



Radar Technology for Weather & Climate Research

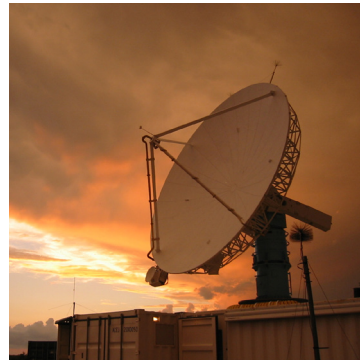
Where Science & Engineering Meet

WHY DOES NCAR USE RADARS FOR RESEARCH?

Atmospheric scientists and researchers use different types of ground-based and aircraft-mounted radar to study weather and climate. Radar can be used to help study severe weather events such as tornadoes and hurricanes, or long-term climate processes in the atmosphere.

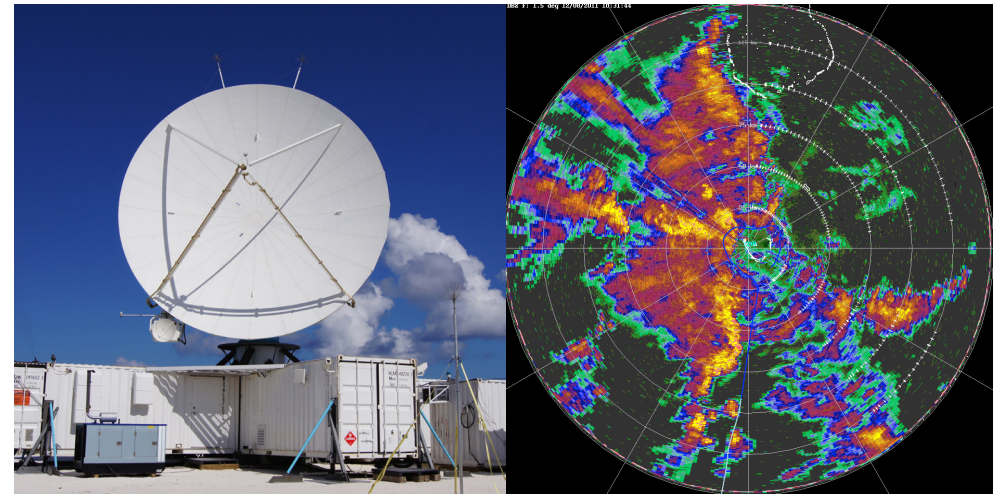
GROUND-BASED RESEARCH RADAR

The NCAR S-Band Dual-Polarization Doppler Radar (S-Pol) is a 10-cm wavelength weather radar initially designed and fielded by NCAR in the 1990s. Continuously modified and improved, this state-of-the-art radar system now includes dual wavelength capability. When the K_a -band is added, a 0.8-cm wavelength radar, it is known as S-PolKa. S-PolKa's mission is to promote a better understanding of weather and its causes and thereby ultimately provide improved forecasting of severe storms, tornadoes, floods, hail, damaging winds, aircraft icing conditions, and heavy snow.



RADAR :: RADIO DETECTION AND RANGING

Radars are critical for understanding the weather; they allow us to "see" inside clouds and know what is really happening. Working together, technicians, engineers, and scientists collectively design and develop the advanced technology of radars that study the atmosphere and the Earth's systems.



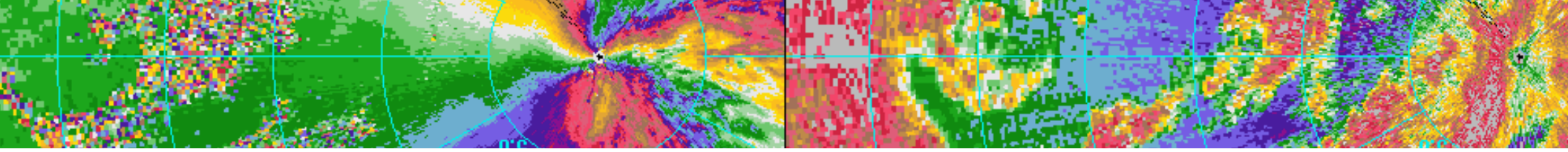
AIRBORNE RESEARCH RADAR

In the air, research aircraft can be outfitted with an array of radars. The NCAR HIAPER Cloud Radar (HCR) can be mounted to the underside of the wing of the NSF/NCAR HIAPER research aircraft (a modified Gulfstream V jet) and delivers high quality observations of winds, precipitation and other particles. It was designed and manufactured by a collaborative team of mechanical, electrical, aerospace, and software engineers; research scientists; and instrument makers from EOL.



