HICO Second Users Meeting 2012 in Glasgow, Scotland

HICO imagery of Funka Bay, Japan

Toru Hirawake, Tomonori Isada, and Sei-Ichi Saitoh

Faculty of Fisheries Sciences, Hokkaido University, Hakodate, Japan

Hakodate Marine bio cluster

hakodate-marine-bio.com

10 October 2012

"Hakodate Marine Bio-Cluster Project"
Theme 1: Monitoring and Forecasting
- Study area -

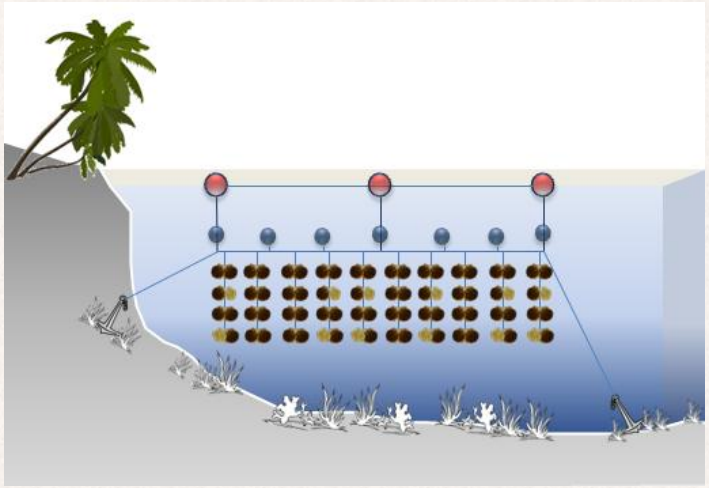
Toward sustainable cultures

- Funka Bay is one of the most important aquaculture sites in Japan, especially scallops and kelps. More than 36% of the scallops and kelps production in Japan is from aquaculture, (FAO, 2007; 2009).

- In Funka bay, it is well known that diatoms as well as harmful algae like dinoflagellate influence the cultured aquatic organisms, subsequently leading to fisheries marketing and human health concerns.

- Therefore, for sustainable scallop and kelp cultures, to understand the influence of phytoplankton functional group on the cultured aquatic organisms is important.

- One of the objectives in this project is to develop a method to indentify diatoms and dinoflagellate by using ocean color remote sensing.



H-MBC cruises & sampling

Cruises

2010

1.US194	(Apr 19~21)
2.US196	(May 21~23)
3.US199	(Jun 19)
4.US201_1	(Aug 20~22)
5.US201_2	(Aug 28~30)
6.US208	(Oct 21~23)
7.US210	(Nov 10~13)

2011

8.US219	(Feb 6~8)
9.OS225	(Feb 21~25)
10.US222	(Mar 6)
11.US228	(May 14~16)
12.US232	(Jul 27~28)
13.US237	(Sep 27~29)
14.US242	(Nov 17~19)

2012

15.US246	(Jan 10)

