Ocean Diurnal Variations Measured by the Korean Geostationary Ocean Color Imager

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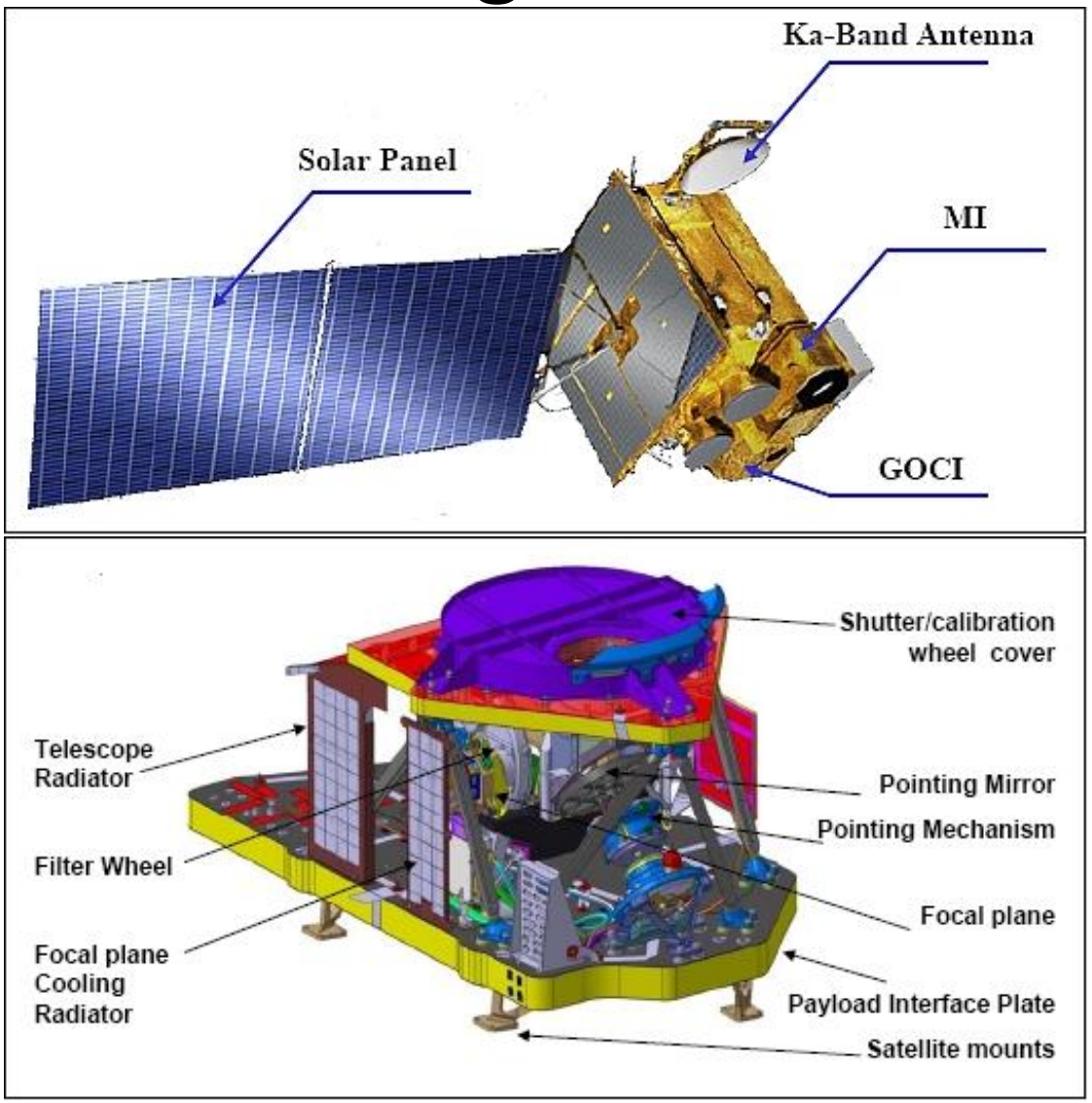
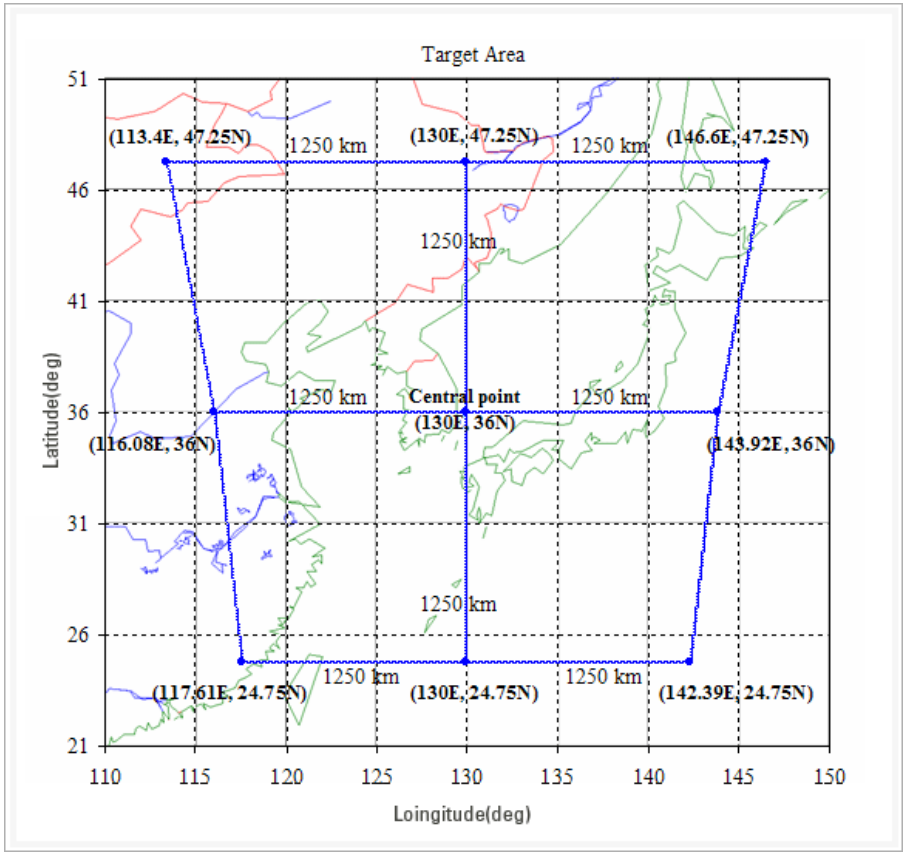
at **'CoRP 9th Annual Science Symposium'** in Madison, Wisconsin

COMS-1 – Communication, Ocean and Meteorological Satellite



GOCI Introduction



412nm	Yellow substance and turbidity
443nm	Chlorophyll absorption maximum
490nm	Chlorophyll and other pigments
555nm	Turbidity, suspended sediment
660nm	Baseline of fluorescence signal, Chlorophyll, suspended sediment
680nm	Atmospheric correction and fluorescence signal
745nm	Atmospheric correction and baseline of fluorescence signal
865nm	Aerosol optical thickness, vegetation, water vapor reference over the ocean

NOAA-MSL12 Processing for GOCI data

- **Collaboration effort between NOAA/NESDIS/STAR and KIOST/KOSC.**
- **NOAA-MSL12 data processing** (based on NASA SeaDAS) is improved for the GOCI data processing.
- Various parameters and **lookup tables** are generated, and a **new atmospheric correction algorithm** has been developed for GOCI data processing in the region (*Wang et al.*, 2012; 2013).
- **New cloud masking method** has been recently developed for very turbid coastal waters (e.g., Yangtz River mouth, Korean Coastal areas).
- The GOCI atmospheric correction algorithm is recently improved using **new vicarious calibration**.
- GOCI Level-1B data (Mar. 2011– Feb. 2013) were obtained from the Korea Ocean Satellite Center and processed using the new atmospheric correction algorithm.
- In situ optical measurements (Mar.– Nov. 2011) are used to quantify and validate GOCI ocean color products with the new atmospheric correction algorithm for GOCI ocean color data processing.

Estimating NIR Contribution

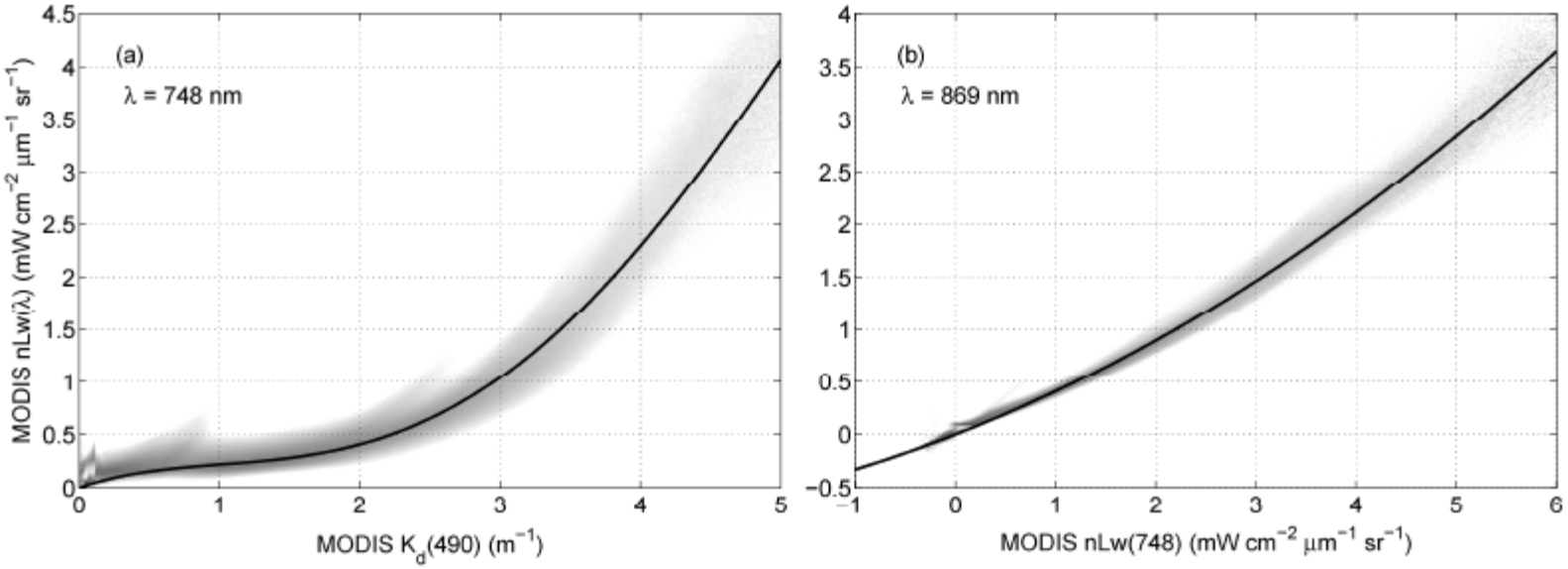
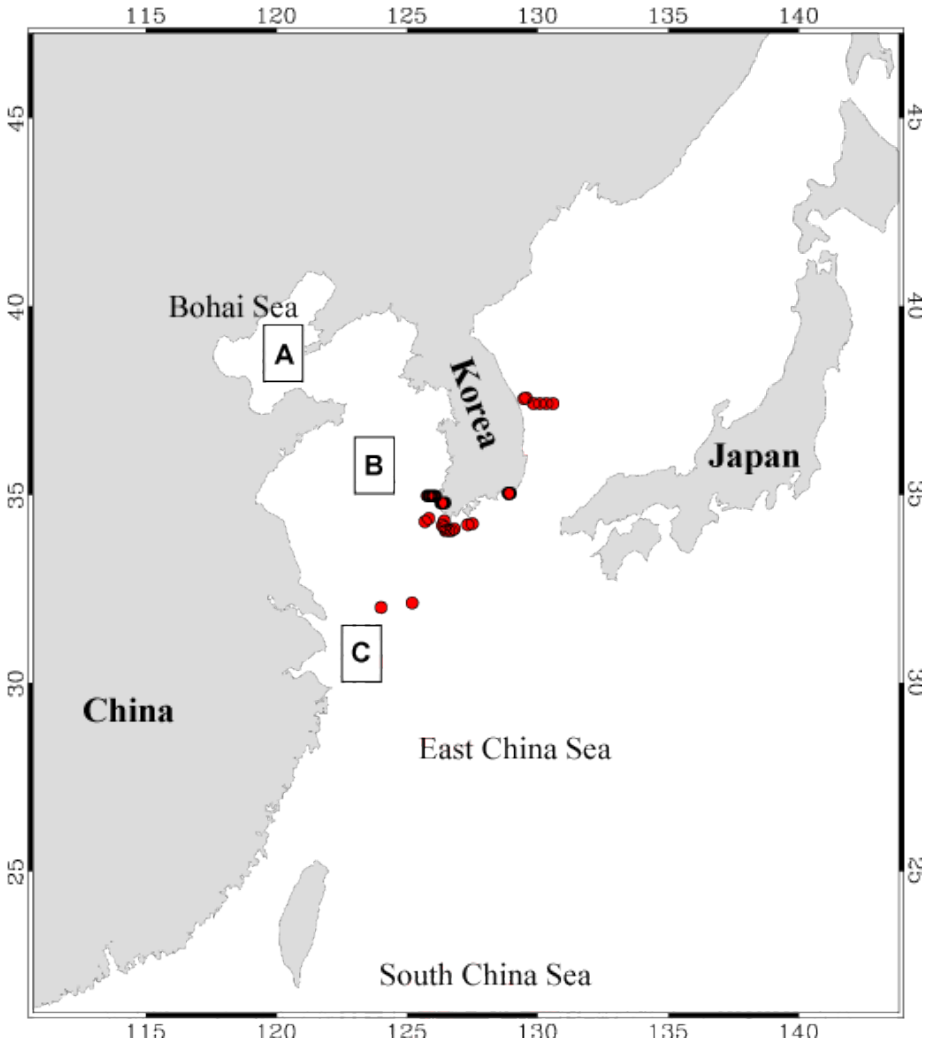


Fig. 2. Scatter plots and empirical polynomial fitting functions for (a) $nL_w(748)$ vs. $K_d(490)$ and (b) $nL_w(869)$ vs. $nL_w(748)$. Note that $nL_w(748)$, $nL_w(869)$, and $K_d(490)$ were derived from MODIS-Aqua measurements (2002 to 2009) using the SWIR atmospheric correction algorithm in this region.

