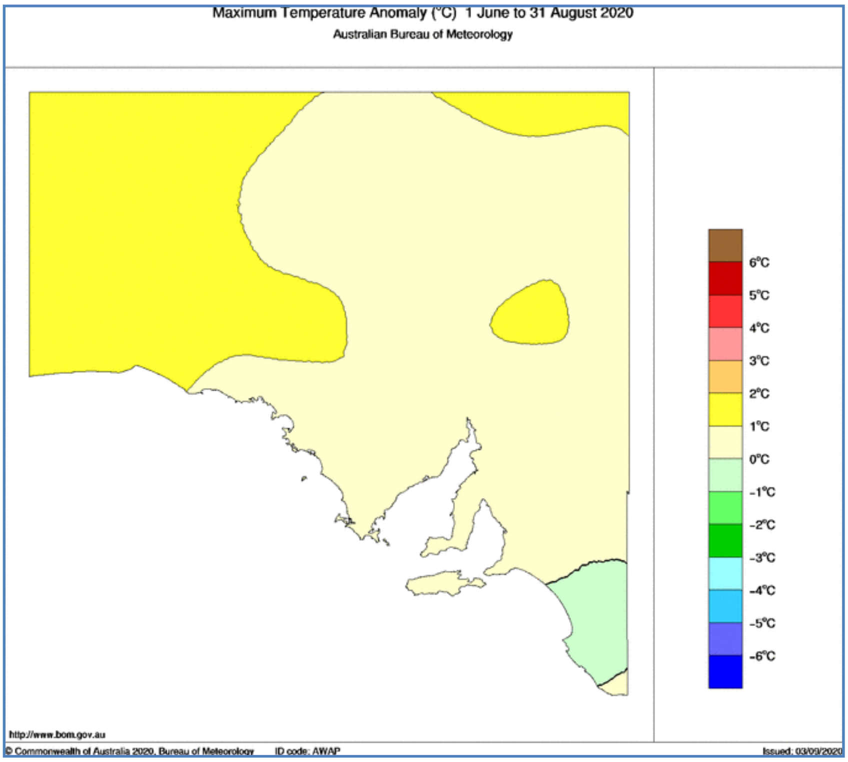
For more information plus a summary of Winter's statistics please see:
http://www.bom.gov.au/climate/current/season/sa/archive/202008.adelaide.shtml

South Australia in winter 2020: dry in the south and west, some cold nights

Rainfall for winter was below to very much below average across large areas of the south and west. While August was wetter than average across much of the north, June and July were very dry months for most areas. Nights were much cooler than average in the east during winter, but daytime temperatures were closer to average in the east and very much above average in the west.

For more information plus a summary of Winter's statistics please see:
http://www.bom.gov.au/climate/current/season/sa/archive/202008.summary.shtml





Greater Adelaide in September 2020: near-average rainfall, warm at times

Rainfall in September was generally close to average across Adelaide and the Hills. Both daytime and night-time temperatures were above average, with several very warm days through the middle of the month resulting in Greater Adelaide's overall warmest September since 2013.

For more information plus a summary of September's statistics please see:
http://www.bom.gov.au/climate/current/month/sa/archive/202009.adelaide.shtml

Australian Government
Bureau of Meteorology

Adelaide (West Terrace / Ngayirdapira), South Australia
September 2020 Daily Weather Observations

The official site for Adelaide, having reopened in May 2017.

