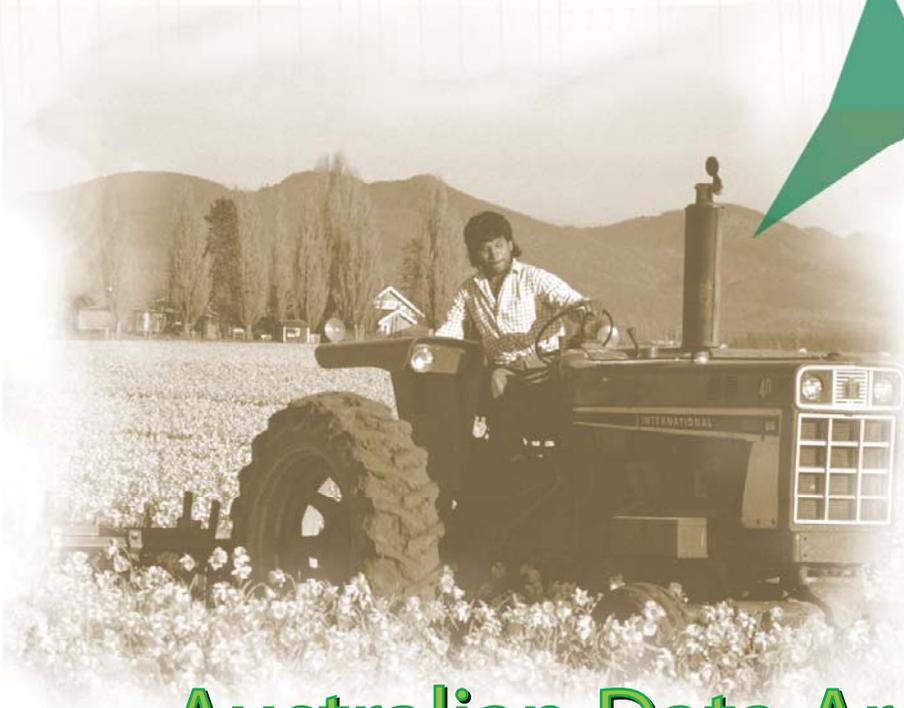
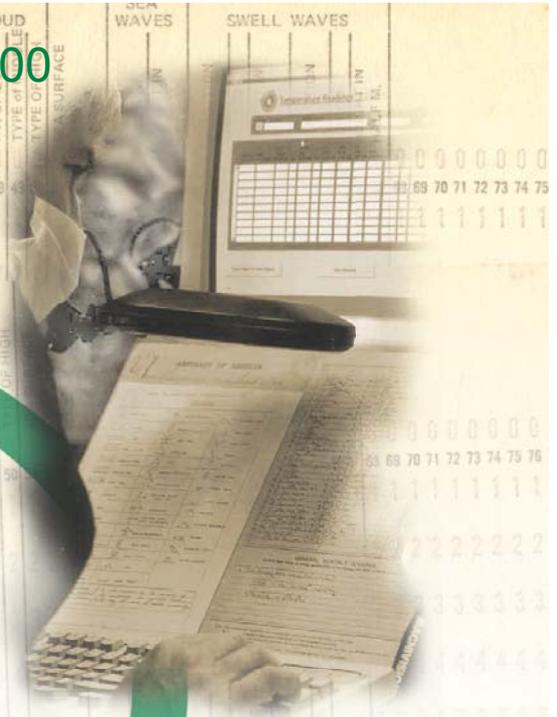


A draft document prepared for Cli-Manage 2000



Australian Data Archive for Meteorology

Every day thousands of observers around the country - rural workers, police officers, postal staff, teachers, and business people - collect information about the weather. The information they provide forms the basis of Australia's climate record - The Australian Data Archive for Meteorology (ADAM for short). Over the decades, this database has become an extremely valuable national resource, widely used by researchers, businesses, schools, and the general public.