- nLw(748) = f(Kd(490)), $f(x) = 0.465x-0.385x^2+0.152x^3-0.0121x^4$
- nLw(869) = g(nLw(748)), $g(x) = 0.368x+0.04x^2$
- *M. Wang, W. Shi, and L. Jiang, "Atmospheric correction using near-infrared bands for satellite ocean color data processing in the turbid western Pacific region", Optical Express, 20(2), 741-753 (2012)*

GOCI Coverage over Korean Peninsular and location of in-situ measurements

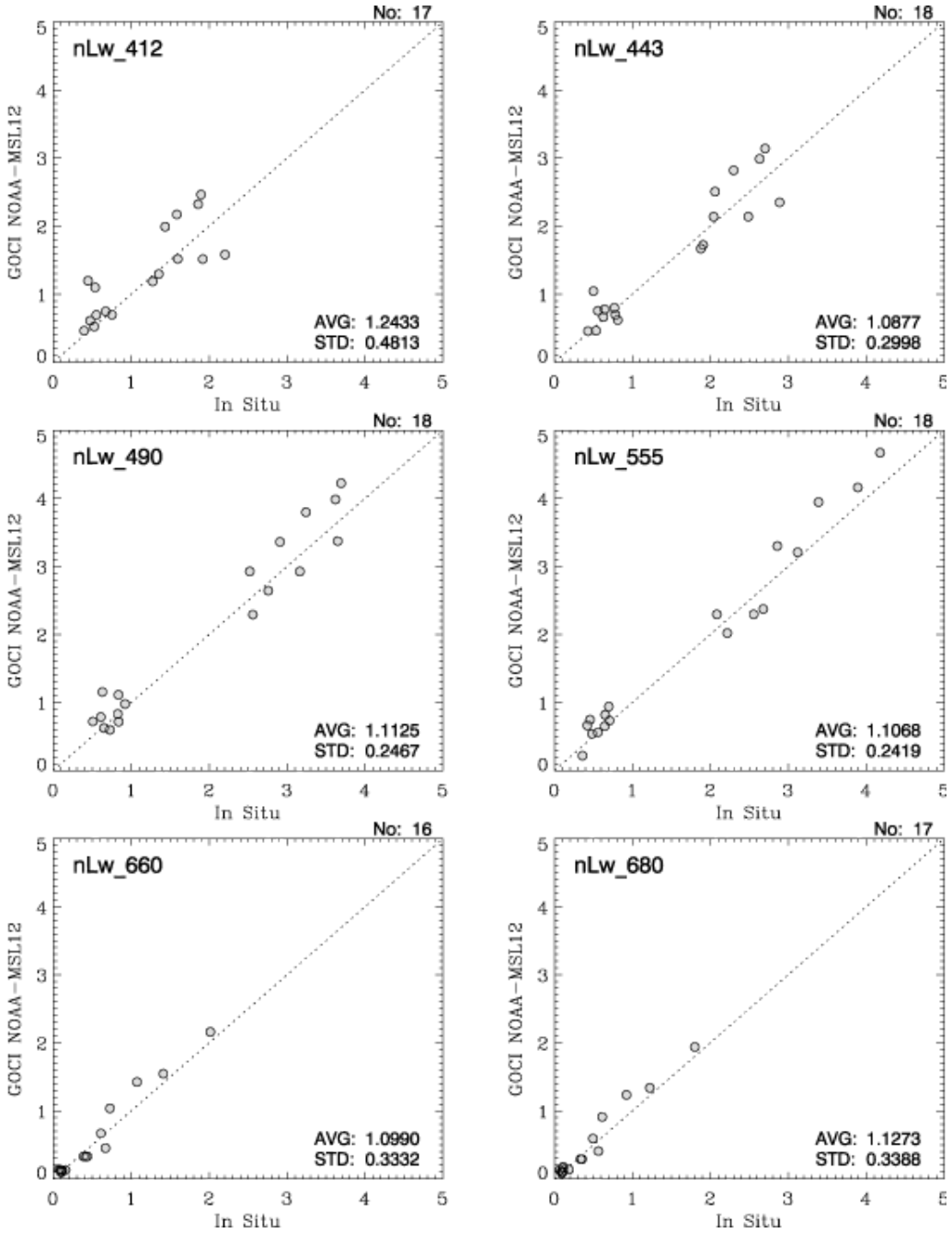


*. In-situ bio-optical measurements are provided by KIOST/KOSC

GOCI Matchup Comparison

M. Wang, J.H. Ahn, L. Jiang, W. Shi, S. Son, Y.J. Park, and J.H. Ryu, "Ocean color products from the Korean Geostationary Ocean Color Imager (GOCI)", Optical Express, 21(3), 3835-3849 (2013)

Matchup between **in-situ** and **GOCI NOAA-MSL12** using **New Gain**

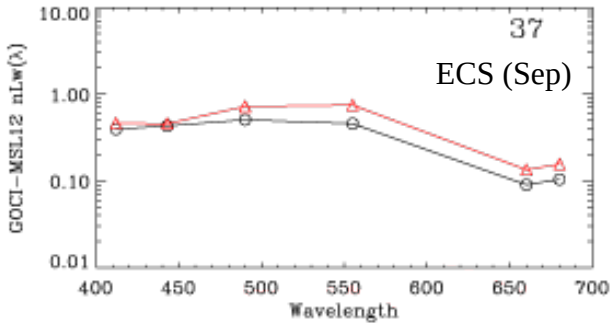


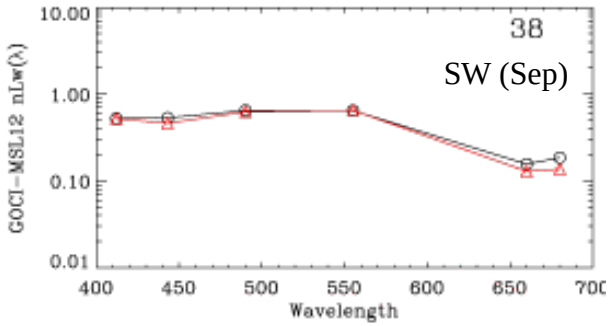
Mean Ratio of GOCI NOAA-MSL12 vs. In Situ

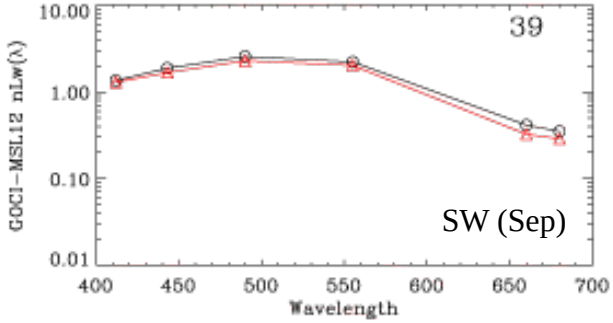
Var	Old (Wang et al. 2013)		New Gain	
	Avg (std)	**No**	**Avg** (std)	**No**
$nL_w(413)$	1.2737 (0.599)	18	1.2433 (0.481)	17
$nL_w(443)$	1.4182 (0.486)	18	1.0677 (0.300)	18
$nL_w(490)$	1.2868 (0.357)	18	1.1125 (0.247)	18
$nL_w(555)$	1.1506 (0.308)	18	1.1068 (0.242)	18
$nL_w(660)$	1.3367 (0.531)	18	1.0990 (0.333)	16
$nL_w(680)$	1.4092 (0.586)	17	1.1273 (0.339)	17

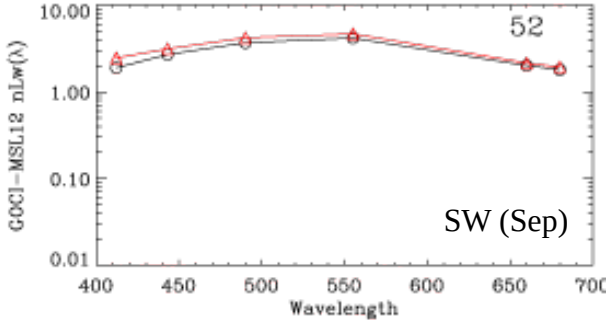
Spectral shape of **in situ** and **GOCI**-derived $nL_w(\lambda)$ measurements

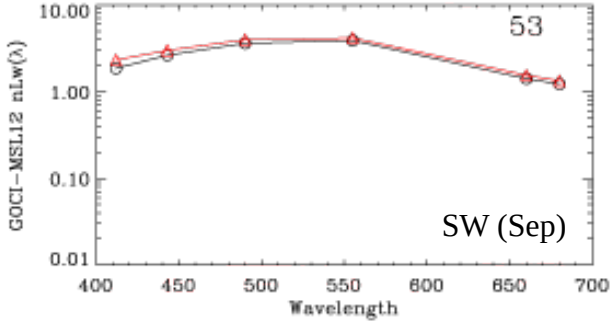
Black-in situ, red-GOCI

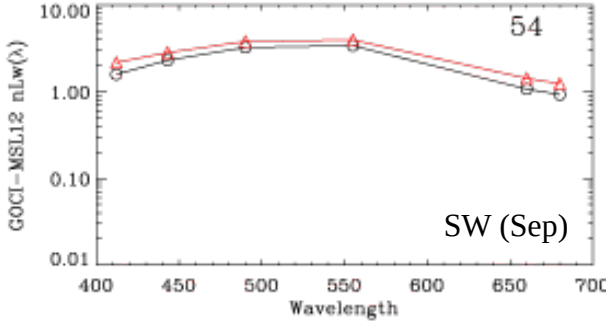


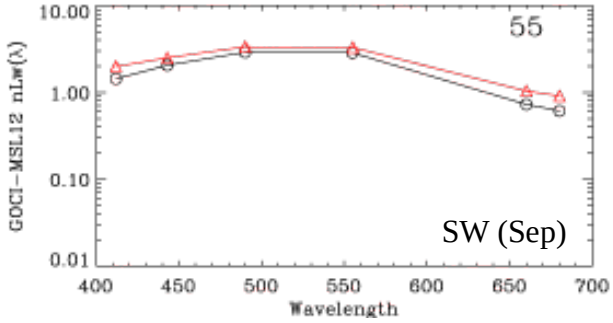


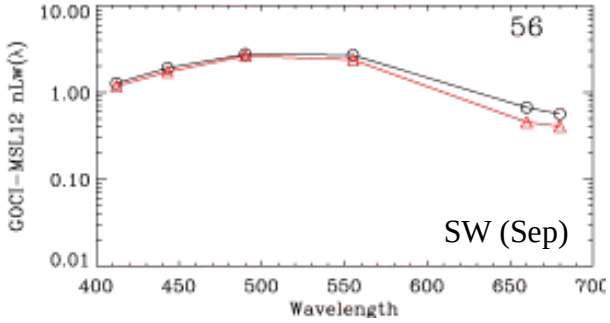








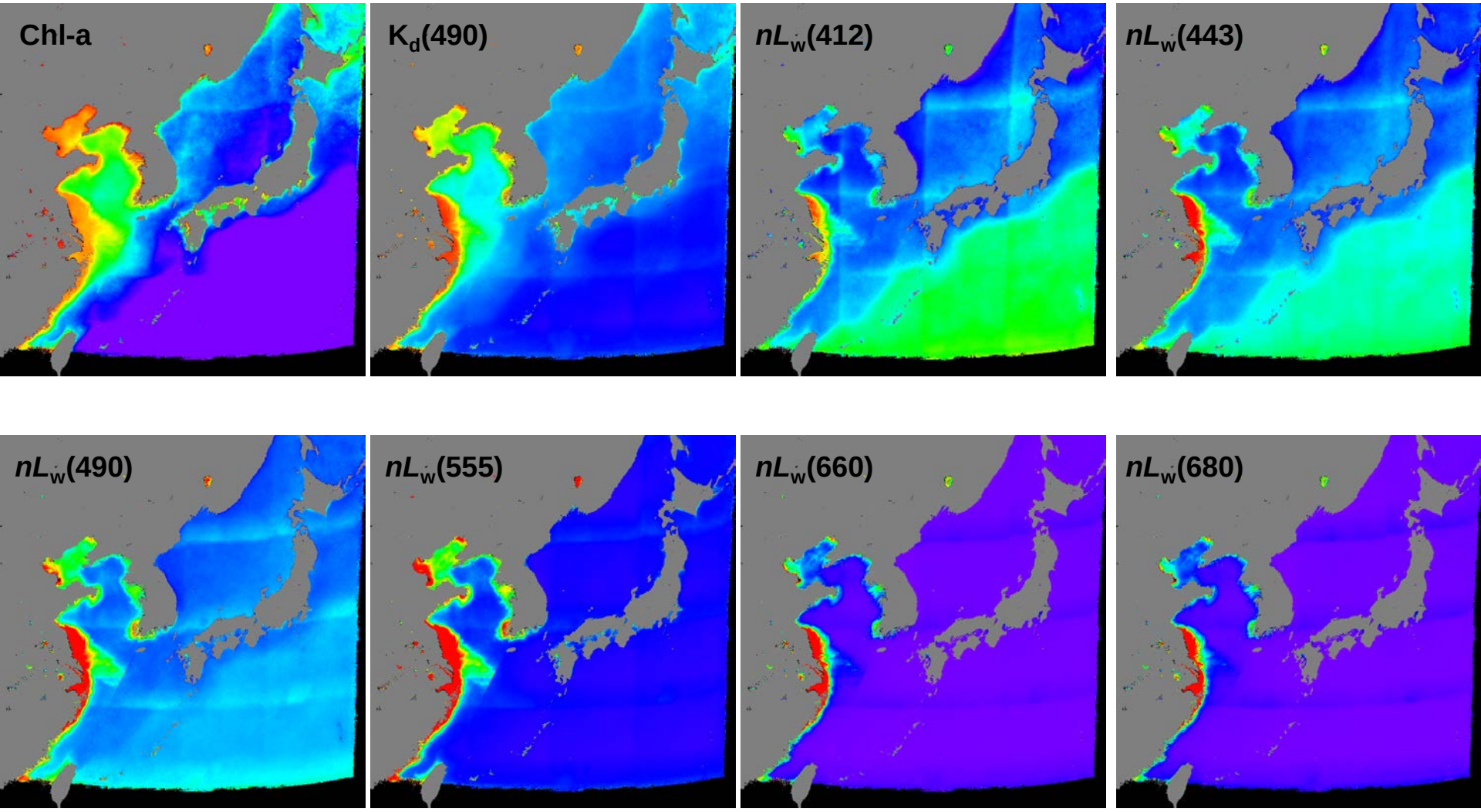




GOCI Composite Images

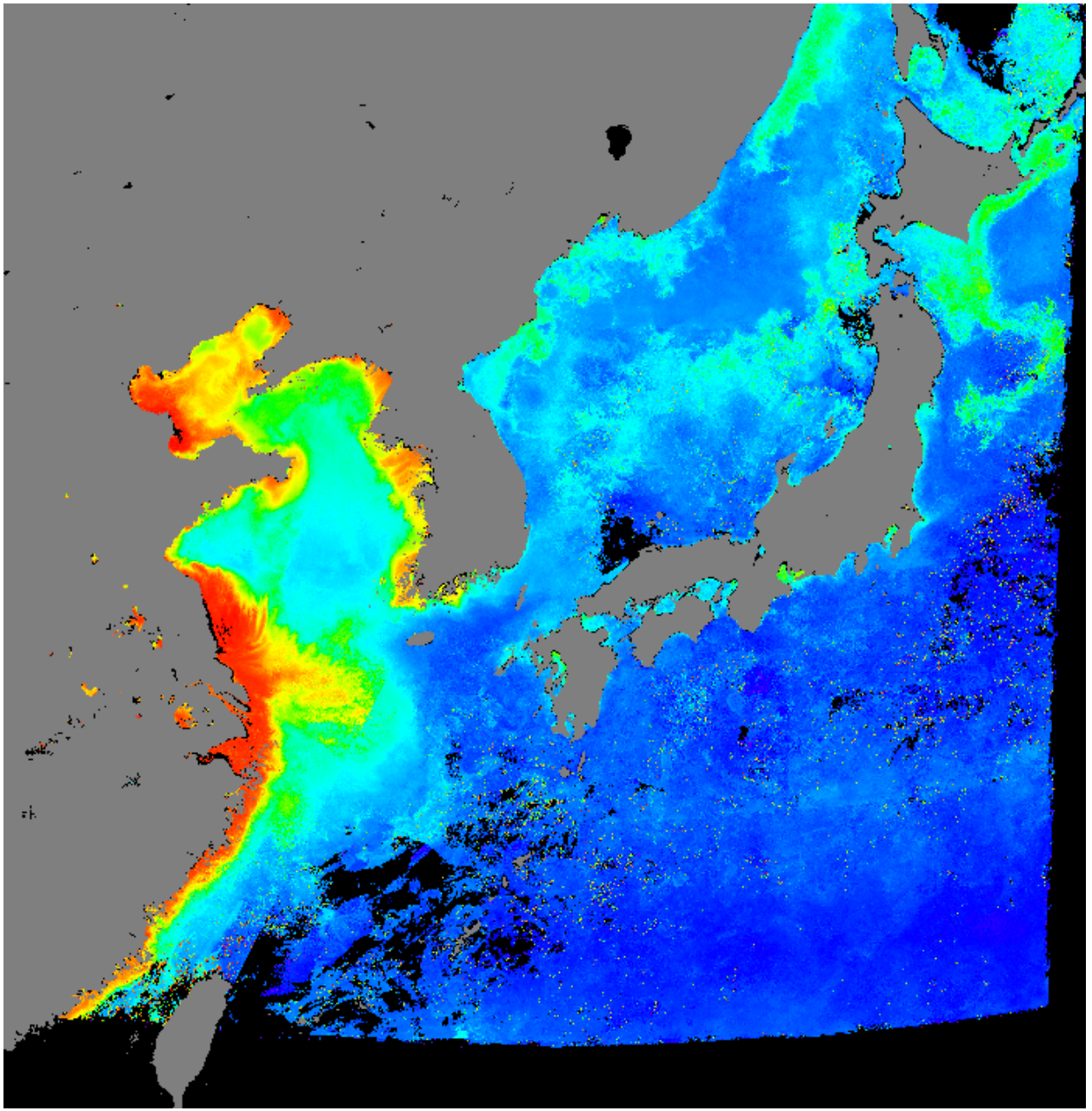
(2011 Mar. – 2012 Oct.)

