

北海道大学  
HOKKAIDO UNIVERSITY

Nov. 4, 2016, 10:10-10:30

W8 (Mesoscale and ...)

PICES 2016 Annual Meeting

Omni Hotel, San Diego, USA

# Mesoscale eddies in the western ~~subarctic~~ North Pacific

Hirofumi Ueno,

H. Ishiyama, Y. Okada, Y. Karasawa (Hokkaido U.)

S. Kouketsu, H. Kaneko, T. Okunishi,  
K. Sasaoka, S. Itoh, R. Inoue

In this W8, we plan to discuss the **Terms of Reference (ToR)** for the new PICES working group on **meso. & submeso. processes.**

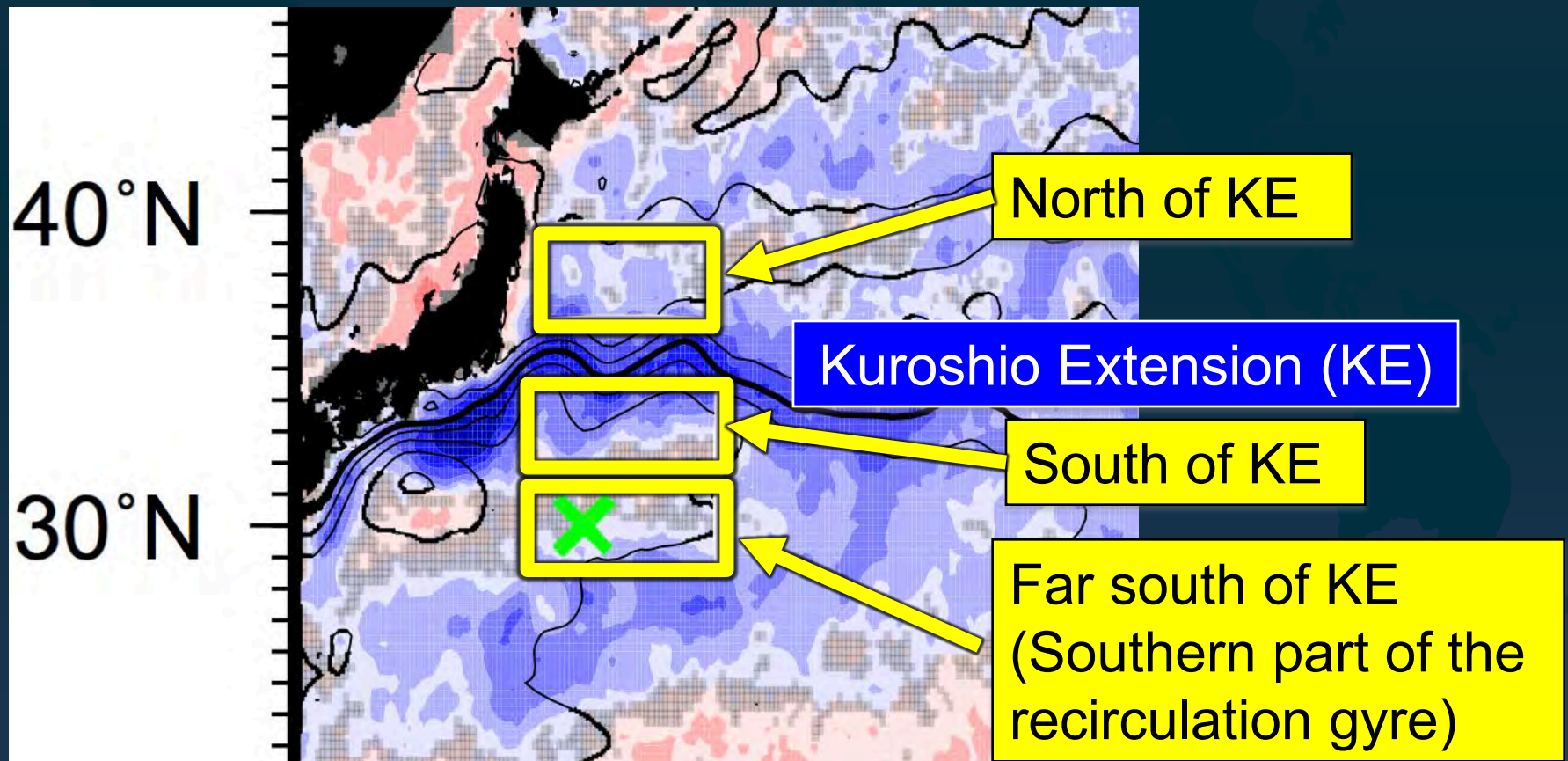
Although I will talk about the draft of ToR after coffee break, the main target of the working group at this stage (should be revised) is the **intercomparison of eddies in the PICES region.**

