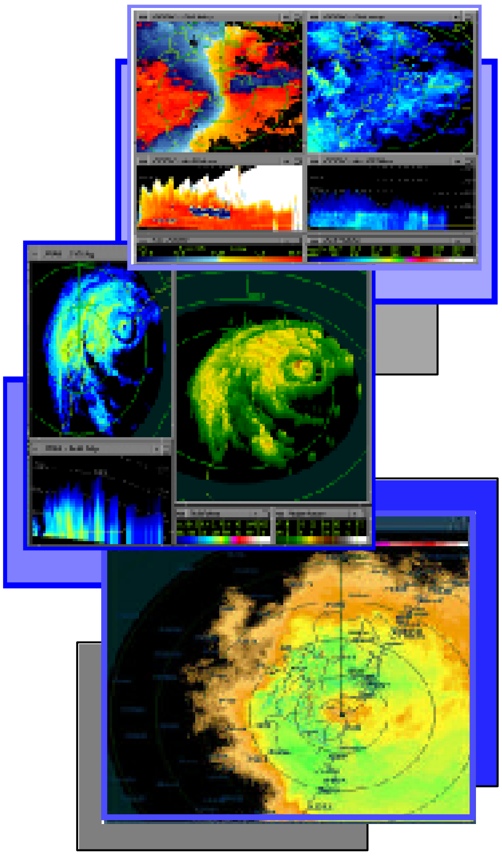
# INTERPRETING WEATHER WATCH RADAR SYSTEMS

## How Weather Watch Radar Works



RADAR (RAdio Detection And Ranging) is a system whereby pulses of radio waves are transmitted by an antenna in a highly focused beam and are reflected off targets and returned to a receiver located with the antenna. For weather watch radar, the targets are areas of rain (or hail, snow or drizzle). The radar attempts to locate all areas of rain within range of the antenna by sweeping the radar beam around just above horizontal. The radarís computer determines the direction of the rain from the orientation of the antenna, and the distance to the rain from the time taken for the radar signal to return to the receiver. Not only is the location of the rainfall determined, but also the ìreflecting powerî of the rainfall (which depends on the size of the raindrops and their concentration) is calculated, thus providing an estimate of rainfall intensity. In summary, the display produced by the radarís computer gives a horizontal map of where rain is falling and an estimate of how heavily it is falling. Note that the radar does not ìseeî clouds but the rainfall which those clouds produce. These areas of rain which the radar ìseesî are often called radar echoes because the radar beam reflects off them.

## Radar Features to Watch For

Rain Bands Radar echoes from widespread rain (e.g. from a frontal rain band) are usually extensive and fairly uniform in intensity, with ill-defined edges. The estimated rainfall intensity usually appears as light to medium because of the smaller raindrop size produced in such rain bands.

## Showers from Cumulus Clouds

Radar echoes from showers falling from cumulus (tall bubbly clouds) appear as sharp-edged cells scattered around the radar display. The estimated rainfall intensity can be medium to heavy owing to the high rainfall rates from such clouds.

## Heavy Precipitation from Thunderstorms

Radar echoes from the rain and hail produced in thunderstorms are very sharp-edged cells with intensecores indicating heavy rainfall. Hailstones produce particularly intense echoes because of their large size.

Thunderstorm precipitation cells can appear as isolated cells or in clusters or lines. Each cell tends to last for 30 minutes or more. Fast moving cells, rapidly growing cells, a bow in the direction of movement of a line of cells and/or a long-lived cell moving in a markedly different direction to others may indicate the potential for severe weather (large hail, damaging winds and/or very heavy rain). Also a very slow moving cell or the repeated passage of a number of cells over a particular location could indicate potential for flashflooding.

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## Tropical Cyclones

Tropical cyclones produce widespread heavy rain. The tendency for the rain bands, often with embedded cells, to spiral around the rain-free cyclone ìeyeî produces a characteristic radar pattern. Of course, many tropical cyclones are so extensive that they are rarely seen entirely by a single radar. Nevertheless, identification of the ìeyeî on radar is very useful in identifying the tropical cyclone centre and its movement.

## Limitations of Radar Interpretation

The following important points should be taken into account when interpreting radar images.

1. The intensity of echoes tends to decrease with increasing distance from the radar. This is because: the radar beam broadens with distance, thus decreasing the proportion of the beam which is filledwith rain, which reduces the echo intensity; the radar beam becomes further from the ground with distance (partly because of the Earthís curvature), thereby missing the lower parts of the rain; and the beam can lose power slightly when passing through very heavy rain, thus reducing the echo intensity further out from the radar. It is essential to keep these limitations in mind when interpreting the outer parts of the 512km range images. The presence of significant echoes at large range probably indicates the presence of large amounts of rain at high levels above the ground (e.g. a thunderstorm).

2. The presence of mountains within the range of the radar can block the radar beam, thus significantly reducing the echo intensity from rain on the other side of the mountains.

3. The radar may sometimes detect faint echoes from non-precipitation targets such as aircraft, large fires, swarms of insects, flocks of birds or even the surface (when unusual atmospheric conditions bend the radar beam back down to the surface!).

4. Remember that the radar display shows radar echoes at around 3000 metres. Thus a weak echo may not mean that it is raining at the ground because under some circumstances light rain 3000m aloft can evaporate completely before reaching the surface. Also, the early development of severe thunderstorms can be missed because all the precipitation is held high above the radar beam by the strong thunderstorm updraft.
5. The intensity of drizzle may be underestimated because of the lack of large droplets

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