

VIIRS Cal/Val Cruises

NOAA/NESDIS Technical Reports on Dedicated VIIRS Cal/Val Cruises

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and VIIRS Cal/Val Cruise Team Members

*Global Science & Technology, Inc.



NOAA Ship *Nancy Foster*
2014, 2015, and 2016



NOAA Ship *Okeanos Explorer* –
April/May 2018

2016 STAR/JPSS Annual Science Meeting
College Park, MD, 14-18 August 2017



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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 (Annual each fiscal year):
 - Participating groups
 - Objectives
 - Observations
 - Reports Published
 - 2014 (NF-14-09) – NESDIS #146
<http://dx.doi.org/10.7289/V52B8W0Z>
 - 2015 (NF-15-13) – NESDIS #148
<http://doi.org/10.7289/V5/TR-NESDIS-148>
 - Report currently in progress for 2016 (NF-16-08)
 - Future: April/May 2018 – TBD
 - Data submission and archiving status and next steps





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Participating Institutions

US Agencies:

NOAA/STAR

NASA/GSFC (2014, 2015)

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

HBOI at Florida Atlantic U.
(2016)

International:

Joint Research Centre of the European Commission (2014)

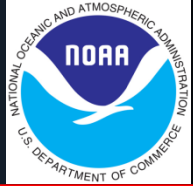


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Cruise Objectives:

- 1) *Validate VIIRS ocean color satellite remote sensing*
- 2) *Characterize and quantify sources of uncertainty associated with in situ ocean color measurements*
- 3) *Characterize the optical properties of dynamic ocean processes*



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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

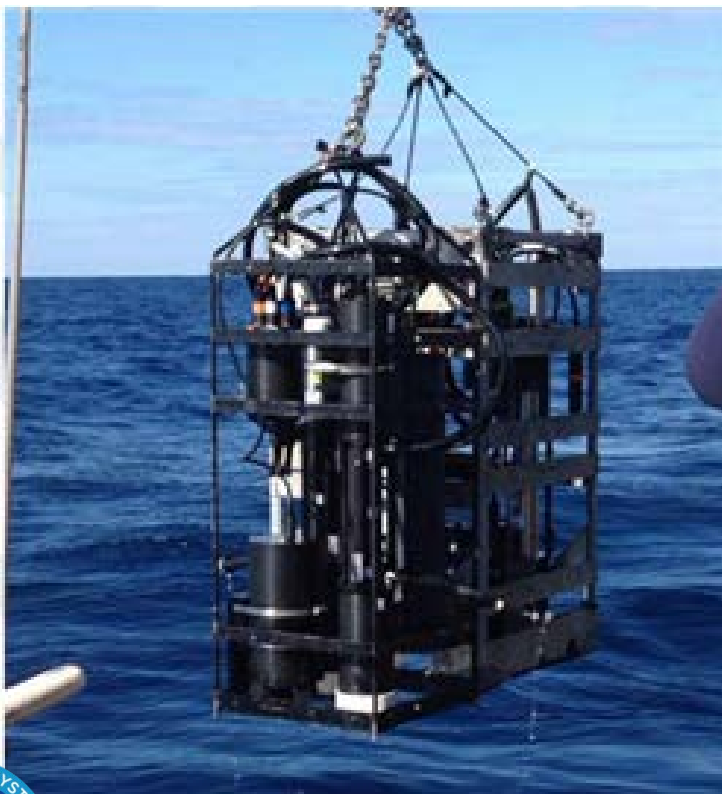
In water profiling, surface floating and above water ocean radiometry



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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)

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Representative Measurements

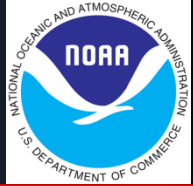
Flow-through continuous measurements

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





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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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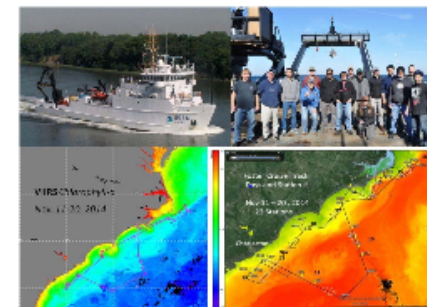
NESDIS Technical Reports