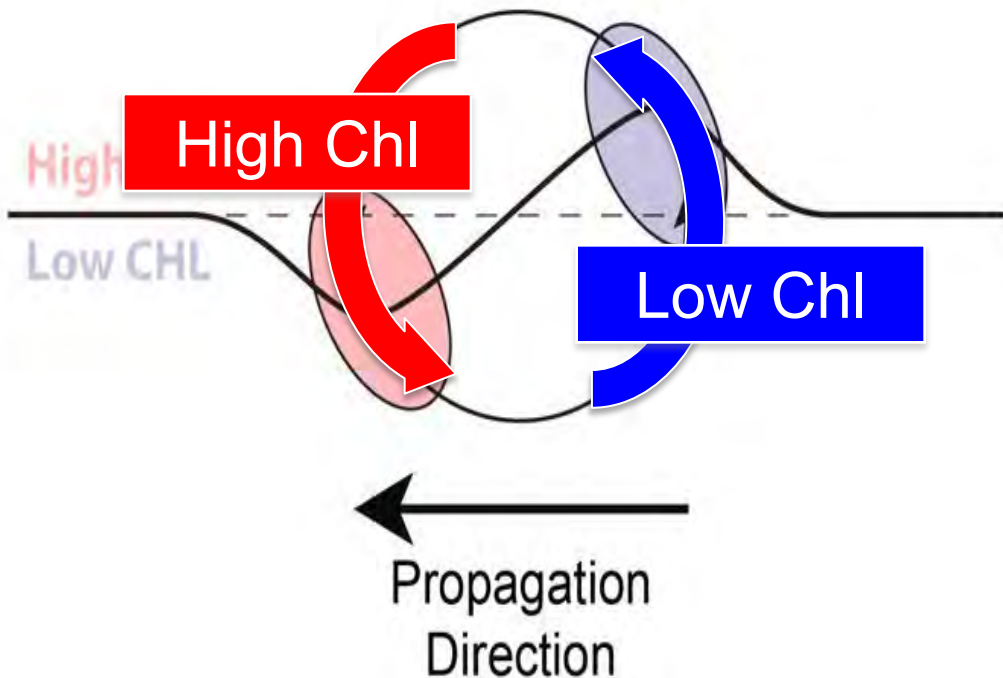
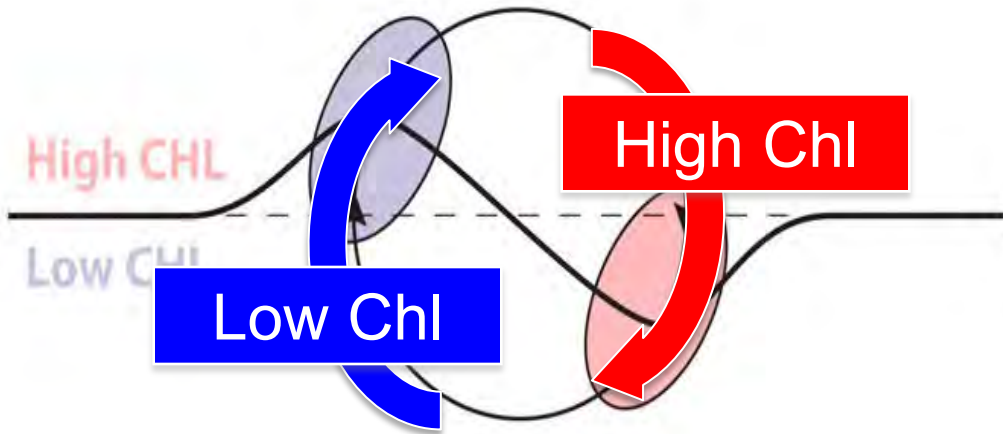
In this presentation, I will talk about a study on eddies around the Kuroshio Ex, which includes intercomparison between eddies.

