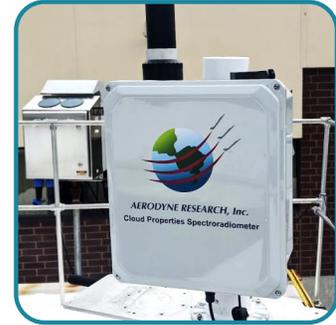


# TWST-COD Sensor

## Accurate and Precise Continuous Monitoring of Cloud Optical Depth (COD)

- Measures VIS spectra (400-1000 nm)
- Provides true 1 Hz sample rate
- Resolves thick/thin cloud ambiguity



Deployed at Aerodyne Research

### Attributes

- High temporal resolution; typical SNR (530 nm) > 1000 at 1 Hz
- Proven radiometric stability under harsh field conditions; frequent recalibration not required
- Sealed IP66 enclosure and backup battery allow for long-term autonomous field operation
- Includes radiometric calibration and a laptop computer fully loaded with executable software for control, data processing and user calibration
- Demonstrated agreement with co-located AERONET sensors within 1% when comparing in-band solar radiance at 440 and 870 nm

### Applications

- Accumulation of COD data for inclusion in climatology models
- Capture of cloud edges and fast evolution of cloud properties
- Study of cloud-aerosol interaction effects
- Collecting ground truth measurements for space-based earth-observing sensors
- Real-time measurement of COD for any event requiring a 'GO - NO GO' decision based upon knowledge of local cloud conditions

### Operating Principles

A calibrated spectroradiometer stares at a narrow segment of the sky directly overhead, recording the spectral radiance in the visible wavelength regime with high temporal resolution. The heart of the sensor consists of a single fiber-optic spectroradiometer with an entrance aperture that is well shielded from the sun. Dark spectra collection is done automatically with a conventional shutter. The equivalent width of the 760 nm oxygen A-band is utilized to resolve the thick/thin cloud ambiguity, thus providing superior performance to AERONET cloud mode.

# TWST-COD Sensor

## Specifications

MEASUREMENT SPECIFICATIONS	
Spectral Range	400-1000 nm
Spectral Resolution	~2 nm
Field of View	0.5 deg. FWHM
Spectral Bands used in COD Retrieval	440, 760, and 870
COD Precision	1% (typical, depends on update rate)
Operating Range	Blue sky to COD > 100
Data Logging Rate	1 Hz (typical), variable sampling interval from 1 to 60 seconds

*1 Year Manufacturer's Warranty*

## Physical Specifications

Weatherproof Box:	IP66, NEMA 4X sealed enclosure with desiccant
Temperature Range:	-10 °C to +40 °C
Precipitation:	Slanted optical window design drains water effectively; periodic cleaning with distilled water may be needed in some environments
Power Usage:	Mains: 100-240 VAC (50-60 Hz), 65 W Laptop provides 5 VDC, 250 mA via USB cable to spectrometer
Weight:	9 kg (20 lbs)
Size:	Box: 38 cm x 33 cm x 18 cm (L x W x H) [15" x 13" x 7"] Baffle: 30 x 5 cm (L x W) [12" x 2"] tube

## Data Output

Communication:	USB 2.0 connection to host computer for power and data
Display:	Simple, effective browser interface
On-Board Storage Capacity:	> 10 years continuous operation

## REFERENCES

"Application of oxygen A-band equivalent width to disambiguate downwelling radiances for cloud optical depth measurement". Edward R. Niple, Herman E. Scott, John A. Conant, Stephen H. Jones, Frank J. Iannarilli, and Wellesley E. Pereira. Atmos. Meas. Tech., 9, 4167-4179 (2016)