



VIIRS Cal/Val Cruises

NOAA activities in support of in situ validation observations for satellite ocean color products

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With contributions from Mike Ondrusek
and VIIRS Cal/Val Cruise Team Members

*Global Science & Technology, Inc.

2016 STAR/JPSS Annual Science Meeting
College Park, MD, 8-12 August 2016



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Acknowledgements

- NOAA/JPSS Ocean Color Cal/Val team
- Officers and crew of the NOAA Ship *Nancy Foster*
- NOAA OMAO
- NOAA JPSS program
- NOAA STAR Ocean Color EDR team
- NOAA CoastWatch/OceanWatch Central



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Outline

- NOAA dedicated to VIIRS Cal/Val cruises: 2014, 2015, upcoming 2016 (and beyond)
- Collaborations and other cruises of opportunity
- NOAA Optical Instrument Calibration Lab
- NOAA support of MOBY and four AERONET-OC sites
- Data assembly, distribution and archiving



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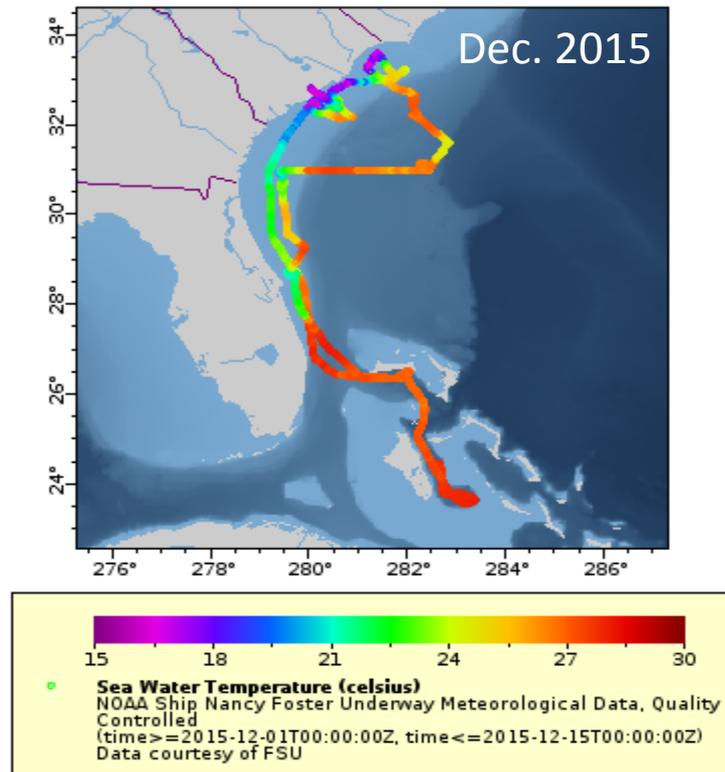
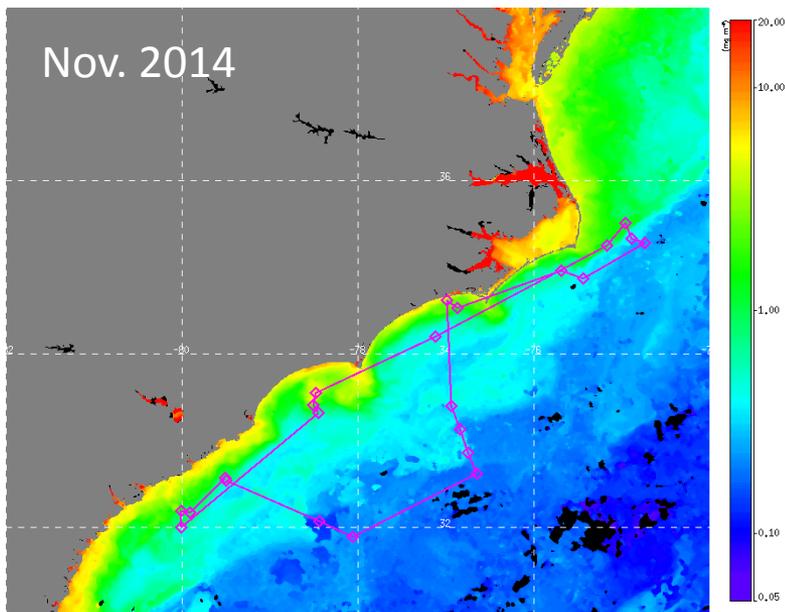
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NOAA dedicated to VIIRS Cal/Val cruises:
2014, 2015, upcoming 2016 (and beyond)