Research Vessels

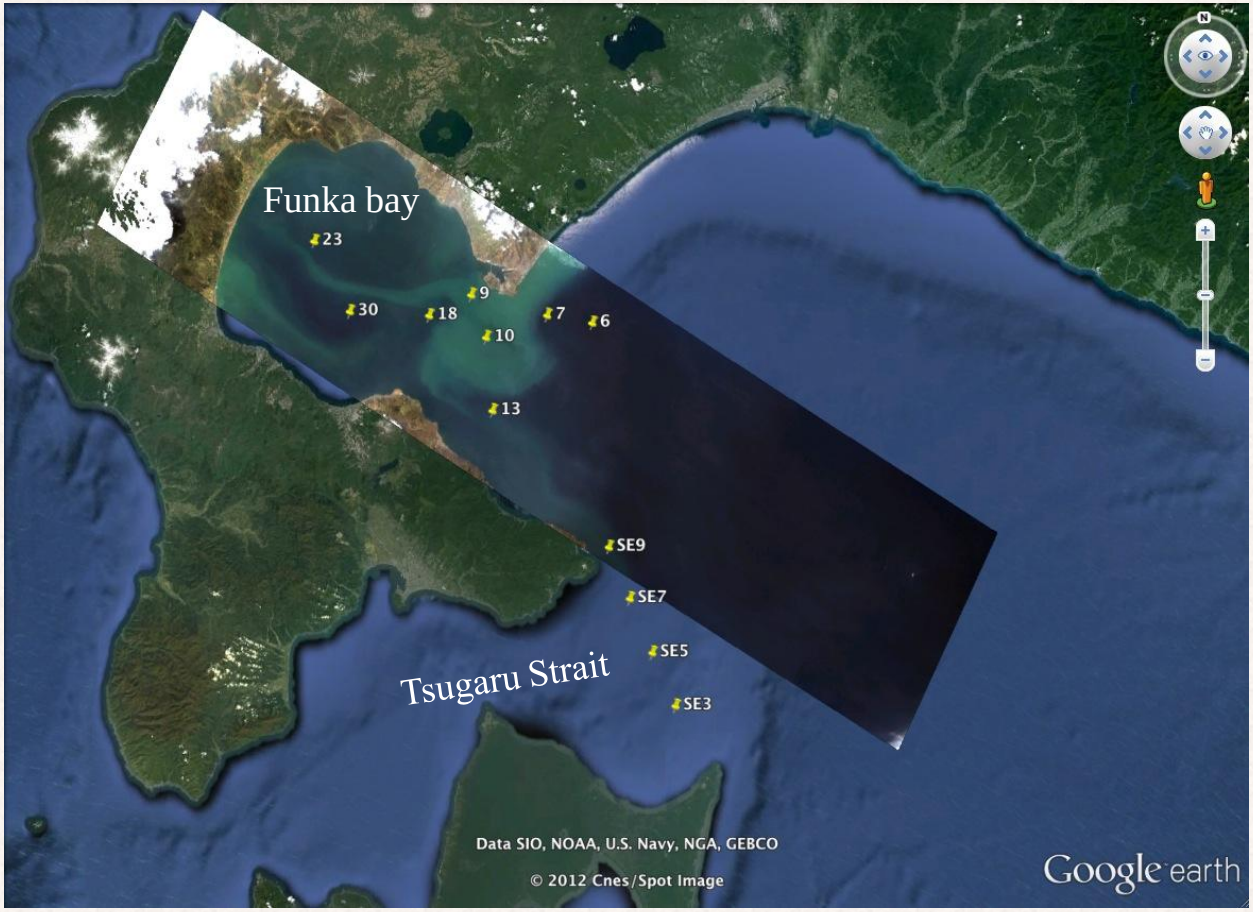
Ushio-Maru and *Oshoro-Maru*


T/S *Ushio-maru*

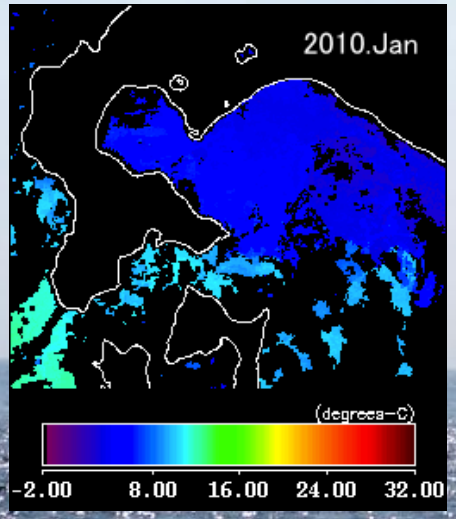

T/S *Oshoro-maru*

Sampling sites

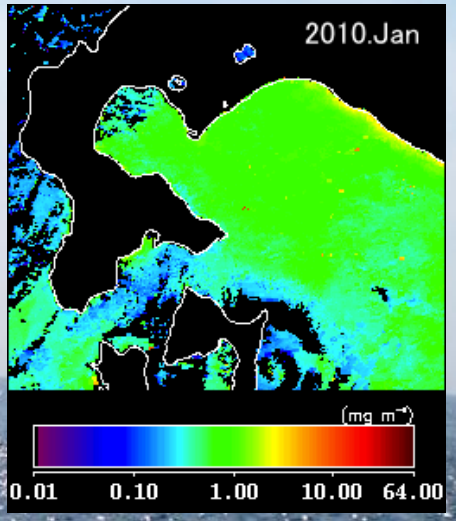
- Funka bay ; 8 sites
- Tsugaru Strait ; 4 sites



