



NOAA Ocean Color Science Team Cal/Val Activity Updates

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Website for VIIRS & OLCI ocean color images, data and Cal/Val:
<http://www.star.nesdis.noaa.gov/sod/mecb/color/>



Acknowledgements: The VIIRS work was supported by JPSS/VIIRS funding. We thank MOBY team for in situ optics data, VIIRS Cal/Val PIs and their collaborators in support of VIIRS Cal/Val activities.

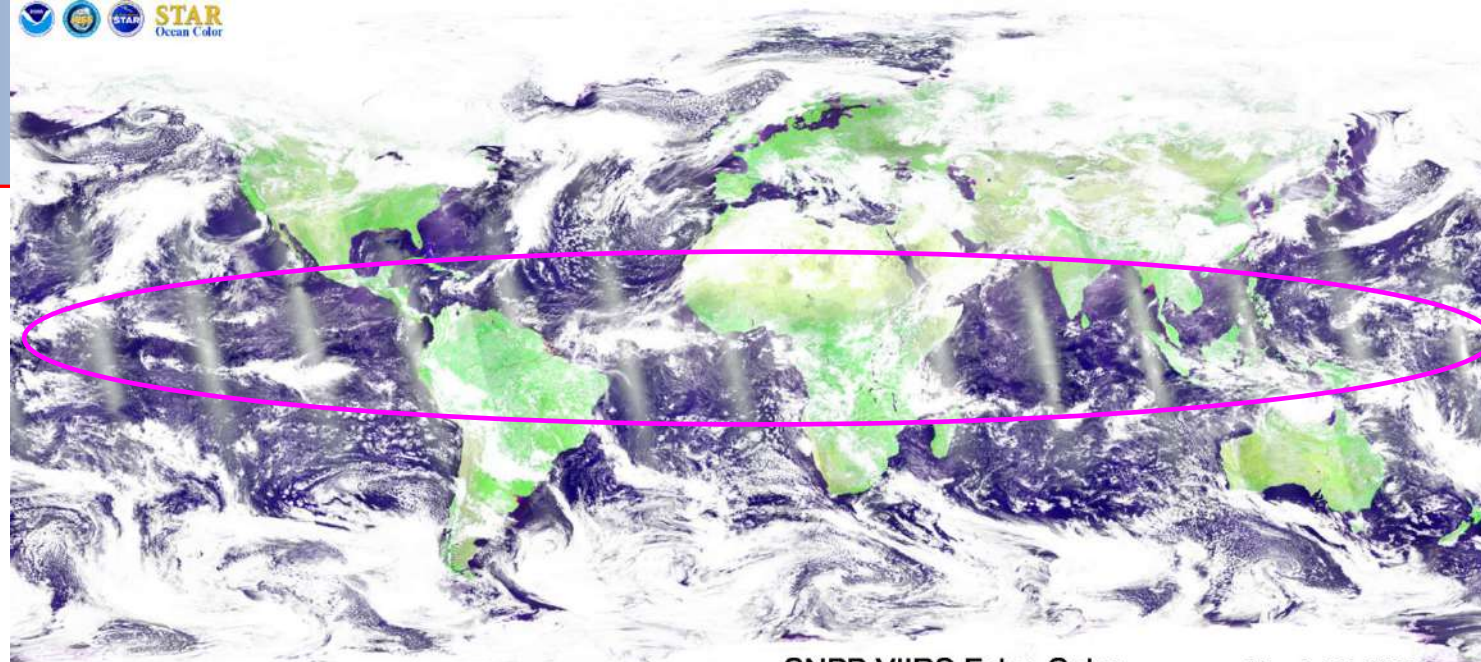


Outlines



- **NOAA OCView Update & Routine Cal/Val**
 - New PACE OCI true/false color images
 - Monitoring of OLCI and VIIRS ocean color products
- **Global water transparency product (Secchi Depth)**
- **Algorithms and Data**
 - Improved land mask dataset
 - Improved cloud masking
- **System vicarious calibrations for three VIIRS sensors using the NIR-SWIR approach**