Cruise Tracks

Both 2014 (November) and 2015 (December) cruises departed from *Foster's* home port of Charleston, SC





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Next Cruise:

3-21 October 2016

14 days at sea (+5 days staging, destaging)

NOAA Ship *Nancy Foster*

From Charleston, SC

NF-16-08



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Participating Institutions

US Agencies:

NOAA/STAR

NASA/GSFC

National Institute of
Standards and Technology
(NIST)

Naval Research Lab
(Stennis)

Universities:

U. Southern Mississippi

U. Miami

U. South Florida

U. Massachusetts – Boston

City College of NY

LDEO at Columbia

International:

Joint Research Centre of
the European Commission
(2014)



Representative Measurements

In water profiling,
surface floating and
above water ocean
radiometry



Apparent Optical Properties (AOPs) – Remote sensing reflectance - Simultaneous profiles with several instruments (e.g. HyperPro; MicroPro (2014 only); C-OPS; also several handheld and deck-mounted instruments)

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Representative Measurements

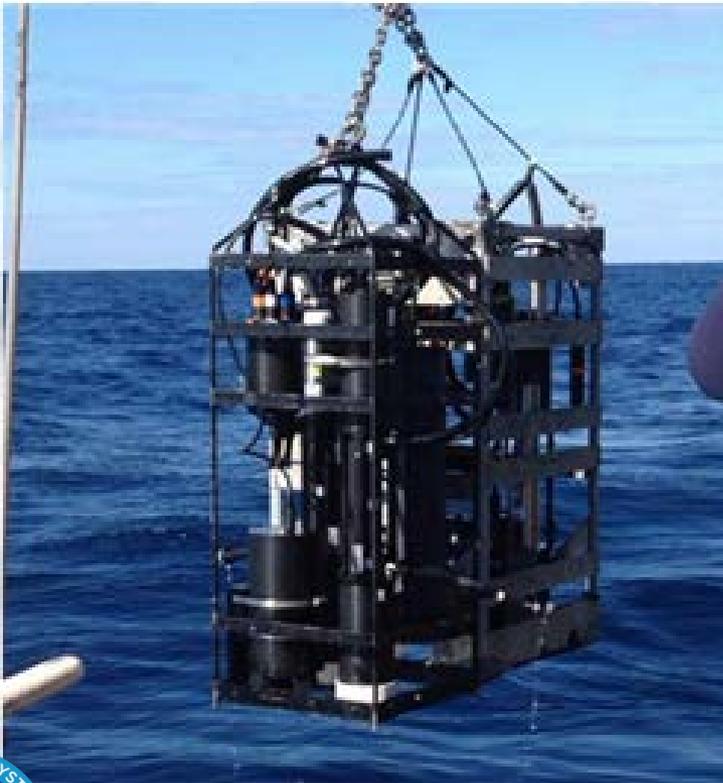
In water profiling, surface floating and above water ocean radiometry