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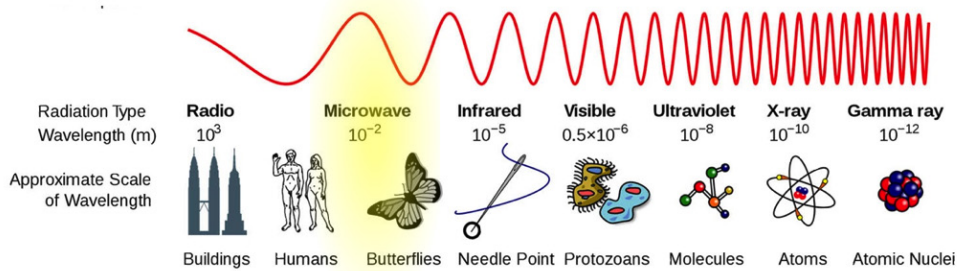


WHAT ARE WEATHER RADARS?

Weather radars are remote sensing instruments and capable of detecting precipitation type (rain, snow, hail, etc), intensity, and motion. Radar data can be used to determine the structure of storms and help with predicting severity of storms.

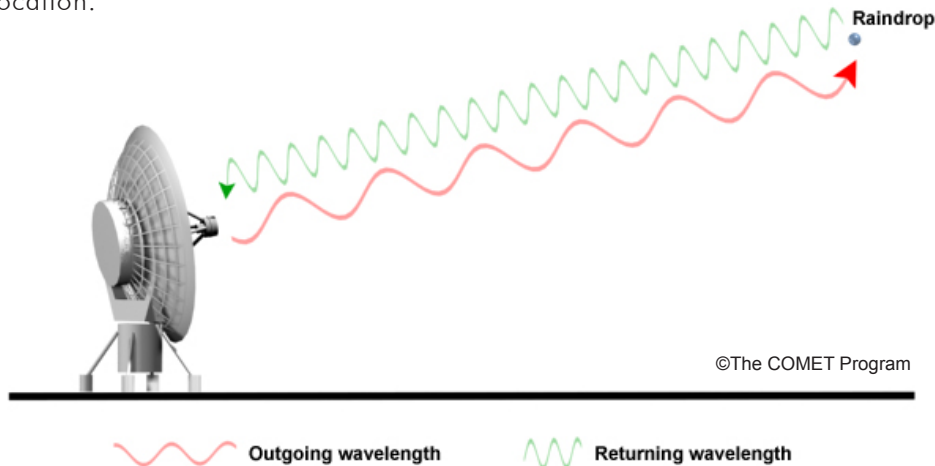
THE ELECTROMAGNETIC SPECTRUM

Energy is emitted in various frequencies and wavelengths from large wavelength radio waves to shorter wavelength gamma rays. Radars emit microwave energy, a longer wavelength, highlighted in yellow.



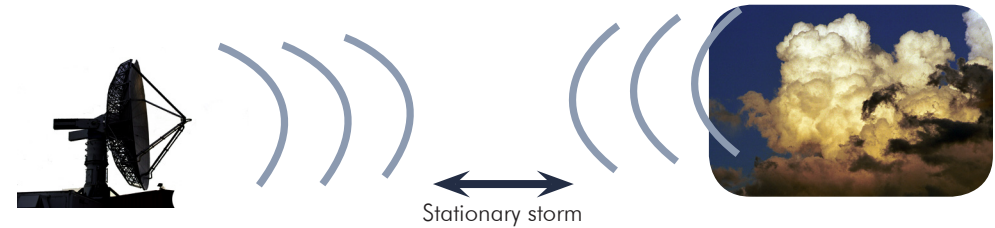
HOW DO RADARS WORK?

The radar transmits a focused pulse of microwave energy (yup, just like a microwave oven or a cell phone, but stronger) at an object, most likely a cloud. Part of this beam of energy bounces back and is measured by the radar, providing information about the object. Radar can measure precipitation size, quantity, speed and direction of movement, within about 100 mile radius of its location.



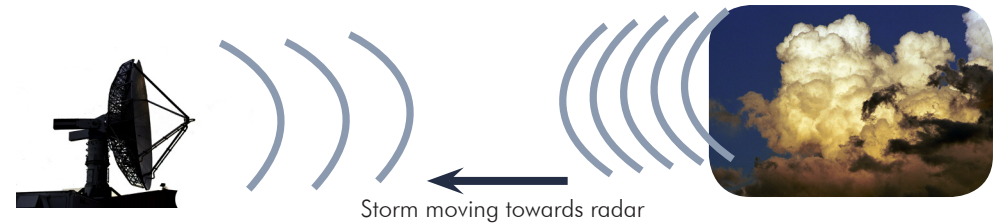
HOW DOES DOPPLER RADAR WORK?

When a storm is stationary, the transmitted energy and the reflected energy or "echo" will not change, as shown below.



WHEN STORMS ARE ADVANCING

When a storm is moving towards the radar, the transmitted wavelength frequency will be less than the reflected wavelength frequency.



WHEN STORMS ARE MOVING AWAY

When a storm is moving away from the radar, the transmitted wavelength's frequency will be greater than the reflected wavelength's frequency.