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Tu	7.4	19.5	0			N	41	15:59	13.8	47		N	15	1019.0	19.0	36		N	22	1011.6
2	We	13.6	19.4	0			WNW	39	13:55	16.0	73		NW	13	1008.1	19.0	40		WNW	17	1008.3
3	Th	9.7	17.5	1.0			NW	46	12:03	12.9	79		WNW	15	1014.4	17.0	54		W	20	1015.0
4	Fr	8.9	18.0	0			NW	39	12:12	11.0	84		N	11	1019.5	16.7	56		WNW	22	1017.4
5	Sa	11.0	18.6	5.4			WSW	24	12:23	12.8	90			Calm	1021.3	17.4	50		SW	11	1020.5
6	Su	8.4	24.7	0			N	31	09:55	18.6	50		N	15	1021.0	24.0	25		NW	15	1018.0
7	Mo	18.3	29.0	0			NNE	54	10:30	22.3	24		NNE	26	1017.1	28.3	21		NNE	31	1012.2
8	Tu	15.4	17.8	0			W	35	02:07	15.9	68		SSW	9	1024.2	16.0	67		SW	13	1025.5
9	We	9.8	19.6	0			E	28	22:11	14.3	52		SSW	6	1029.0	19.2	34		NE	9	1024.8
10	Th	10.3	23.5	0			ENE	35	17:07	16.5	41		NE	13	1022.9	22.4	31		NNE	15	1018.8
11	Fr	16.1	29.3	0			ENE	35	03:33	22.6	34		NNE	19	1021.9	29.2	31		NNW	9	1018.5
12	Sa	14.9	24.3	0			SSW	39	15:11	20.0	60		ENE	11	1021.4	17.8	70		SW	19	1019.6
13	Su	9.6	16.1	9.2			WSW	30	12:48	13.4	65		SSW	11	1026.6	15.3	57		SW	15	1025.8
14	Mo	9.2	17.0	0			W	28	13:16	13.0	88		W	6	1031.2	15.9	63		WSW	15	1029.4
15	Tu	6.0	20.4	0			W	19	15:16	14.1	65		NE	6	1030.5	20.3	54		WSW	9	1024.6
16	We	10.3	26.6	0			NW	35	14:00	17.8	44		NE	11	1018.7	26.2	22		NW	17	1014.3
17	Th	15.8	22.4	0			E	54	21:16	16.7	61		ESE	15	1018.7	17.9	60		ESE	24	1016.8
18	Fr	15.7	27.1	0			ENE	50	02:22	22.4	44		NE	19	1018.4	25.3	38		ENE	11	1014.4
19	Sa	18.5	25.0	0			NW	35	14:01	20.2	64		NE	15	1009.1	22.5	50		NW	15	1003.9
20	Su	14.1	28.1	0			WNW	70	17:08	18.8	64		N	15	1005.9	27.7	29		NNW	31	999.2
21	Mo	10.0	19.3	0.6			NNW	59	12:03	15.4	42		N	20	1005.4	17.7	53		WNW	19	1005.0
22	Tu	9.4	15.8	11.0			W	59	06:29	13.2	75		W	26	1012.3	14.1	68		WSW	26	1013.9
23	We	10.3	15.8	4.4			WSW	43	13:33	11.6	88		W	17	1019.3	14.9	53		WSW	28	1019.0
24	Th	9.6	15.4	0.4			WNW	48	12:18	12.0	73		WNW	20	1016.5	10.7	91		WNW	17	1010.3
25	Fr	6.8	14.3	5.4			SSW	54	07:10	9.1	69		S	22	1011.3	12.6	50		SW	26	1013.2
26	Sa	5.9	14.7	4.4			SW	35	10:04	10.3	75		SSW	9	1022.7	13.7	53		WSW	19	1022.4
27	Su	4.8	18.0	0.2			ENE	30	23:28	12.9	53		NNE	7	1027.7	16.3	53		WSW	13	1024.0
28	Mo	11.7	21.5	0			NNE	33	11:18	15.9	48		NE	11	1025.2	21.1	33		NE	15	1019.7
29	Tu	15.8	20.0	0			NW	41	12:05	18.8	36		NE	19	1016.2	13.9	94		NNE	7	1015.0
30	We	12.2	16.6	15.6			W	33	12:09	14.8	72		WNW	15	1013.4	15.5	78		WNW	15	1012.7
Statistics for September 2020																					
	Mean	11.3	20.5							15.6	60			13	1019.0	18.9	50			17	1016.5
	Lowest	4.8	14.3							9.1	24			Calm	1005.4	10.7	21		NNE	7	999.2
	Highest	18.5	29.3	15.6			WNW	70		22.6	90		#	26	1031.2	29.2	94		#	31	1029.4
	Total			57.6																	