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Representative Measurements

In water profiling, surface floating and above water ocean radiometry

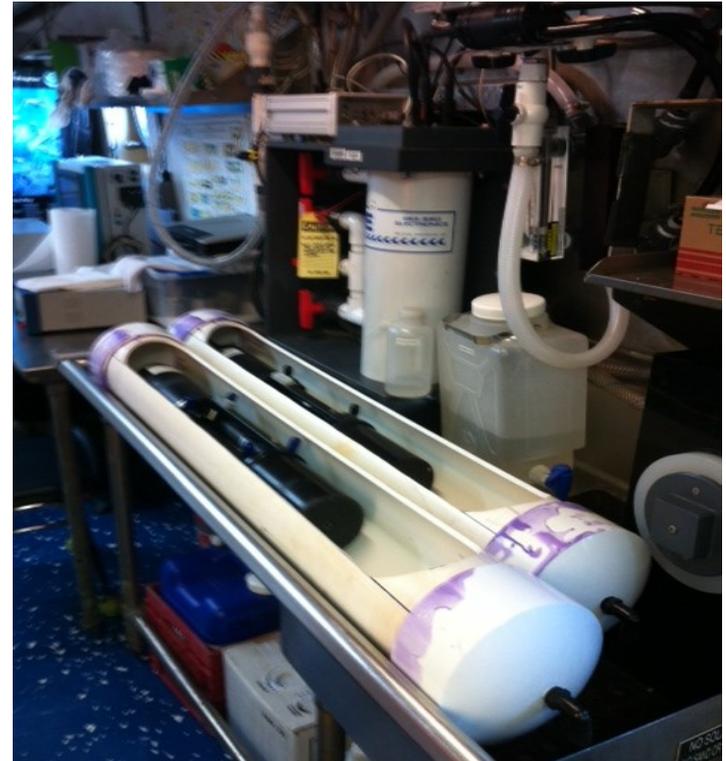


Inherent Optical Properties (IOPs) -Total absorption; CDOM absorption; scatter and backscatter; fluorometry (chlorophyll, CDOM, phycoerythrin)

Representative Measurements

Flow-through continuous measurements

- **IOPs - Beam**
attenuation/scattering; backscatter;
CDOM and chlorophyll fluorescence
- **Phytoplankton characterization -**
Dynamic imaging particle analysis
(FlowCam); phytoplankton
functional groups; chlorophyll and
phycobilipigments; photosynthetic
efficiency (2014 only)





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Representative Measurements

Discrete water sampling and analyses

Filter pad spectral absorption

HPLC phytoplankton pigment analyses

CDOM absorption

Dissolved organic carbon

Particulate organic carbon and particulate nitrogen

Fluorometric extracted chlorophyll

Suspended particulate material

Particle fluorescence and digital imaging (FlowCam)

Variable fluorescence (2014 only)

Advanced Laser Fluorometer (ALF; 2014 only)

Phycobilipigment concentration (2014 only)