Climatology GOCI Images from Mar. 2011 to Oct. 2012 (at 12:00)



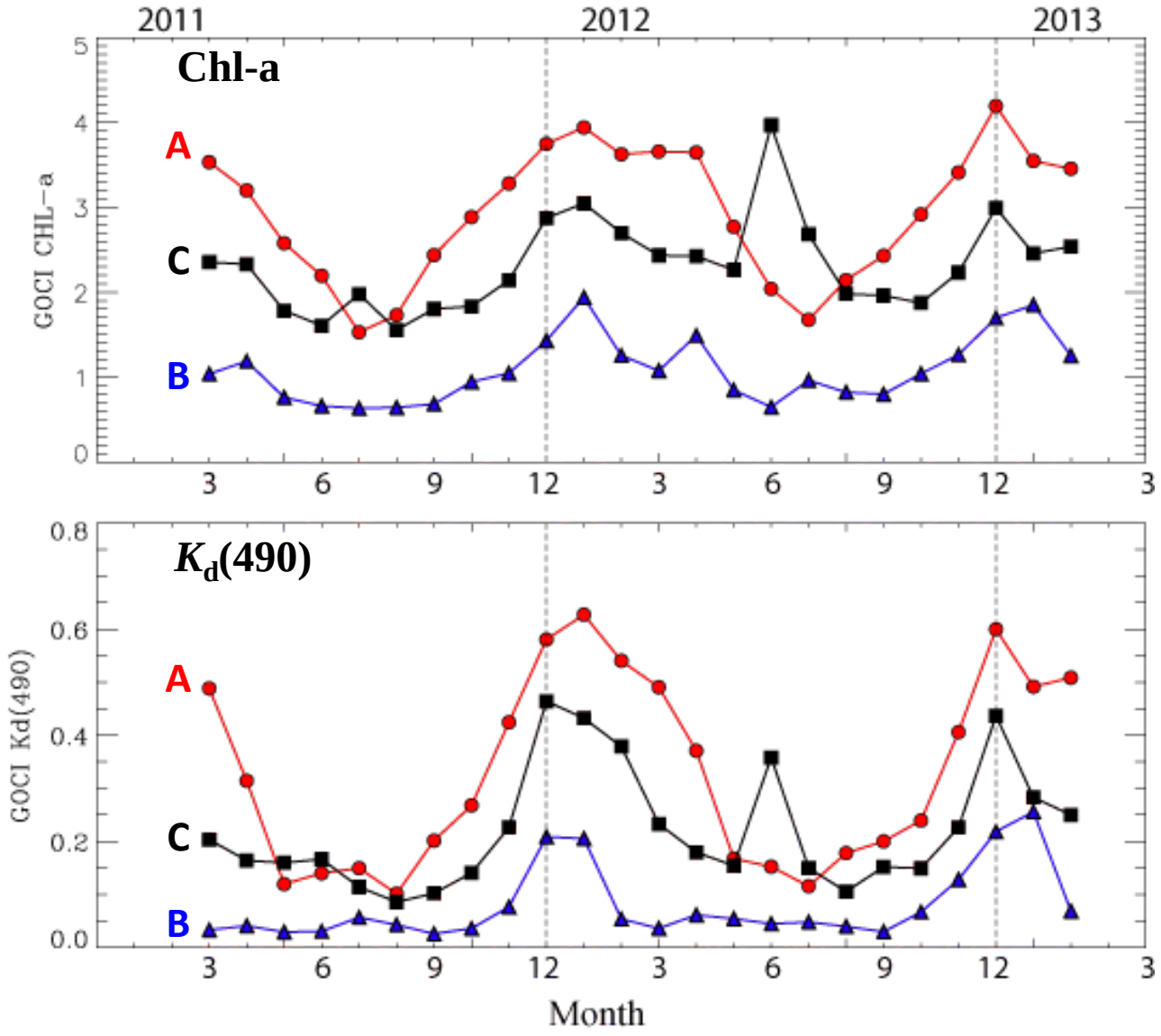
Monthly Composite Images of GOCI $K_d(490)$

(Mar. 2011 – Oct. 2012, at 12:00)



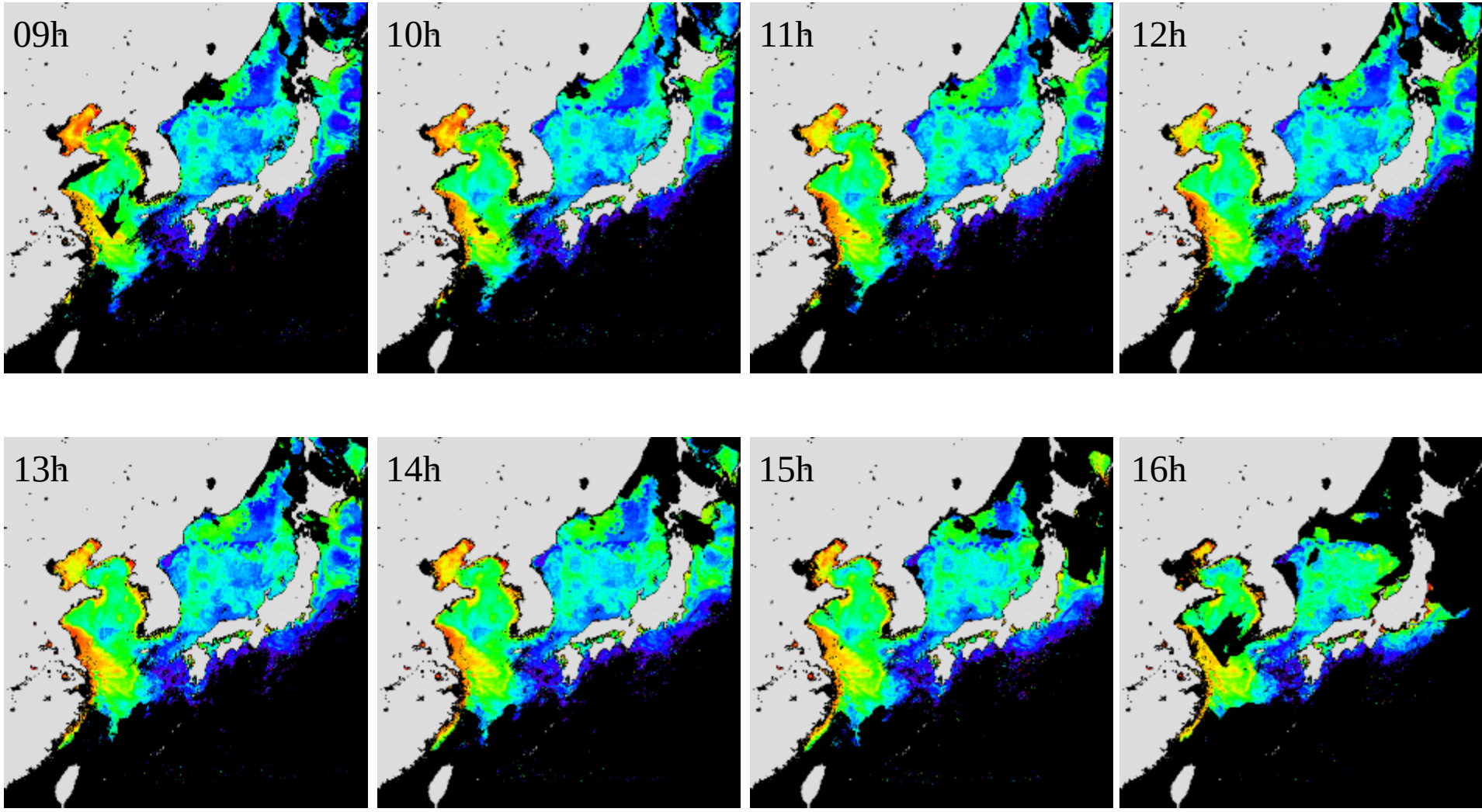
Time Series of GOCI *Chl-a* & $K_d(490)$ Monthly Mean

(Mar. 2011 – Oct. 2012, at 12:00)



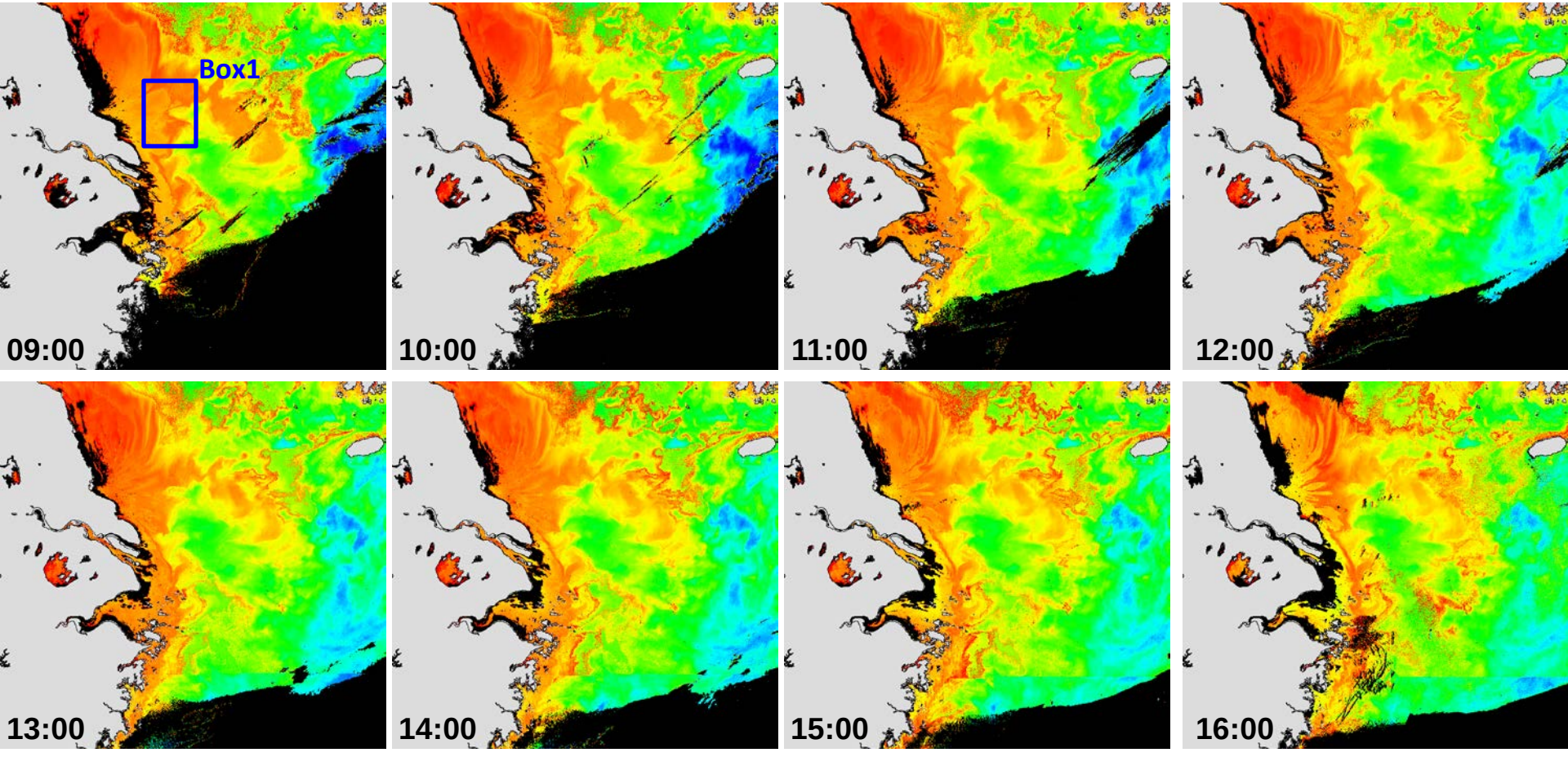
GOCI Images for
Diurnal Changes

GOCI-MSL12 **Chl-a** (Apr. 5, 2011)

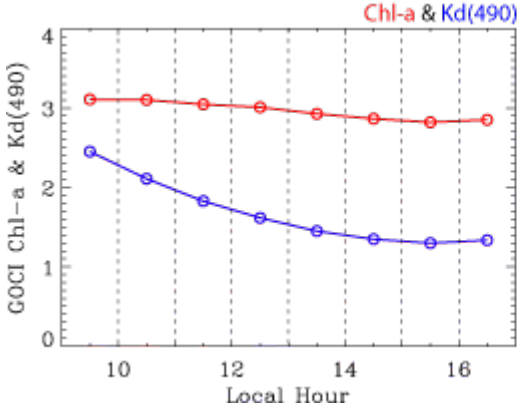


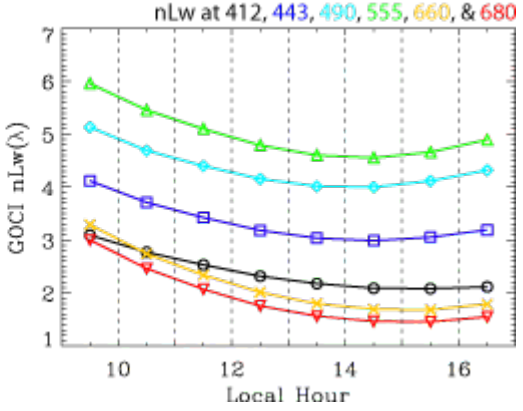
GOCI Images in the East China Sea

GOCI NOAA-MSL12 **Chl-a** (2012-04-26)

