WEATHER RADAR

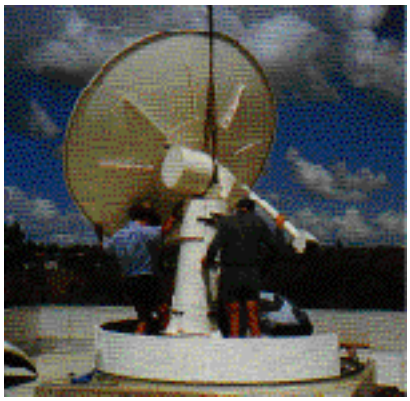
Radar's ability to locate rain and severe storms, and to measure winds in the upper atmosphere, make it a most useful meteorological tool. Australian weather observers have had more than 50 years' experience with Weather Watch and Windfinding applications since meteorological experiments with military radars during World War II.

Today the Bureau of Meteorology operates a network of 60 meteorological radars. Half are dedicated to either Weather Watch or Windfinding functions, the others perform both roles.

These radars have a high-powered microwave radio transmitter operating at a wavelength between 3-10 cm, and a steerable dish (paraboloidal) antenna which focusses transmitted energy into a narrow beam. A sensitive receiver detects reflected energy ('echoes') from objects or areas of rain which may be hundreds of kilometres away. The radar gives the position of reflecting objects by timing the echoes and displaying the direction to which the antenna is pointing.

WEATHER WATCH RADAR

Weather Watch radars detect rain and hail and estimate their intensity from the strength of the echoes. The radar screen typically shows rain location on a map overlay - in effect, looking down on a storm - and presents various rain intensities in different colours. Most radars also offer a vertical cross-section view through storms to give an indication of height.



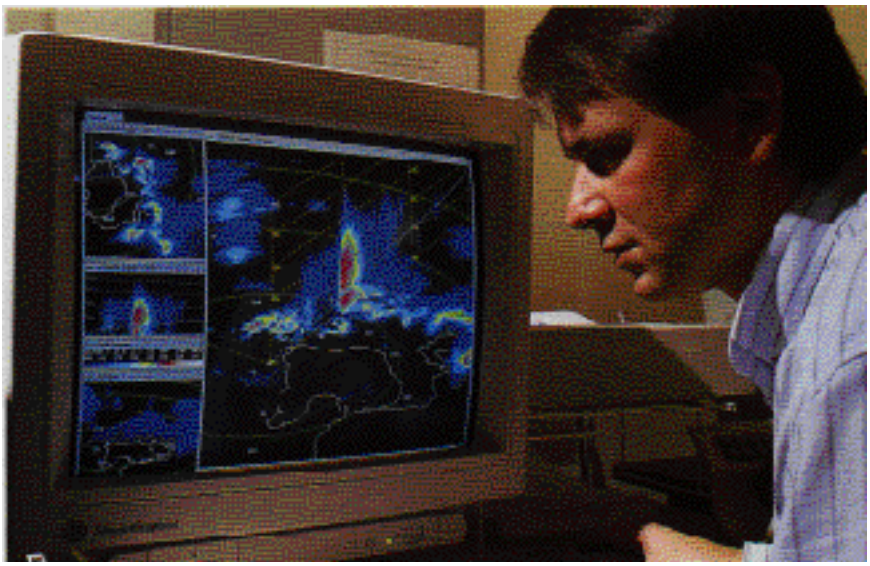
Installing a WF 100 Weather Watch radar at Townsville.

Weather Watch radars are frequently placed on high ground to clear local obstructions and give best coverage. They can depict light rain to a distance of about 150 km, and severe thunderstorms to over 400 km, limited mainly by the earth's curvature.

All Australian capital cities and many major centres have Weather Watch radar coverage. There is particularly wide cover of northern coastal areas subject to tropical cyclones.

Meteorologists in major forecasting centres can call up any Australian radar, and can also overlap images from neighbouring radars to show, for instance, total radar coverage from Adelaide to Melbourne. They can identify many weather phenomena from distinctive radar patterns: the spiral bands of a tropical cyclone, the distinctive structure of a cold front, the small hook-like shape which identifies a tornado. Recorded time-lapse radar sequences help forecasters estimate the arrival time of storms, and are also valuable for weather research or storm damage investigations.

The Bureau of Meteorology has developed RAPIC (radar picture), a personal computer-based system displaying radar information and many major weather features.It has also has been widely adopted by Australian media, airlines, mining and construction companies and public authorities, and is in service overseas.



The latest Weather Watch radars can present three-dimensional cross-sections of storms. The image at right shows horizontal and vertical profiles of a Melbourne storm: colours indicate rain intensity.