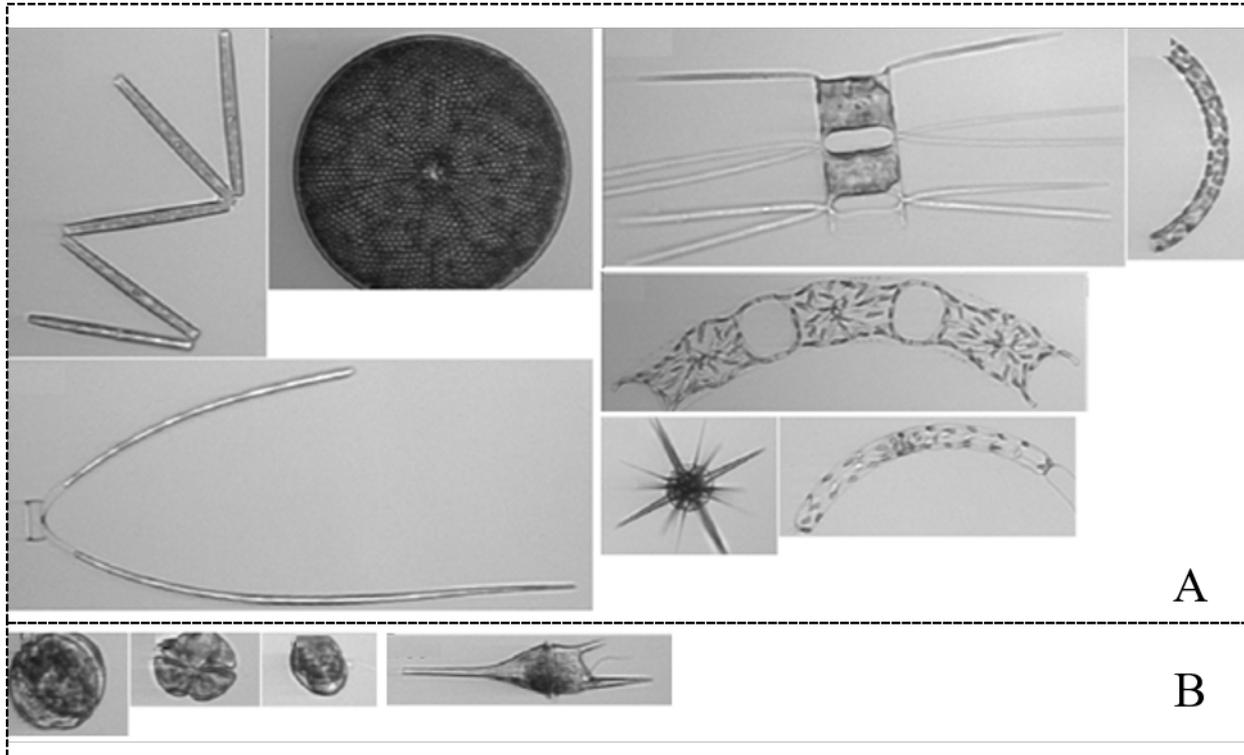


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Large ($>10\mu\text{m}$) Phytoplankton Cells



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Data Submission and Archiving

- **2014 Cruise (NF-14-09) Data**– Initiated archive with NCEI with data on hand. Ascension number and DOI are TBD. Please submit outstanding datasets.
- **2014 Cruise (NF-15-13) Data**– Assembling datasets now – please submit your data.



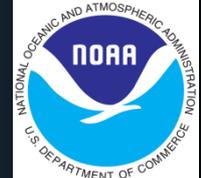
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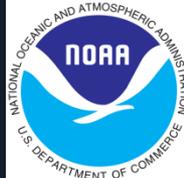


2014
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Accounting of Cruise Data Submissions NF-14-09

Group	Dataset	2014
NOAA/STAR (Mike)	Hyperpro profiling (Rrs, etc.)	only matchup stations (n=9)
NOAA/STAR (Mike)	ECO Pucks on Hyperpro 2x triplets (Chl, CDOM, phycoerythrin, bb at 443, 450 860)	
NOAA/STAR (Mike)	chl-a fluorometric (method?)	
NOAA/STAR (Mike)	Microtops	
NOAA/STAR (Mike)	ASD (Rrs - above water)	
NOAA/STAR (Eric)	TSM	
Stennis (Ryan - USM)	ASD (Rrs - above water)	only matchup stations (n=9 this might be everything for handheld)
Stennis (NRL)	ASD (Rrs - above water)	?
Stennis (Ryan)	Hyperpro (Rrs - floating)	only matchup stations (n=9; check on whether more stations for floating)
Stennis (Bob)	Flowthrough ac9 unfiltered (a, b, c)	x
Stennis (Bob)	Flowthrough ac9 filtered (ag, ap,	x
Stennis (Bob)	Flowthrough (bb)	x
Stennis (?)	Microtops	
UMB (Jianwei)	SBA floating hyperpro (Rrs)	x
UMB (Jianwei)	IOP BB9 (bb)	x
UMB (Jianwei)	IOP ACS180 filtered and unfiltered (apg, cpg)	x
UMB (Junfang)	Spectral Evolution Handheld	
USF (David)	Filter Pad Absorption (ap, ad, aph)	x
USF (David)	Chlorophyll (Welschmeyer)	x
USF (David)	Chlorophyll (Acidification)	x
USF (David)	ASD HandHeld above water (Rrs)	7 stations - (this is probably everything they have?)
USF (?)	Microtops	
USF (?)	Hyperpro	Meeting, College Park, MD, 8-12 August 2016





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2014
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2014

