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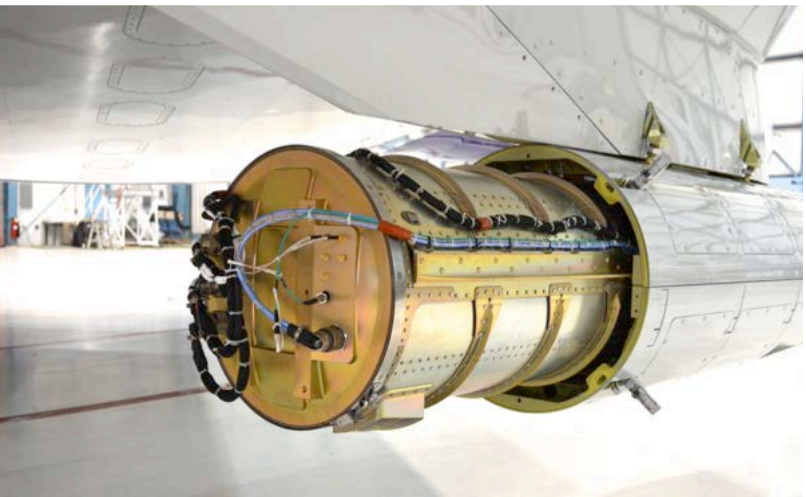
development • deployment • *data* • discovery

HIAPER Cloud Radar

The HIAPER Cloud Radar (HCR) is a research-grade airborne millimeter wavelength radar that serves the atmospheric science community by providing remote sensing capabilities on the NSF/NCAR HIAPER aircraft. The combination of the high-sensitivity and high-resolution HCR measurements and the high-altitude, long-range capabilities of HIAPER provides the ability to study a wide range of clouds in remote regions. The HCR makes dual-polarization and Doppler measurements that are useful for studying cloud microphysics and document cloud properties in remote locations such as over the oceans and in arctic regions, benefitting research ranging in scale from cloud scale processes to determining how cloud systems impact regional and global climate.



AVAILABLE FACILITY

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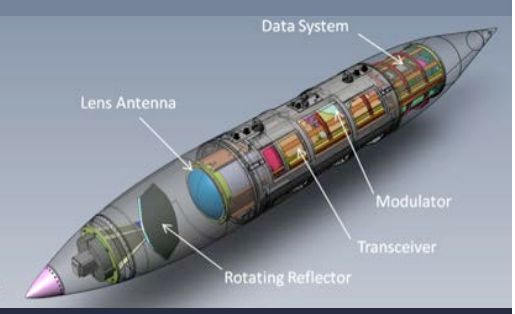
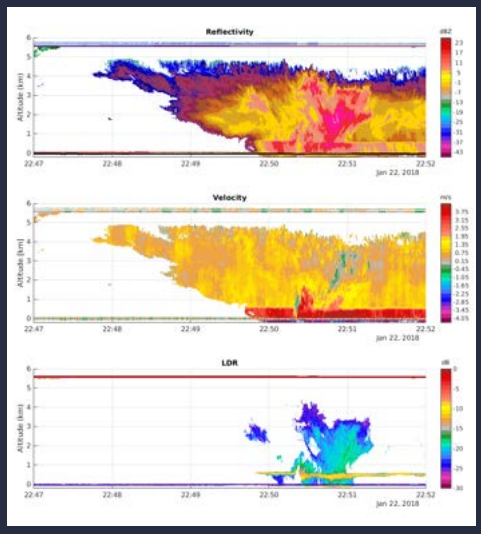


HCR Specifications

- Wavelength: 3.2 mm (W-band)
- Antenna Gain: 46.2 dB
- Beamwidth: 0.7º
- Transmitter: Klystron
- Peak Power: 1.5 kW
- Pulse width: 0.2 – 1.0 µs
- PRF: 10 kHz
- Polarization: vertical, horizontal, alternating
- Range resolution: 38.4 -153.6 m
- Along-flight-track resolution: 20 m
- Unambiguous range: 15 km
- Unambiguous velocity range: ± 8 m/s
- Sensitivity: -43 dBZ @ 1 km, 0.5 µs pw



About HCR

During flight, the HCR can operate in staring mode (e.g., nadir, zenith, or horizontal) and also has cross-track scanning capability. A key feature of the HCR is the real-time antenna stabilization system that uses the INS/GPS aircraft attitude data to correct the beam pointing angle for aircraft motion during flight, thereby significantly improving vertical velocity measurement during nadir and zenith staring mode.

The radar is housed in a 20-inch diameter wing pod and can be flown on different aircraft capable of supporting the pod. When not in flight, the HCR can operate in a ground-based configuration, enabling long-term cloud monitoring at a fixed site.

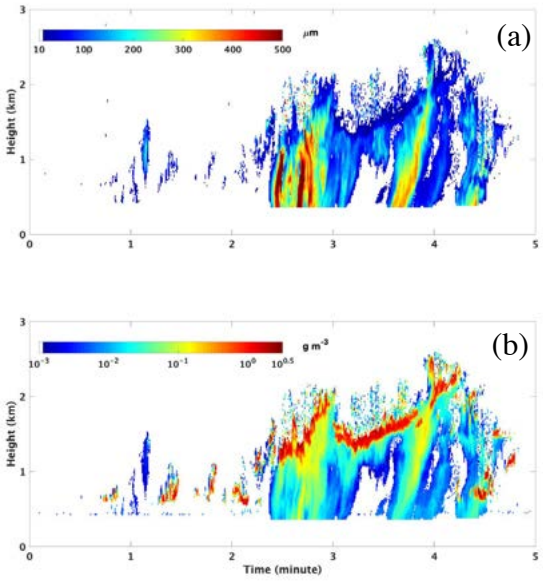
System Description

The standard moments products such as reflectivity, Doppler velocity, spectrum width, and dual-polarization variables are archived in netCDF CFRadial format. The raw in-phase and quadrature time series information are also archived, enabling spectral analysis.

The pod-based configuration of HCR uses a lens antenna to illuminate a reflector that can rotate in the cross-track direction. The reflector can rotate up to 60 degrees per second and has the ability to move in the tilt direction (along track) to adjust for the changing pitch of the aircraft.

HCR in Combination with HSRL

The HCR in combination with the High-Spectral Resolution Lidar (HSRL) will extend capabilities of both systems for investigating interaction of aerosol, cloud, and precipitation. For example, HSRL backscatter and HCR radar reflectivity are used for estimating particle size without any assumptions of shape or mathematical form of the drop size distribution (e.g., exponential, gamma or lognormal functions). The estimated particle size (panel a) along with HCR reflectivity is used for retrieving liquid water content (panel b).



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