Introduction:

- BSRN data has been collected at CLH for 15 years and continues today.
- Pictures of COVE-CLH COVE-CLH’s power system and a new calibration site are shown.
- The Department of Energy (D.O.E.) gained ownership of CLH on October 1, 2012 for wind monitoring purposes.

Notes:

- COVE-CLH is approximately 23 km off the coast of Southeast Virginia.
- Latitude: 36.90 N, Longitude: 75.71 W.
- Downwelling instrument elevation: Approximately 37 meters.
- Upwelling instrument elevation: Approximately 21 meters.
- Note the upwelling instrumentation is installed at the end of an 8 meter extension from the structure on the west side.

List of Measurements:

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Instrument (Model)</th>
<th>Units</th>
<th>Wavelength in nm</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Shortwave Irradiance</td>
<td>Kipp and Zonen Pyrheliometer</td>
<td>W/m²</td>
<td>200-4000</td>
<td>Since May 2000</td>
</tr>
<tr>
<td>Diffuse Shortwave Irradiance</td>
<td>Kipp and Zonen Pyranometer</td>
<td>W/m²</td>
<td>200-4000</td>
<td>Since May 2000</td>
</tr>
<tr>
<td>Global Shortwave Irradiance</td>
<td>Kipp and Zonen Pyranometer</td>
<td>W/m²</td>
<td>200-4000</td>
<td>Since May 2000</td>
</tr>
<tr>
<td>Longwave Irradiance</td>
<td>Eppley Pyrgeometer (PIR)</td>
<td>W/m²</td>
<td>5000-50000</td>
<td>Since May 2000</td>
</tr>
<tr>
<td>Global and Diffuse Narrowband</td>
<td>Yankee Environmental Systems MPRS (MFRS)</td>
<td>415, 496, 614, 671, 711, 868 and 950</td>
<td>Since 2000. Aerosol Optical Depth derived from MPRS</td>
<td></td>
</tr>
<tr>
<td>Narrowband Radiance</td>
<td>Ciemel Electronique SeaPRISM 165m (CE 318N SP9 Ver. 5)</td>
<td>412, 443, 490, 532, 551, 667, 870 and 1020</td>
<td>Part of AERONET Network since October 1999</td>
<td></td>
</tr>
<tr>
<td>Normalized Water Leaking Radiance</td>
<td>Ciemel Electronique SeaPRISM 165m (CE 318N SP9 Ver.5)</td>
<td>413, 441, 489, 530, 551, 668, 869 and 1020</td>
<td>Part of AERONET-OC since November 2005</td>
<td></td>
</tr>
<tr>
<td>Aerosol and Cloud Vertical Structure</td>
<td>Science and Engineering Services Micro-Pulse Lidar (Type 3)</td>
<td>523</td>
<td>Part of MPL-NET since May 2004</td>
<td></td>
</tr>
<tr>
<td>Integrated Precipitable Water Vapor</td>
<td>Trimble Global Navigation Satellite System (NoIR9)</td>
<td>cm</td>
<td>Part of NOAA’s GPS-MET network since July 2001</td>
<td></td>
</tr>
</tbody>
</table>

Black Carbon

Mage Scientific Aethalometer (AE-42-7-HS-AW) µg/m³ 370, 430, 470, 520, 565, 700 and 950 Since March 2006

Light Scattering Extinction Coefficient

Radiance Research Neaphotometer (MK03) t/m 530 Since March 2006

Sky Temperature

Helionics Infrared Thermometer (KT 19.85) Kelvin 9600-11500 Since December 2005

Sea Surface Temperature

Helionics Infrared Thermometer (KT 19.85) Kelvin 9600-11500 Since 2001

Air Temperature

Rotronic (Hygromet-S3) °C Since May 2000

Relative Humidity

Rotronic (Hygromet-S3) % Since May 2000

Bareometric Pressure

Yokota (PTB 101B) mb Since May 2000

Wind Speed and Wind Direction

R. M. Young (OS103) m/s and 0.36° Since May 2000

Photosynthetically Active Radiation (PAR)

LI-COR (LI-190SB) µmol/m²/s Since 2001. Calibrations are inconsistent

Surface Wetness Sensor (Rain Sensor)

Skye (SKLW 1900) mV Since October 2006

Echolocation Calls

Anabat Since April 2012

Calibration site at NASA Langley. Having a land location calibration site allows for greater opportunities to collect data on clear sky days. Compare to the multi-day lead time and logistics of a COVE-CLH trip, which requires a helicopter ride and predicting the weather a few days in advance. Sunphotometers and pyrheliometers with their associated Campbell Scientific dataloggers are calibrated here as a set and then taken to COVE-CLH. This set is directly traceable to the World Radiation Group in Davos, Switzerland.

Locations where newly calibrated instruments are installed at COVE-CLH. Global pyranometer position (left). Diffuse pyranometer and direct pyrheliometer on solar tracker (right).

Downwelling Parameter Comparison

<table>
<thead>
<tr>
<th>Parameter</th>
<th>n</th>
<th>YM(x)+b</th>
<th>R²</th>
<th>Mean Bias</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW-Global</td>
<td>22883</td>
<td>0.903x + 43.638</td>
<td>0.951</td>
<td>7.057</td>
<td>61.825</td>
</tr>
<tr>
<td>SW-Total</td>
<td>21730</td>
<td>0.938x + 14.094</td>
<td>0.952</td>
<td>4.415</td>
<td>58.928</td>
</tr>
<tr>
<td>SW-Diffuse</td>
<td>21802</td>
<td>0.915x + 12.85</td>
<td>0.954</td>
<td>3.62</td>
<td>55.374</td>
</tr>
</tbody>
</table>

Statistics of coincident surface observations at COVE-CLH and satellite derived CERES SYN op X-11 Edition 3A, about the X/Y time (black) for downwelling SW and LW radiation. CERES SYN X-11 Edition 3A was developed by the CERES Science team. The linear fit line is in red. Correlations are good and mean bias is small for all except downwelling SW-Diffuse. Downwelling LW has the best overall statistics with data points tightly clustered about the X=Y line.

CLH’s Future:

- CLH’s future with the D.O.E. is constantly changing. The latest news is the D.O.E. is investigating an “Option B” for CLH (with full renovation for CLH being “Option A”). Option B is using the tower “as is” which includes a data campaign for at least two full calendar years. The primary instrument would be a “WINDCUBE” LiDAR system in place of a tall meteorology tower. Some other sensors may also be included. We have a good relationship with the D.O.E. and our research will not be affected during this time.

References:

- We thank the D.O.E. for allowing continued use of CLH for atmospheric and oceanic research.
- We thank NASA Langley’s Chemistry and Physics Atmospheric Boundary Layer Experiment (CAPABLE) for allowing us to establish a land calibration site for our instrumentation.
- Sunphotometer data supplied by the CERES/BMM (Atmospheric Radiation Measurement) Validation site at http://www.cove.larc.nasa.gov

13th BSRN Scientific Review and Workshop – Bologna 9-12 September 2014