Group	Dataset	
CCNY	Hypersas-POL	
CCNY	GER	
CCNY	Microtops	
JRC (Giuseppe)	Micropro (profiling; Es, Ed, Lu, Kl?, Kd, Eu, Ku, R, Q, Rrs nLw)	x
JRC (Giuseppe)	IOPs in same file, maybe calculated??	x
JRC (Giuseppe)	TRIoS- he says most data no good - good at 5 stations)	
NASA(Scott)	C-OPS (profilling Rrs: Ed, Lu, Es,	x
NASA(Scott)	IOPS (acs, unfiltered: cgp, agp, ag,)	x
NASA(Scott)	IOPS (ac9, filtered: ag)	x
NASA(Scott)	IOPS (bb3: bbp)	x
NASA(Scott)	IOPS (VSF-9: VSF)	x
NASA(Scott)	HyperSAS	
NASA (Aimee)	POC	
NASA (Aimee)	DOC	
NASA (Aimee)	CDOM	
NASA (Aimee/Crystal)	HPLC	x
LDEO (Joaquim)	ALF	
LDEO (Joaquim)	FIRe	
LDEO (Joaquim)	bbe	
LDEO (Joaquim)	phyocobilipigments	
LDEO (Joaquim)	Flow Cam	
LDEO (Joaquim)	microscopy	
U. Miami (Ken)	NURADS (8 stations)	X
NIST	n/a	

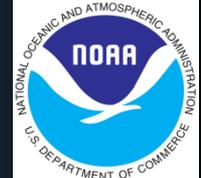
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2015
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Accounting of Cruise Data Submissions NF-15-13

Group	Dataset	Dec-15
NOAA/STAR (Mike)	Hyperpro profiling (Rrs)	
NOAA/STAR (Mike)	ECO Pucks on Hyperpro 2x triplets (Chl, CDOM, phycoerythrin, bb at 443, 450 860)	
NOAA/STAR (Mike)	chl-a fluorometric (Welschmeyer)	
NOAA/STAR (Mike)	ASD (Rrs - above water)	check for completeness
NOAA/STAR (Eric)	TSM	
Stennis (Ryan - USM)	ASD (Rrs - above water)	check for completeness
Stennis (NRL)	ASD (Rrs - above water)	check for completeness
Stennis (Ryan)	Hyperpro (Rrs - floating)	
Stennis (Bob)	Flowthrough ac9 unfiltered (a, b, c)	
Stennis (Bob)	Flowthrough ac9 filtered (ag, ap,	
Stennis (Bob)	Flowthrough (bb)	
UMB (Jianwei)	RISBA (was SBA) floating hyperpro (Rrs)	
UMB (Jianwei)	IOP BB7FL2 (bb at 412, 440, 488, 532, 595, 695, 715; CDOM fl; Chl fl)	
UMB (Jianwei)	IOP ACS180 filtered and unfiltered (apg, cpg)	
UMB (Guoqing)	Flow Cytobot	
UMB (Junfang)	Spectral Evolution Handheld	check for completeness
USF (David)	Filter Pad Absorption (ap, ad, aph)	x (rec'd but trouble unzipping)
USF (David)	Chlorophyll (Welschmeyer)	x (rec'd but trouble unzipping)
USF (David)	Chlorophyll (Acidification)	x (rec'd but trouble unzipping)
USF (David)	CDOM absorption (new for 2015 from ap sampling)	x (rec'd but trouble unzipping)
USF (David)	ASD HandHeld above water (Rrs)	check for completeness
USF (?)	Microtops	?
USF (?)	Hyperpro - profiling	x (rec'd but trouble unzipping)