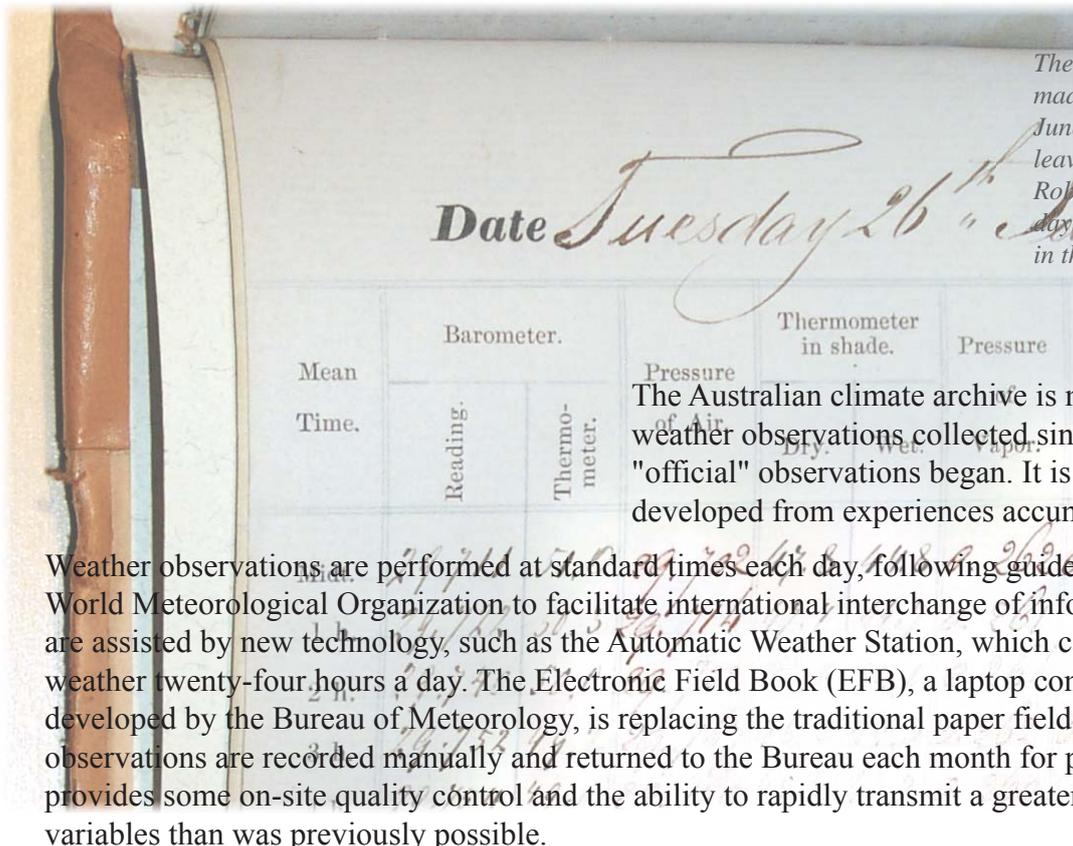
Why do we have a climate database?

Through application in industries such as aviation, shipping, agriculture and also the wider community, weather observations have value well beyond contributing to weather forecasting. The information collected can be subsequently used in a variety of ways, including:

- Helping to manage and improve the efficiency of everyday businesses (eg estimating energy demand)
- In a range of environmental issues such as sustainable development and pollution modelling
- Crop simulation studies to help improve yields
- Contributing to national safety standards (eg. safety in tropical cyclone areas and lightning protection)
- Developing irrigation strategies
- Assisting architects to design energy efficient buildings
- Supporting our international obligations (eg. under the World Meteorological Organization, the Framework Convention on Climate Change)
- Helping engineers and hydrologists to design structures such as dams, bridges and drainage systems
- Refining weather forecasting and seasonal climate prediction tools
- Allowing researchers to study climate variability and change
- Educating students from primary to university level, and of course
- Helping to plan the next holiday

In supporting monitoring and prediction, services, research and international activities, the national climate database provides the foundations for the Bureau of Meteorology to carry out its mission. Through improved quality of data, a longer climate record, and a growing awareness of potential applications for climate data, the Australian Data Archive for Meteorology increases its value to the whole community each year.

A brief history of the climate archive



The final meteorological observations made at Flagstaff Hill, Melbourne, in June 1860 by William John Wills before leaving on his ill-fated journey with Robert O'Hara Burke. One year and two days later he would make his final entry in the explorer's diary.

The Australian climate archive is more than a simple repository of weather observations collected since the mid-1800s, when "official" observations began. It is a resource that has been developed from experiences accumulated over many generations.