SST

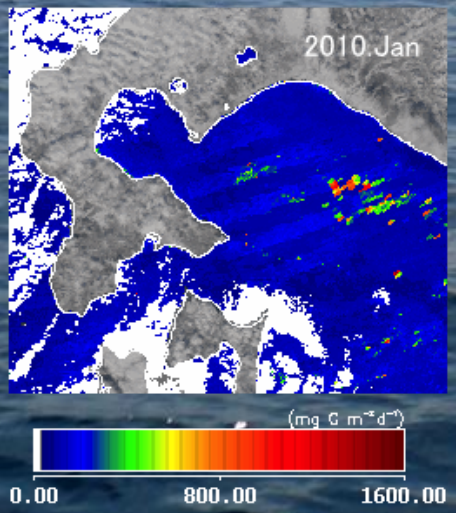


Chl *a*

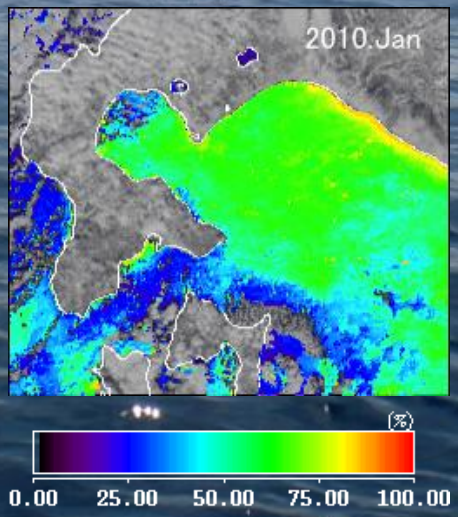


Funka bay tuned algorithms for primary production and phytoplankton size classes

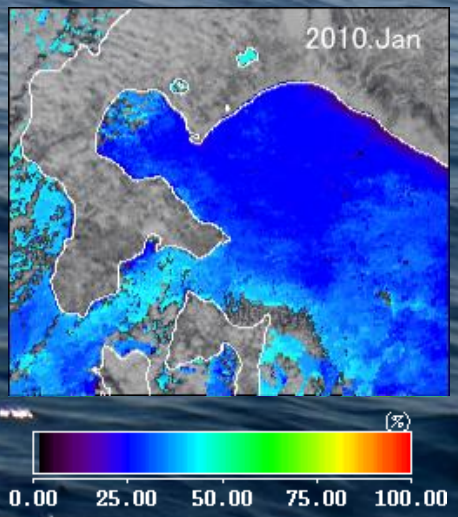
Primary production



Micro-sized phytoplankton



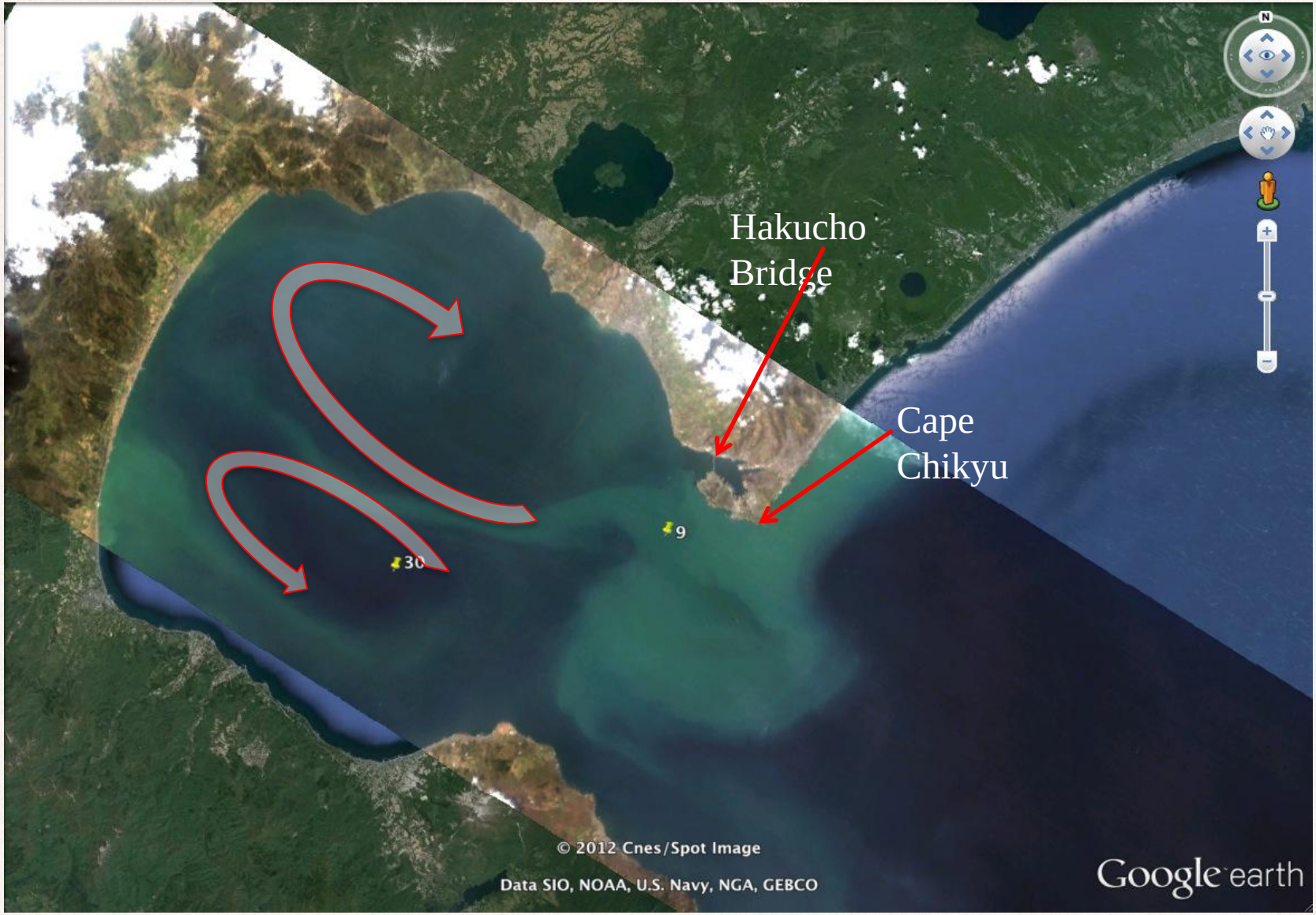
Pico-sized phytoplankton



Method
Behrenfeld and Falkowski (1997)
Hirawake *et al*. (2011, 2012)

Method
Uitz *et al*. (2006); Hirata *et al*. (2011)

HICO and MODIS imageries

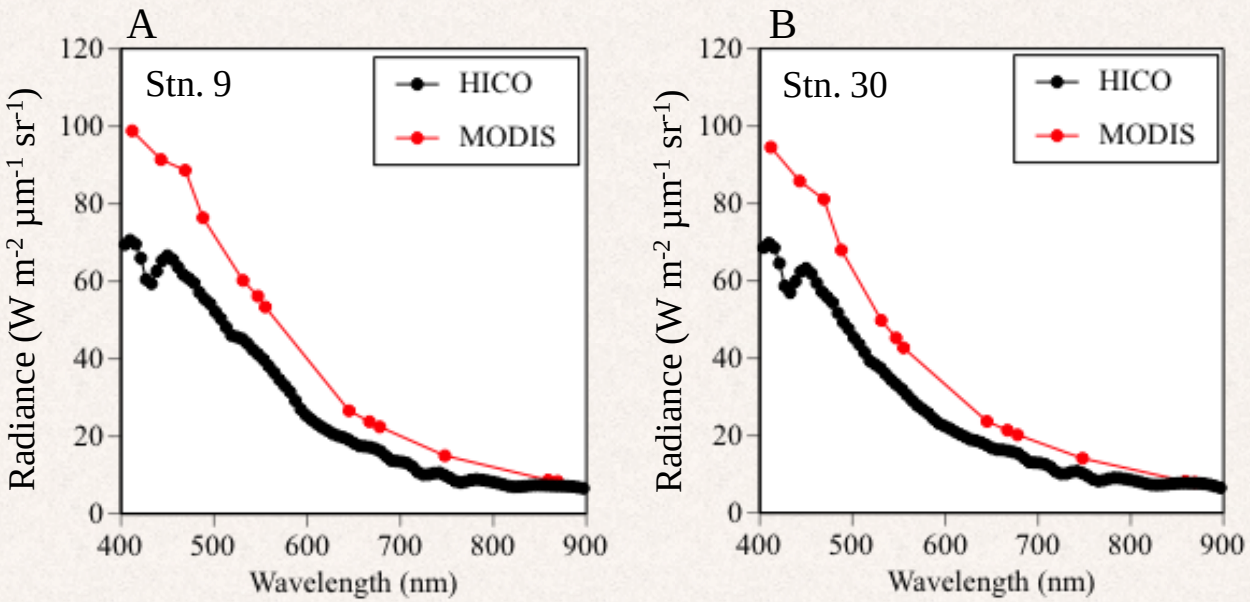


True color image of HICO (Red: 638.9 nm, Green: 553.0 nm, Blue: 461.4 nm) in May 9, 2012, overlaid on Google™ earth. The image was geolocated with the rad_geom file. Two yellow tags represent main sampling stations. Stns.9 and 30 are located off Cape Chikyu and near the center of Funka Bay, respectively. The bridge (Hakucho Bridge) was clearly identifiable from this HICO image.

HICO and MODIS imageries

Quasi true color image of MODIS/Aqua (Red: 645 nm; Green: 555 nm, Blue: 469 nm) in May 9, 2012. Resolution is 500 m.