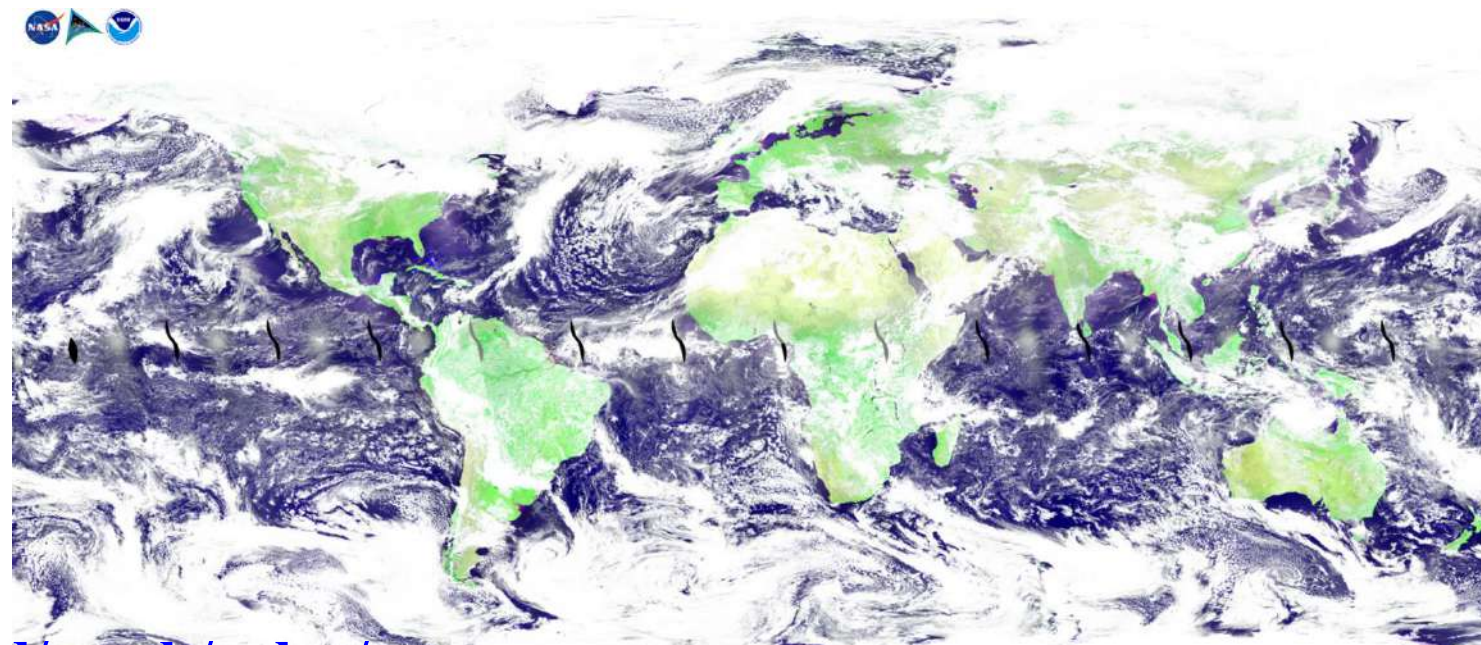
VIIRS-SNPP Daily False Color Images



SNPP VIIRS False Color

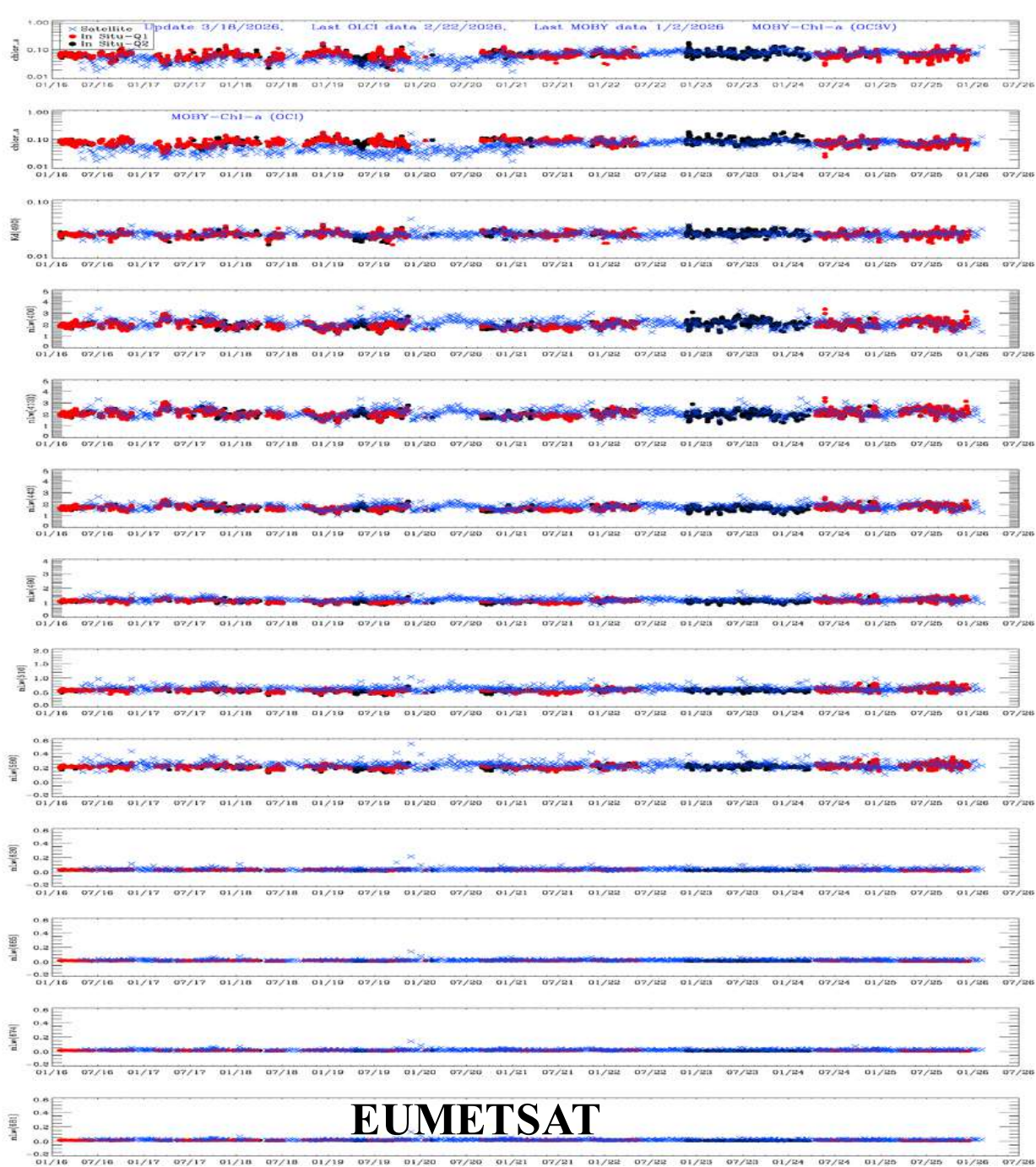
March 22, 2026

PACE OCI Daily False Color Image



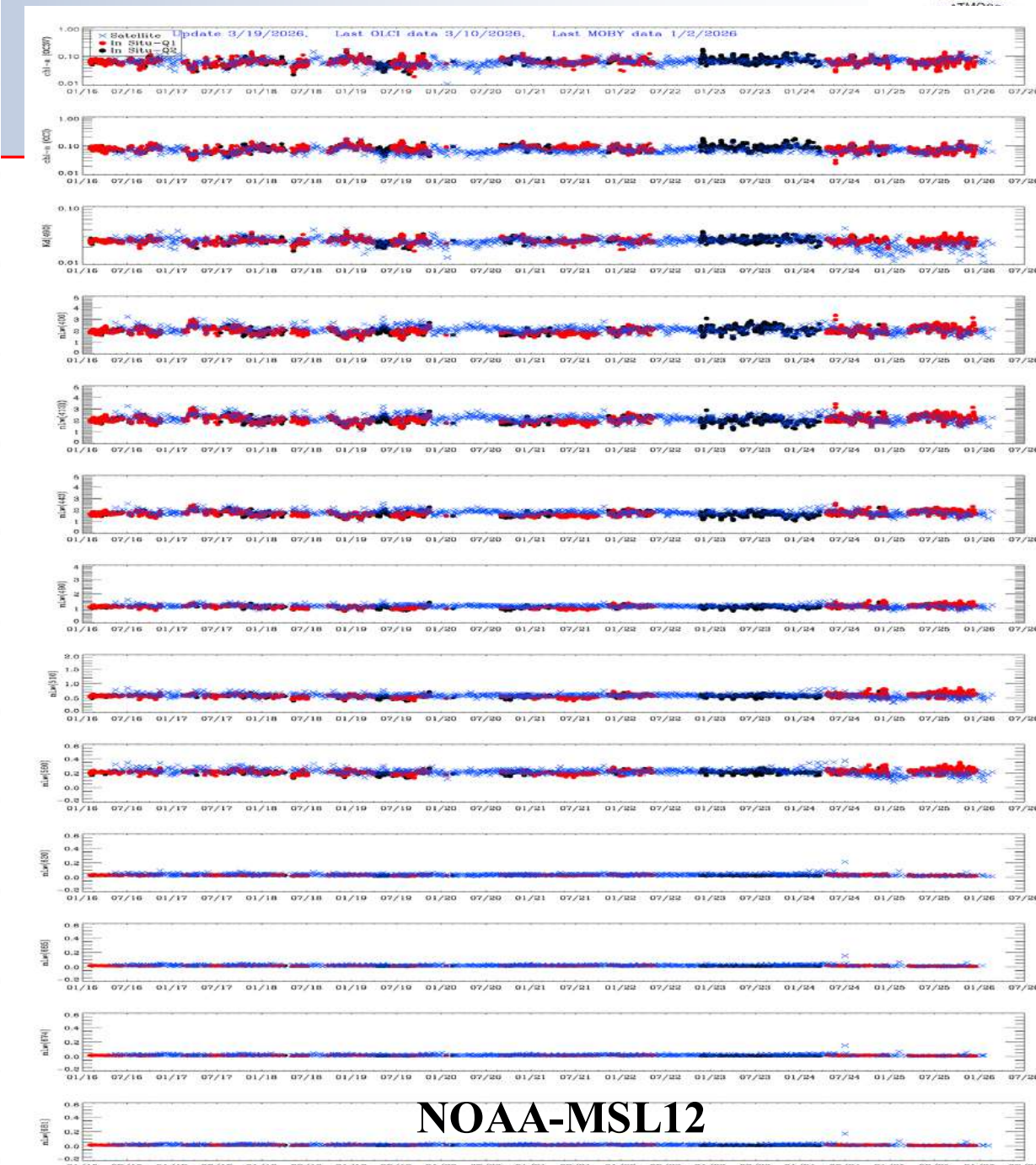
PACE OCI False Color

March 22, 2026



EUMETSAT

(Red/Black: In Situ; Blue: S3A)