- NOAA dedicated to VIIRS Cal/Val cruises (Annual each fiscal year):
 - Completed
 - 2014** (NF-14-09) – NESDIS #146 published <http://dx.doi.org/10.7289/V52B8W0Z>
 - 2015** (NF-15-13) – NESDIS #148 published <http://doi.org/10.7289/V5/TR-NESDIS-148>
 - In Progress
 - 2016** (NF-16-08) – Report *in progress*
 - Draft of content and Tables A1-A7 sent out last week
 - Please discuss at workshop tomorrow:
 - proposed “Above Water Group” chapter
 - Review Tables A1-A7
 - Next draft before Labor Day

NOAA Technical Report NESDIS 146

doi:10.7289/V52B8W0Z

Report for
Dedicated JPSS VIIRS Ocean Color
Calibration/Validation Cruise



Washington, D.C.
September 2015

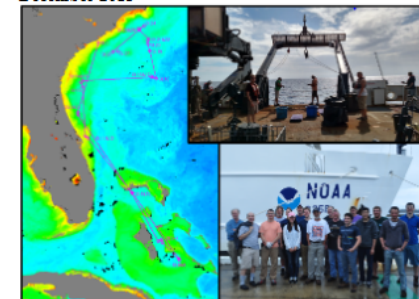


U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Environmental Satellite, Data, and Information Service

NOAA Technical Report NESDIS 148

doi:10.7289/V5/TR-NESDIS-148

Report for
Dedicated JPSS VIIRS Ocean Color
Calibration/Validation Cruise
December 2015



Washington, D.C.
October 2016



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Environmental Satellite, Data, and Information Service

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Next Cruise

April/May 2018

Depart: Florida Keys

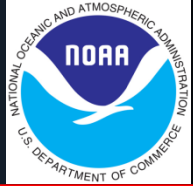
Return:



NOAA Ship *Okeanos Explorer*



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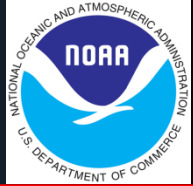
Data Submission and Archiving

- **Dr. Sheekela Baker-Yeboah**, Physical Oceanographer from NCEI has joined STAR/SOCD and will be working on in situ archiving.
- **2014 (NF-14-09) Data**– Initiated archive with NCEI with data on hand. Ascension number and DOI are TBD. Please submit outstanding datasets.
- **2015 (NF-15-13) and 2016 (NF-16-08) Data**– Assembling datasets now – please submit your data.
- Data Submission Log on Google Drive:
<https://docs.google.com/spreadsheets/d/1p2zbFR0pVrxknHOkoE8EC5yDfTh9sfscpcsxyx9IOH8/edit#gid=1730912765>





VIIRS Cal/Val Etc.



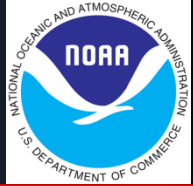
Summary

- 3 Successful dedicated cruises:
 - 2014 <http://dx.doi.org/10.7289/V52B8W0Z>
 - 2015 <http://doi.org/10.7289/V5/TR-NESDIS-148>
 - 2016 Report *In progress*
- Next cruise, NOAA Ship *Okeanus Explorer*, April/May 2018
- Message for participants:
 - Please submit outstanding datasets for 2014, 2015 and 2016
 - Please work with Sheekela for preparing or updating your datasets for archiving





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Data Submission Log pages to follow

■ Data Submission Log on Google Drive:

<https://docs.google.com/spreadsheets/d/1p2zbFR0pVrxknHOkoeE8EC5yDfTh9sfscpcsx9y9IOH8/edit#gid=1730912765>