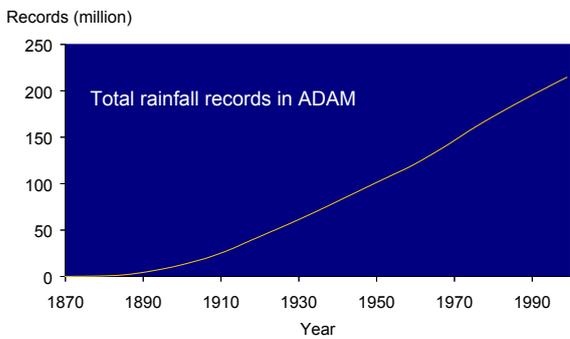
Weather observations are performed at standard times each day, following guidelines provided by the World Meteorological Organization to facilitate international interchange of information. Increasingly they are assisted by new technology, such as the Automatic Weather Station, which can continuously monitor weather twenty-four hours a day. The Electronic Field Book (EFB), a laptop computer with software developed by the Bureau of Meteorology, is replacing the traditional paper field books in which observations are recorded manually and returned to the Bureau each month for processing. The EFB provides some on-site quality control and the ability to rapidly transmit a greater range of meteorological variables than was previously possible.



The Bureau of Meteorology originally held information solely in manuscript form. By the 1950s data were being stored on 80 column punch cards, which enabled basic statistics to be produced by machine. Two decades later magnetic tape was introduced, which allowed data to be accessed electronically. Improvements continued and it was becoming clear by the 1980s that a more appropriate system was needed. After much planning it was decided that a modern database management system would be a more effective way to manage climate data and, in 1994, ADAM was born.

Australian Data Archive for Meteorology

ADAM stores meteorological observations from Bureau of Meteorology managed observing systems over mainland Australia and from neighbouring islands, the Antarctic, ships and ocean buoys. It also stores a limited number of observations from other local and international sources to support research and improve Bureau services.

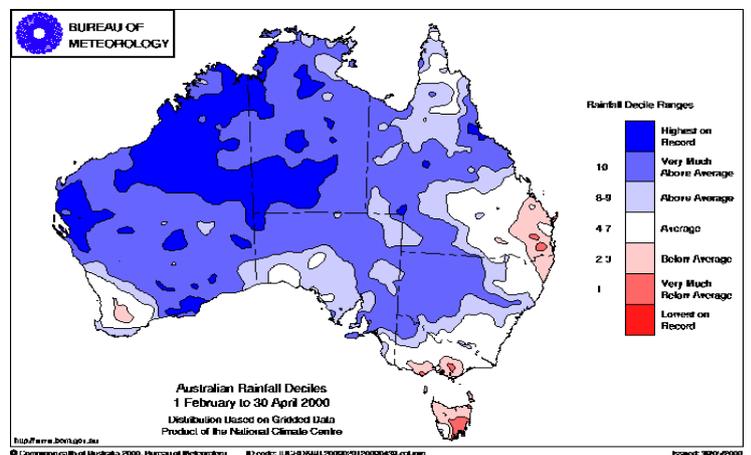
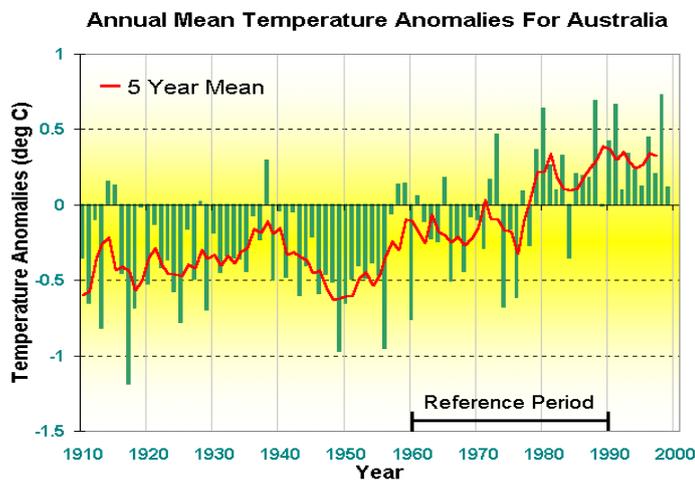


The graph above shows the growth in the number of rainfall records over the decades. Other elements have similarly increased in quantity, and in variety.

The most common observation type stored in ADAM is daily rainfall. Dating back to the mid-1800s, these total more than 200 million records from a network of over 16000 locations. Examples of other types of weather data (from a smaller network) stored in ADAM include air temperature, humidity, wind velocity, sunshine, cloud cover, soil temperatures, upper atmospheric wind and temperature, and observed weather phenomena (for example, thunder, frost and dust).