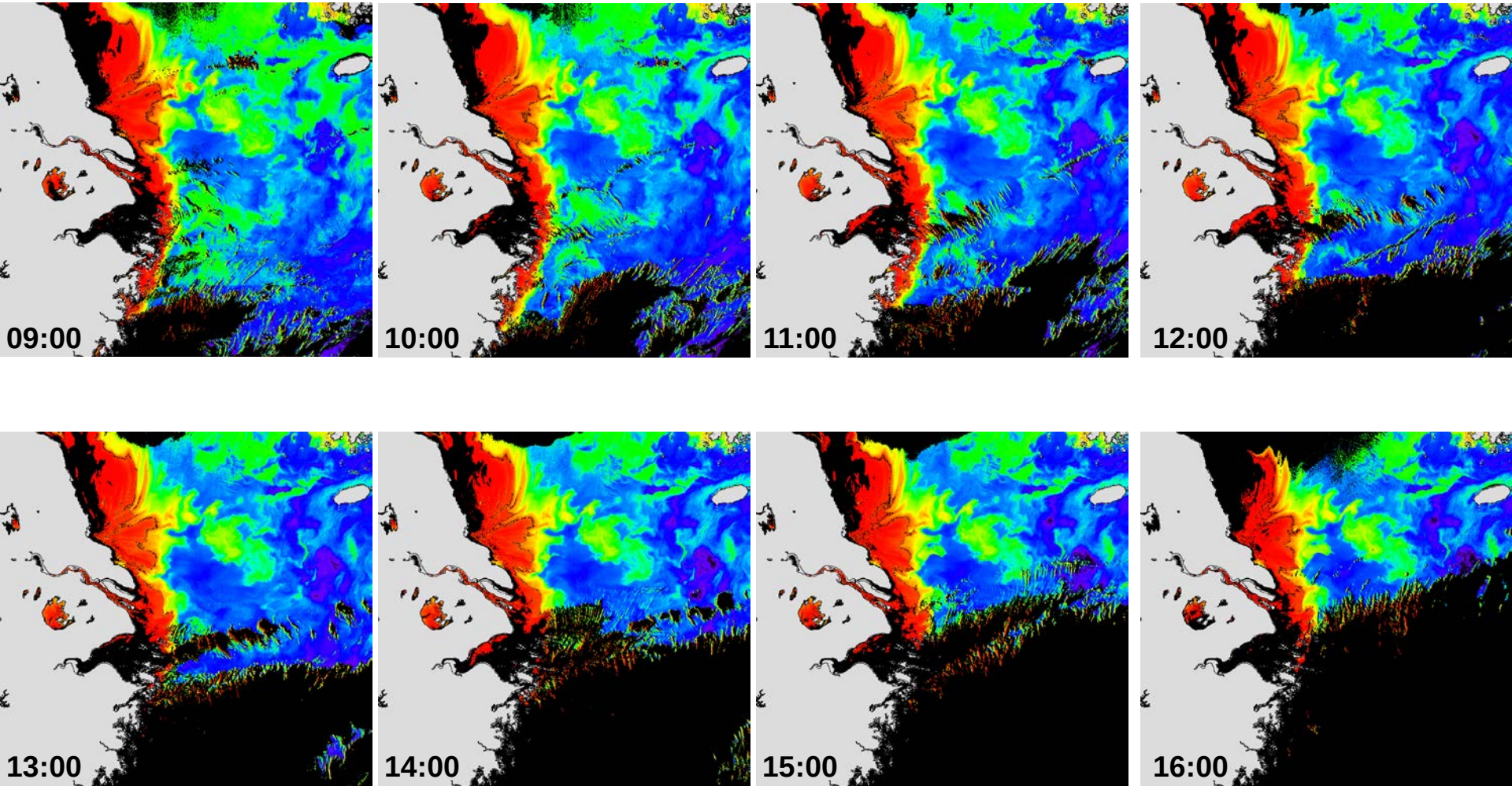


Diurnal Changes

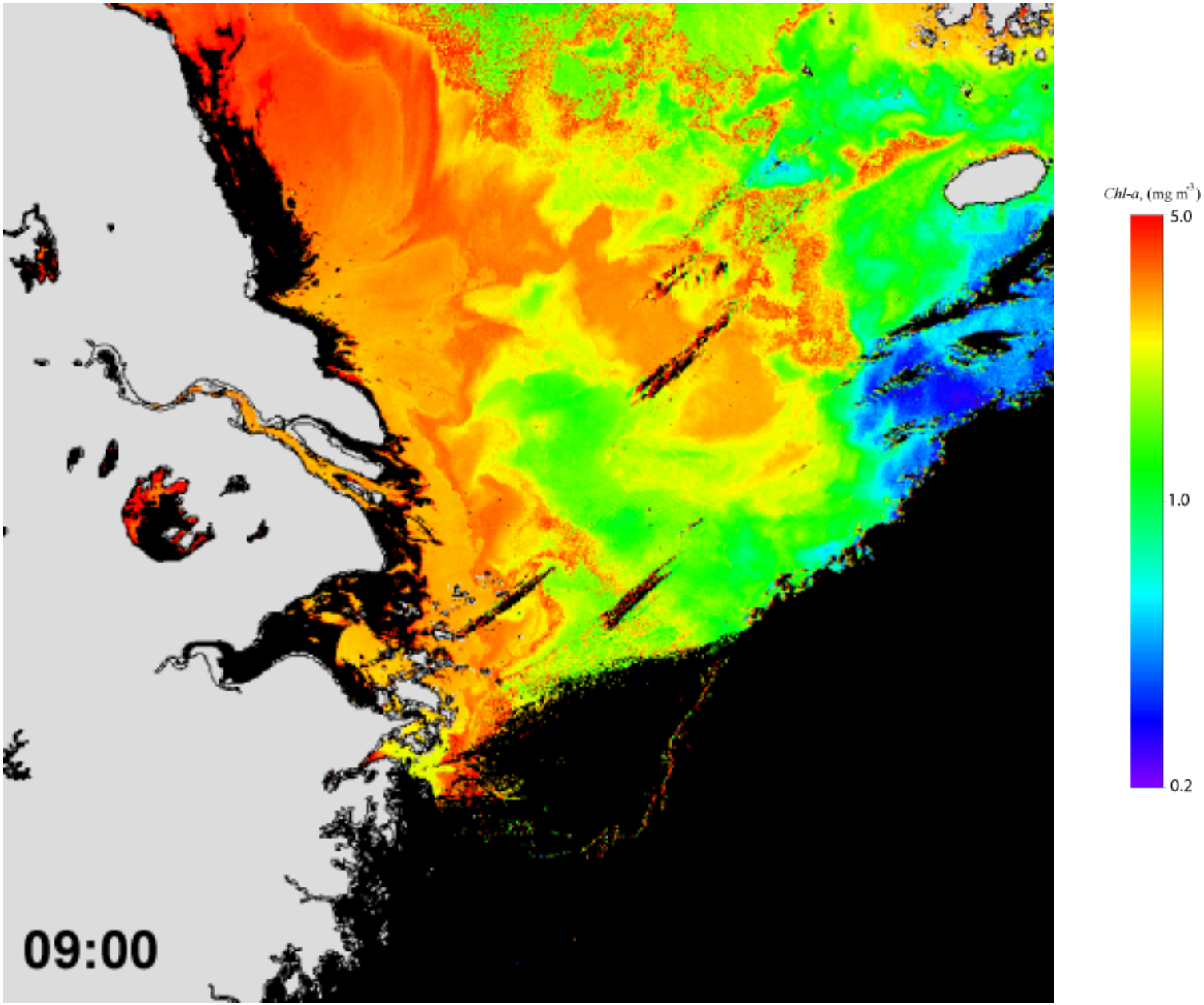




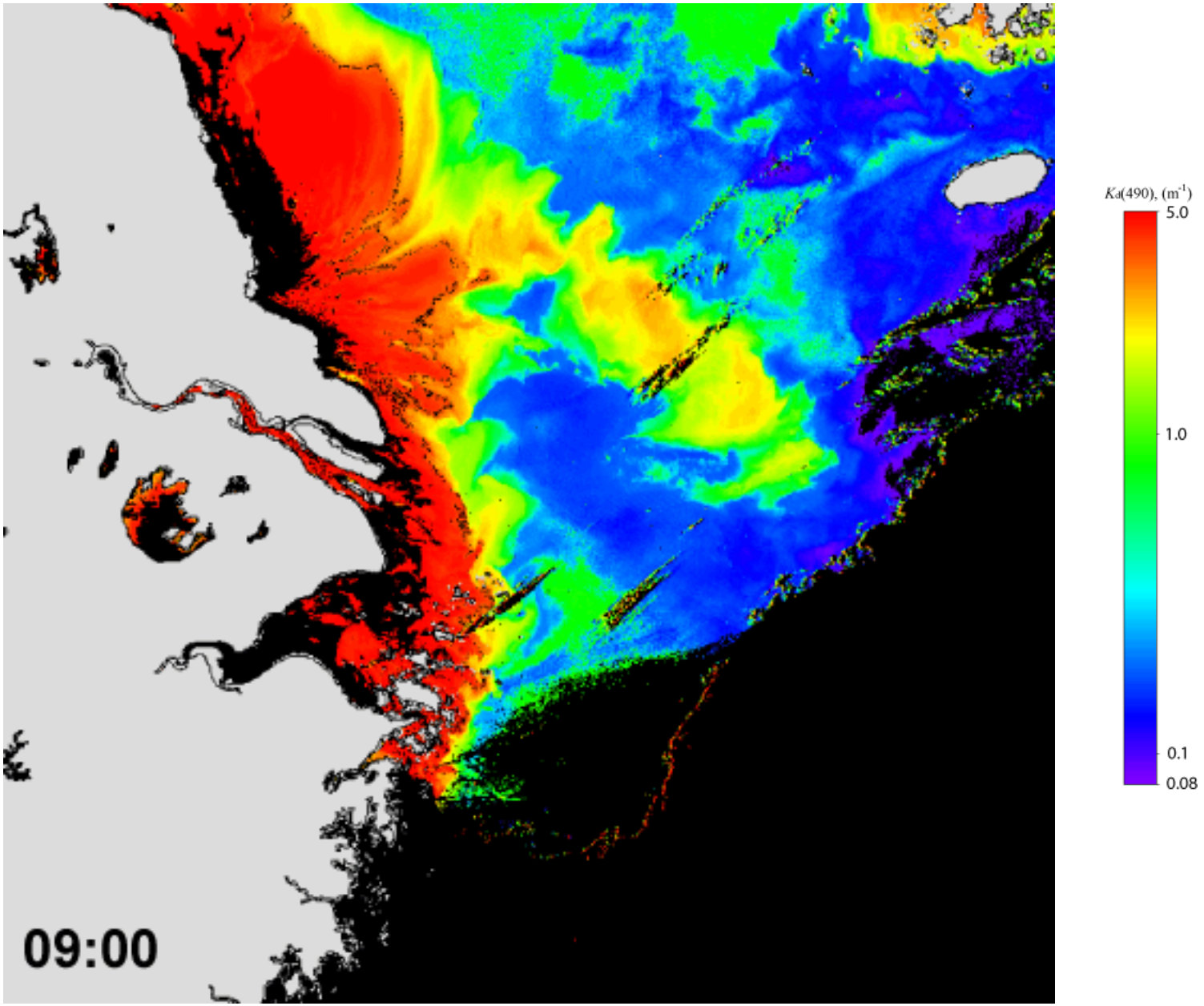
GOCI NOAA-MSL12 $K_d(490)$ (2012-04-27)



GOCI NOAA-MSL12 **Chl-a** (2012-04-26)

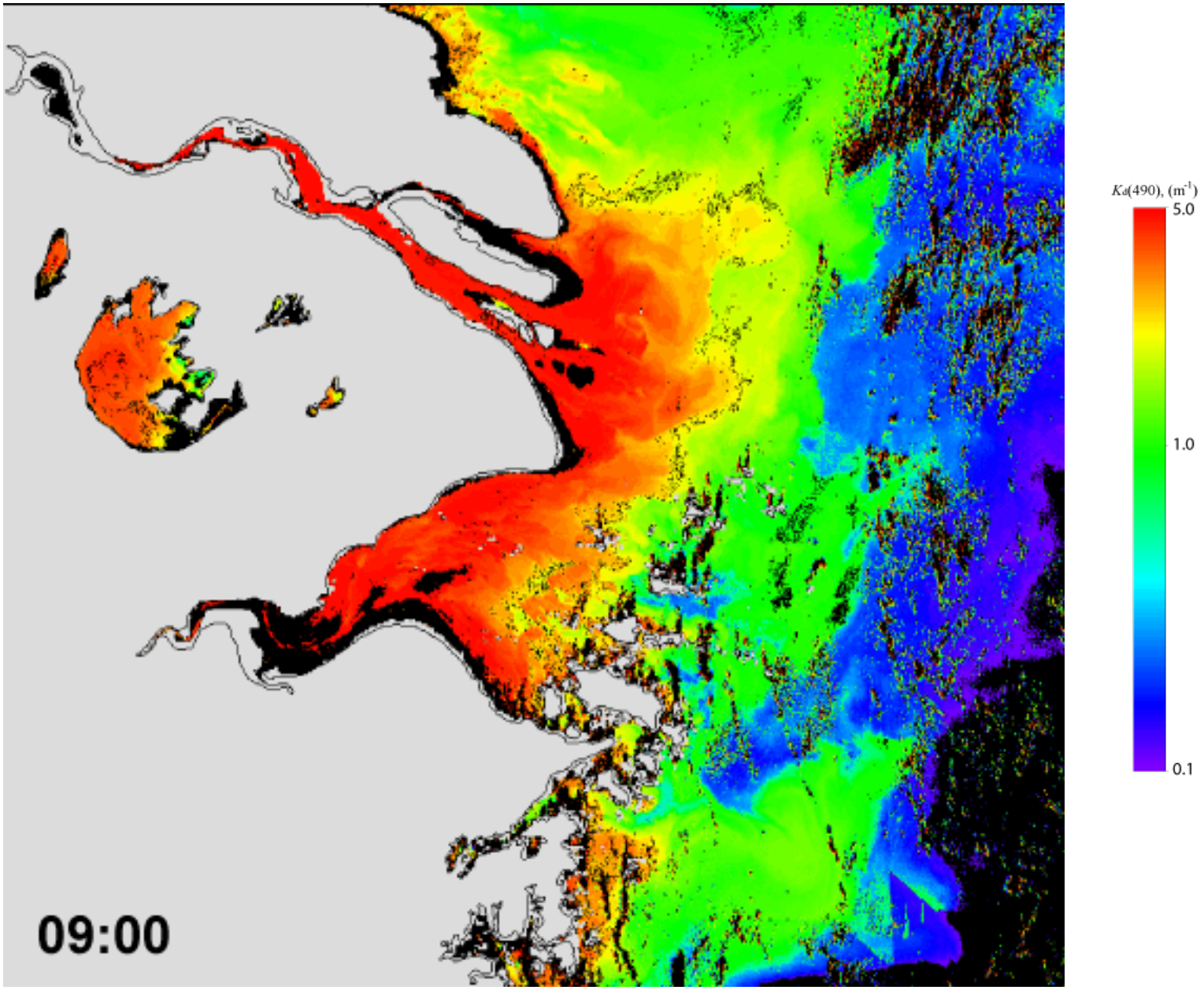


GOCI NOAA-MSL12 $K_d(490)$ (2012-04-26)



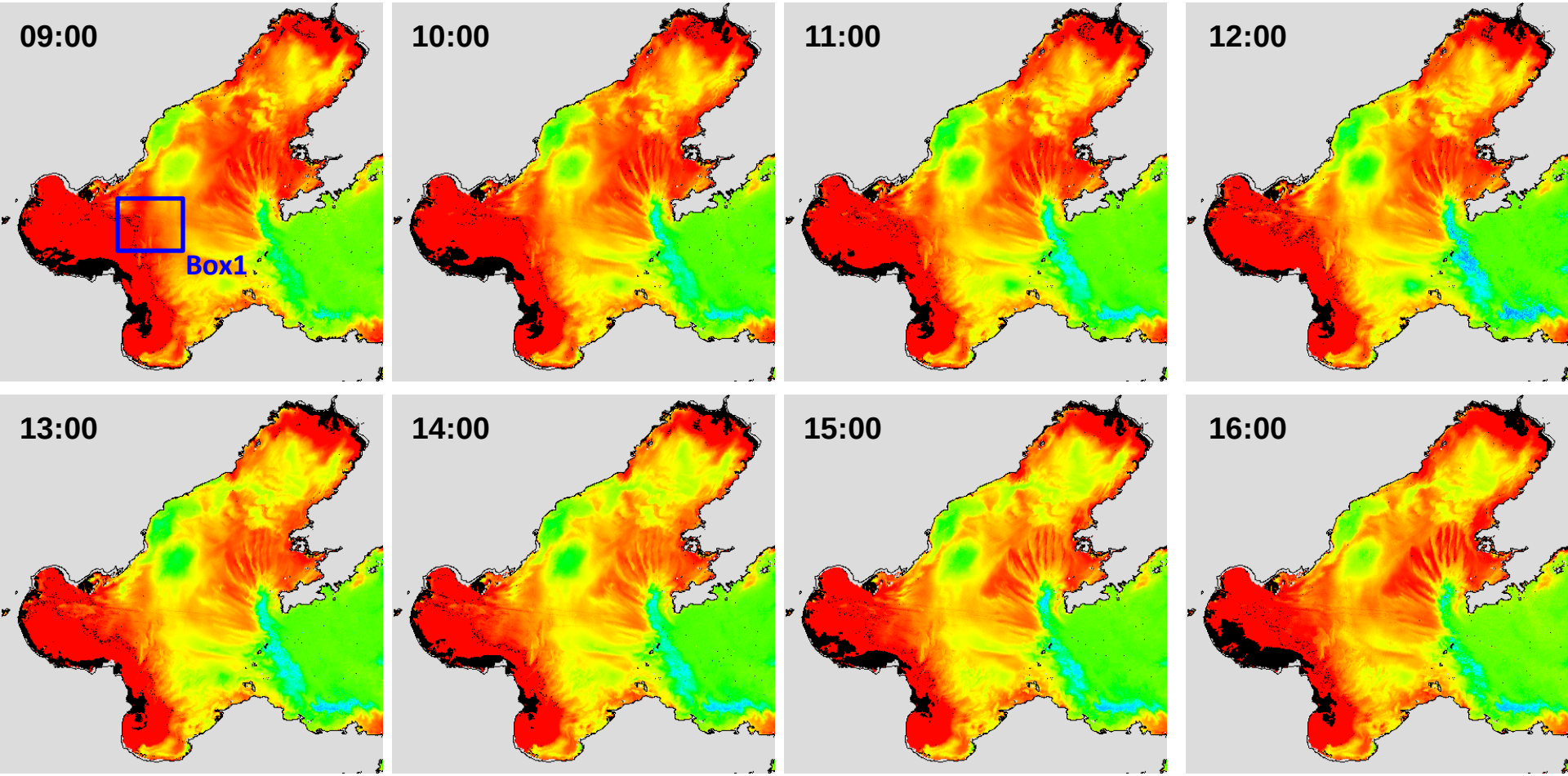
GOCI Images in
Hangzhou Bay & Lake Taihu

GOCI NOAA-MSL12 $K_d(490)$ (2012-07-29)

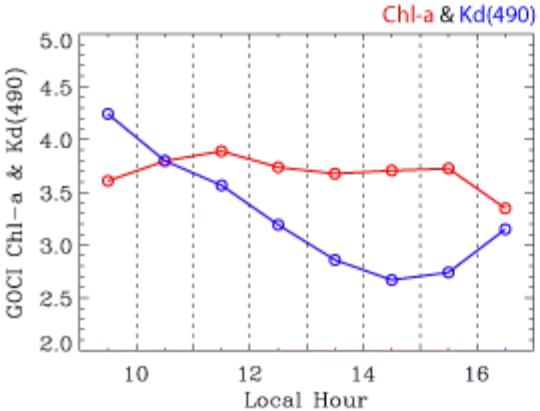


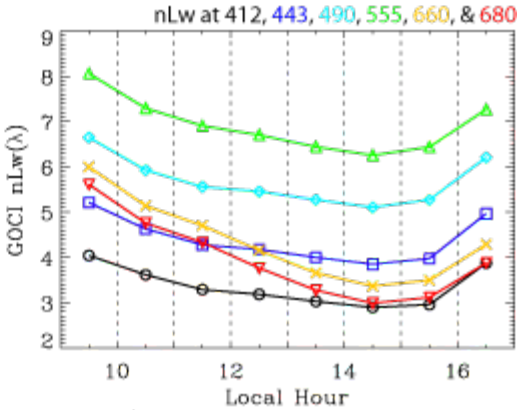
GOCI Images in the Bohai Sea

GOCI NOAA-MSL12 $K_d(490)$ (2012-03-25)