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2014

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Accounting of Cruise Data Submissions NF-14-09

| Group | Dataset | Status (VL) | Mike O. has? | Menghua has? |
|----------------------|--|---|---|--------------|
| NOAA/STAR (Mike) | Hyperpro profiling (Rrs, etc.) | only matchup stations (n=9) | yes | yes |
| NOAA/STAR (Mike) | ECO Pucks on Hyperpro 2x triplets (Chl, CDOM, phycoerythrin, bb at 443, 450 860) | | no - reprocessing required; not highest priority; completion date expected: TBD | |
| NOAA/STAR (Mike) | chl-a fluorometric (method?) | | yes | |
| NOAA/STAR (Mike) | Microtops | https://aeronet.gsfc.nasa.gov/new_web/cruises_new/Nancy_Foster_14.html | online | |
| NOAA/STAR (Mike) | ASD (Rrs - above water) | | yes | |
| NOAA/STAR (Eric) | TSM | not available, samples melted | n/a data not available | n/a |
| Stennis (Ryan - USM) | ASD (Rrs - above water) | only matchup stations (n=9 this might be everything for handheld) | yes; Mike says 9 stations is complete | yes |
| Stennis (NRL) | ASD (Rrs - above water) | | | |
| Stennis (Ryan) | Hyperpro (Rrs - floating) | only matchup stations (n=9; check on whether more stations for floating) | yes; Mike says 9 stations is complete | yes |
| Stennis (Bob) | Flowthrough ac9 unfiltered (a, b, c) | x | yes | yes |
| Stennis (Bob) | Flowthrough ac9 filtered (ag, ap, | x | yes | yes |
| Stennis (Bob) | Flowthrough (bb) | x | yes | yes |
| Stennis (?) | Microtops | available online? | Not found at aeronet site? | |



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2014

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Accounting of Cruise Data Submissions NF-14-09

| Group | Dataset | Status (VL) | Mike O. has? | Menghua has? |
|----------------|---|---|---------------------------------------|--------------|
| UMB (Jianwei) | SBA floating hyperpro (Rrs) | x | yes | yes |
| UMB (Jianwei) | IOP BB9 (bb) | x | yes | yes |
| UMB (Jianwei) | IOP ACS180 filtered and unfiltered (apg, cpg) | x | yes | yes |
| UMB (Junfang) | Spectral Evolution Handheld | not available because of incorrect setup. | n/a data not available | |
| USF (David) | Filter Pad Absorption (ap, ad, aph) | x | yes | yes |
| USF (David) | Chlorophyll (Welschmeyer) | x | yes | yes |
| USF (David) | Chlorophyll (Acidification) | x | yes | |
| USF (David) | ASD HandHeld above water (Rrs) | 7 stations - (this is probably everything they have?) | yes; Mike says 7 stations is complete | yes |
| USF (?) | Microtops | available online? | Not found at aeronet site? | |
| USF (?) | Hyperpro | | yes | yes |
| CCNY | Hypersas-POL | | yes | |
| CCNY | GER | | yes | |
| CCNY | Microtops | available online? | Not found at aeronet site? | |
| JRC (Giuseppe) | Micropro (profiling; Es, Ed, Lu, Kl?, Kd, Eu, Ku, R, Q, Rrs nLw | x | yes | yes |
| JRC (Giuseppe) | IOPs in same file, maybe calculated?? | x | yes | yes |
| JRC (Giuseppe) | TRIoS- he says most data no good - good at 5 stations) | x | yes; 5 stations | yes |



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Accounting of Cruise Data Submissions NF-14-09

| Group | Dataset | Status (VL) | Mike O. has? | Menghua has? |
|----------------------|--|-------------|--------------------------------|--------------|
| NASA(Scott) | C-OPS (profiling Rrs: Ed, Lu, Es, | x | yes | yes |
| NASA(Scott) | IOPS (acs, unfiltered: cgp, agp, ag,) | x | yes | yes |
| NASA(Scott) | IOPS (ac9, filtered: ag) | x | yes | yes |
| NASA(Scott) | IOPS (bb3: bbp) | x | yes | yes |
| NASA(Scott) | IOPS (VSF-9: VSF) | x | yes | yes |
| NASA(Scott) | HyperSAS | | no | |
| NASA (Aimee) | POC | x | yes - pulled from NASA SeaBASS | |
| NASA (Aimee) | DOC | x | yes - pulled from NASA SeaBASS | |
| NASA (Aimee) | CDOM | x | yes - pulled from NASA SeaBASS | |
| NASA (Aimee/Crystal) | HPLC | x | yes | yes |
| LDEO (Joaquim) | ALF | | no | |
| LDEO (Joaquim) | FIRE | | no | |
| LDEO (Joaquim) | bbe | | no | |
| LDEO (Joaquim) | phyocobilipigments | | no | |
| LDEO (Joaquim) | Flow Cam | | no | |
| LDEO (Joaquim) | microscopy | | no | |
| U. Miami (Ken) | NURADS (8 stations) | X | y | |
| NIST | n/a | | n/a | n/a |