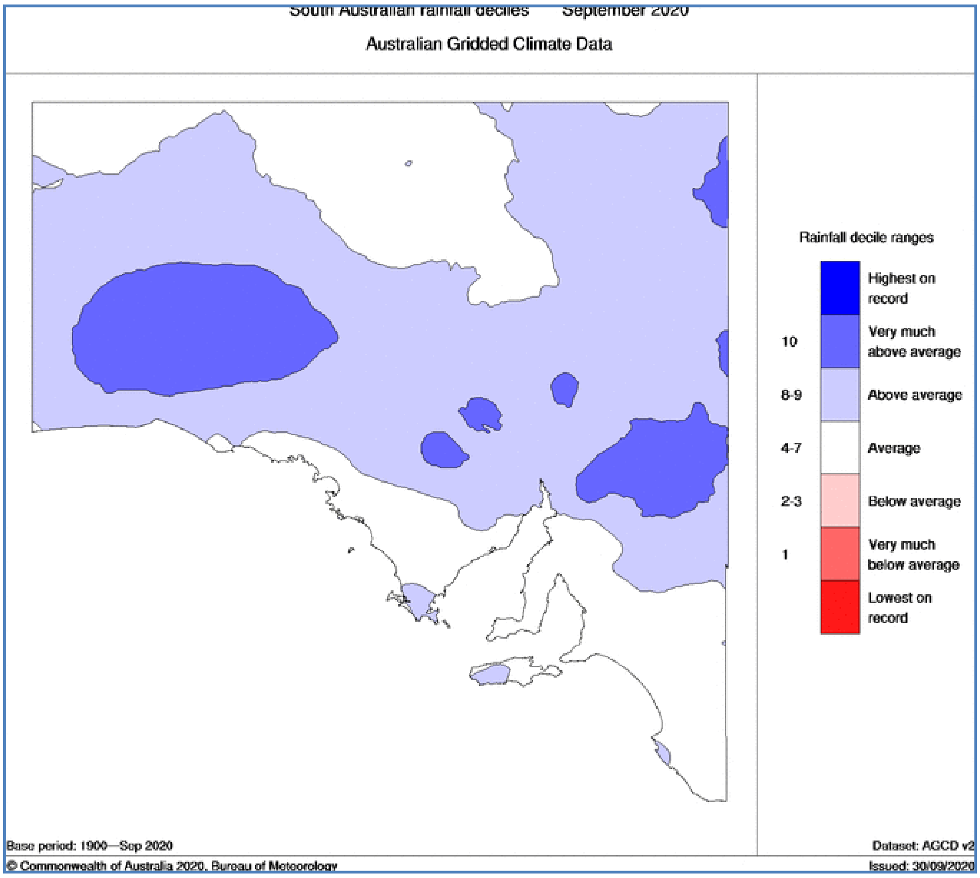
Observations were drawn from Adelaide (West Terrace / Ngayirdapira) {station 023000}
This is the "official" site for Adelaide, having reopened in May 2017. Observations are available from the Kent Town site {station number 023090} up until 31 July 2020.