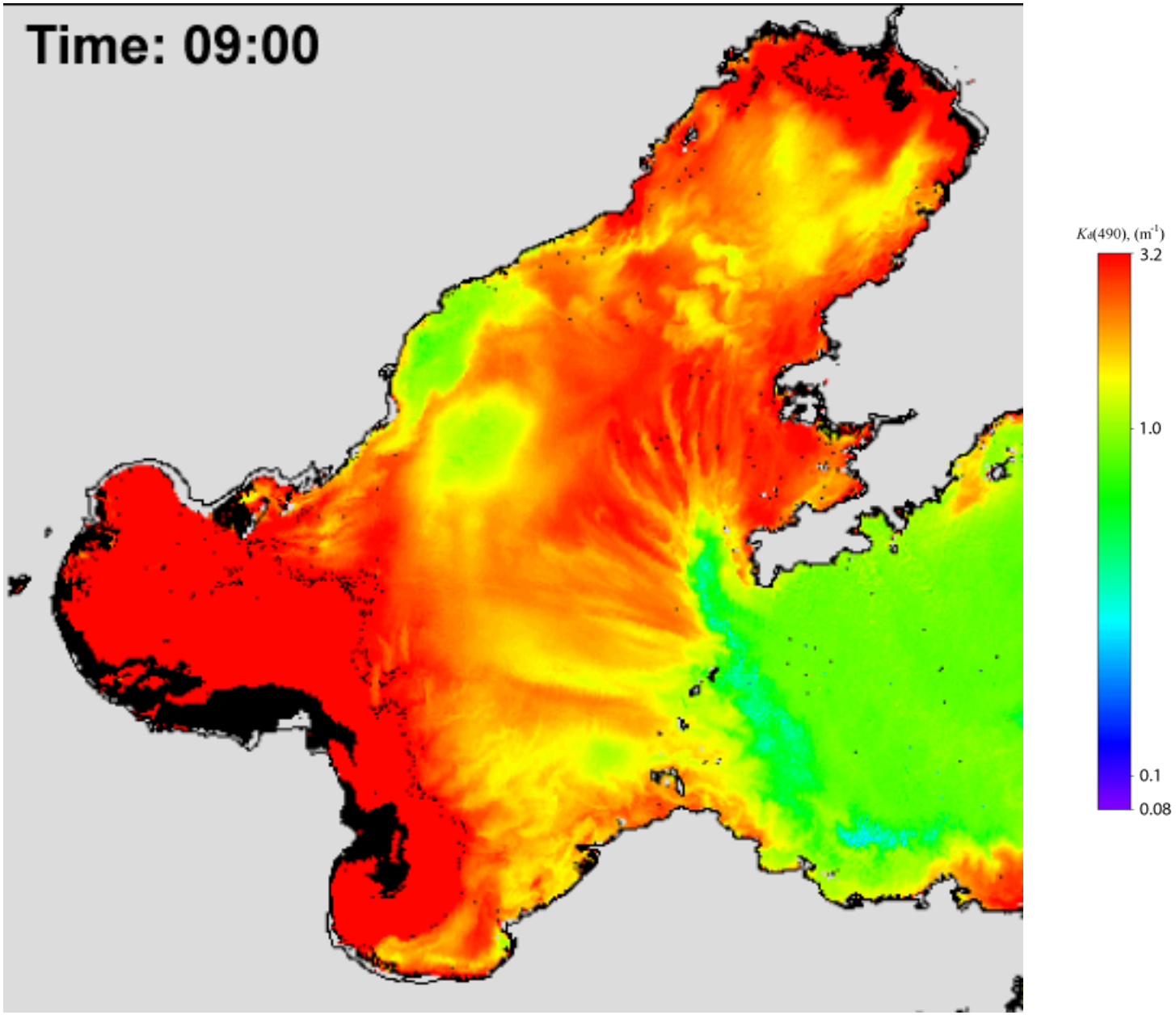


Diurnal Changes (Box1)

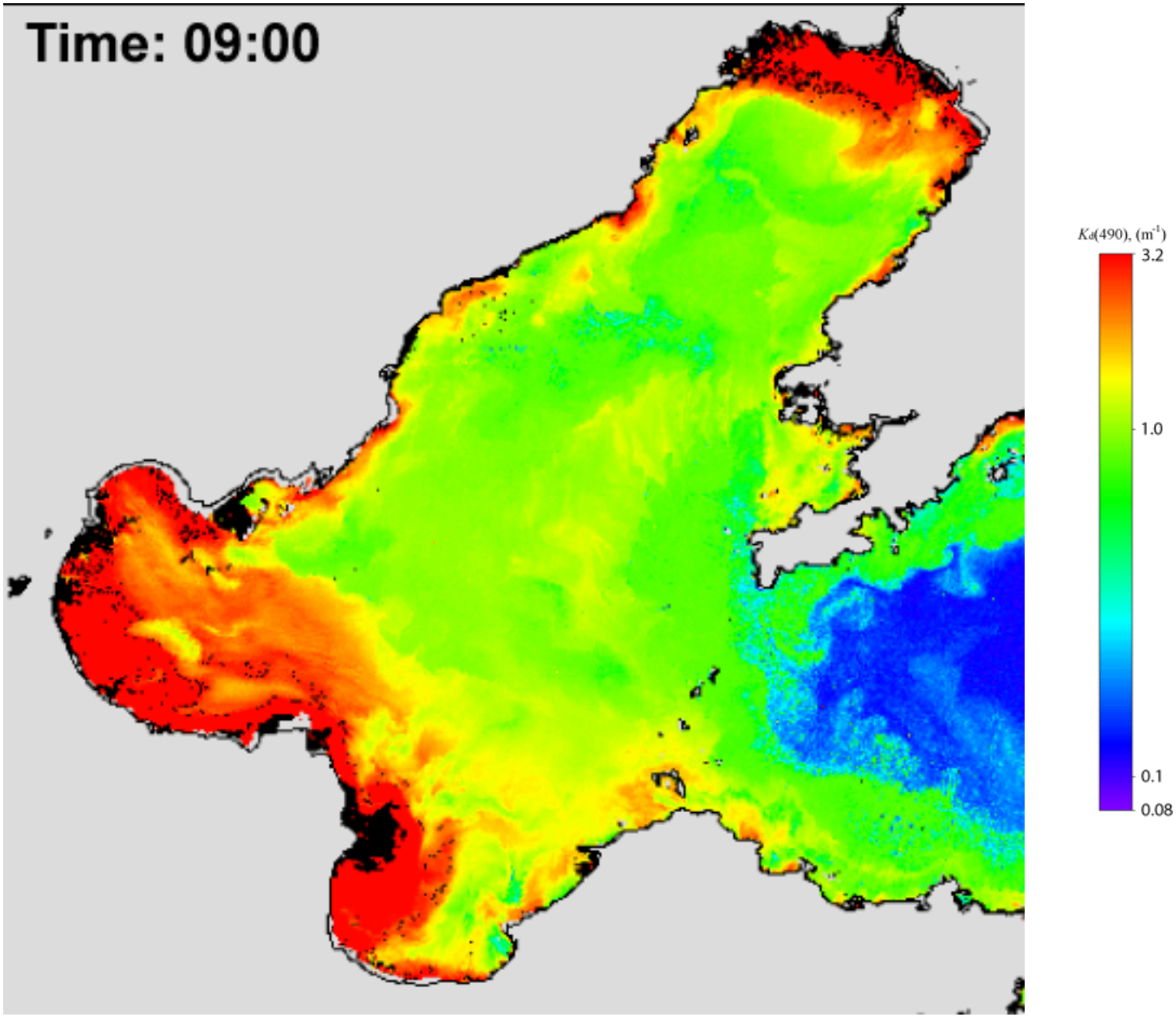




GOCI NOAA-MSL12 $K_d(490)$ (2012-03-25)



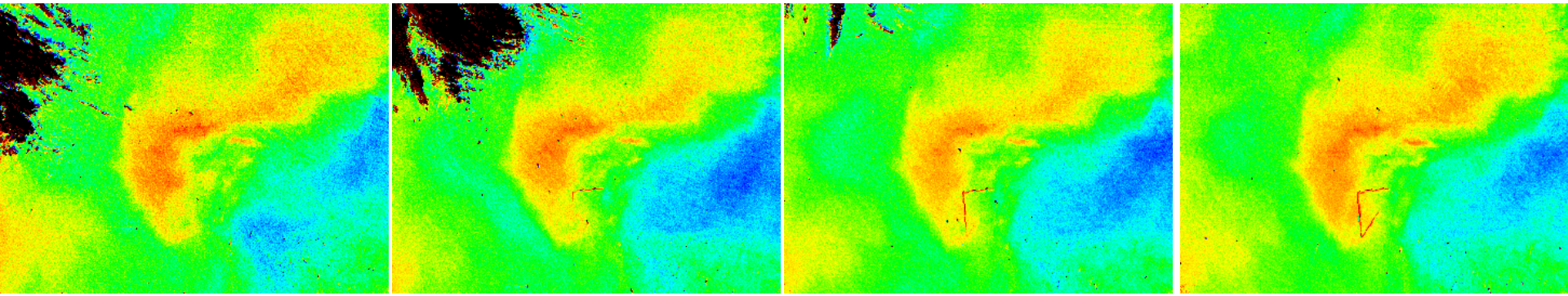
GOCI NOAA-MSL12 $K_d(490)$ (2012-08-23)



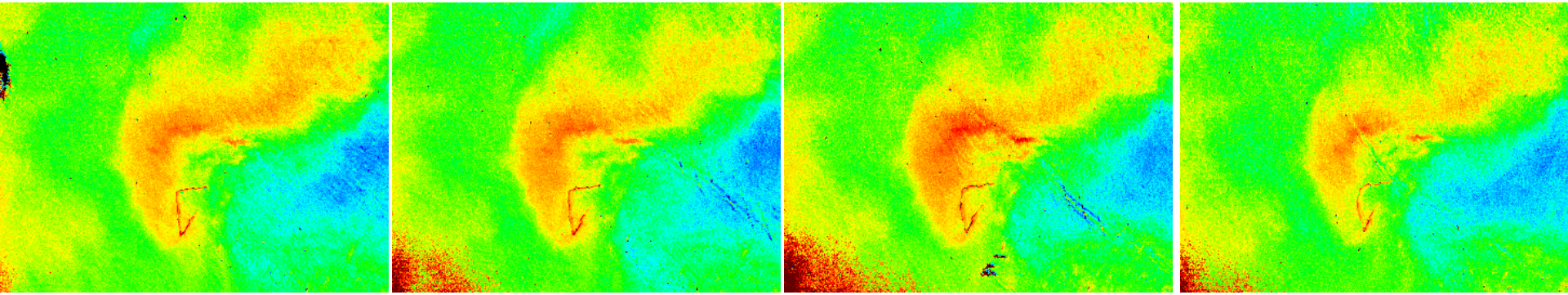
GOCI Images in
Dump Site in the Yellow Sea

GOCI NOAA-MSL12 $K_d(490)$ (Jul. 19, 2011)

09h 10h 11h 12h



13h 14h 15h 16h

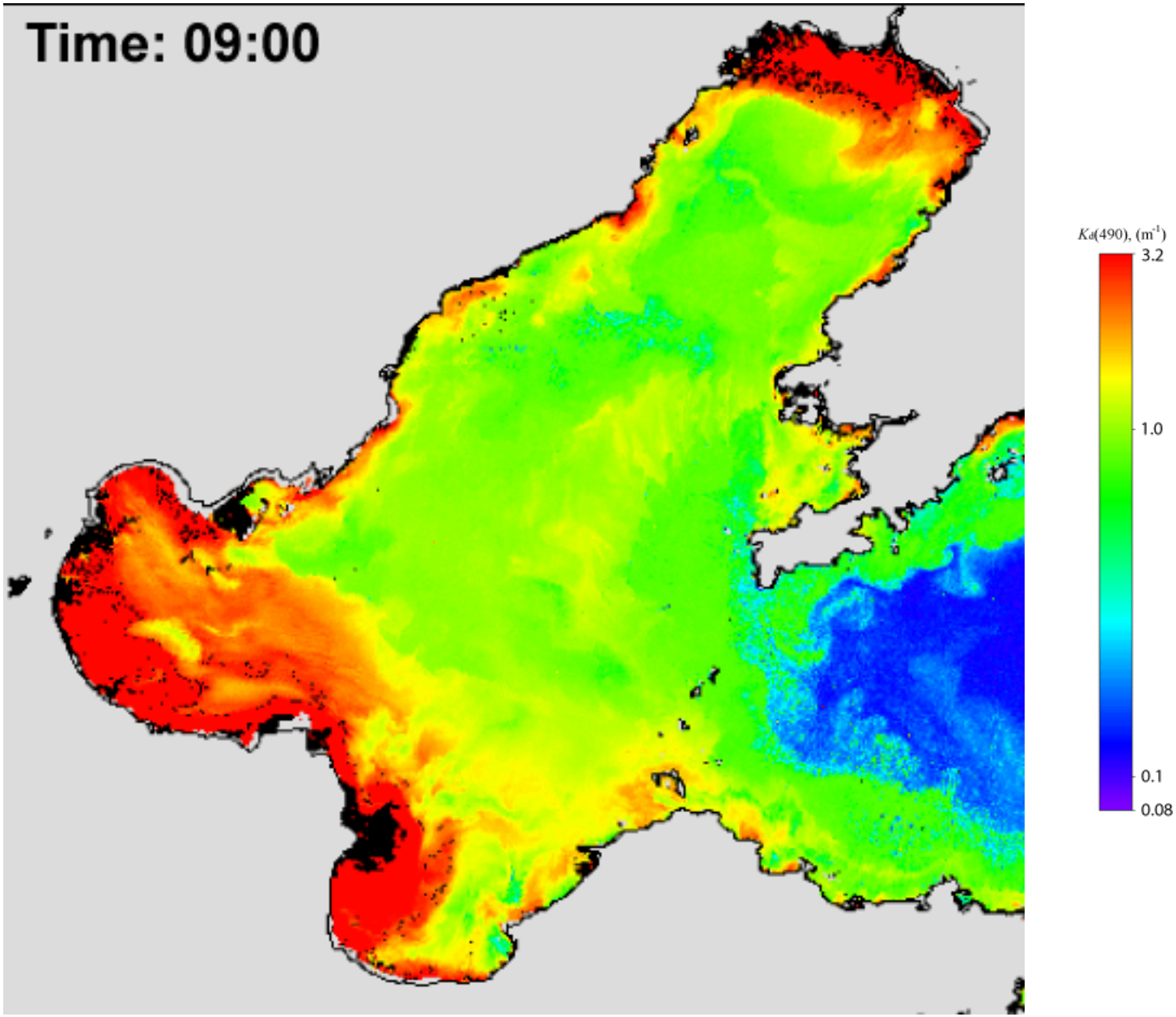


Summary and Conclusions

- The GOCI ocean color products for the GOCI coverage region have been derived using an iterative NIR-corrected atmospheric correction algorithm.
- Validation results show a reasonably good agreement between GOCI retrievals and in situ measurements.
- This study demonstrates that GOCI ocean color products can be confidently used to characterize and quantify the ocean environments as well as the diurnal variability of the marine ecosystem in the western Pacific.
- This unique capability from geostationary satellite sensor can complement the ocean color observations of other polar-orbiting satellites such as MODIS and VIIRS, which have a global coverage but lack the temporal resolution to monitor the dynamics of marine environments on an hourly basis.

Thank you!