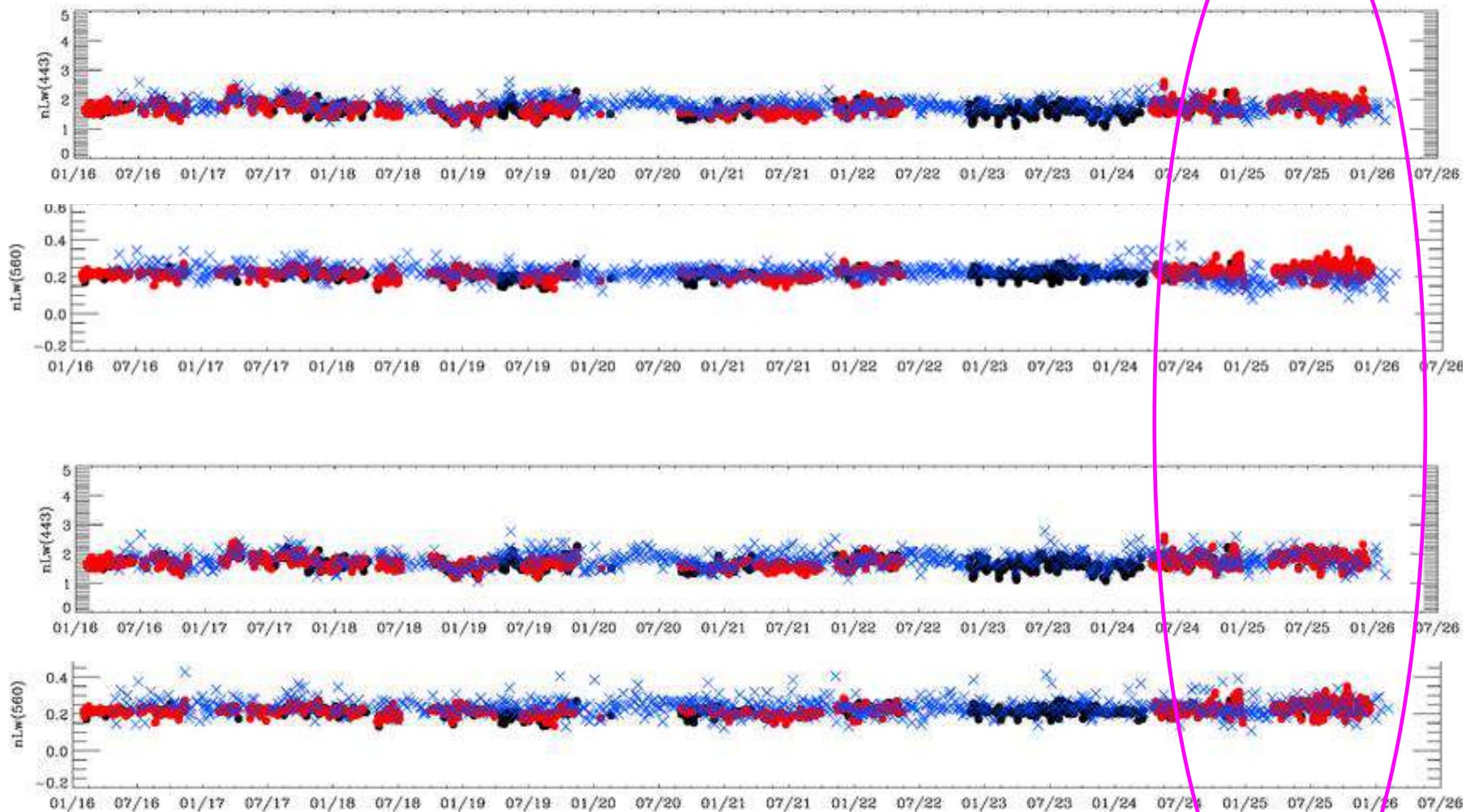


NOAA-MSL12

Matchup Comparisons of OLCI & MOBY In Situ



NOAA-MSL12

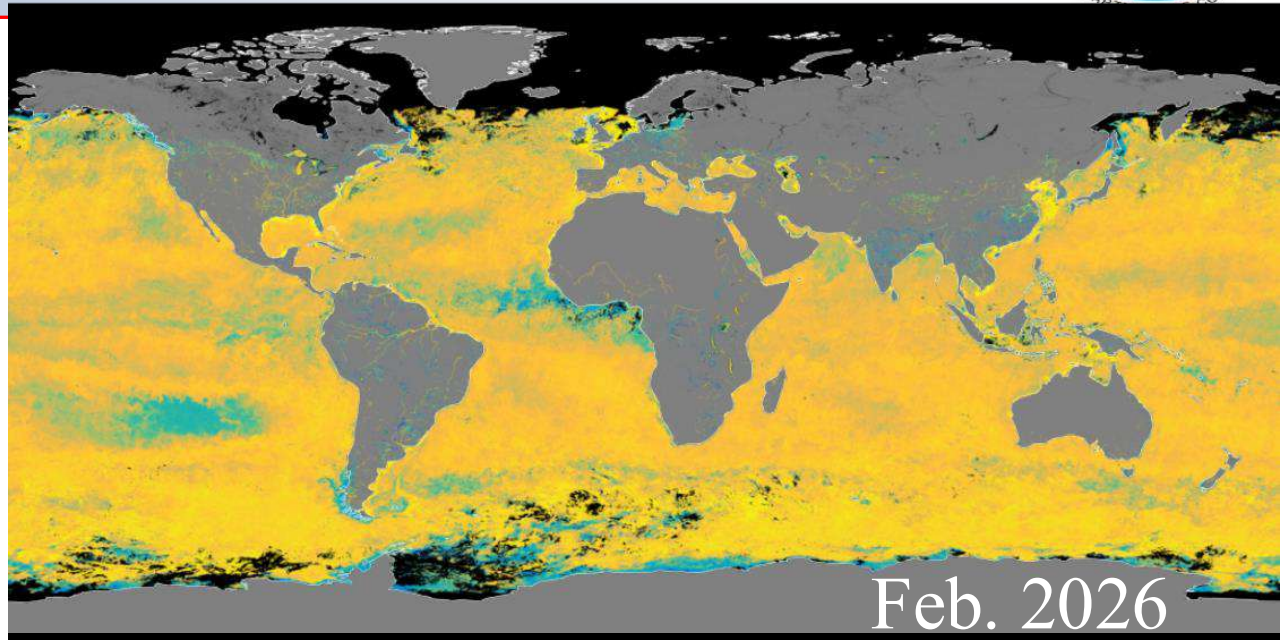
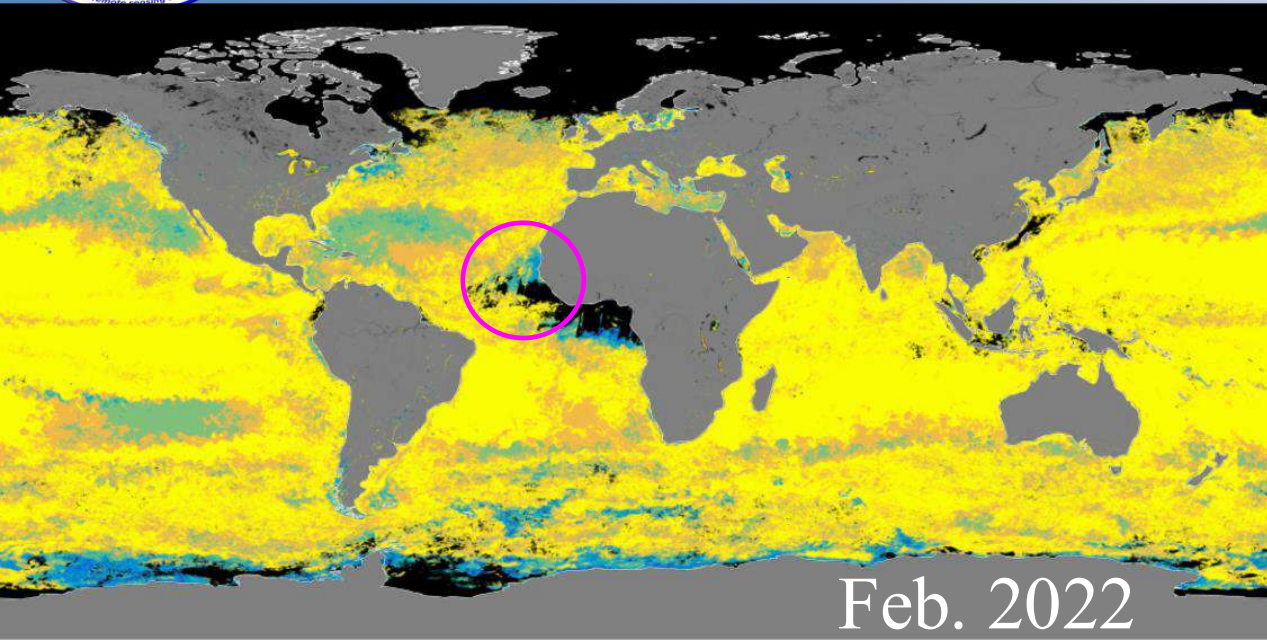


EUMETSAT

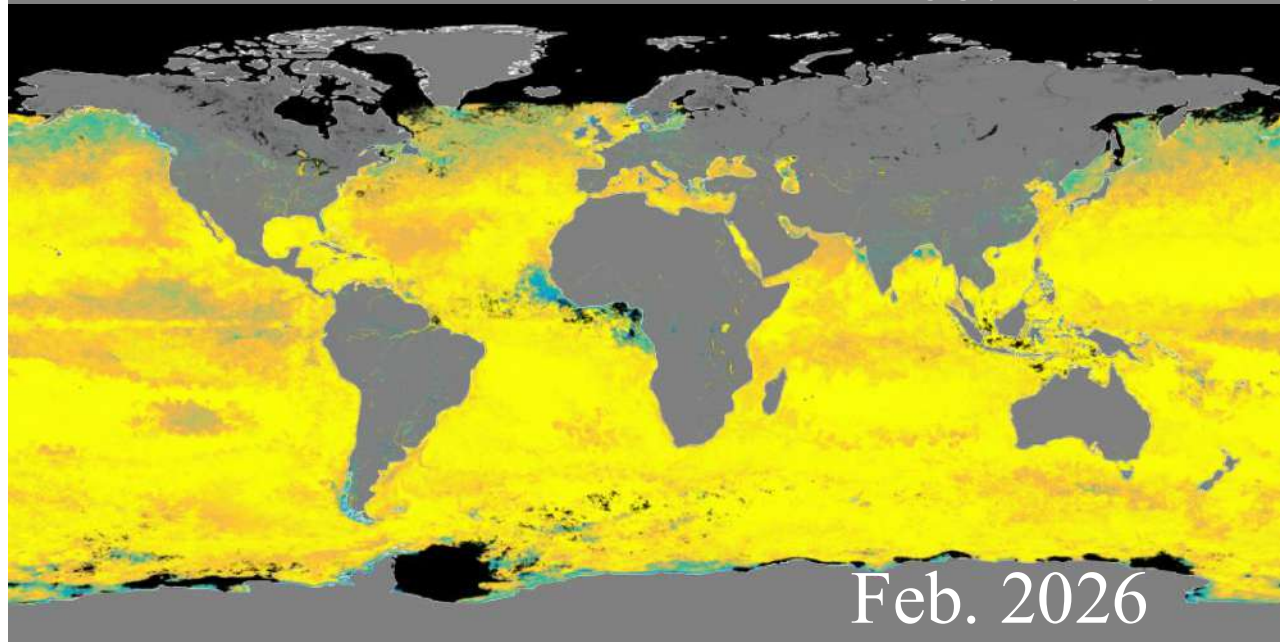
(Red/Black: In Situ; Blue: S3A)

