

## High-frequency Validation of Radiometric Measurements, Inherent Optical Properties and Phytoplankton Functional Types in the Coastal Waters of Sagami Bay (C030)







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**B=Direct Overpass, Y=Partial Overpass** 

## Problem:

Coastal oceans remain one of the most difficult marine environments to optically characterize spatially and temporally due to multiple complexities, e.g., proximity to land mass, shallow environment, high turbidity, complex stratification/mixing, boundary effects on circulation, river and terrestrial input, high primary production, complex biogeochemical interactions, high biodiversity, etc.

# Temporal & Spatial Variability (Chl-a, Sigma-t, MLD, Z<sub>eu</sub>) Euphotic Depth (Zeu) 70-80-Mixed Layer Depth (MLD) 2016 2017 2019 2020 2018 2021

Pigments: HPLC (Shimadzu)

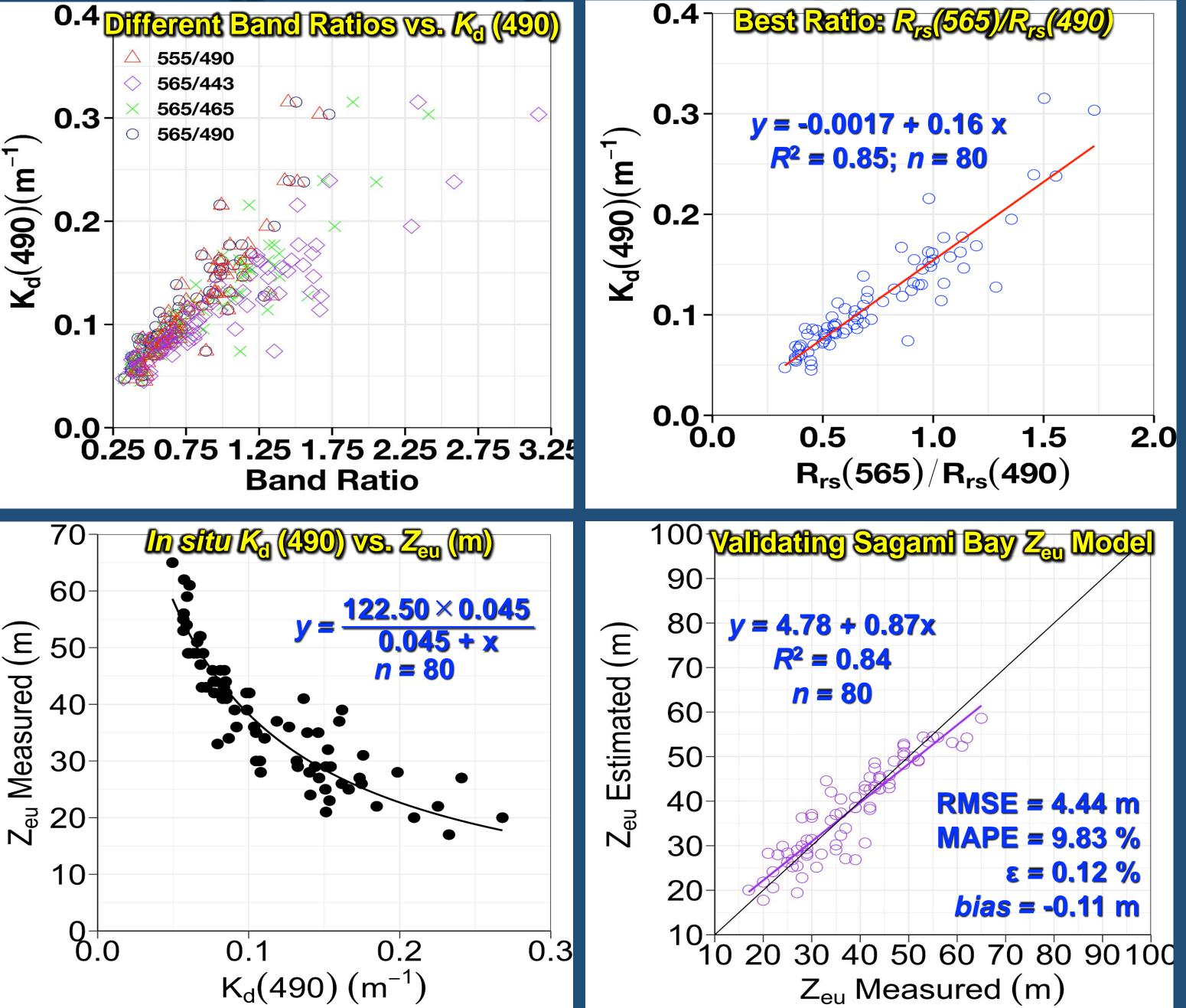
Accurately quantify at relatively high-frequency (monthly) in situ radiometric measurements, inherent optical properties (IOPs) and phytoplankton functional types (PFTs) from Sagami Bay, Japan towards resolving coastal ocean bio-optical complexities and vicarious validation efforts of the GCOM-C/SGLI (Shikisai) ocean color remote sensing observational platform.