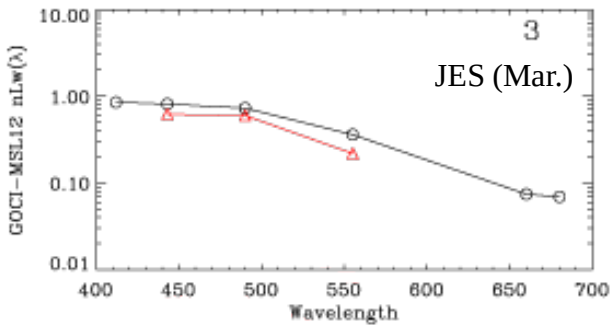
GOCI NOAA-MSL12 $K_d(490)$ (2012-08-23)

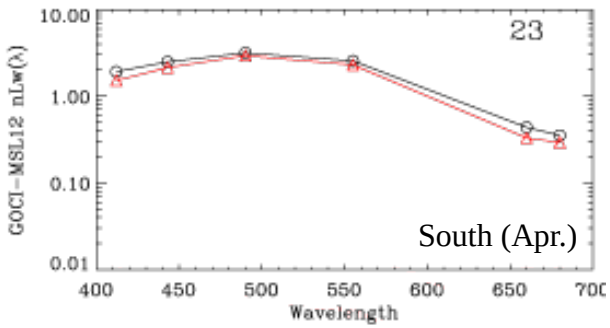


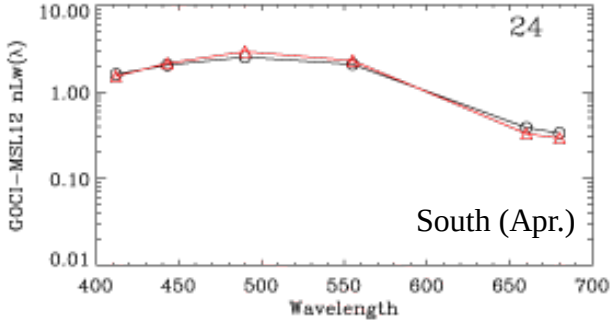
Backup

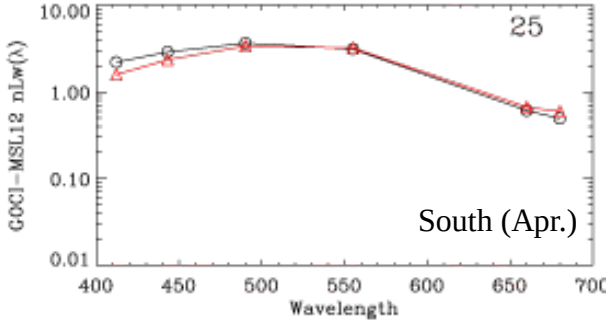
Spectral shape of **in situ** and **GOCI**-derived $nL_w(\lambda)$ measurements

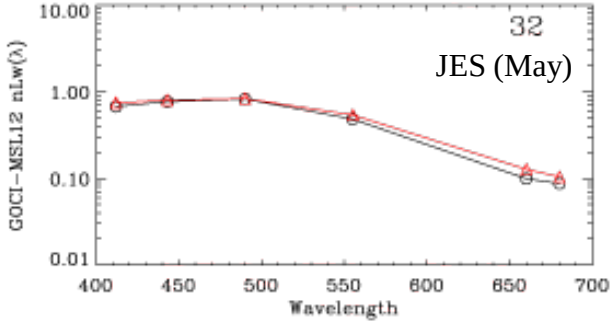
Black-in situ, red-GOCI

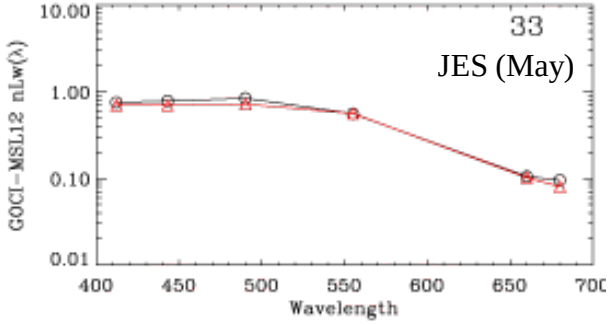


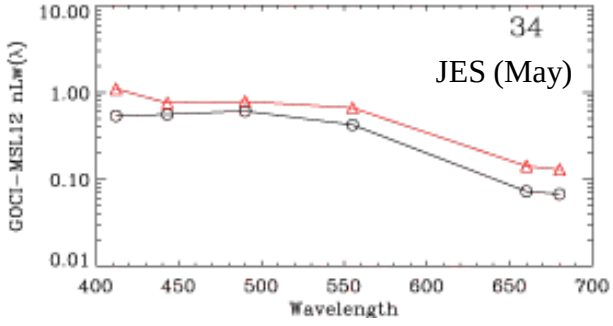


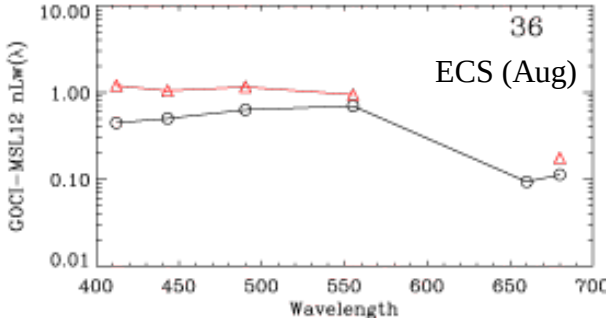




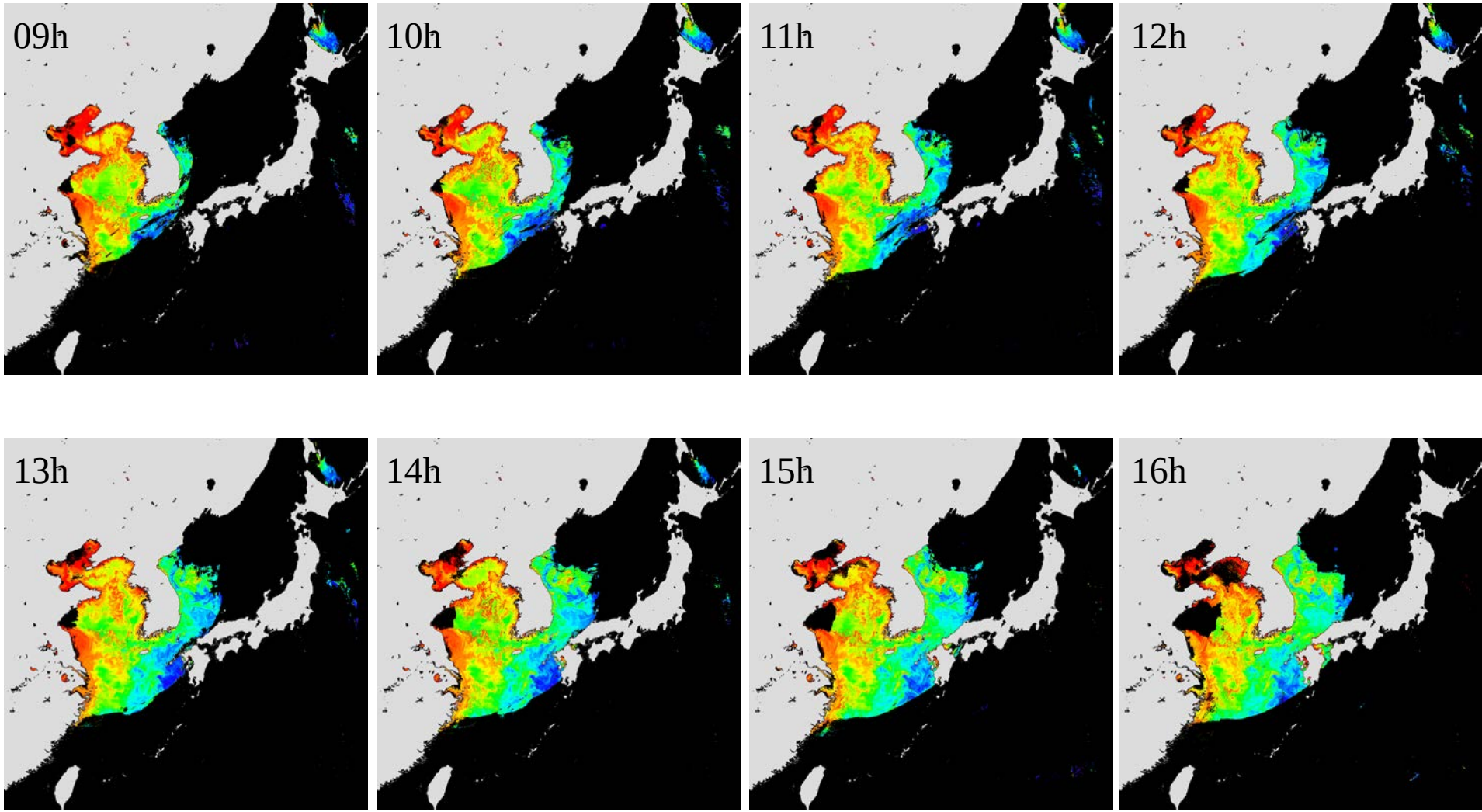




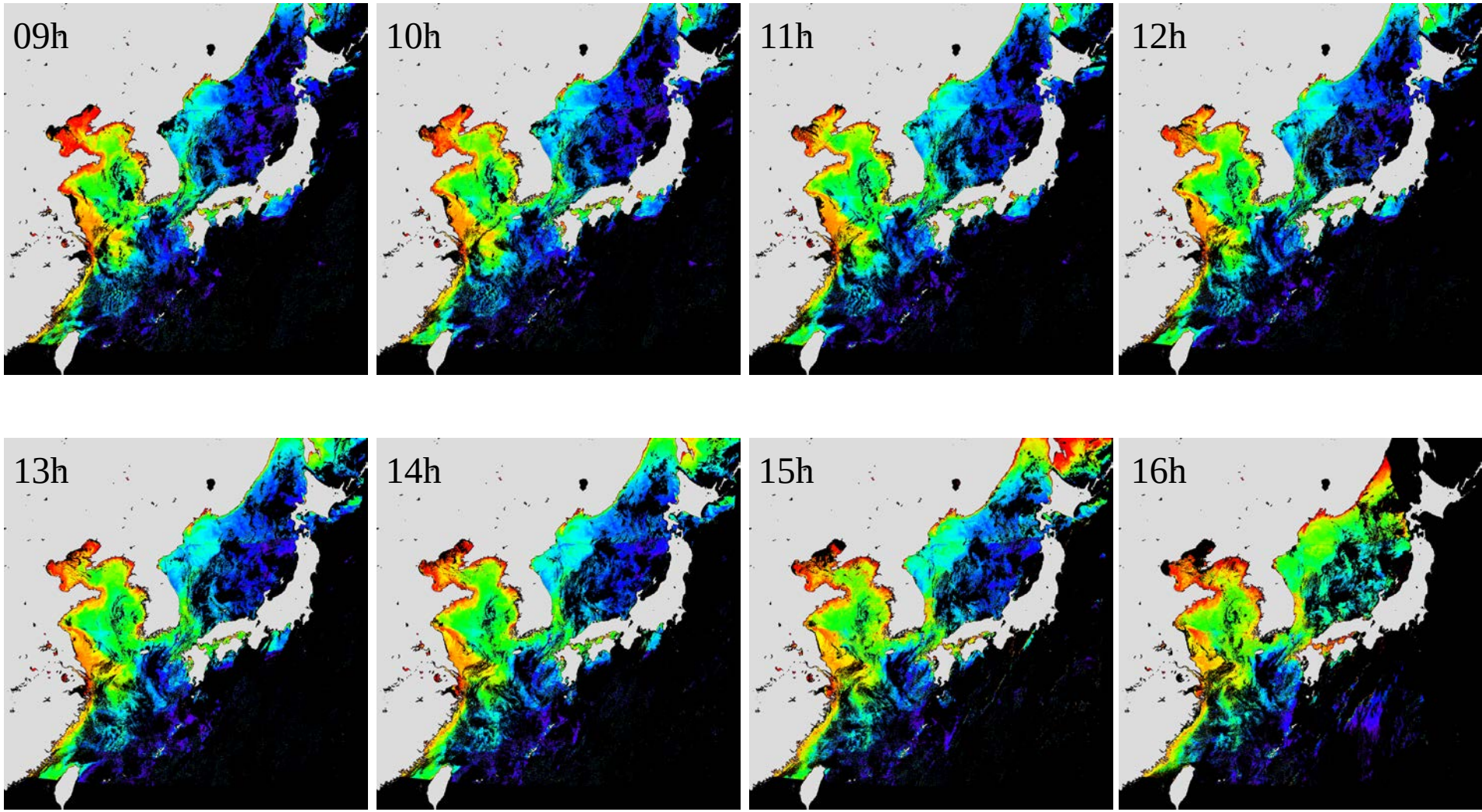




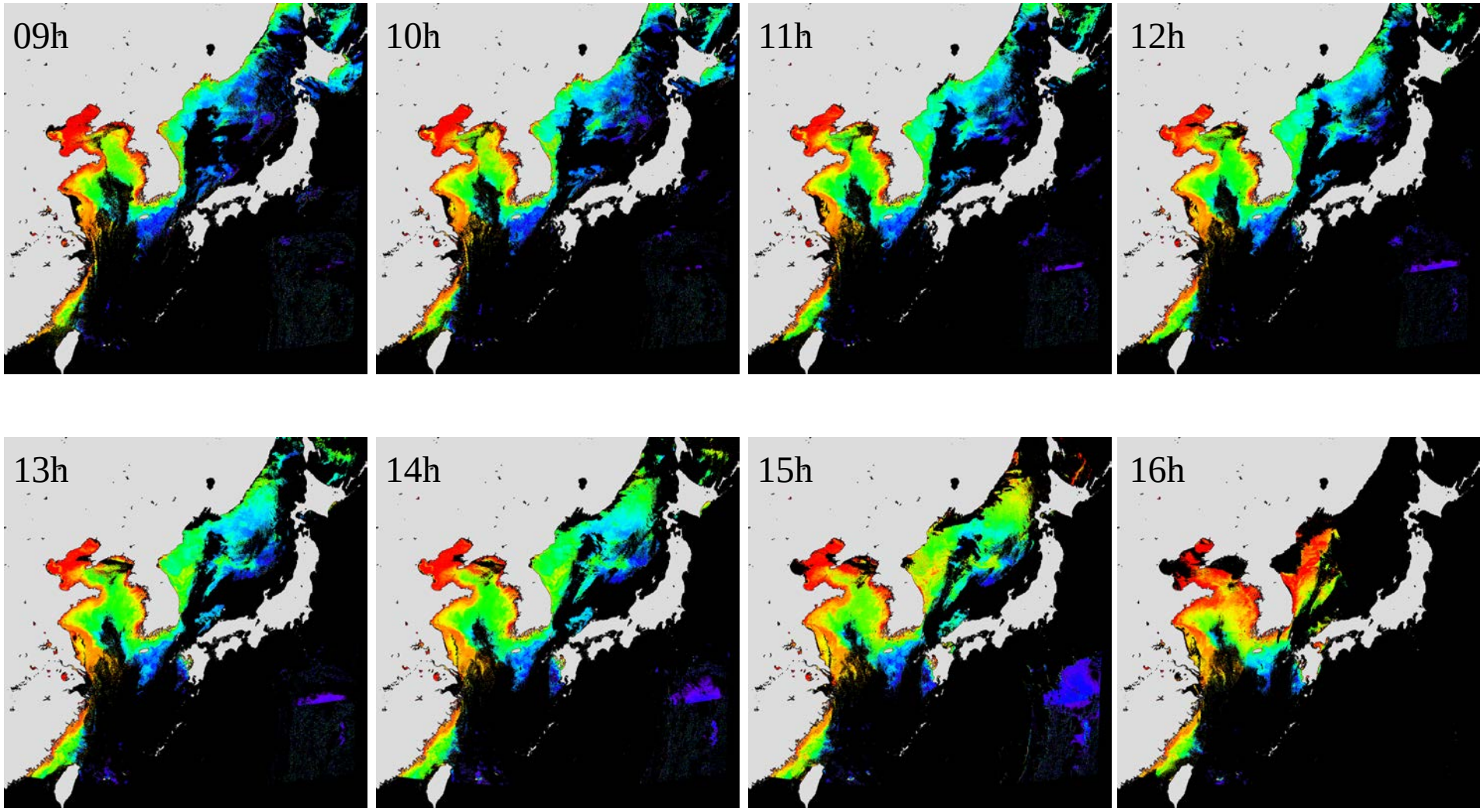
GOCI-MSL12 ***Chl-a*** (Apr. 26, 2012)



GOCI-MSL12 ***Chl-a*** (Oct. 2, 2012)

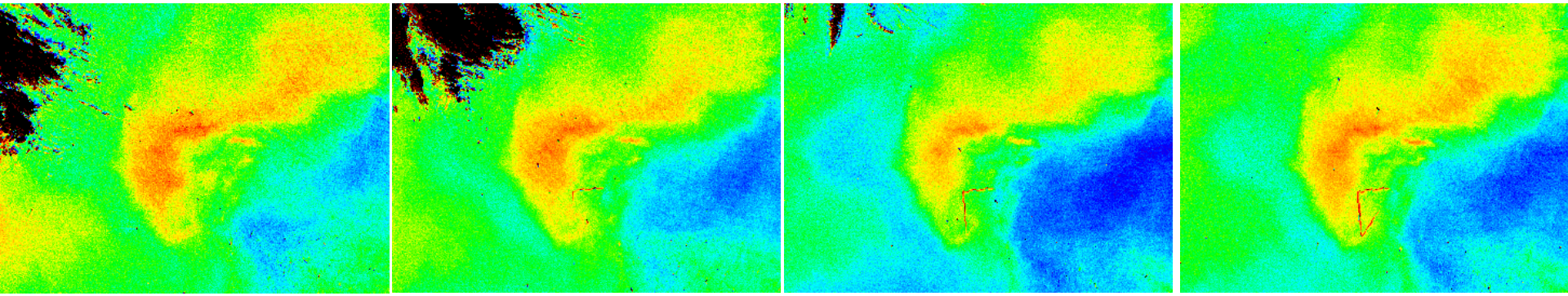


GOCI-MSL12 ***Chl-a*** (Oct. 18, 2012)