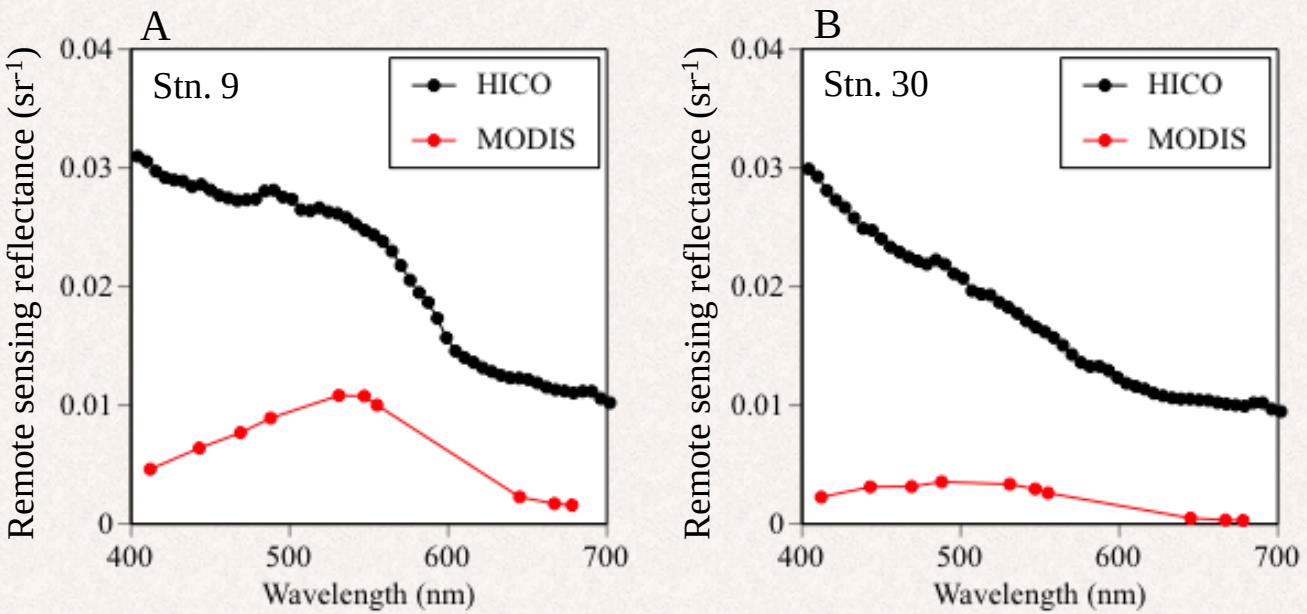
Spectral distribution of radiance derived from HICO and MODIS



Spectral distribution of radiance (W m^{-2} μm^{-1} sr^{-1}) derived from HICO and MODIS at Stns. 9 (A) and 30 (B) in Funka bay on May 9, 2012.

The distribution of hyperspectral radiance derived from HICO data was thought to be similar to calibrated top of atmosphere radiance derived from MODIS data.

Spectral distribution of remote sensing reflectance derived from HICO and MODIS



Spectral distribution of remote sensing reflectance (sr^{-1}) derived from HICO and MODIS at Stns. 9 (A) and 30 (B) in Funka bay on May 9, 2012.

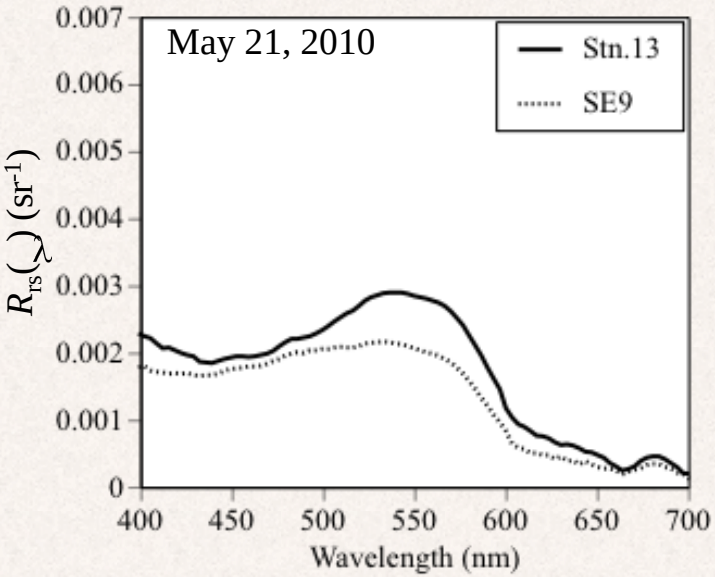
- Values of hyperspectral $R_{rs}(\lambda)$ corrected atmospherically by Tafkaa 6s were within the range from 0.01 to 0.03 sr^{-1} in visible range.

