



Measurements and Status at the CERES Ocean Validation Experiment (COVE)

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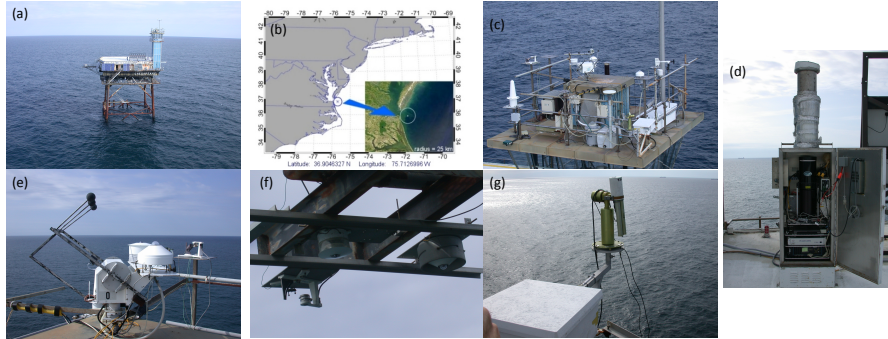


Clouds and the Earth's Radiant Energy System (CERES) Ocean Validation Experiment (COVE) at CLH website: <http://cove.larc.nasa.gov>

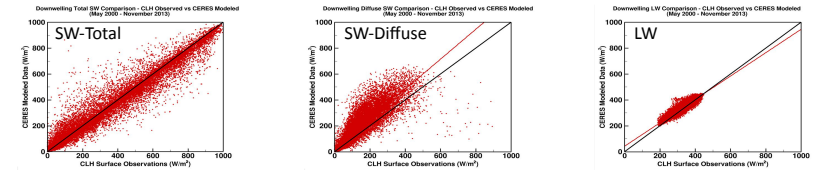


Introduction:

- Pictures of COVE and select COVE instrumentation are shown.
- A table of current measurements and instrumentation is displayed. Many have continuous data for 15 years and counting.
- Data Analysis of satellite-derived versus surface-observed measurements are presented.
- A climatology of black carbon measurements from an Aethalometer is depicted.
- Over-ocean measurements at COVE are in jeopardy. Other potential sites are described.

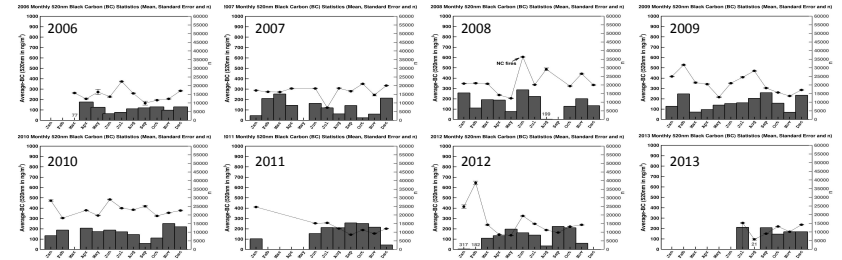


Instruments at COVE. Left to Right: (a) COVE is ~25 km off the coast of Southeast Virginia, (b) Latitude: 36.90 N, Longitude: 75.71 W, (c) Downwelling instrument elevation: ~37 meters, (d) Micro-Pulse Lidar (MPL), (e) Solar tracker with shaded broadband Shortwave (SW) and Longwave (LW) instruments and a pyrhelometer. A Multi-Filter Rotating Shadowband Radiometer (MFRSR) is in the background, (f) Upwelling instrument elevation: ~21 meters. The upwelling broadband SW and LW instruments and a MFRSR are installed at the end of an 8 meter extension from the structure on the west side, (g) Aerosol Robotic Network (AERONET) sunphotometer at downwelling instrument elevation.



Downwelling Parameter Comparison	n	Y=mx+b	R ²	Mean Bias	Standard Deviation
SW-Total	21730	Y = 0.938x + 14.094	0.952	4.415	60.928
SW-Diffuse	21802	Y = 1.154x + 23.137	0.791	-40.922	65.374
LW	37507	Y = 0.903x + 43.638	0.908	-10.810	16.938

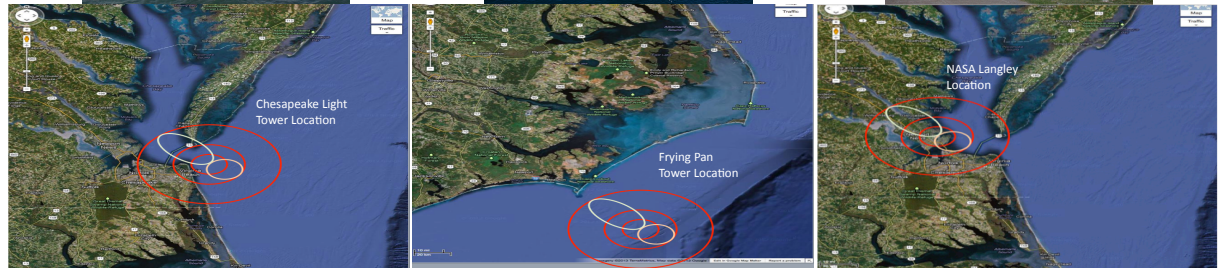
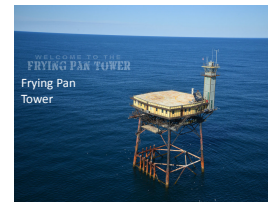
Statistics of coincident surface observations at COVE and satellite-derived (CERES SYN 1 deg-3hour Edition 3A) downwelling SW and LW radiation. Correlations are good and mean biases are small except downwelling SW-Diffuse. Downwelling LW has the best overall statistics with datapoints tightly clustered on the X=Y line.