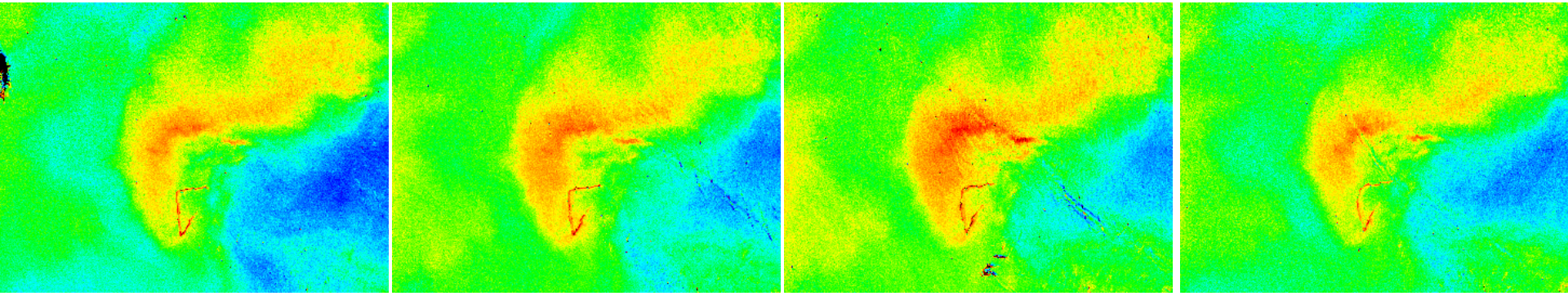


GOCI NOAA-MSL12 ***Chl-a*** (Jul. 19, 2011)

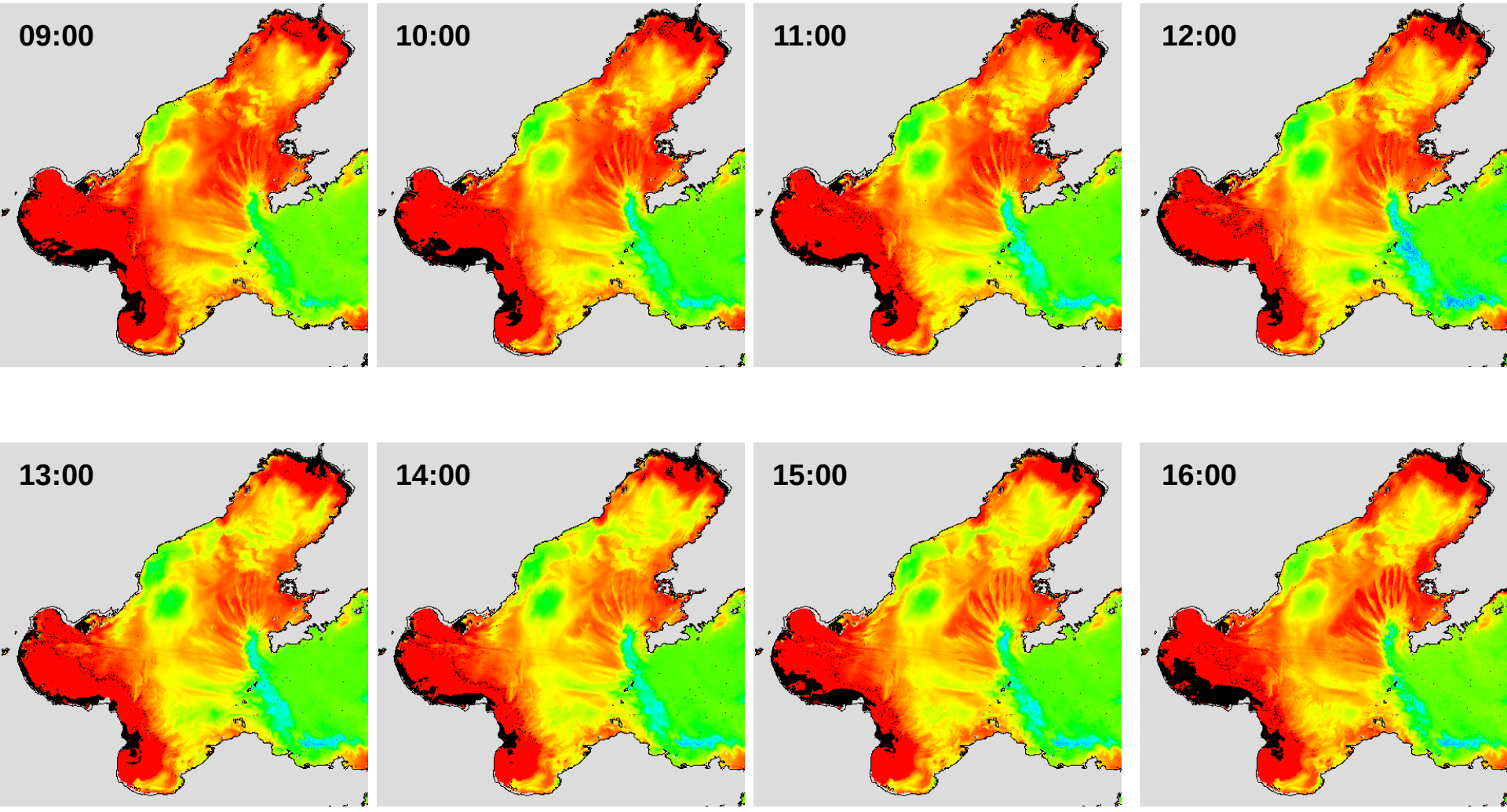
09h 10h 11h 12h



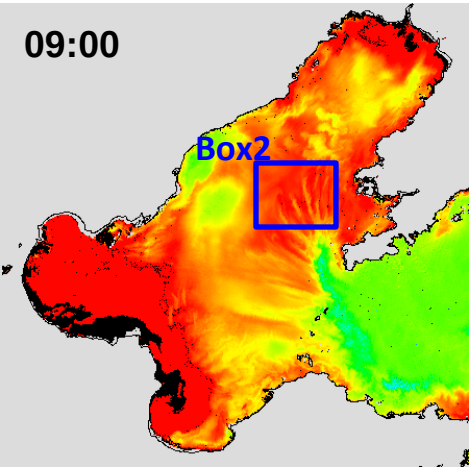
13h 14h 15h 16h

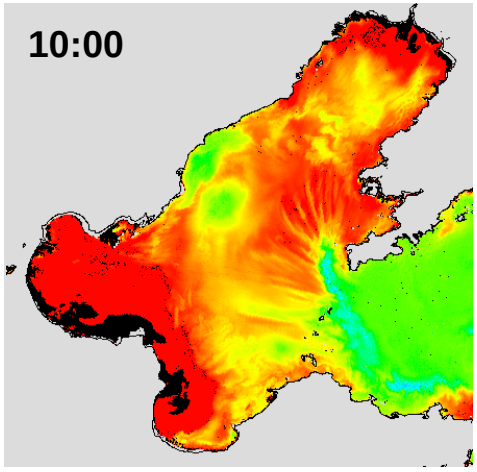


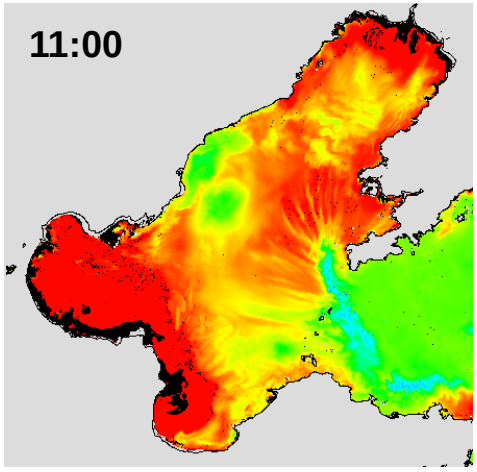
GOCI NOAA-MSL12 $K_d(490)$ (2012-03-25)

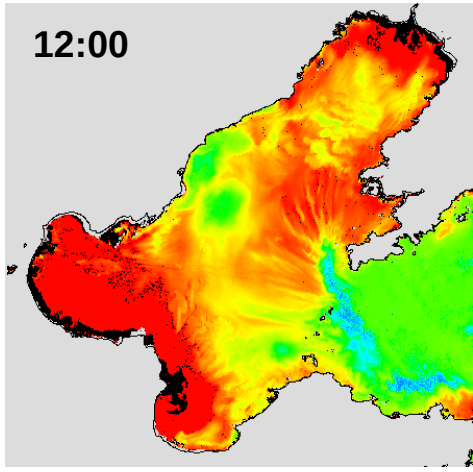


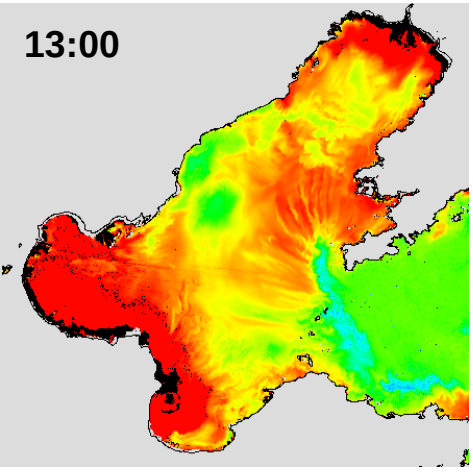
GOCI NOAA-MSL12 $K_d(490)$ (2012-03-25)

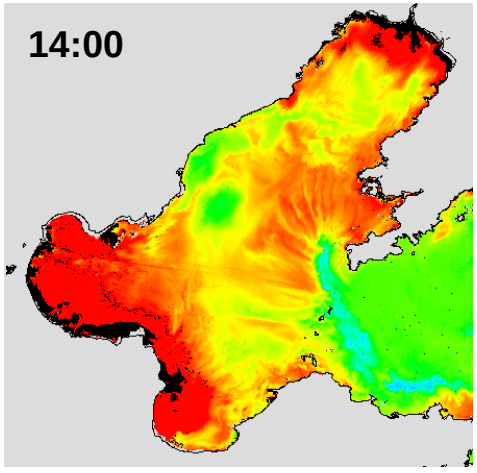


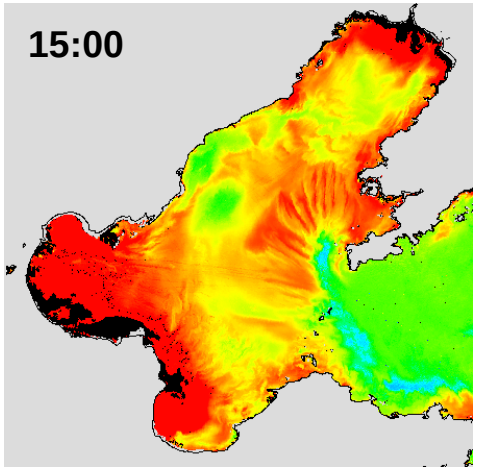


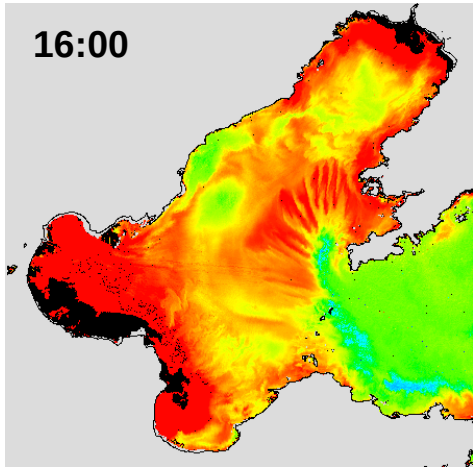




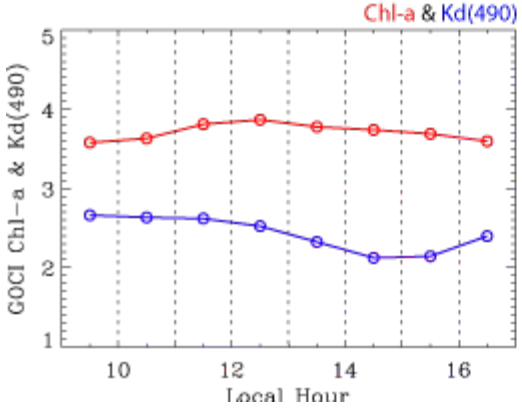


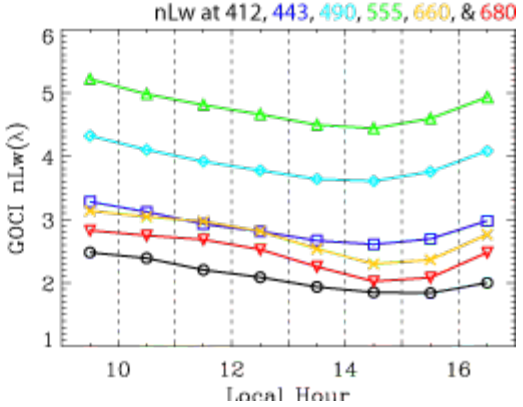




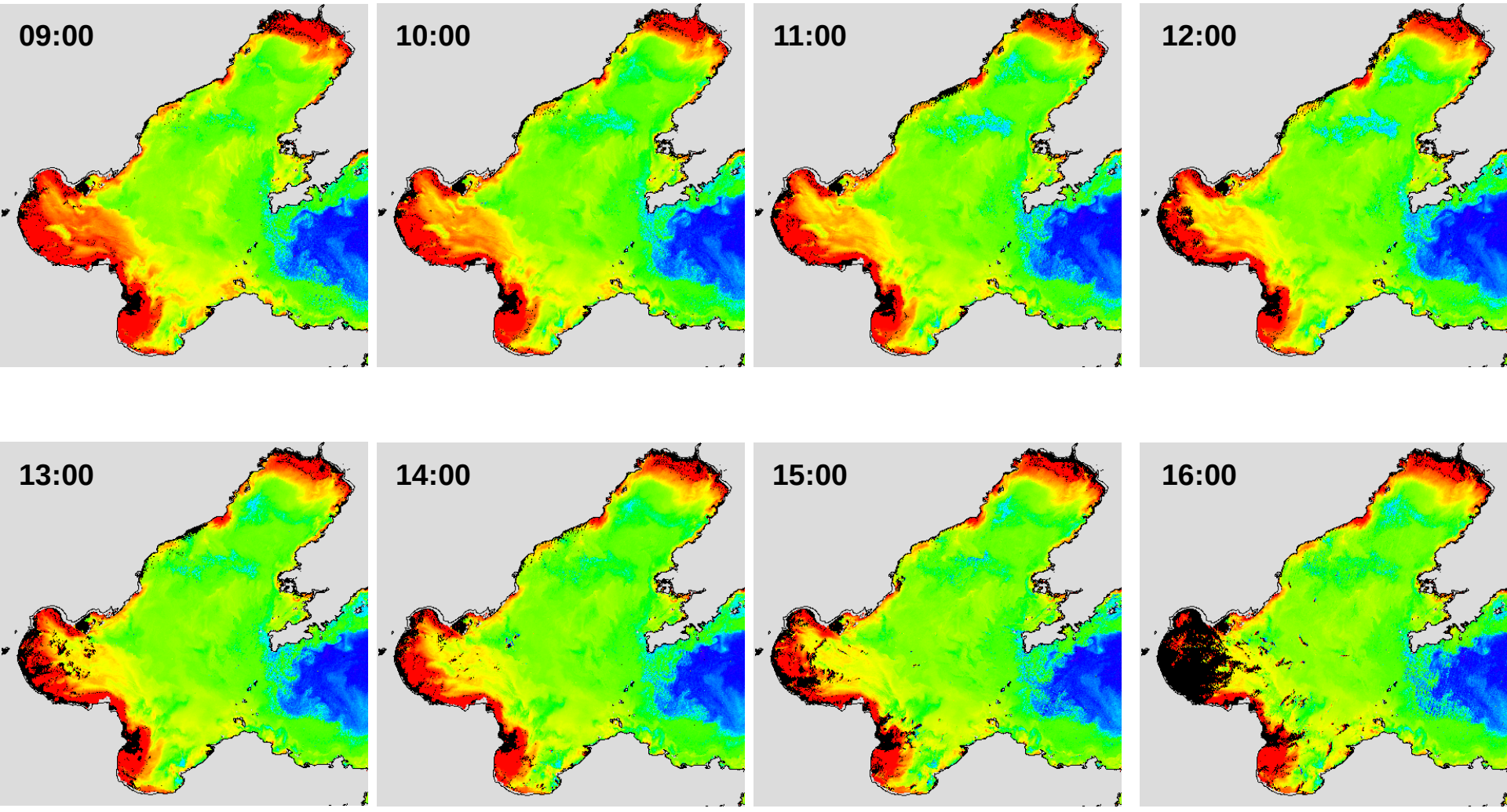


Diurnal Changes (Box2)