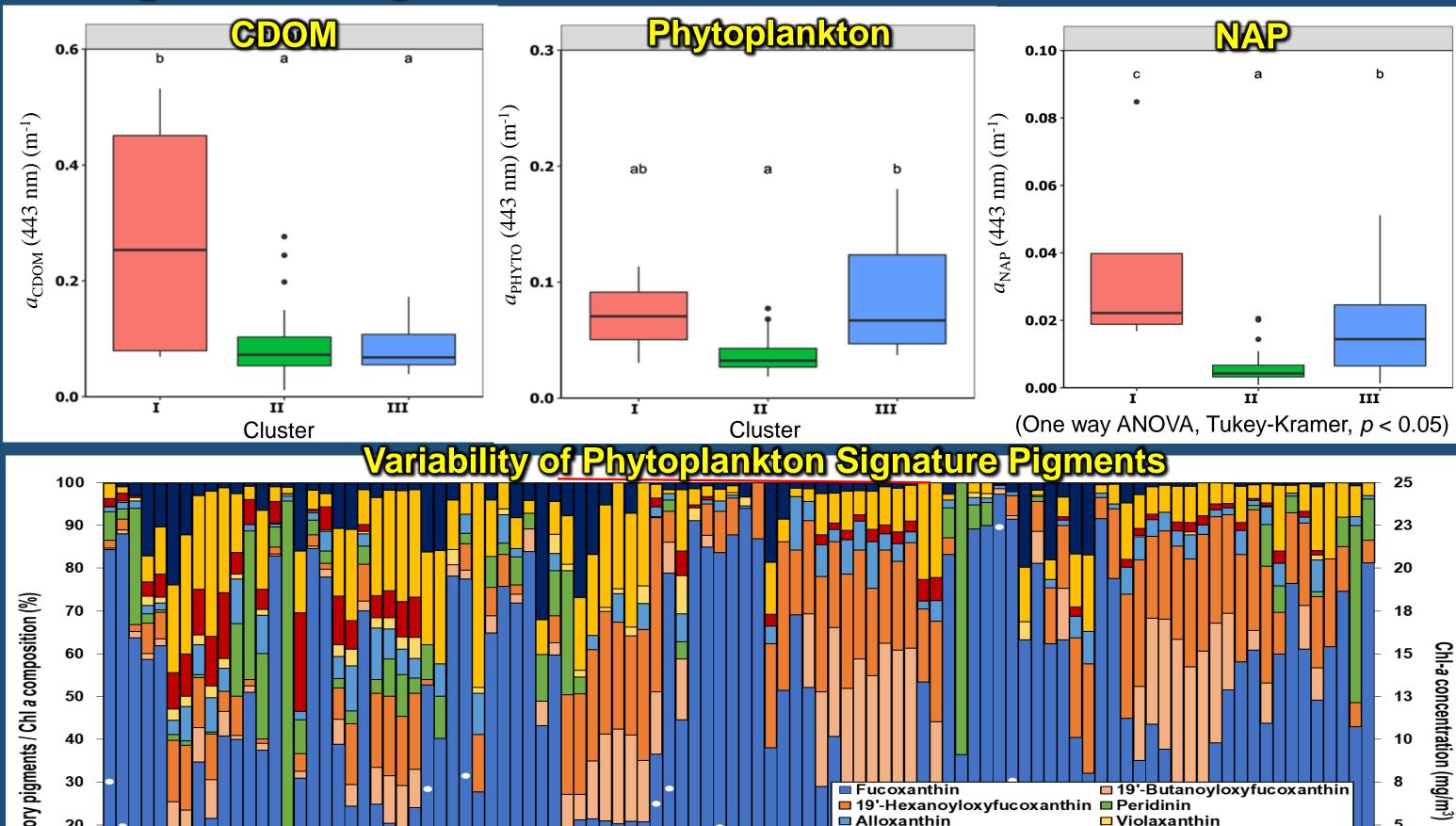
### **Material & Methods:** Obs. FY2021 FY2021 Obs. Date (JST) Date (JST) 27-Sep-21 6-Apr-21 16-Apr-21 8-Oct-21 29-Apr-21 15-Oct-21 7-May-21 4-Nov-21 11-Nov-21 14-May-21 Station M Izu Peninsula 18-May-21 19-Nov-21 25-May-21 26-Nov-21 17-Dec-21 1-Jun-21 16'36" N 23-Dec-21 18-Jun-21 139° 17'58" E 25-Jun-21 27-Dec-21 Measurements★Analysis (FY2016 - FY2021): 2-Jul-21 7-Jan-22 6-Jul-21 18-Jan-22 CTD: RINKO-Profiler (JFE Advantech) 13-Jul-21 21-Jan-22 • MLD: $\Delta \sigma t(z) = \sigma t(z) - \sigma t(5m) > 0.125 \text{ kg/m}^3$ 16-Jul-21 10-Feb-22 Optics: PRR-800 & C-OPS (Biospherical) 14-Feb-22 16-Aug-21 18-Feb-22 24-Aug-21 • Euphotic Depth: $Z_{eu}$ ( $\lambda$ , $\int PAR$ )= 4.6 / $K_{d}$ 1-Mar-22 31-Aug-21 • $R_{rs}$ (shape) ( $\lambda$ ) = $R_{rs}$ ( $\lambda$ ) / $\int_{400}^{700} R_{rs}$ ( $\lambda$ ) d $\lambda$ 8-Mar-22 8-Sep-21 16-Mar-22 16-Sep-21 Absorption: Lambda-35 (Perkin Elmer) **23-Sep-21** | Completed: 21/28