Matchup Comparisons of OLCI & MOBY In Situ

MSL12-derived QA Score for OLCI-S3A



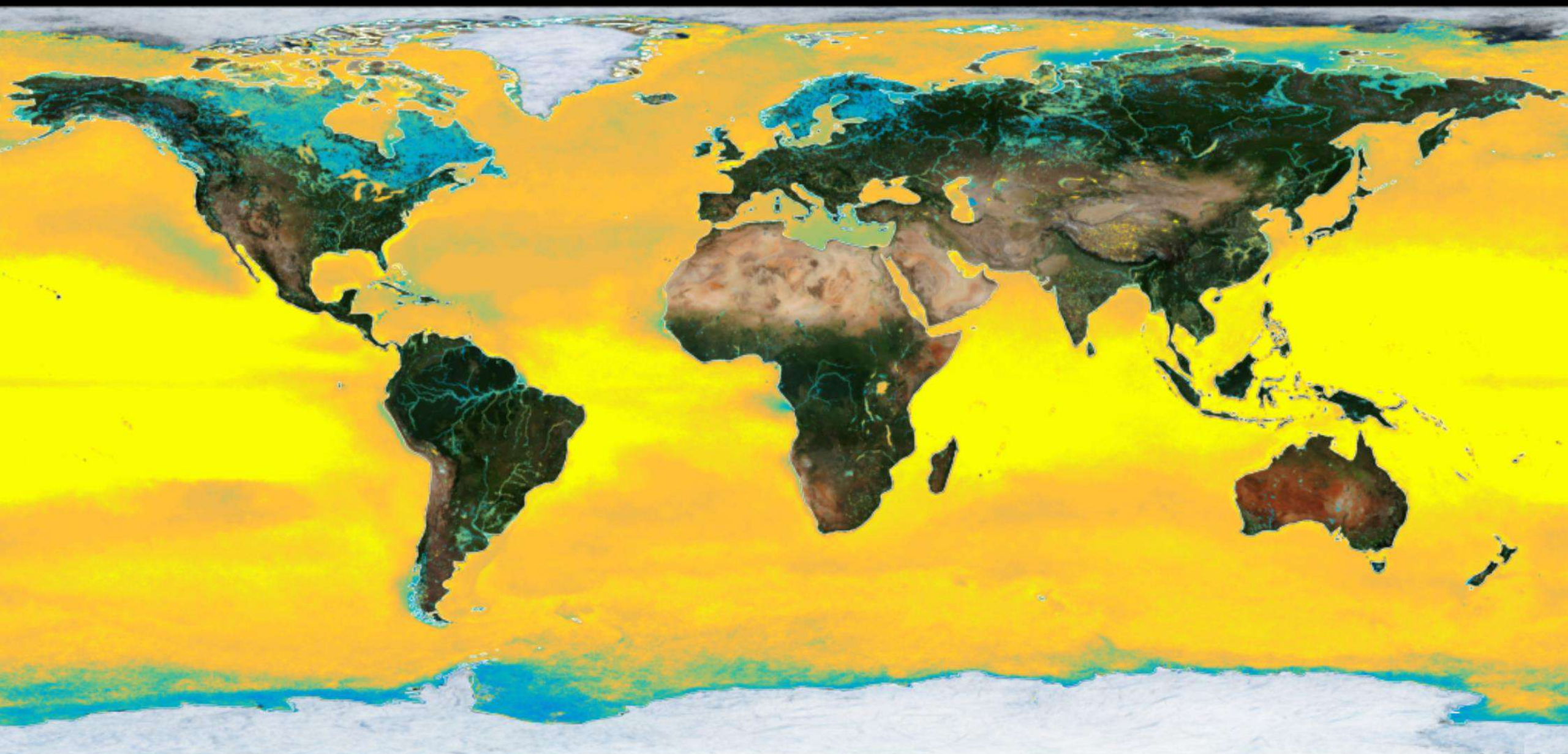
MSL12-derived
QA Score for VIIRS-SNPP →



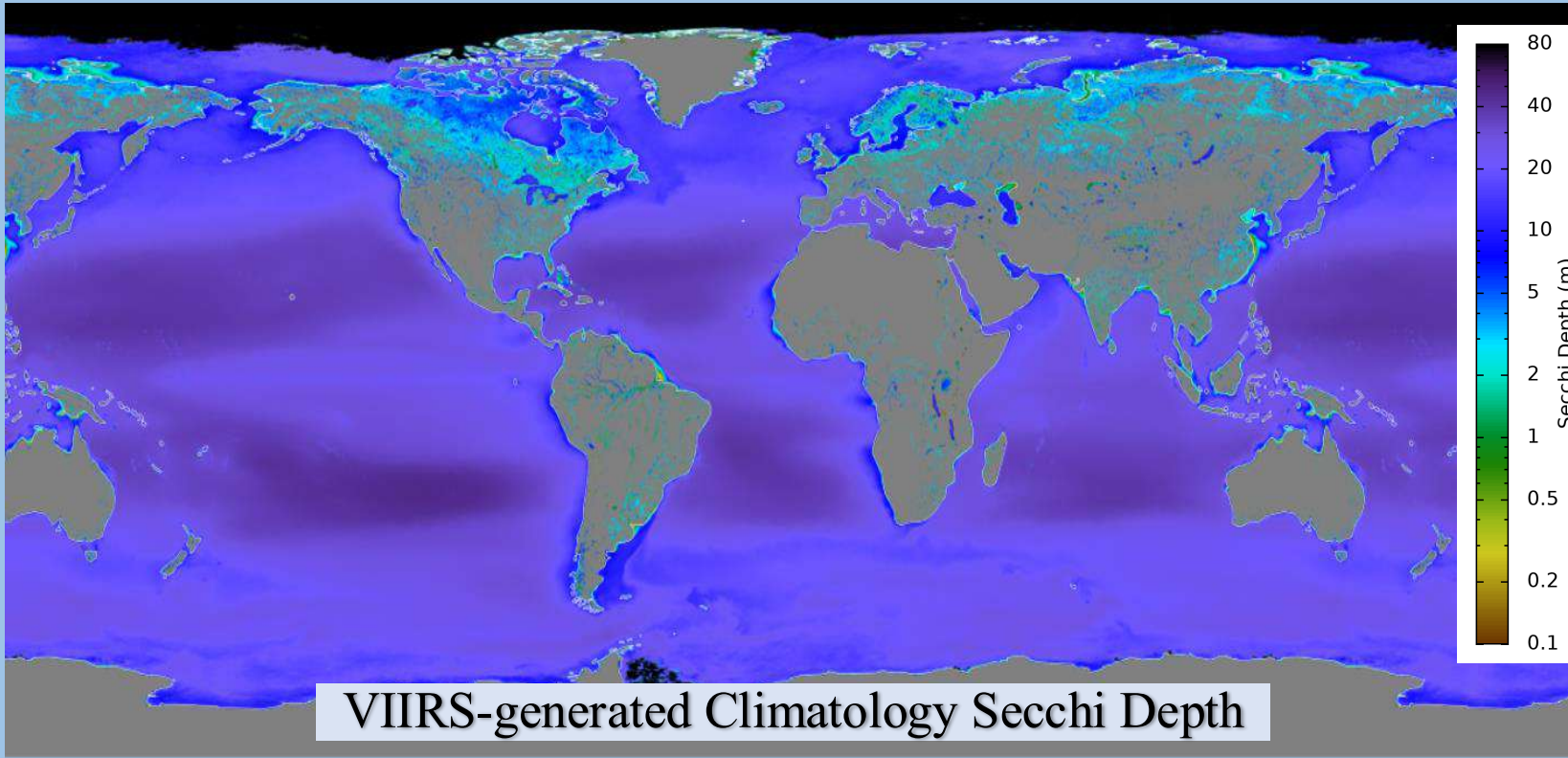


Climatology QA Score (EUMETSAT)

(2016--present)