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Accounting of Cruise Data Submissions NF-15-13

| Group | | Dec-15 | Mike O. has? | Menghua has? |
|----------------------|--|----------------------------------|---|--|
| NOAA/STAR (Mike) | Hyperpro profiling (Rrs) | x only values for VIIRS matchups | yes | yes |
| | ECO Pucks on Hyperpro 2x triplets (Chl, CDOM, phycoerythrin, bb at 443, 450 860) | | no - reprocessing required; not highest priority; completion date expected: TBD | |
| NOAA/STAR (Mike) | chl-a fluorometric (Welschmeyer) | | yes | |
| NOAA/STAR (Mike) | ASD (Rrs - above water) | check for completeness | MO checking | |
| NOAA/STAR (Eric) | TSM | | yes | |
| Stennis (Ryan - USM) | ASD (Rrs - above water) | check for completeness | MO checking | |
| Stennis (NRL) | ASD (Rrs - above water) | check for completeness | MO checking | |
| | | | yes - has 2 sets; USM (Ryan) and NRL (Wesley); both processed by Sherwin | no - only station info. For Floating Hyperpros |
| Stennis (Ryan) | Hyperpro (Rrs - floating) | | | |
| Stennis (Bob) | Flowthrough ac9 unfiltered (a, b, c) | | no | |
| Stennis (Bob) | Flowthrough ac9 filtered (ag, ap, bb) | | no | |
| Stennis (Bob) | Flowthrough (bb) | | no | |
| UMB (Jianwei) | RISBA (was SBA) floating hyperpro (Rrs) | | yes | no - only station info. |
| UMB (Jianwei) | IOP BB7FL2 (bb at 412, 440, 488, 532, 595, 695, 715; CDOM fl; Chl fl) | | no | |
| UMB (Jianwei) | IOP ACS180 filtered and unfiltered (apg, cpg) | | no | |
| UMB (Guoqing) | Flow Cytobot | | no | |
| UMB (Junfang) | Spectral Evolution Handheld | check for completeness | MO checking | |

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Accounting of Cruise Data Submissions NF-15-13

| Group | | Dec-15 | Mike O. has? | Menghua has? |
|-------------|---|---|---------------------------|--|
| USF (David) | Filter Pad Absorption (ap, ad, aph) | x (rec'd but trouble unzipping) | MO checking | |
| USF (David) | Chlorophyll (Welschmeyer) | x (rec'd but trouble unzipping) | yes | yes |
| USF (David) | Chlorophyll (Acidification) | x (rec'd but trouble unzipping) | yes | yes |
| | CDOM absorption (new for 2015 from ap sampling) | x (rec'd but trouble unzipping) | MO checking | |
| USF (David) | ASD HandHeld above water (Rrs) | check for completeness | MO checking | |
| USF | Microtops | https://aeronet.gsfc.nasa.gov/new_web/cruises_new/Nancy_Foster_15.html | n/a | |
| USF (?) | Hyperpro - profiling | x (rec'd but trouble unzipping) | yes - Mike has good files | yes |
| CCNY | Hypersas-POL | only for matchup stations; only at VIIRS channels | yes; MO has all | no - only 3 photos |
| CCNY | ASD | only for matchup stations; only at VIIRS channels | MO checking | |
| CCNY | GER | only for matchup stations; only at VIIRS channels | yes; MO has all | |
| OSU (Nick) | Hyperpro - profiling | | yes | yes, but all directories (need to arrange for matchup) |
| OSU (Nick) | Spectral Evolution Handheld | check for completeness | MO checking | |