Observations may also cover different time periods. For example, air temperature observations at some sites may be made at three hourly intervals during a day, but maximum wind gust will be reported only once a day. The number of different observations and the frequency of observation vary between stations and weather elements.

To support this large database, the ADAM system contains supporting database tables and software tools required to enter, retrieve and quality control data efficiently. A set of detailed rules and procedures ensure consistent treatment of information.



Data in ADAM are invaluable for a range of scientific activities, for example in climate change analysis. The graph on the left shows that Australia experienced relatively warmer conditions during the last twenty years of the twentieth century. The analysis on the right uses rainfall observations from thousands of locations to show a continent experiencing the extremes of climate - very wet in the north-west but very dry in parts of the east over a three month period.

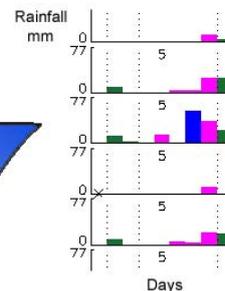
The Quality Monitoring Process

The usefulness of climate data is highly dependent on its continuity and accuracy. Observations must pass through rigorous quality control processes before being archived in ADAM. These include checking for:

- Values that extend beyond what is considered realistic
- Inconsistent observations (e.g. high rainfall recorded together with clear skies)
- Discontinuous or abrupt changes in values over a short period of time

Doubtful observations are examined to determine whether they are truly in error or just unusual. Data can be subjected to physical and statistical checks, compared against those for nearby stations with similar observations, or staff may refer to the original observations or observers for verification.

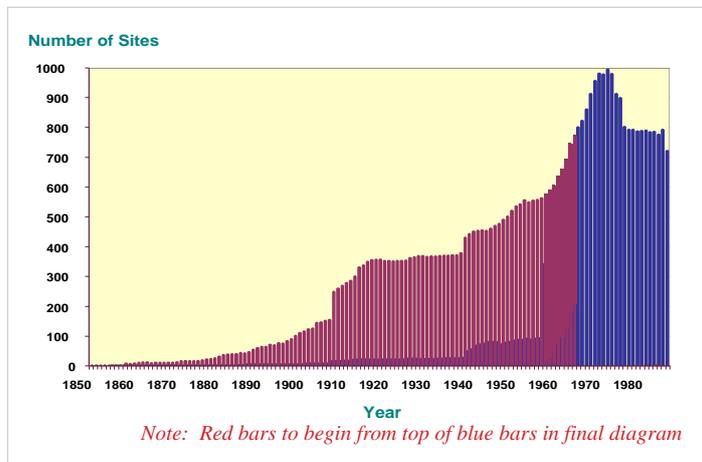
The ongoing development of quality monitoring software will not only improve the quality of data held in ADAM, but also provide feedback on trends in quality, instrumentation performance and observation practices.



Software tools such as RainQC use sophisticated algorithms to highlight suspect data (the rainfall value shown in blue in both graphics). The rainfall total of 55mm along the north-eastern coast of Australia on day 7 looks doubtful when compared with neighbouring totals for the same day (see left), especially in light of the good agreement found on other days.

Developing ADAM for the future

ADAM is continually being developed to improve the quality of stored data and the ability to meet the needs of users. As well as new quality monitoring techniques, the Bureau is extending the range of available observations, and work is underway to incorporate data measured at more frequent intervals.



The blue graph shows for each year the total number of stations with data currently held in ADAM. The red graph indicates the additional information held on manuscripts which can be digitised by projects such as CLIMARC and others.

The Climate Archives (CLIMARC)* project is extending the pre-1957 data holdings by computerising further daily and hourly climate data for 50 key sites across Australia. These historical data will be extremely valuable for a number of reasons, including: input to crop simulation models; improving climate predictions; and studying changes in climate extremes.

The Australian community may access the data in ADAM by contacting any Bureau information office, and some data and products are already available through the Bureau's web site. Greater access to ADAM through the Internet can be expected in the future.

* This activity is supported by the Agriculture, Forestry and Fisheries Australia and Australia's Rural R&D Corporations under the CVAP program. It is co-managed by the Queensland Department of Primary Industries and funded by several organisations

Further Information

For further information about ADAM please contact

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 Victoria, 3001, Australia
 Bureau of Meteorology website: <http://www.bom.gov.au>