- These values were remarkably higher than multispectral $R_{rs}(\lambda)$ derived from MODIS/Aqua.

In situ hyperspectral remote sensing reflectance ($R_{rs}(\lambda)$) with HyperProII

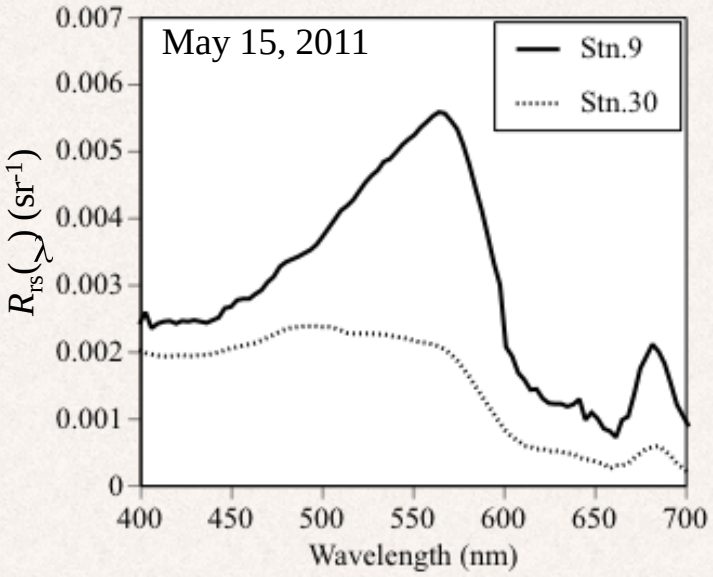
During spring bloom

2010



Solar zenith angles and Chl *a* concentration
Stn.13; 45.1º, 3.62 mg m^{-3}
Stn.SE9; 21.7º, 2.74 mg m^{-3}

2011

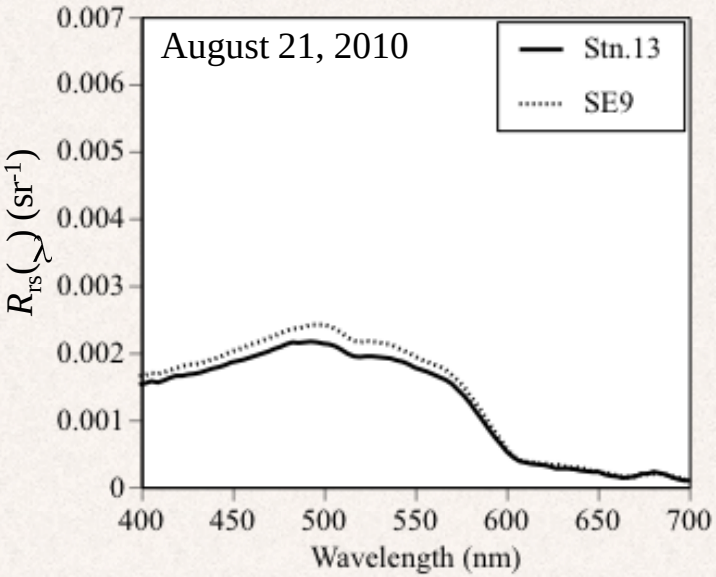


Solar zenith angles and Chl *a* concentration
Stn.9; 39.4º, 4.98 mg m^{-3}
Stn.30; 33.1º, 3.14 mg m^{-3}

In situ hyperspectral remote sensing reflectance ($R_{rs}(\lambda)$) with HyperProII