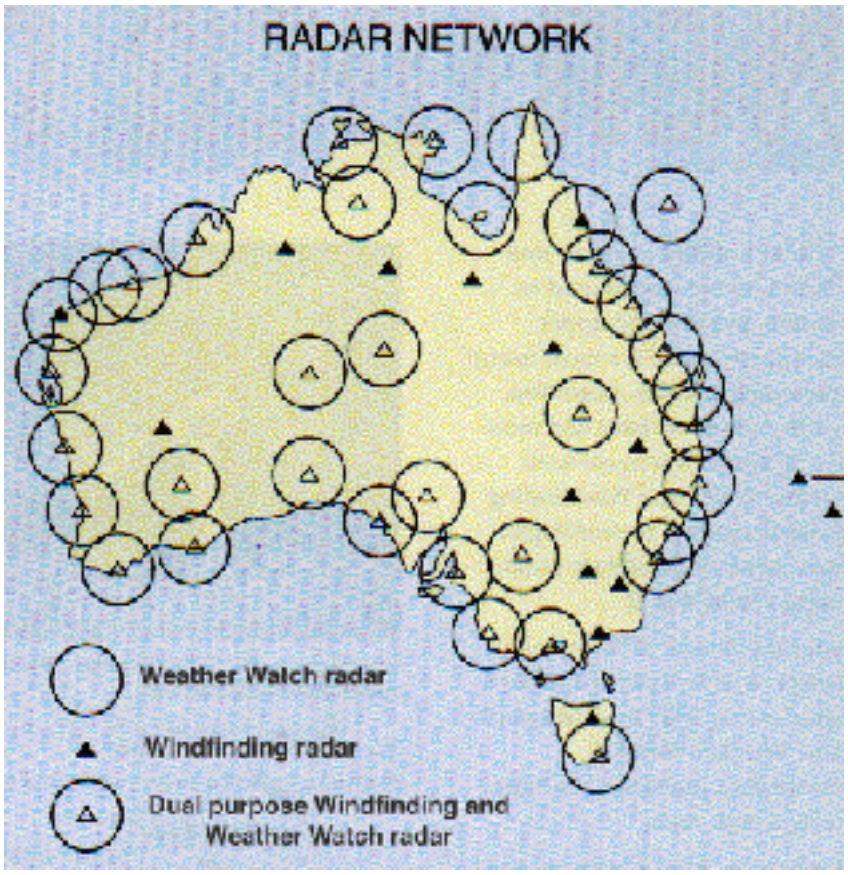
WINDFINDING RADAR

Windfinding radars help Australian meteorologists update their three-dimensional picture of upper atmosphere winds four times a day by tracking radar-reflective 'targets' carried by gas-filled balloons.

Windfinding stations located on a roughly regular grid usually launch four upper-wind balloons a day at about the same time. The radar typically monitors the balloon's position every minute as it rises at around 300 metres a minute. A typical wind sounding may last between 1-2 hours and may reach up to 30 km in height, and often 200 km downwind in strong winds, before the balloon bursts.

The resulting profile of wind speed and direction at different heights is essential to general forecasting, and particularly important to aviation safety and flight economics.

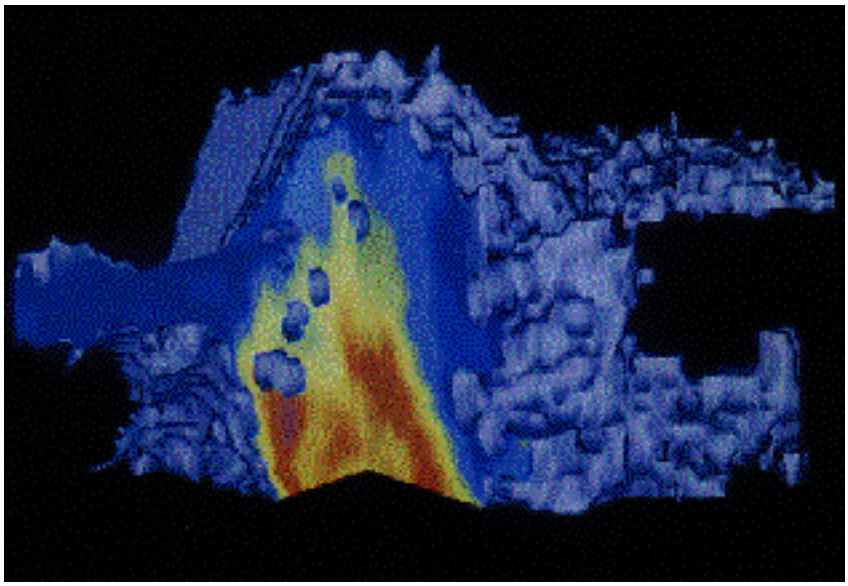
(Some balloons also carry a radio-sonde transmitter to send back temperature and humidity information.)



RESEARCH

The Bureau is conducting research with wind profilers, powerful vertically-aimed radars which obtain echoes directly from eddies within the atmosphere. Profilers have the potential for automatic and continuous operation, with new data every few minutes, instead of the six hours between balloon windfinding flights.

Doppler radar, which offers three-dimensional perspectives of wind motion within storms, is used at Darwin for research into very short-range analysis and prediction of convective weather.



Weather radars combined with computer-based analysis and graphics systems offer a very useful tool for observing severe local storms. They can present three dimensional cutaway views from any perspective. This radar image shows the intensity of rain and hail (red indicates heaviest rain).