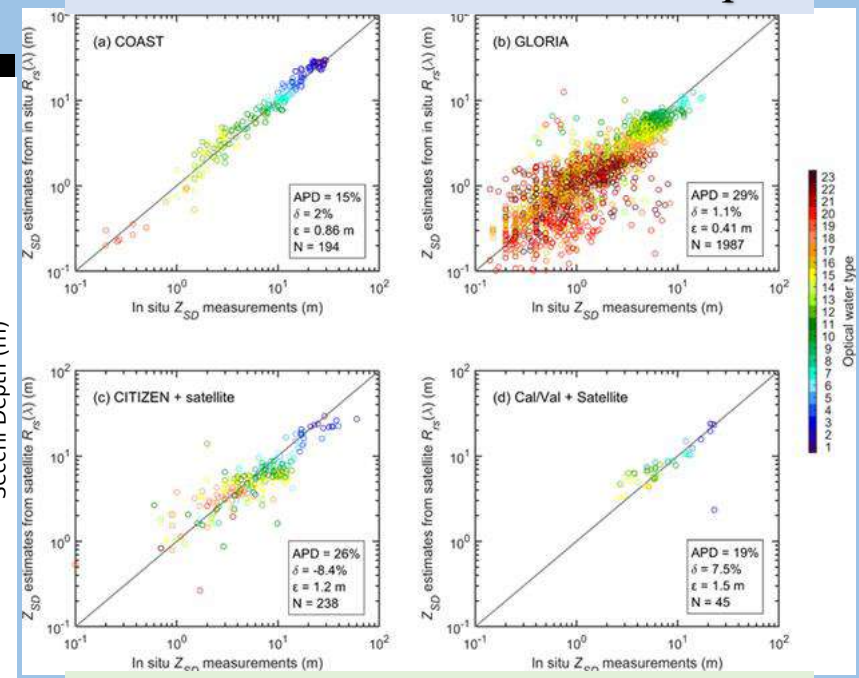


Global Water Transparency Product

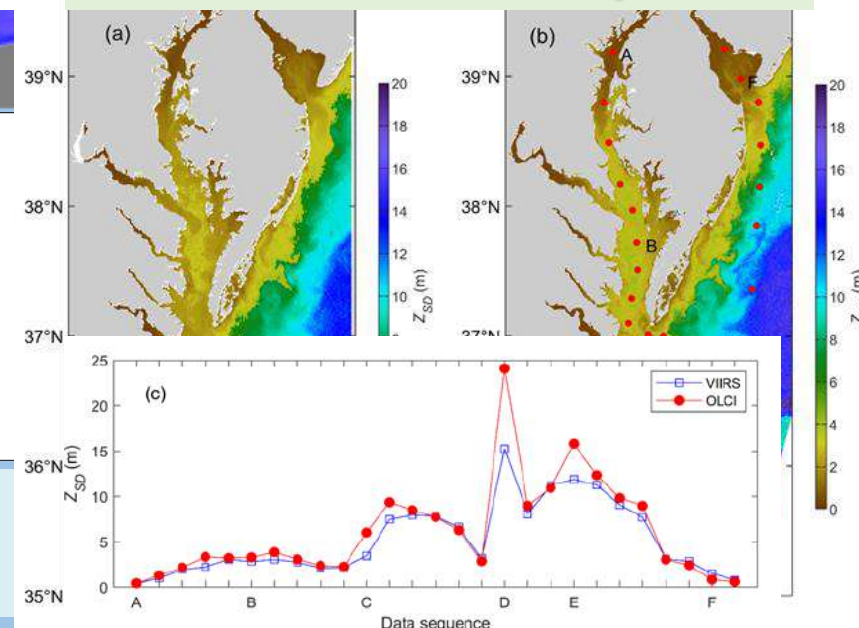


VIIRS-generated Climatology Secchi Depth

Validation Results for Secchi Depth



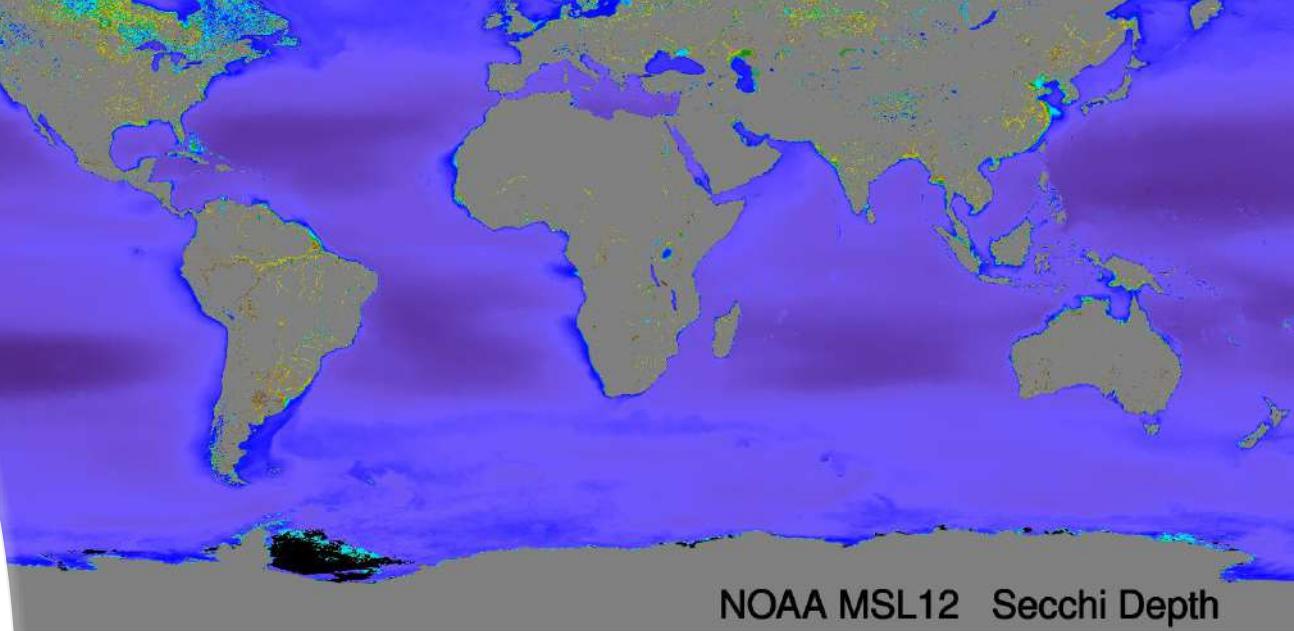
VIIRS & OLCI Secchi Depth Data



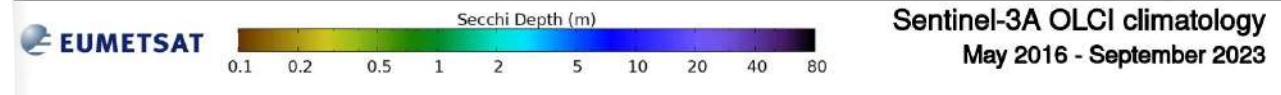
- New satellite-derived Secchi depth (Z_{SD}) products are created for global waters and have been routinely produced from VIIRS and OLCI.
- Derived from nLw spectra and appropriately accounted for solar-zenith angle effect.
- The derived Z_{SD} data are reliable across different global water classes (open oceans, coastal regions, and inland waters).
- Secchi depth can be easily understood by the user community and can be easily measured by citizen scientists.

Wei, J., M. Wang, L. Jiang, Z. Lee, R. Kirby, K. Mikelsons, and G. Lin, "Satellite observations of water transparency from VIIRS in global aquatic ecosystems," *Remote Sens. Environ.*, **330**, 114981, 2025. <https://doi.org/10.1016/j.rse.2025.114981>

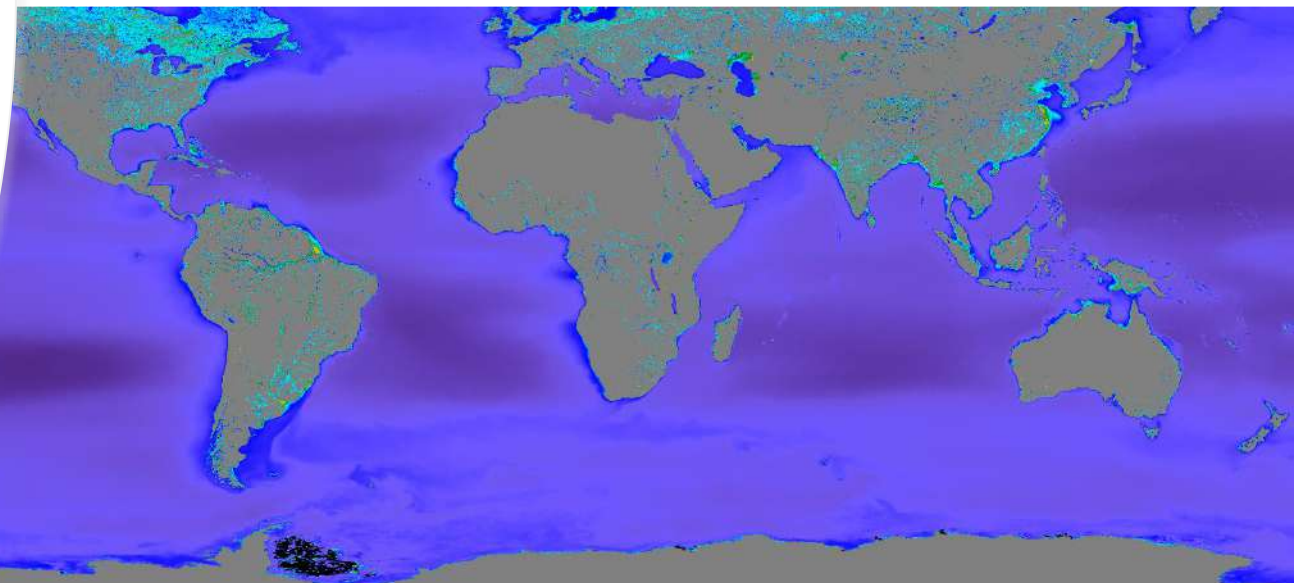
Global Water
Transparency
Products from
VIIRS and OLCI



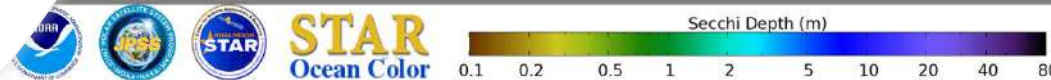
NOAA MSL12 Secchi Depth



Sentinel-3A OLCI climatology
May 2016 - September 2023



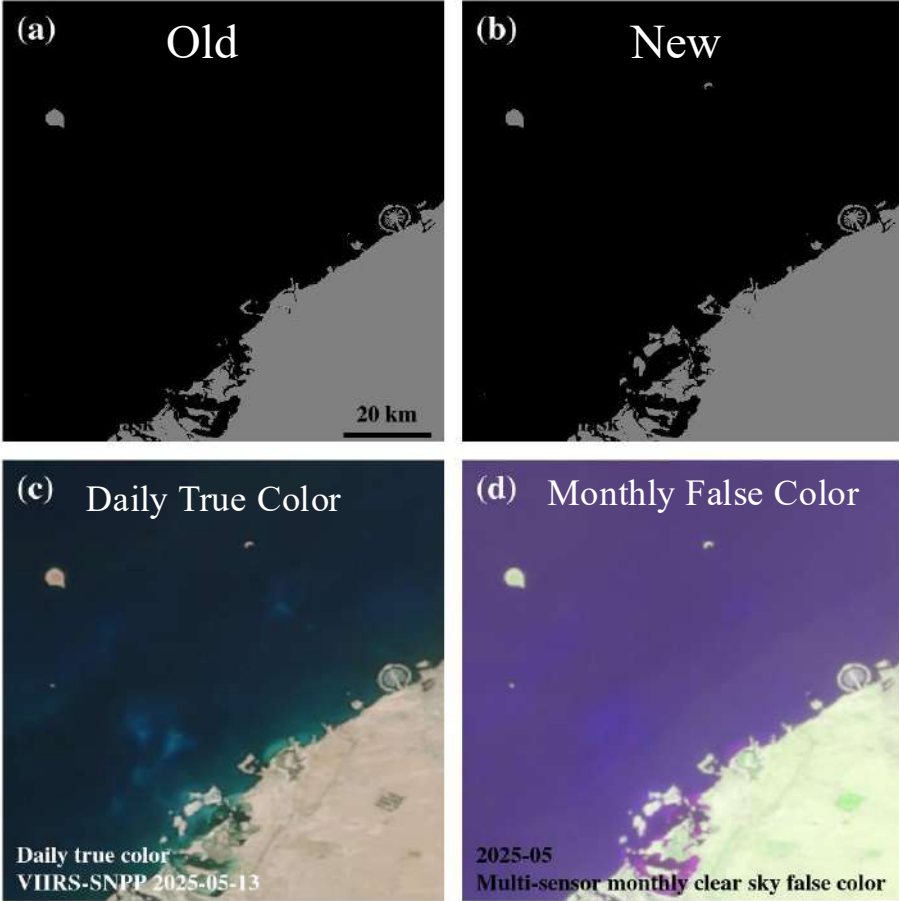
Science Quality (NIR-SWIR) Secchi Depth



SNPP VIIRS climatology
January 2012 - February 2025

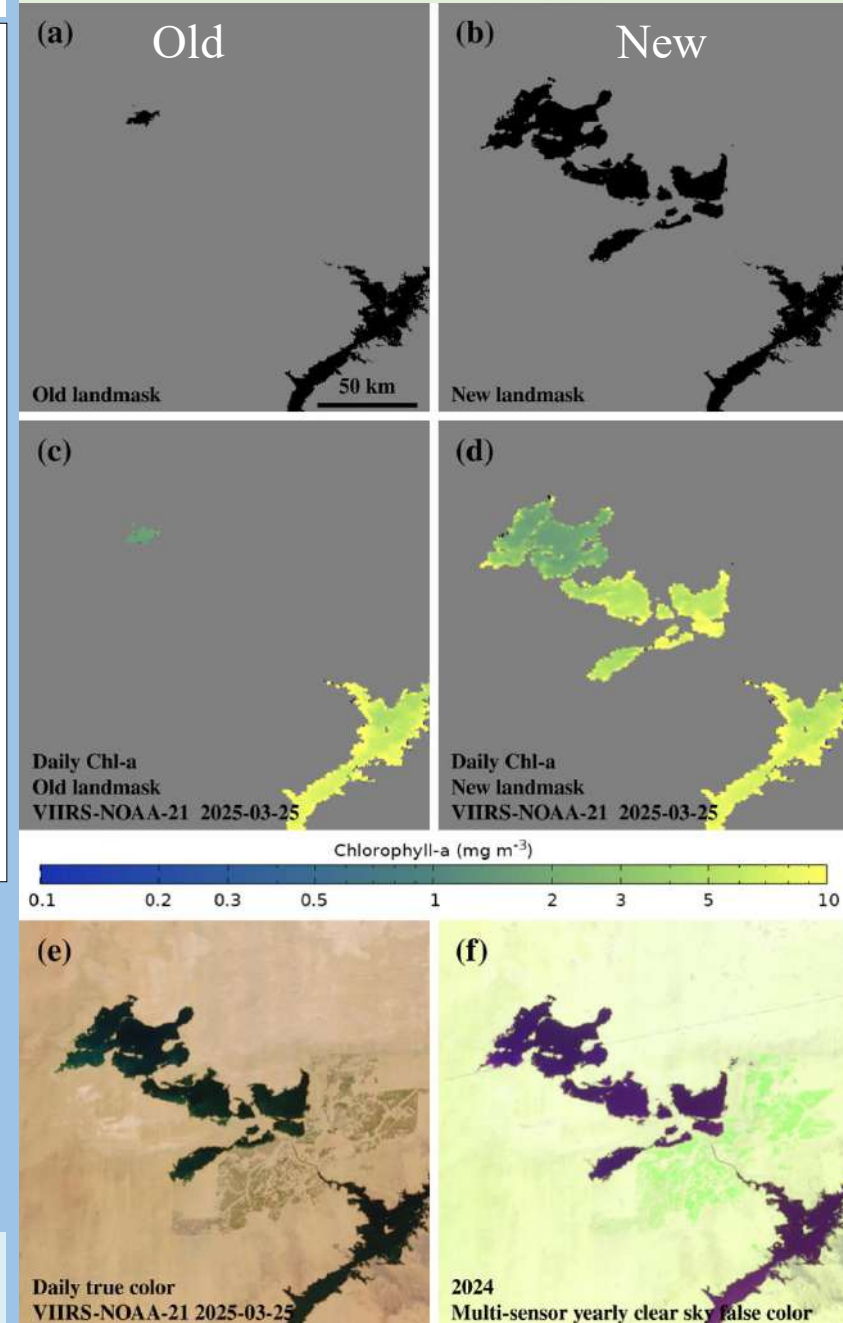
Improved Global Land Mask for Coastal/Inland Waters