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Accounting of Cruise Data Submissions NF-15-13

| Group | | Dec-15 | Mike O. has? | Menghua has? |
|-------------------|--------------------------------------|--------|--------------------------------|--------------|
| NASA(Scott) | C-OPS (profilling Rrs: Ed, Lu, Es, | | no | |
| NASA(Scott) | C-OPS (profilling Rrs: Ed, Lu, Es, | | no | |
| NASA(Scott) | IOPS (acs, unfiltered: cgp, agp, ag, | | no | |
| NASA(Scott) |) | | no | |
| NASA(Scott) | IOPS (ac9, filtered: ag) | | no | |
| NASA(Scott) | IOPS (bb3: bbp) | | no | |
| NASA(Scott) | IOPS (VSF-9: VSF) | | no | |
| NASA(Scott) | HyperSAS | | no | |
| NASA (Joaquin C.) | POC | | yes - pulled from NASA SeaBASS | |
| NASA (Joaquin C.) | DOC | | yes - pulled from NASA SeaBASS | |
| NASA (Joaquin C.) | CDOM | | yes - pulled from NASA SeaBASS | |
| NASA (Joaquin C.) | HPLC | X | yes | yes |
| LDEO (Joaquim G.) | Nutrients (which?) | | no | |
| LDEO (Joaquim G.) | Flow Cam | | no | |
| U. Miami (Ken) | NURADS (8 stations) | X | yes | |



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2016

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Accounting of Cruise Data Submissions NF-16-08

| Group | | Oct-16 | Mike O. has? | Menghua has? |
|------------------|--------------------------------------|---|--------------|--------------------------|
| NOAA/STAR (Mike) | Hyperpro profiling (Rrs) | | yes | yes (SeungHyun confirm?) |
| NOAA/STAR (Mike) | ASD | Rrs | | |
| NOAA/STAR (Mike) | operated NASA C-OPS | nlw, Rrs | | |
| NOAA/STAR (Mike) | water samples to be analyzed by NASA | HPLC, POC, DOC, CDOM | | |
| NOAA/STAR (Eric) | SPM (TSS) | SPM | | |
| USF | Microtops | https://aeronet.gsfc.nasa.gov/new_web/cruises_new/Nancy_Foster_16.html | | |
| USF | Extracted Chl-a | Chl-a | | |
| USF | Filter Pad Absorption | a, ad, ag | | |
| CCNY_Gilerson | HyperSAS | RRS for stations only (no underway) | | |
| CCNY_Gilerson | GER | RRS for stations | | |
| LDEO_Goes | Nutrients | N02+N03, Si, P | | |
| LDEO_Goes | Phycobilipigments | concentrations | | |
| LDEO_Goes | microscopy | phtyoplankton counts, ID | | |
| LDEO_Goes | FIRe | fv/fm, sigma | | |
| LDEO_Goes | ALF | several | | |
| LDEO_Goes | FlowCAM | phtyoplankton types | | |



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2016

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Accounting of Cruise Data Submissions NF-16-08

| Group | | Oct-16 | Mike O. has? | Menghua has? |
|-------------------|------------------------------|---------------------------------------|--------------|--------------|
| UMB | SBA HyperPro (floating) | nLw, Rrs | | |
| UMB | Profiling IOP package | various IOPs | | |
| UMB | Spectral Evolution Handheld | Rrs | | |
| UMB | IFCB flowcytobot | DATA NO GOOD - WILL NOT DELIVER | NO | NO |
| HBOI_Twardowski | MASCOT IOP profiling package | many parameters | | |
| Stennis/USM & NRL | Underway IOPS | bb, c, ap, ag, etc. | | |
| Stennis/USM & NRL | Handheld ASD | Rrs | | |
| Stennis/USM & NRL | Floating Hyperpro | nLw, Rrs, other parameters on package | | |
| Stennis/USM & NRL | Secchi Disk | | | |
| U. Miami | NURADS | | | |
| OSU | HyperPro profiling | nLw, Rrs, etc. on package | | |
| OSU | Spectral Evolution Handheld | Rrs | | |
| NIST | n/a | n/a | | |



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