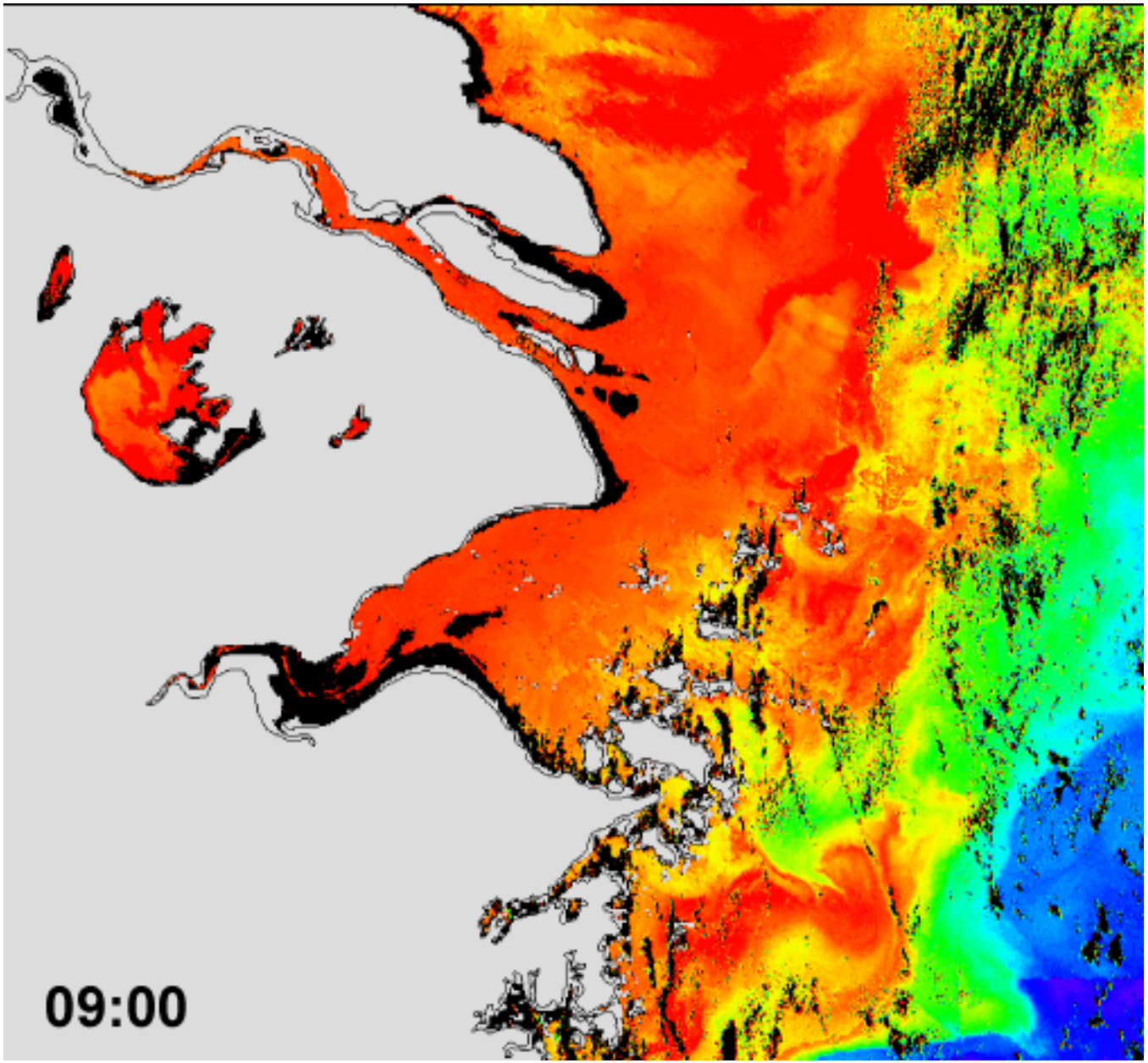




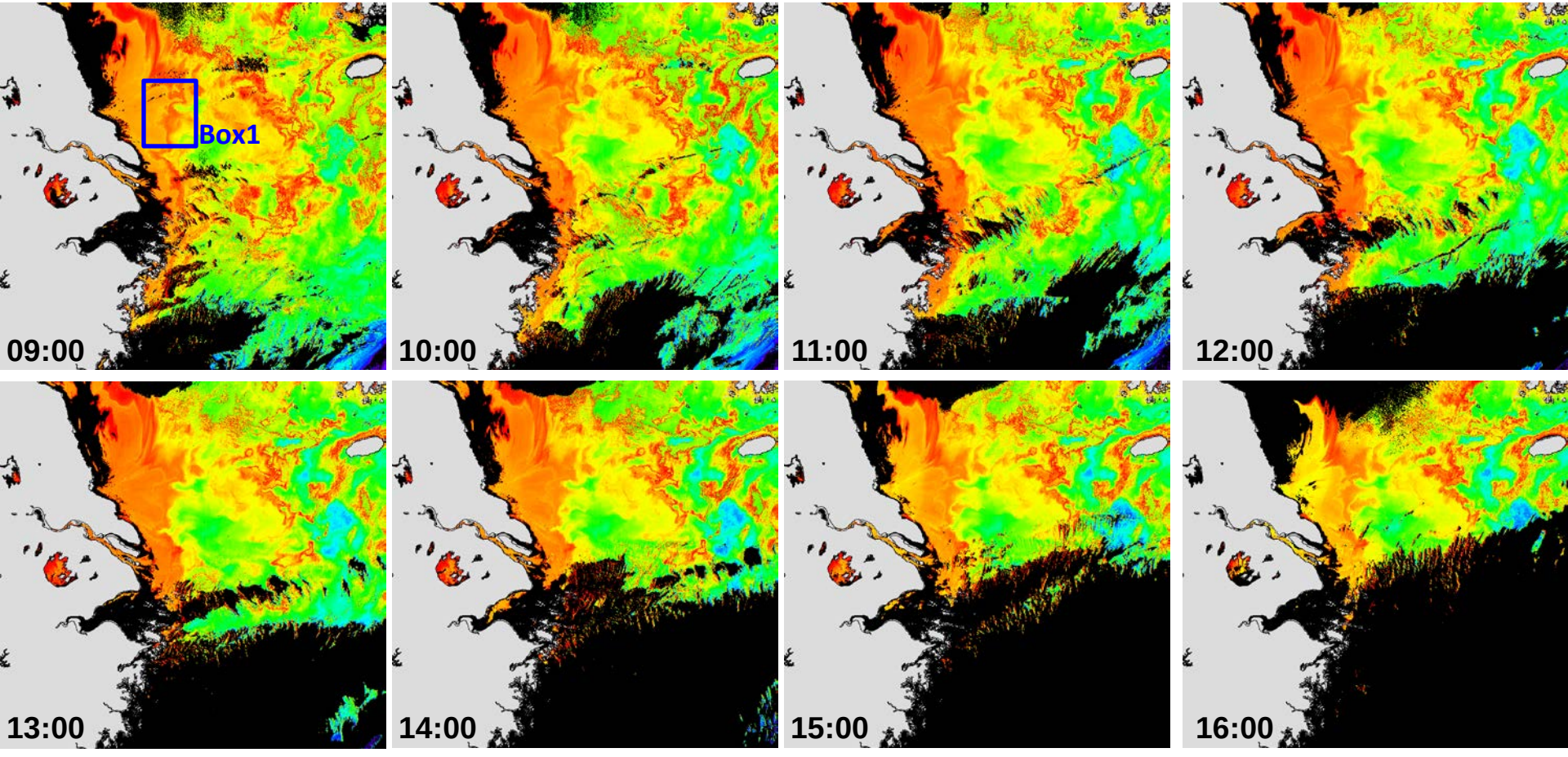
GOCI NOAA-MSL12 $K_d(490)$ (2012-08-23)



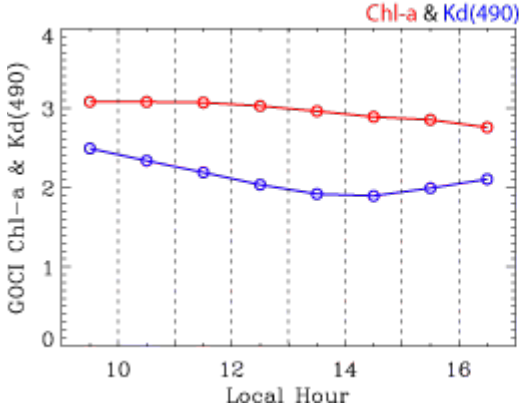
GOCI NOAA-MSL12 **Chl-a** (2012-07-29)

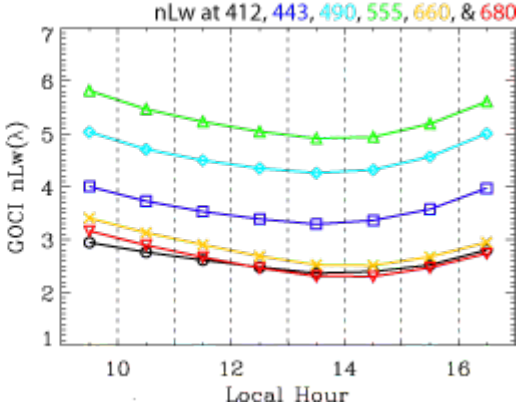


GOCI NOAA-MSL12 **Chl-a** (2012-04-27)

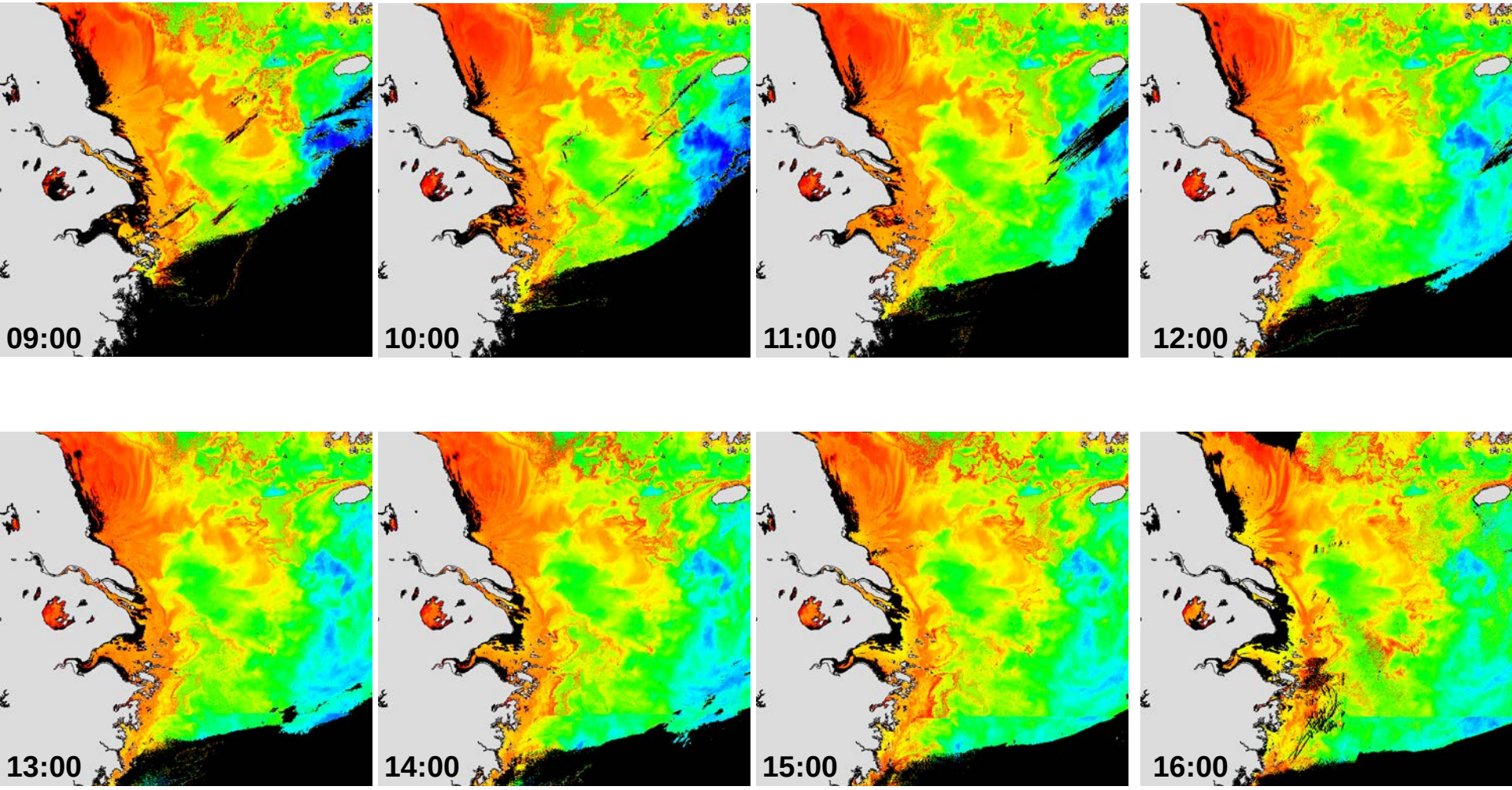


Diurnal Changes

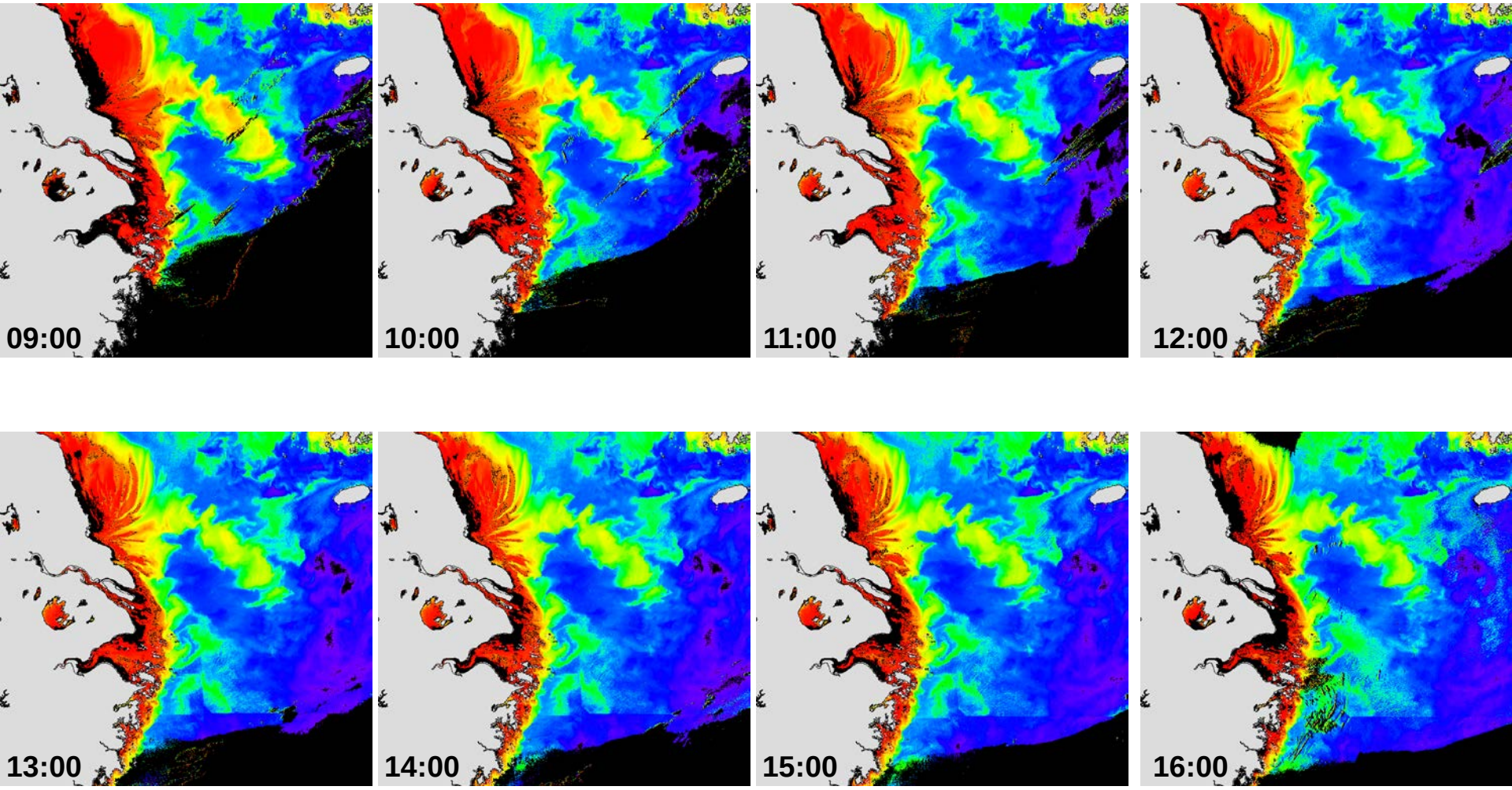




GOCI NOAA-MSL12 **Chl-a** (2012-04-26)



GOCI NOAA-MSL12 $K_d(490)$ (2012-04-26)



GOCI NOAA-MSL12 **Chl-a** (2012-04-27)