UAE coastline



- Improved medium (**230 m**) spatial resolution land mask based on augmenting earlier results of [Mikelsons et al. \(2021\)](#) to reflect recent changes in global water surface coverage.
- Clear-sky false color imagery** can be effectively used to identify changes to the surface water coverage.
- This land mask update is critical for remote sensing of coastal oceans and inland waters.
- Majority of inland water surface changes are directly **linked to human activities**.
- List the changes to water surface areas and approximate time periods for these water bodies.

Toshka Lakes, Egypt



Global Land Mask Data Link:

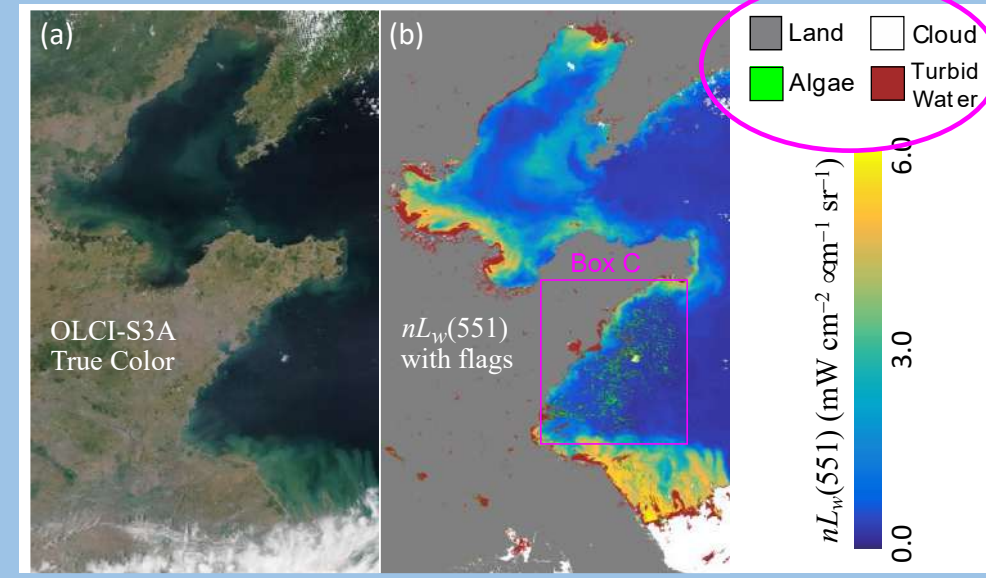
<https://data.mendeley.com/datasets/9r93m9s7cw.2>

Mikelsons, K. and M. Wang, "Improved land mask for satellite remote sensing of oceans and inland waters," *Earth Syst. Sci. Data*, 18, 231–244, 2026. <https://doi.org/10.5194/essd-18-231-2026>

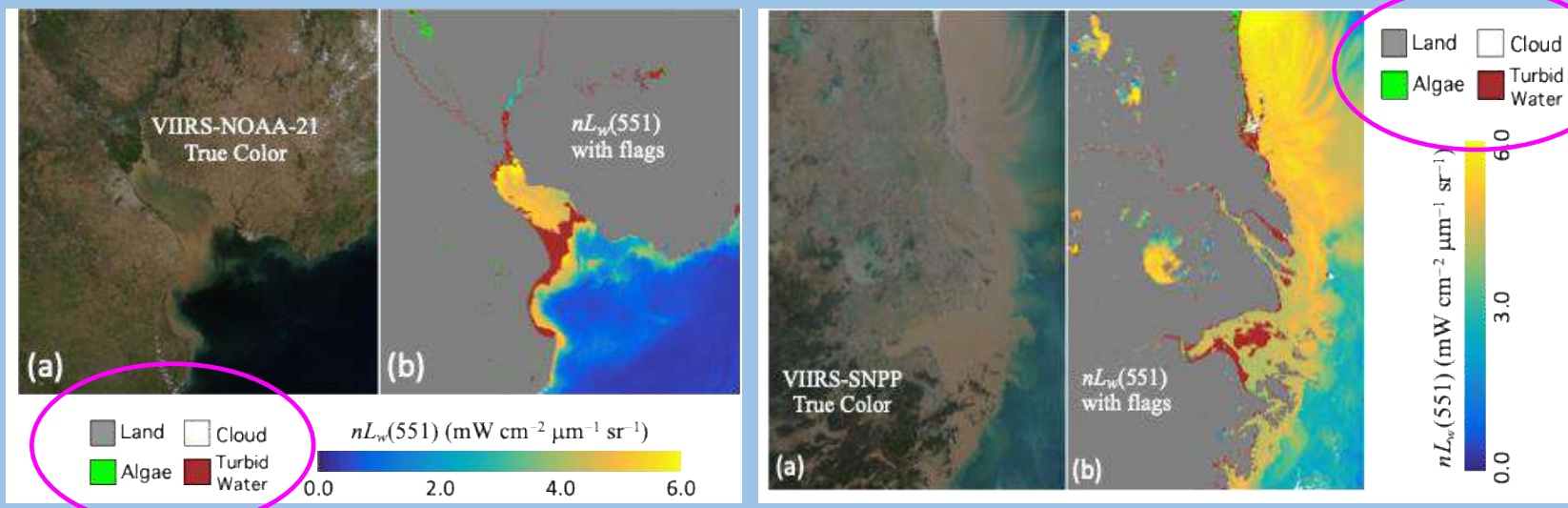
Improved Cloud Masking over Extremely Turbid Waters and Intensive Floating Algae

- The **Alternate Floating Algae Index (AFAI)** and a new normalized AFAI (nAFAI), as well as **ratios of the Rayleigh-corrected reflectance** from the blue and NIR bands are used to improve the cloud masking over extremely turbid waters and intensive algae blooms.
- Adding a recovery procedure after the original cloud masking (using reflectance threshold at the NIR or SWIR bands).
- Eliminating almost all false cloud pixels.
- Reducing false cloud masking pixels by ~30–40% over the highly turbid China East Coast.

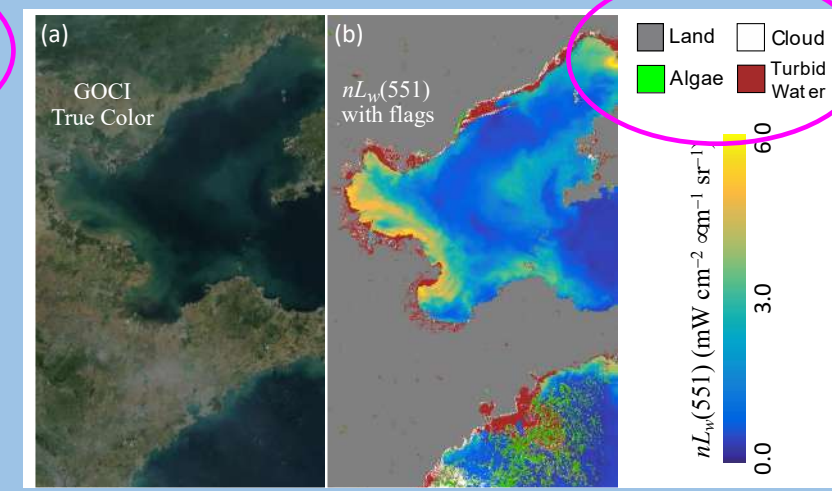
A Case from OLCI



Two Cases from VIIRS



A Case from GOCI





The SVC Approach for Three VIIRS Sensors



The SVC gain results for the NIR-, SWIR12-, SWIR13-, and SWIR23-based ocean color data processing using the Multi-Sensor Level-1 to Level-2 (**MSL12**) for VIIRS over **MOBY** Site

Reminder of atmospheric correction for VIIRS-SNPP:

NIR (M6 & M7) uses **745** and **862** nm bands

SWIR12 (M8 & M10) uses **1238** and **1601** nm bands

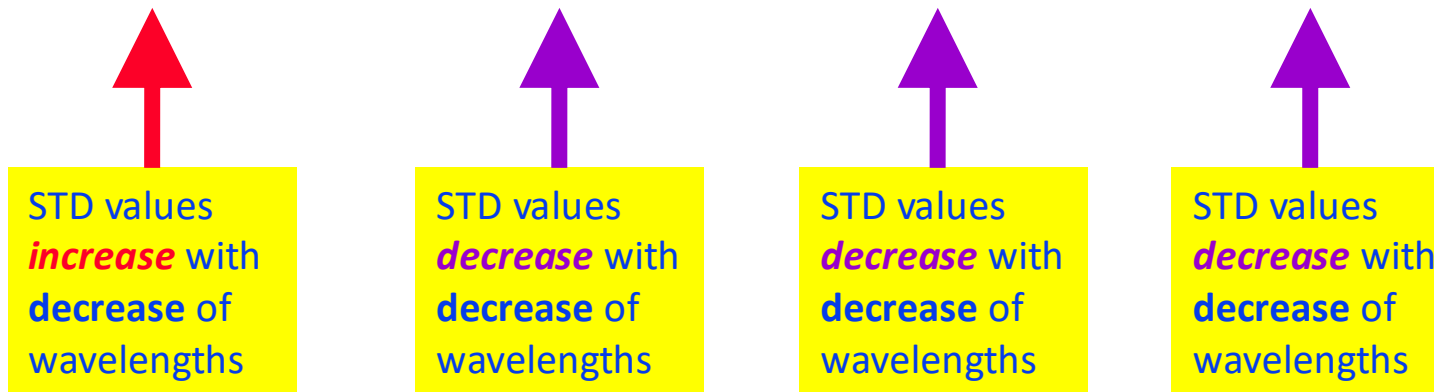
SWIR13 (M8 & M11) uses **1238** and **2257** nm bands

