AOP Measurements at USF

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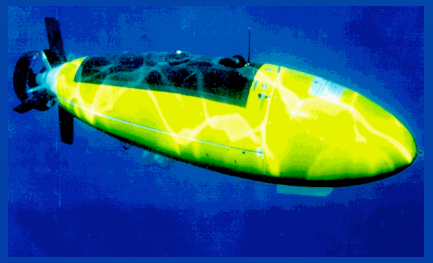
Past USF Measurements and Future Activities



Past:

- Bahamas, FL Keys, Gulf of Mexico (Carder:1998-2005)
  - Hyperspectral AOPs from slow-drop profiler
  - Hyperspectral AOPs from Unmaned Underwater Vehicles (UUV – both ROV & AUV)
- CARIACO program (Muller-Karger): multispectal AOP's, 1997 - present

Current and Future:

- CARIACO (2009-2012)
- AOPs from AUV/Glider
- Multispectral & hyperspectral profilers

USF AOP Equipment

Multispectral

- Biospherical Instruments: MER, PRR600, PRR2600
- Satlantic: OCR-507

Hyperspectral

- Handheld radiometers (Spectrascan, Ocean Optics, ASD, Spectrix)
- USF: Spectrix, AMOS
- Licor: Li-1800 (above water)
- Satlantic: HyperOCR
- HOBI Labs: HydroRad-4

Carder AOP Measurements

- AOP [$E_d(\lambda)$, $L_u(\lambda)$, $E_{d0+}(\lambda)$] measurements from UUV, profilers, and fixed platforms
- Majority of measurements collected from 1998-2005 using USF 'Spectrix' radiometers (internal shutter for dark samples)
- Spectral and radiometric calibration using in-lab light source and solar validation
- ~2-3 nm data binned into spectral (usually 5,10, or 15 nm) intervals using Matlab or custom software

Computed directly from AOPs

- $R_{rs}(\lambda, z)$ & $K_d(\lambda, z)$

Subsequent estimates

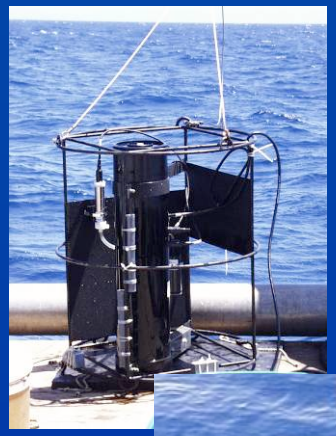
- $R_{rs}(\lambda)$, $R_{bottom}(\lambda)$
- $E_{d\text{-}bottom}(\lambda)$

and further model estimates

- $a_{total}(\lambda)$
- $a_{ph}(\lambda)$, $a_g(\lambda)$, $c(\lambda)$

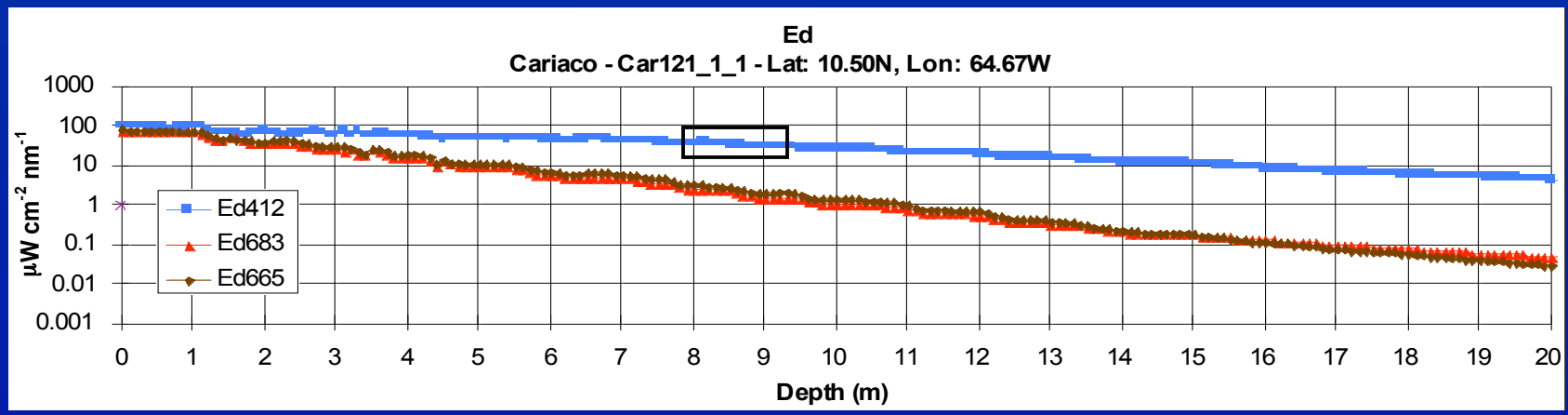
CARIACO

- E_d & L_u (& E_s): Biospherical MER (1997-1999,13 wavelengths); PRR-600, 7 wavelengths
- Derived products: K_d, R_{rs}, PAR
- Additional measurements: $R_{rs}(l)$ and HPLC pigment.
- All data submitted to SeaBASS
- Monthly measurements from 1997 – 2009, projected to continue to 2012



CARIACO collection and processing

- Data is collected between 11 am and 2 pm in CARIACO (10.5°N)
- Dark cast in the field 24 hrs before data cast.
- Biospherical and IDL software (customized) is used to process the PRR-600 data.
- CARIACO data is separated into casts, binned (10 cm intervals), and an extrapolation interval is visually selected



Field Data Validation/Sanity check

- In CARIACO done with surface (R_{rs}) and historical measurements
- When possible compare to $E_{d0+}(\lambda)$
- With UUV data: comparison with nearby $R_{rs}(\lambda)$, $E_{d0+}(\lambda)$, or IOP and discrete water sample measurements combined with radiometric models

(compare E_d, L_u, R_{rs} or K_d with estimates from IOPs & models)

AOPs from gliders

- 4 Webb-gliders with E_d and L_u sensors at USF
- Satlantic OCR507: 412,443,490,555,620,665, & 683 nm
- Fluor. Chl & CDOM, b_b(660), & CTD
- Expect immediate deployment over West Florida Shelf

Ancillary measurements

- Fundamental: Depth, time, lat & lon., orientation (roll, pitch, heading), altitude above seabed, temperature, chl. & $b_b(660)$
- Often available: fluor. chl & gelbstoff, b_b & c at one or more wavelengths, E_{d0+} (par), salinity, meteorological & seastate info
- May be available: $R_{rs}(\lambda)$, $E_{d0+}(\lambda)$, ac9 data, $a(\lambda)$, WETLabs eco-VSF, bottom type, discrete water samples [$a_p(\lambda)$, $a_{phi}(\lambda)$, $a_g(\lambda)$, Chl, phaeo.]

Measurement Concerns

- Maintaining Instruments: calibration, validation, service
- Available expertise and time
- Control/stability of instrument orientation
- Biofouling
- Aging of instrumentation
- Self-shading of instruments
- Transportation (international instrument shipping -> lack of regular maintenance)
- Comparison between diverse instruments and models (not enough or too much?)

AOP future goals

- Operational deployment of UUV/gliders with AOP sensors
- Develop processing protocols for AOPs from gliders
- Improve operational protocols for reliable AOP measurements from diverse platforms
- Combine AOP measurements with satellite or airborne data to improve accuracy or provide validation measurements (additional satellite cal/val data)
- Under some conditions, IOPs estimated from AOPs can be as accurate as IOP measurements

Acknowledgements

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