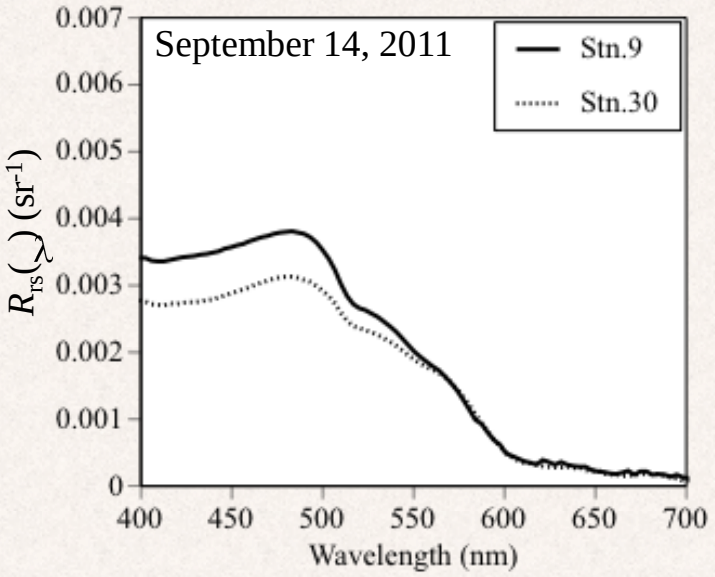
During summer

2010



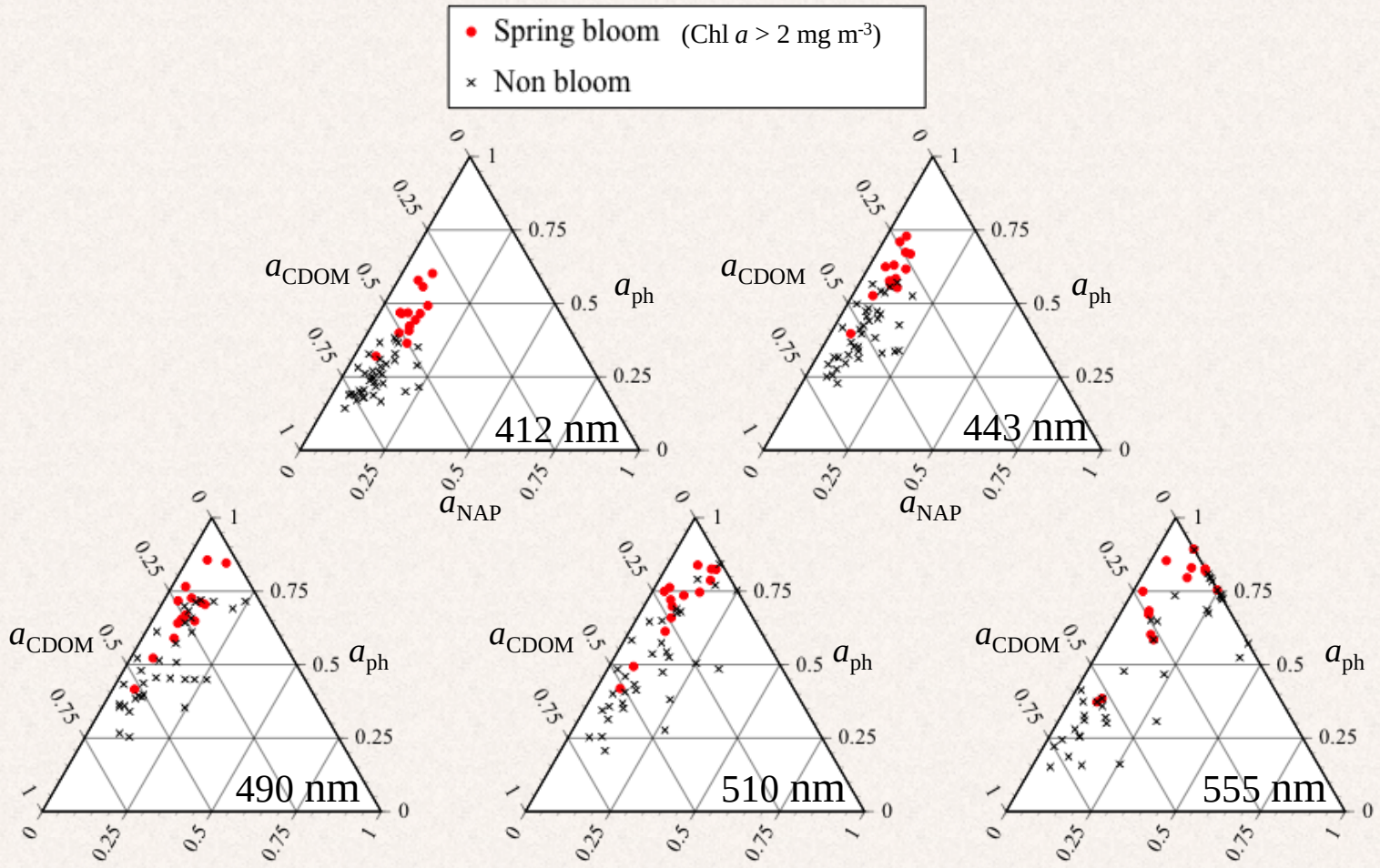
Solar zenith angle and Chl *a* concentration
Stn.13; 37.7º, 0.64 mg m^{-3}
Stn.SE9; 40.0º, 0.60 mg m^{-3}