SWIR23 (M10 & M11) uses **1601** and **2257** nm bands

The SVC gain sets for the NIR, SWIR12, SWIR13, and SWIR23 OC data processing (VIIRS-SNPP)

NIR: 745 & 862 nm
 SWIR12: 1238 & 1601 nm
 SWIR13: 1238 & 2257 nm
 SWIR23: 1601 & 2257 nm

VIIRS-SNPP Spectral Band (nm)	VIIRS NIR- and SWIR-Based SVC Gains							
	NIR-derived $g^{(NIR)}(\lambda)$ and STD		SWIR12-derived $g^{(SWIR12)}(\lambda)$ and STD		SWIR13-derived $g^{(SWIR13)}(\lambda)$ and STD		SWIR23-derived $g^{(SWIR23)}(\lambda)$ and STD	
410 (M1)	0.9752	0.0160	0.9755	0.0206	0.9755	0.0205	0.9769	0.0228
443 (M2)	0.9732	0.0152	0.9734	0.0214	0.9735	0.0214	0.9751	0.0251
486 (M3)	0.9772	0.0141	0.9775	0.0222	0.9773	0.0225	0.9795	0.0284
551 (M4)	0.9685	0.0106	0.9688	0.0243	0.9684	0.0254	0.9714	0.0366
638 (I1)	1.0100	0.0117	1.0102	0.0279	1.0096	0.0304	1.0131	0.0491
671 (M5)	0.9740	0.0059	0.9737	0.0285	0.9733	0.0312	0.9767	0.0510
745 (M6)	0.9765	—	0.9765	0.0318	0.9758	0.0333	0.9788	0.0580
862 (M7)	1.0000	—	1.0000	0.0315	1.0000	0.0339	1.0007	0.0620
1238 (M8)	—	—	1.0050	—	1.0050	—	1.0034	0.0435
1601 (M10)	—	—	0.9960	—	—	—	0.9960	—
2257 (M11)	—	—	—	—	1.0230	—	1.0230	—



Differences (%) between the SWIR- and unified SVC gain sets (VIIRS-SNPP)

Diff12: SWIR12 vs. NIR
Diff13: SWIR13 vs. NIR
Diff23: SWIR23 vs. NIR

VIIRS-SNPP Spectral Band (nm)	$g^{(SVC)}(\lambda)$ and Differences Between SWIR- and NIR-Based SVC Gains			
	Unified SVC $g^{(SVC)}(\lambda)$	Diff12 (%) (SWIR12 vs. NIR)	Diff13 (%) (SWIR13 vs. NIR)	Diff23 (%) (SWIR23 vs. NIR)
410 (M1)	0.9752	0.031	0.031	0.174
443 (M2)	0.9732	0.021	0.031	0.195
486 (M3)	0.9772	0.031	0.010	0.235
551 (M4)	0.9685	0.031	-0.010	0.299
638 (I1)	1.0100	0.020	-0.040	0.307
671 (M5)	0.9740	-0.031	-0.072	0.277
745 (M6)	0.9765	0.000	-0.072	0.236
862 (M7)	1.0000	0.000	0.000	0.070
1238 (M8)	1.0050	—	—	-0.159
1601 (M10)	0.9960	—	—	—
2257 (M11)	1.0230	—	—	—

NIR: 745 & 862 nm
SWIR12: 1238 & 1601 nm
SWIR13: 1238 & 2257 nm
SWIR23: 1601 & 2257 nm

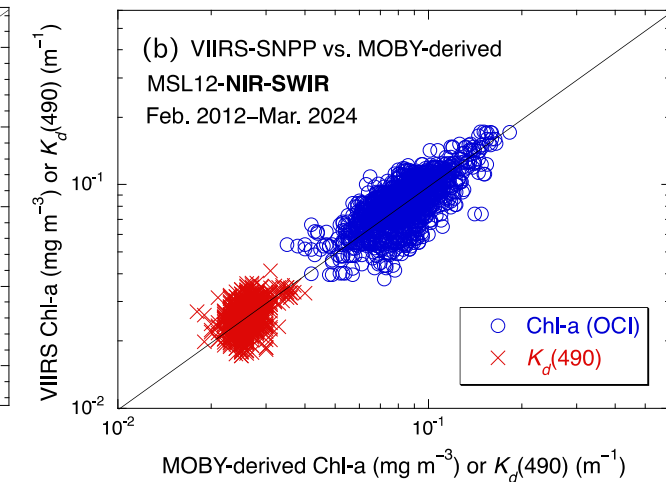
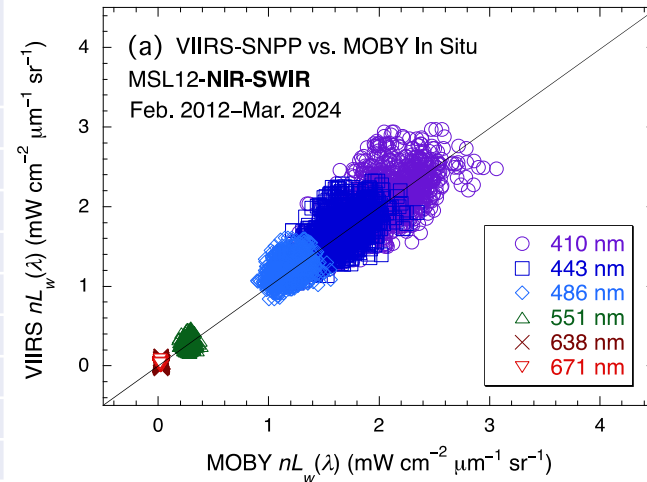
Gain differences between the NIR and SWIR12/SWIR13 methods are mostly within ~0.05%!

Gain differences between the NIR and SWIR23 method are significantly high mostly within ~0.25%!

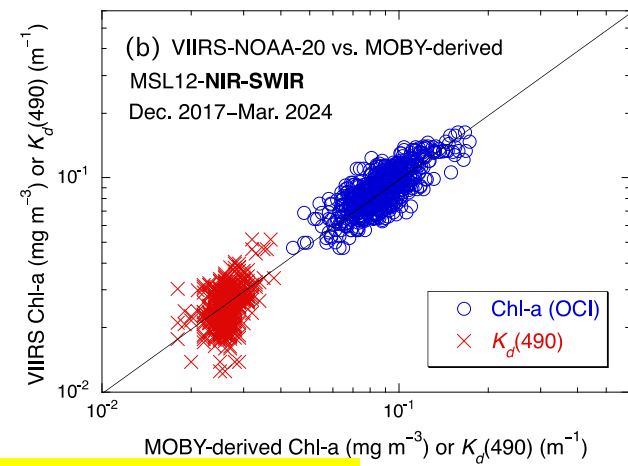
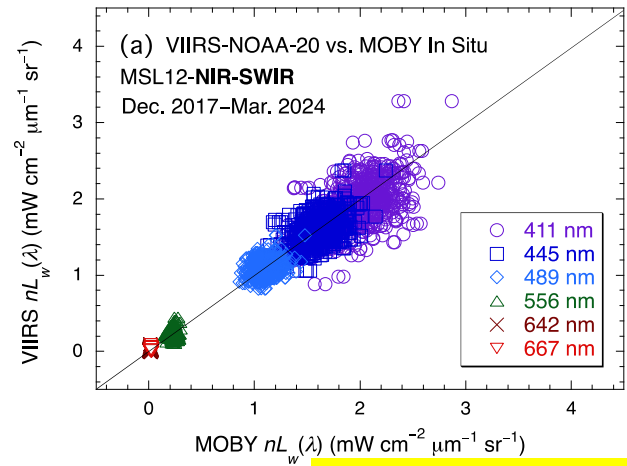


New System Vicarious Calibration Gain Sets for Three VIIRS Sensors

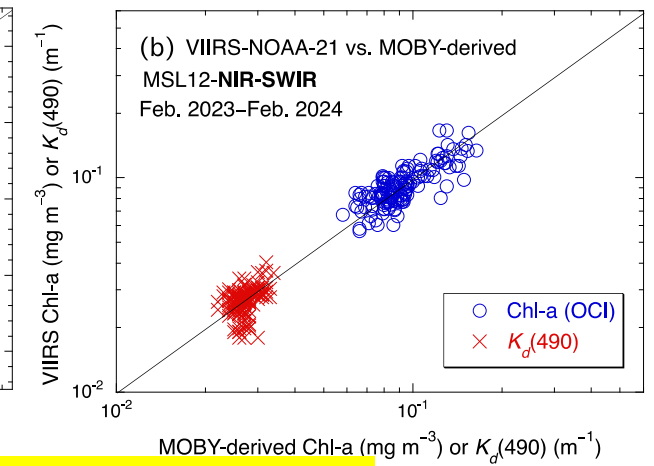
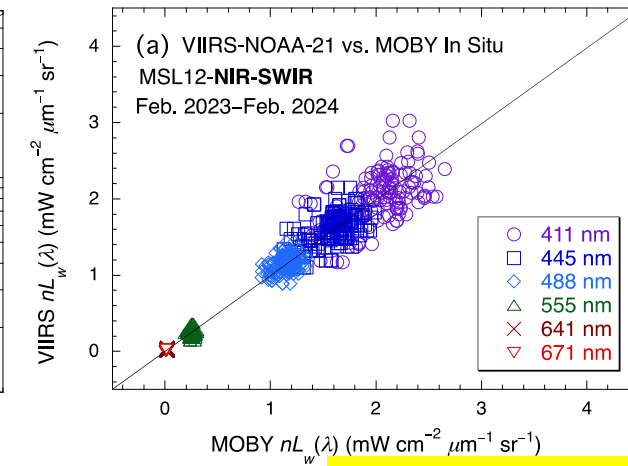
VIIRS-NOAA-21 Spectral Band (nm)	$g^{(SVC)}(\lambda)$ and Differences Between SWIR- and NIR-Based SVC Gains			
	Unified SVC $g^{(SVC)}(\lambda)$	Diff12 (%) (SWIR12 vs. NIR)	Diff13 (%) (SWIR13 vs. NIR)	Diff23 (%) (SWIR23 vs. NIR)
411 (M1)	Band	SNPP	NOAA-20	NOAA-21
445 (M2)	M6	0.9765	1.0052	1.0051
488 (M3)	M7	1.0000	1.0000	1.0000
555 (M4)	M8	1.0050	1.0435	0.8982
641 (I1)	M10	0.9960	1.0235	0.8779
671 (M5)	M11	1.0230	1.0330	0.8434
747 (M6)				
868 (M7)				
1241 (M8)				
1613 (M10)	0.8779	—	—	—
2252 (M11)	0.8434	—	—	—