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2015
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Group	Dataset	Dec-15
CCNY	Hypersas-POL	only for matchup stations; only at VIIRS channels
CCNY	ASD	only for matchup stations; only at VIIRS channels
CCNY	GER	only for matchup stations; only at VIIRS channels
OSU (Nick)	Hyperpro - profiling	x
OSU (Nick)	Spectral Evolution Handheld	check for completeness
NASA(Scott)	C-OPS (profiling Rrs: Ed, Lu, Es,	
NASA(Scott)	C-OPS (profiling Rrs: Ed, Lu, Es,	
NASA(Scott)	IOPS (acs, unfiltered: cgp, agp, ag,)	
NASA(Scott)	IOPS (ac9, filtered: ag)	
NASA(Scott)	IOPS (bb3: bbp)	
NASA(Scott)	IOPS (VSF-9: VSF)	
NASA(Scott)	HyperSAS	
NASA (Joaquin C.)	POC	
NASA (Joaquin C.)	DOC	
NASA (Joaquin C.)	CDOM	
NASA (Joaquin C.)	HPLC	X
LDEO (Joaquin G.)	Nutrients (N, P, Si)	
LDEO (Joaquin G.)	Flow Cam	
U. Miami (Ken)	NURADS (8 stations)	X
NIST	n/a	





VIIRS Cal/Val Etc.



Collaborations and cruises of opportunity

NOAA

- **JPSS/VIIRS external cal/val teams (ongoing)**
 - Puerto Rico; Hawaii; Gulf of Mexico; West Coast/California; Chesapeake Bay; etc.
- **NOAA OAR Ocean Acidification Program**
 - ECOA – East Coast US
 - WCOA – West Coast US
- **NOAA Coral Reef Watch**
 - Puerto Rico; Hawaii; Australia
- **NOAA/STAR research**
 - Chesapeake Bay, etc.

NASA/South Korea (“KORUS” May-June 2016)

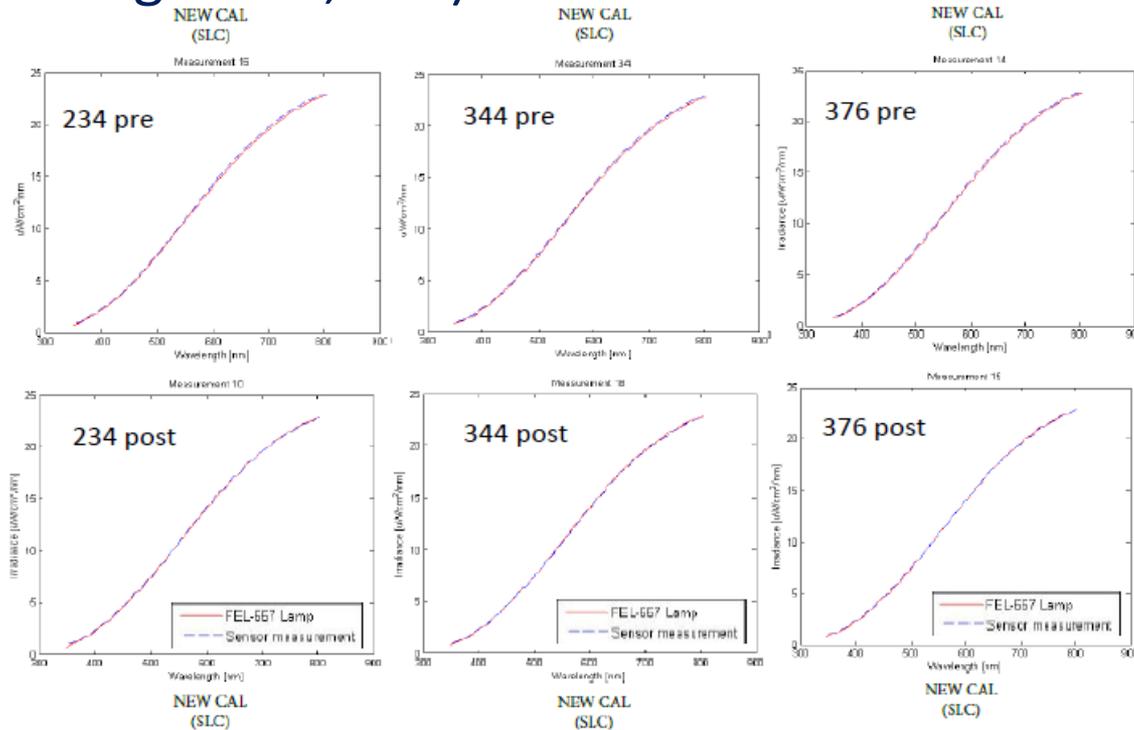
Australia

- **CSIRO** – June-July 2016
- **CORAL** – Upcoming Late Aug – Oct 2016



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NOAA Optical Instrument Calibration Laboratory (NCWCP, College Park, MD)