2011

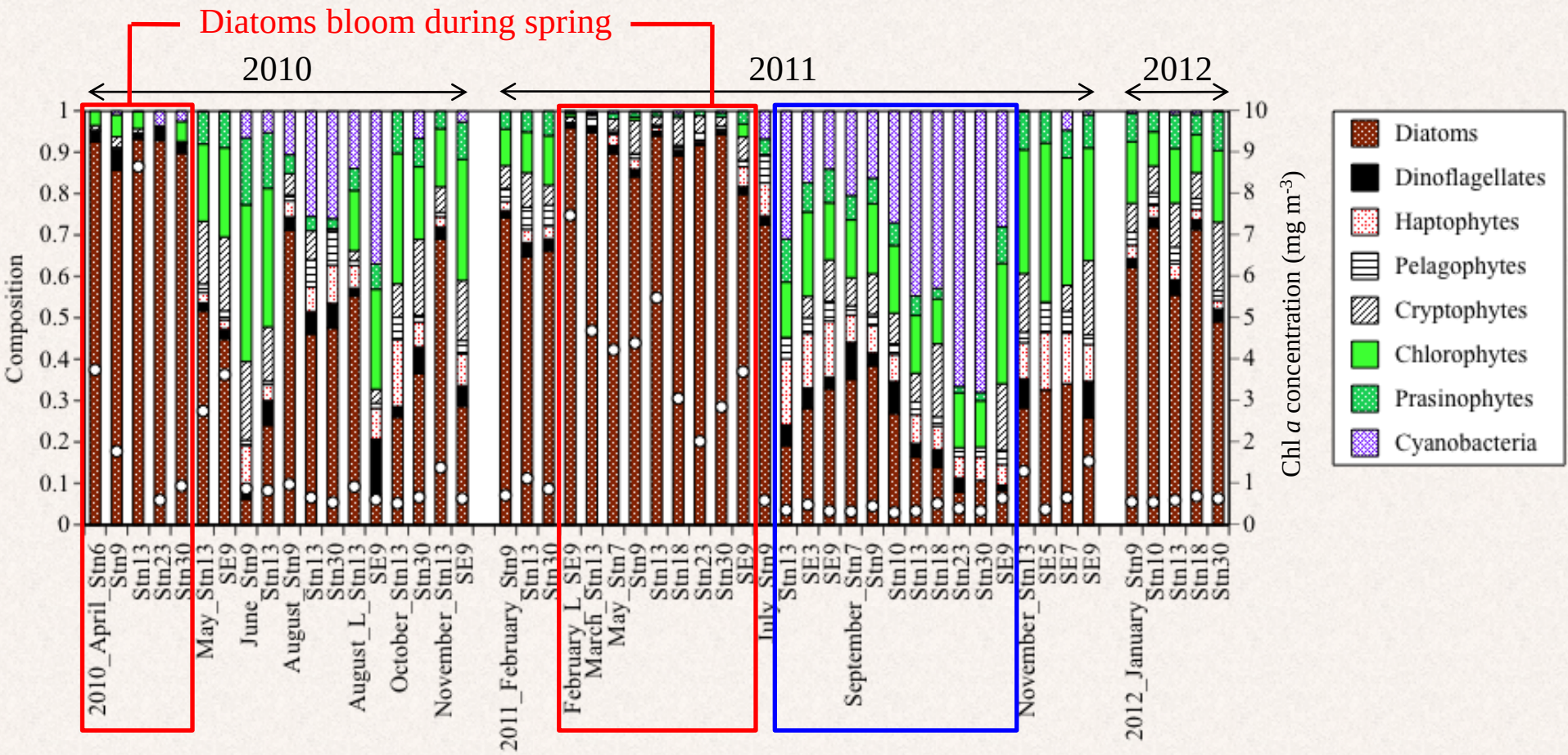


Solar zenith angle and Chl *a* concentration
Stn.9; 48.9º, 0.44 mg m^{-3}
Stn.30; 54.1º, 0.32 mg m^{-3}

Ternary plots representing the relative contribution of NAP, phytoplankton, and CDOM to absorption

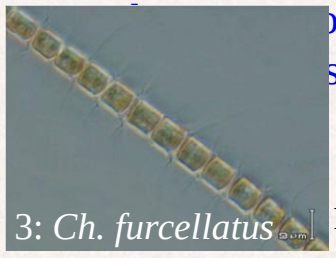


Spatiotemporal change of phytoplankton community structure estimated by HPLC-CHEMTAX (Mackey *et al*., 1996; Wright *et al*., 2009)



of cyanobacteria

summer



Photos by Dr. Koji Suzuki

Summary

- The high-resolution image derived from HICO was of great benefit to an assessment of water dynamic in Funka bay.

- It is important to accurately estimate and remove the aerosol radiance contributions in the visible light.

- Therefore, we should need to specify the aerosol model or attempt to use other operational atmospheric correction algorithms to retrieve a more accurate product of hyperspectral $R_{rs}(\lambda)$.