VIIRS-SNPP (2012-2024)

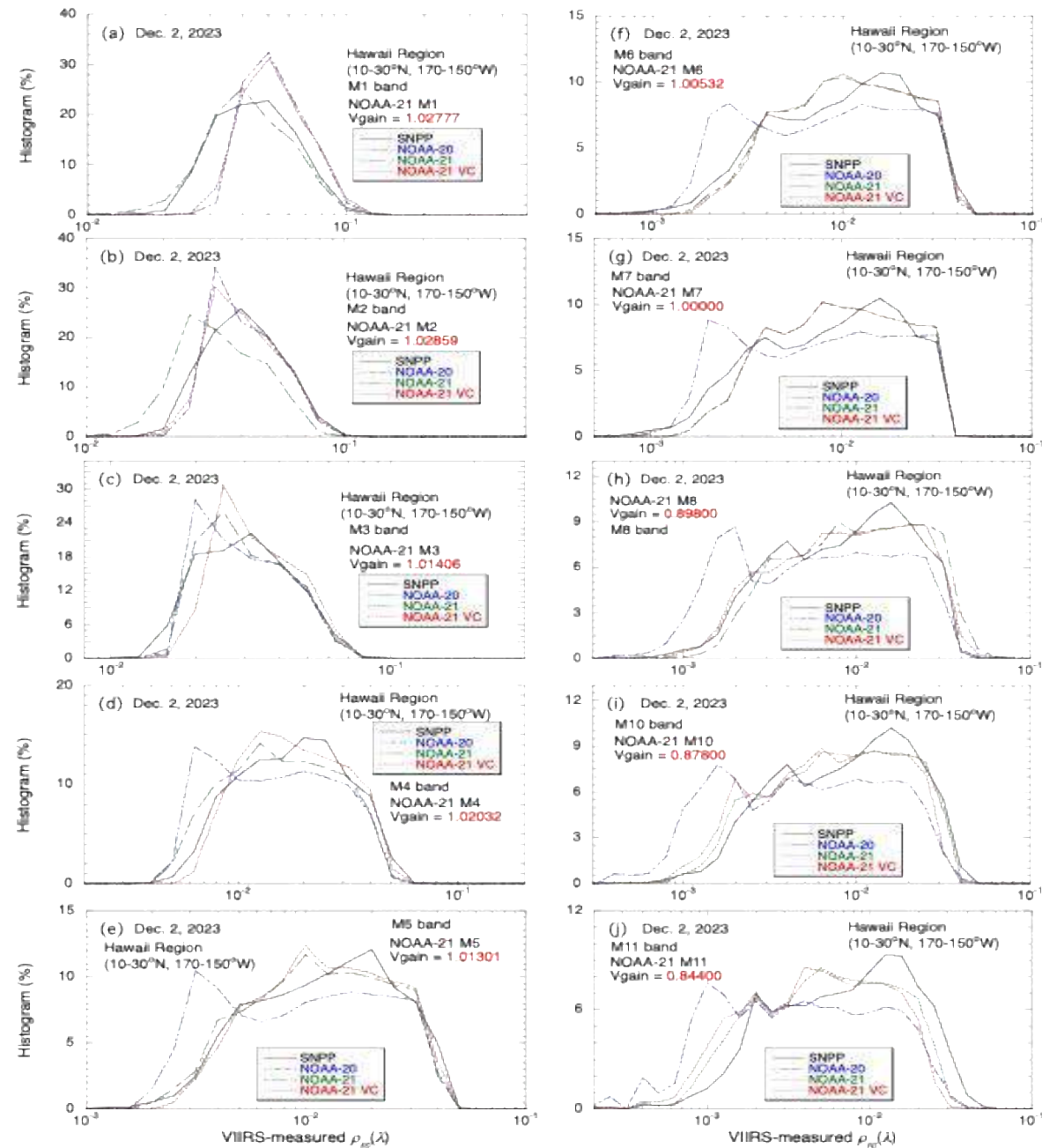


VIIRS-NOAA-20 (2017-2024)



VIIRS-NOAA-21 (2023-2024)

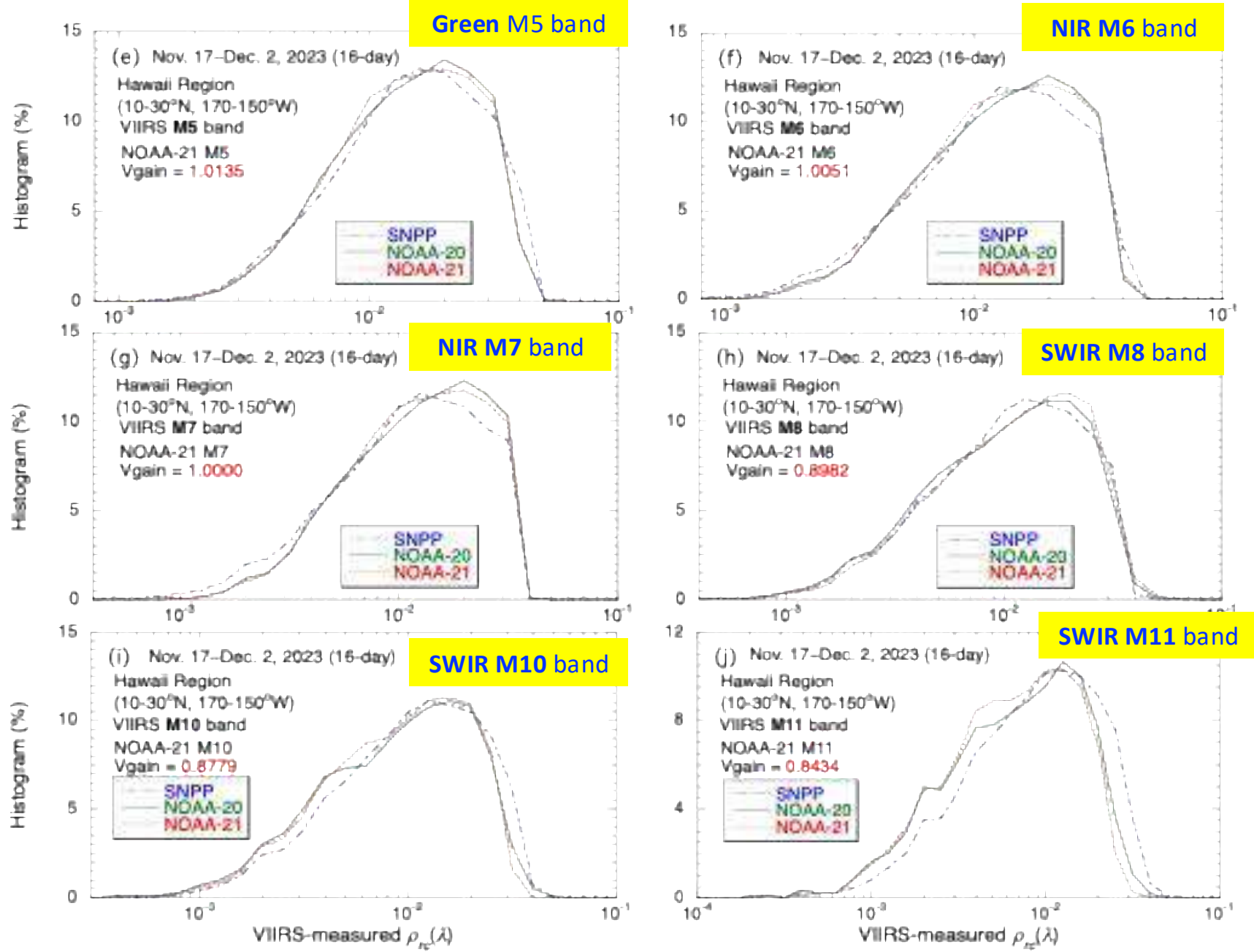
VIIRS-measured Rayleigh-corrected reflectance (One-day) over MOBY site (Dec. 2, 2023)



VIIRS-measured Rayleigh-corrected reflectance (16-day) over MOBY site (Nov. 17-Dec. 2, 2023)

SVC gains are applied for three VIIRS sensors

Results show that the SVC gains are reasonable!





Conclusions



- At NOAA, global OLCI ocean color products from Sentinel-3A and 3B are being routinely downloaded and compared with in situ MOBY and AERONET-OC in situ data, as well as VIIRS ocean color products.
- New PACE true and false color images are now being routinely produced in OCView.
- We are now routinely producing global water transparency product.
- New updated global land mask data (250 m) are available to download and useful for ocean color remote sensing over coastal and inland waters.
- New enhanced cloud masking procedure significantly improve water property retrievals over extremely turbid coastal and inland waters, as well as for intensive floating algae.

VIIRS, OLCI, and SGLI Global Images and Cal/Val:

<https://www.star.nesdis.noaa.gov/sod/mecb/color/>

Ocean Color Data Distribution:

<https://coastwatch.noaa.gov/>

Thank You!