In collaboration with NIST

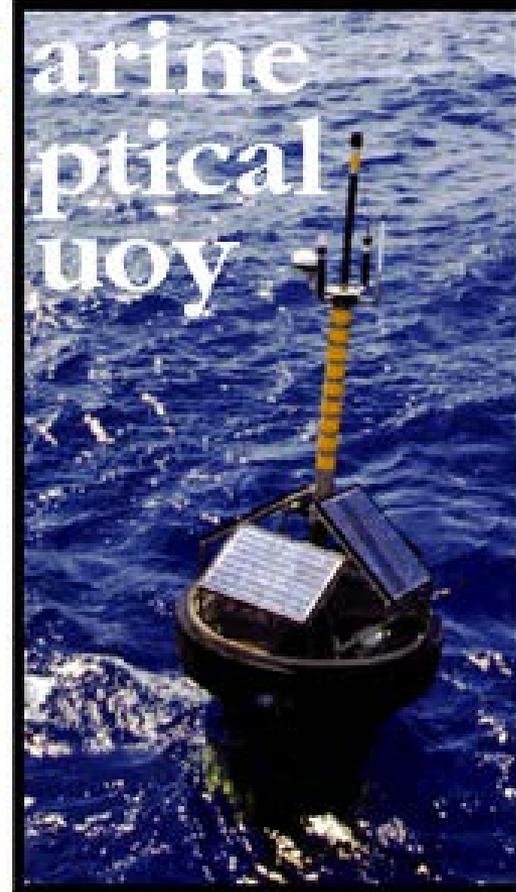


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NOAA support of MOBY

Marine
Optical
Buoy
Y

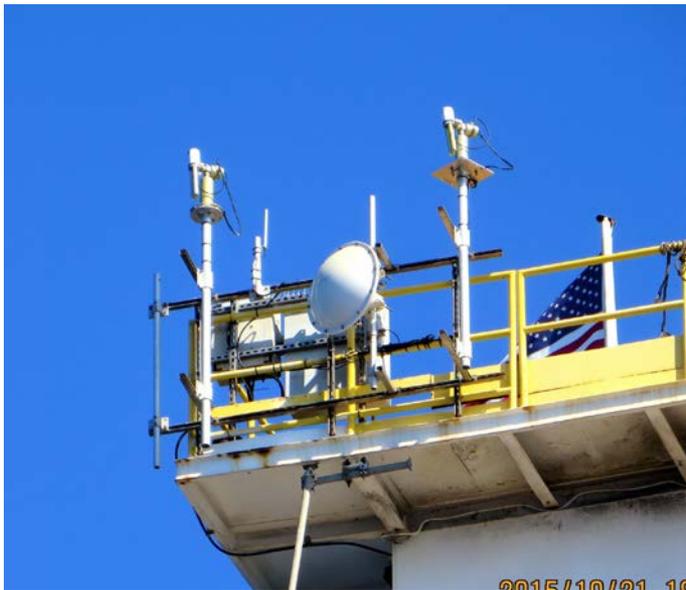


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NOAA support of 4 AERONET-OC Sites



- **WavCIS**
Stennis, Gulf of Mexico
- **Eureka**
OSU & USC, US West Coast
- **LISCO**
- **CCNY**, Long Island Sound

- **Lake Erie**
NOAA/GLERL and UNH



VIIRS Cal/Val Etc.



Summary

- **Successful 2014 and 2015 cruises**
- **Next cruise NF-16-08: 3-21 October 2016 (14 days)**
- **Participants, please submit outstanding datasets for 2014 & 2015**



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