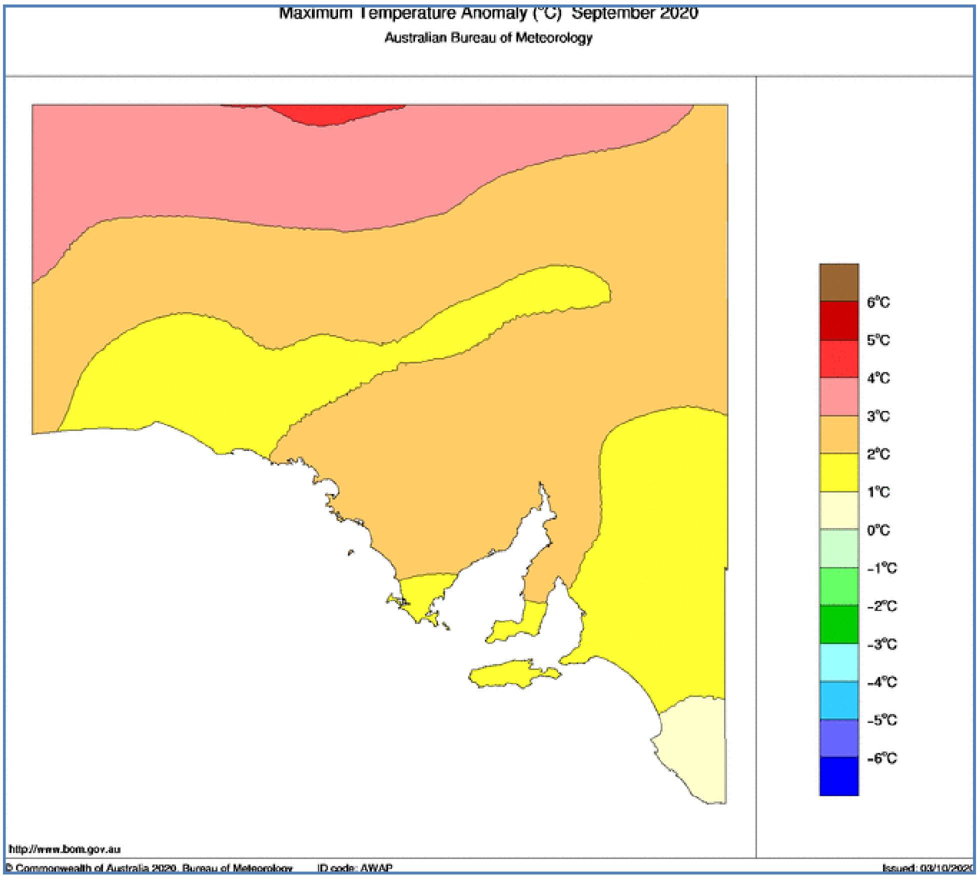
IDCJDW5081.202009 Prepared at 13:02 UTC on 7 Oct 2020

South Australia in September 2020: warm throughout the state, wet across the north

Both daytime and night-time temperatures were warmer than average across the state and the state's overall mean temperature for September was the second-highest on record. Rainfall in September was above to very much above average, across the Pastoral districts and generally close to average for the Agricultural districts, making it the state's overall wettest September since 2016.

For more information plus a summary of September's statistics please see:
http://www.bom.gov.au/climate/current/month/sa/archive/202009.summary.shtml





Australian Meteorological Association Inc (AMetA) - www.ameta.org.au

NEXT MEETING

16th February 2021 Venue TBA

(See “FROM THE PRESIDENT’S PEN”, page 1)

MEMBERSHIP FEES WAIVED FOR YEAR 2020 - 2021

See “FROM THE PRESIDENT’S PEN”, (page 1)

Article Competition

The Australian Meteorological Association (AMetA) magazine *Monana* is running an article writing competition until October 2020. The competition has the following conditions:

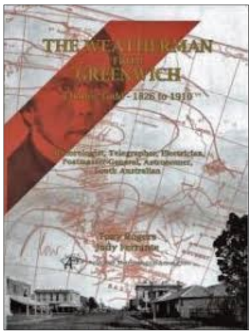
*(1) The article must have a **weather related theme**;*

(2) The article size should between 250 words and 500 words (½ to 1 A4 page of normal text). Accompanying photos encouraged, but not essential.

(3) The competition is open to all financial AMetA members (excluding Committee members);

(4) Only one prize per edition will be awarded. If multiple articles are published, the final decision for awarding prizes will rest with the magazine editors.

*(5) Subject to availability, the winner may select either an Arduino with prototype shield, or a a copy of the AMetA publication “**The Weatherman from Greenwich**”.*



(6) Entries are to be emailed to monana@ameta.org.au as plain text, word or Publisher files with photos as .png, .jpg or gif (if not included in the file).

For further information about AMETA & meeting details please contact:

Secretary:	Darren Ray
Phone:	0427872983
Email	secretary@ameta.org.au

For newsletter contributions, comments or suggestions please contact:

Monana	monana@ameta.org.au