![Colorado State University] **CSU CHIVO Radar**

CSU CHIVO is a dual-polarization C-band radar based on the Vaisala WRM200 weather radar

FEATURES

- 250 kW Magnetron transmitter, low-maintenance solid-state modulator
- Lightweight semi-yoke pedestal
- 1° beamwidth low side lobe antenna
- Modular design, containerized shelter with all radar electronics
- State of the art RVP900 signal processor and IRIS user interface
- Fully remotely operable
- Excellent image rejection to avoid interference from other radars
- Built-in automatic calibration system

The CSU CHIVO radar measures dual-polarization data over a range of > 200 km. Secondary products such as rainfall rate and hydrometeor classification are also computed. Output data is available in a number of standard formats, including CfRadial. Quick-look images are generated and posted to a webserver for immediate access to the data.

Attenuation Correction

CHIVO implements advanced attenuation correction based on the CSU DROPS algorithm to correct for signal attenuation using dual polarization data.

Technical Data

Transmitter

Type	Coaxial magnetron VMC-2033A
Modulator type	Solid state
Frequency range	5.5 – 5.7 GHz
Peak power	250 kW
Pulse widths	0.5, 0.8, 1.0 or 2.0 µs
Duty Cycle	0.12% maximum
Phase stability	< 0.5° rms
Pulse Repetition Frequency	50 – 2400 Hz
Average Power	300 W
Modes	STAR or LDR

Antenna and Pedestal

Operating temperature	-40 – +55 °C
Operating humidity	0 – 95% non-condensing
Storage temperature	-50 – +60 °C
Total weight	1530 kg
Operating altitude	Up to 3000 m
Operating ambient pressure	700 hPa

Antenna

Type	Center-fed parabolic
Reflector diameter	4.5 m
Gain (typical)	45 dBi
Beam width	< 1.0°
Peak side lobes at principal planes	< -29 dB (typically < -30 dB)
Integrated cross-pol isolation	< -35 dB
Cross-pol isolation at principal planes	< -36 dB
H/V alignment (squint angle)	< 0.1 °
Weight	620 kg

Pedestal

Type	Semi-yoke elevation over azimuth
Elevation limits	-2° – 108°
Maximum scan rate	40 °/s
Acceleration	20 °/s^2
Position accuracy	< 0.1°
Motors	Brushless AC servo
Weight	910 kg

Signal Processing

Signal processor	Vaisala RVP900
Azimuth averaging	2 – 1024 pulses
Clutter filter	Adaptive (GMAP), > 50 dB clutter suppression
Data outputs	All dual-polarization moment data
Dual PRF velocity de-aliasing	2:3, 3:4 or 4:5
IF digitization	16 bit, 100 MHz
Number of range bins	Up to 8168
Optional data output	Raw I/Q time-series
Processing modes	Pulse pair, FFT
Range resolution	75, 120, 150 or 300m

System Specifications

Input Power	Voltage: 3-phase 230/400VAC, 50/60 Hz Can operate on generator
Pedestal	1050 W (max), 200 W (typical)
Radar cabinet	2650 W
Cabinet cooler	1500 W
Support equipment	1000 W (max)
External data connection	Ethernet, site-specific point-to-point wireless data link
Data rate required	10 Mbit/s (min), 100 Mbit/s (optimal)

Antenna Tower and Radome

Radome type	6.7 m, foam core A-sandwich panels
Tower height	20 ft/6.1m (typical), height can be adjusted in increments of 10 ft/3m
Static tower design	Includes stairs, landing, external mount for PPU, concrete pad with 6 ft/1.8m piers
Mobile tower design	Simplified design with ladder, no concrete pad, levelling blocks for radar shelter
Tower environmental specifications	115 mph/185 km/h wind speed
Radar shelter	20' ISO container, with HVAC, insulation

RADAR RECEIVER

Type	Dual-stage, dual-channel IF downconverter and digitizer
Noise figure	< 2 dB
Dynamic Range	> 99 dB
Image rejection	> 100 dB (including waveguide filters)
Tuning range	5.5 – 5.7 GHz
First IF	442 MHz
Second IF	60 MHz

RADAR CONTROLLER

Type	Vaisala RCP8 with IRIS
Scan modes	PPI, RHI, Volume, Sector, Manual, Rapid Scan
Local display	Real time, Ascope, BITE, products

RADAR CABINET

Dimensions (W×H×D)	600×1800×1150 mm
Weight	380 kg
Cooling	Integrated cooler
Operating temperature	+10 – +40 °C

Deployments

The CHIVO radar is based in Fort Collins, Colorado, at Colorado State University. It can be deployed to remote field sites. An example of such a deployment is the 2018 RELAMPAGO field campaign where CHIVO was deployed near Córdoba, Argentina, for a duration of three months.

Post-processing software

Raw radar products are post-processed to generate a variety of secondary products including rain rate, hydrometeor identification and hail signature identification. The software can be customized to suit the needs of field campaigns. Output data is written in CfRadial-compliant netCDF files. Data is transferred to remote locations using FTP, rsync or LDM.

Local Operations and Data Storage

The radar shelter provides workstations to operate the radar locally. Local data storage is available to prevent data loss during network outages.

The radar is normally operated remotely through its network connection.

Contact information

For more information about CHIVO and deployments, please contact:

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