### $R_{rs}$ ( $\lambda$ ): Optical Water Types (OWT) I, II & III **Spectral Variability** 0.008 0.007 0.006 0.005 <u>ဖ</u> 0.004 0.003 0.002 0.001 400420440460480500520540560580600620640660680700 Wavelength (nm) Trapezoidal integration of $R_{rs}(\lambda)$ $R_{\rm rs}$ (shape) ( $\lambda$ ) = $R_{\rm rs}$ ( $\lambda$ ) / $\int_{400}^{700} R_{\rm rs}$ ( $\lambda$ ) d $\lambda$ shape) 0.006 0.005 0.004 0.003 400420440460480500520540560580600620640660680700 Wavelength (nm) $R_{rs}$ (490) vs. $R_{rs}$ (565) 0.009- Average R<sub>rs</sub> (shape) **OWT - III** OWT-I **Bio-optical Properties & PFTs**

### Modeling $Z_{eu}$ (m) using $K_{d}$ (490) from $R_{rs}$ (565)/ $R_{rs}$ (490) 0.4 Different Band Ratios vs. K<sub>d</sub> (490) **Best Ratio:** $R_{rs}(565)/R_{rs}(490)$ 555/490 565/443

R/V Tachibana





## **Conclusions & Acknowledgements**

- Sagami Bay revealed three ( $R_{rs}$ ) Optical Water Types [OWT-I = CDOM significant; **OWT-II** = Transparent (clean) Coastal Waters; **OWT-III** = Transition Coastal Waters) based on 80 in situ radiometric measurements
- CDOM absorption was significant in OWT-I, and phytoplankton biomass (absorption) was relatively significant in OWT-III compared to other OWTs; all biooptical factors (IOPs) were low in OWT-II, suggesting transparent coastal waters
- Phytoplankton signature pigments showed clear seasonality with high diatom biomass in Spring-Summer and relatively high cyanobacteria in Summer-Fall
- Coccolithophore bloom was observed in Sagami Bay in May 2020 based to "Shikisai"; the first documentation in 25-years (data not shown)
- Plankton diversity (Envi.DNA) and PFTs (CHEMTAX) were determined and preliminary relationship to in situ optical data was determined (data not shown)
- ullet Robust euphotic zone depth ( $Z_{\rm eu}$ ) estimation model was developed based on  $K_d$ (490) derived from  $R_{rs}$ (565)/ $R_{rs}$ (490) band ratio
- Z<sub>eu</sub> research product can be calculated from *Shikisai* with high confidence in Sagami Bay – validation match-ups will be tested and analyzed

Acknowledgments: This study was partially supported by internal funding from Soka University in addition to the generous JAXA research grant ER2GCGCF312 – THANK YOU! We would like to thank all members of *Team Manazuru* from Soka University and Yokohama National University for assistance during field observations. Extra-special sincere gratitude is expressed to our ship captain/navigator Mrs. M. Kimura (YNU) – thank you!