Eight year climatology of black carbon measurements at COVE using the 520nm channel. Left Y-axis is monthly average (in ng/m³). Right Y-axis is number of points (n). Error bars are standard error. Monthly averaged black carbon values generally fluctuated throughout the climatology period. Note the June 2008 data that spiked due to wildfires nearby in North Carolina. Gaps in data occur due to Aethalometer instrument failure or instrument needed for intensive operation periods elsewhere.

List of Measurements

Measurement	Instrument (Model)	Units	Wavelength in nm	Remarks
Direct Shortwave Irradiance	Kipp and Zonen Pyrhelometer (CH1)	W/m ²	200-4000	Since May 2000
Diffuse Shortwave Irradiance	Kipp and Zonen Pyranometer (CM31)	W/m ²	200-4000	Since May 2000
Global Shortwave Irradiance	Kipp and Zonen Pyranometer (CM22)	W/m ²	200-4000	Since May 2000
Longwave Irradiance	Eppley Pyrgometer (PIR)	W/m ²	5000-50000	Since May 2000
Global and Diffuse Narrowband Irradiance	Yankee Environmental Systems MFRSR (MFR-7)	415, 496, 614, 671, 671, 868 and 939		Since 2000. Aerosol Optical Depth derived from MFRSR
Direct and Diffuse Narrowband Radiance	Cimel Electronique SeaPRISM Sunphotometer (CE 318N SP9 Ver. 5)	412, 443, 490, 532, 551, 667, 870 and 1020		Part of AERONET Network since October 1999
Normalized Water Leaving Radiance	Cimel Electronique SeaPRISM Sunphotometer (CE 318N SP9 Ver.5)	mW/cm ² sr μm	413, 441, 489, 530, 551, 668, 869 and 1020	Part of AERONET-OC since November 2005
Aerosol and Cloud Vertical Structure	Science and Engineering Services Micro-Pulse Lidar (Type 3)		523	Part of MPL-NET since May 2004
Integrated Precipitable Water Vapor	Trimble Global Navigation Satellite System (NetR9)	cm		Part of NOAA's GPS-MET network since July 2001
Black Carbon	Magee Scientific Aethalometer (AE-42-7-HS-AW)	μg/m ³	370, 430, 470, 520, 565, 700, and 950	Since March 2006
Light Scattering Extinction Coefficient	Radiance Research Nephelometer (M903)	1/m	530	Since March 2006
Sky Temperature	Heitronics Infrared Thermometer (KT 19.85)	Kelvin	9600-11500	Since December 2005
Sea Surface Temperature	Heitronics Infrared Thermometer (KT 19.85)	Kelvin	9600-11500	Since 2001
Air Temperature	Rotronic (Hygroclip-S3)	°C		Since May 2000
Relative Humidity	Rotronic (Hygroclip-S3)	Percent		Since May 2000
Barometric Pressure	Vaisala (PTB101B)	mb		Since May 2000
Wind Speed and Wind Direction	R. M. Young (05103)	m/s and 0-360°		Since May 2000
Photosynthetically Active Radiation (PAR)	LI-COR (LI-190SB)	mV	400-700	Since 2001. Calibrations are inconsistent
Surface Wetness Sensor (Rain Sensor)	Skye (SKLW 1900)	mV		Since October 2006
Ultrasonic Echolocation Calls	Anabat			Since April 2012



Satellite footprint scenarios of 3 different surface validation sites. Frying Pan Tower would be the best pure-ocean site. The NASA Langley site, being on land, has yet to be determined how well a surface validation site it would be. The inner red circle is a 20km CERES satellite nadir footprint centered on the site. The pink circle is a 20km footprint tangent to the site. The middle red circle is the locus of all nadir viewing footprints. The light green ellipse is a sample 40 degree off-nadir footprint. The outer red circle is the locus of all possible 40 degree off-nadir footprints.

Latest News and Future of COVE:

- COVE's future for scientific studies at Chesapeake Light Tower (CLT) is in peril. The Department of Energy (DOE, current owners of CLT) has requested that current occupants cease operations at the tower before 2015 due to DOE safety regulations. DOE plans to place CLT on General Service Administration (GSA) for auction which could open an opportunity to return.
- Frying Pan Tower (FPT) has great potential but needs safety improvements before it can be considered. The private owner expects to be begin structural repairs in 2015.

References:

- We thank the DOE for allowing atmospheric and oceanic research at COVE.
- We thank NASA Langley's Chemistry and Physics Atmospheric Boundary Layer Experiment (CAPABLE) for allowing us to establish a land calibration and measurements site for our instrumentation. Website: <http://capable.larc.nasa.gov/>
- Surface versus satellite data supplied by the CERES/ARM (Atmospheric Radiation Measurement) Validation site at <http://www.cave.larc.nasa.gov>