# Mesoscale eddy effects on temporal variability of surface chlorophyll *a* in the Kuroshio Extension

Shinya Kouketsu<sup>1</sup> · Hitoshi Kaneko<sup>2</sup> · Takeshi Okunishi<sup>3</sup> · Kosei Sasaoka<sup>1</sup> ·  
Sachihiko Itoh<sup>2</sup> · Ryuichiro Inoue<sup>1</sup> · Hiromichi Ueno<sup>4</sup>

J. Oceanography, 2015

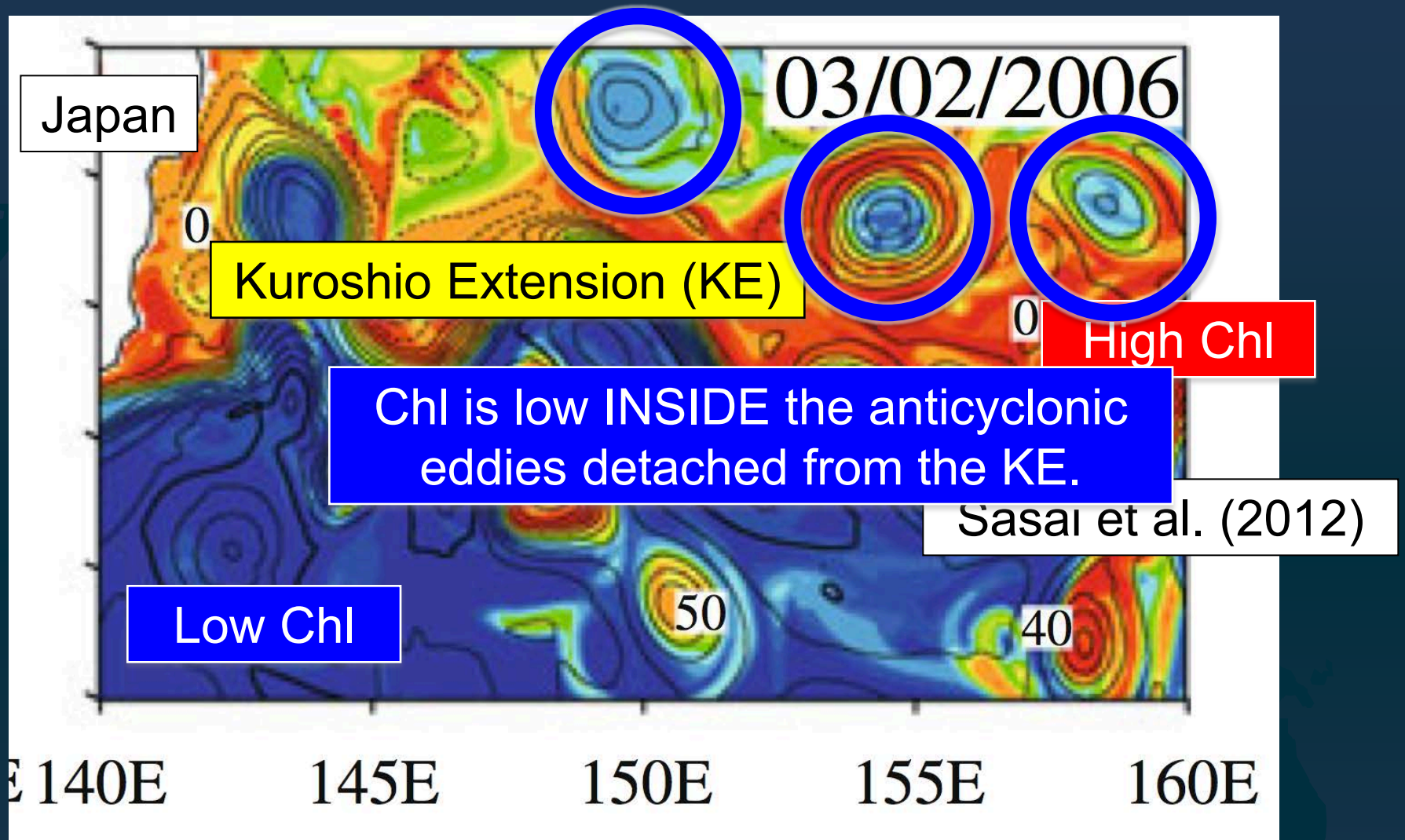




The relation between eddies and Chl has been studied intensively during the last decade.

Chelton et al. (2011) indicated that globally dominant mechanism is eddy-induced horizontal advection.

Chelton et al. (2011)



In the strong current region such as KE, the effect of trapping of Chl seems to be dominant (e.g. Sasai et al. 2012).



# The purpose of this study

- To clarify the relation btwn eddy and Chl around the Kuroshio Ex.
- To discuss the impact of eddies on the decadal variation of Chl around the Kuroshio Ex.

# Data

A faint world map is visible in the background of the slide, showing the continents in a light blue color against the dark blue background.

- **SSHA (AVISO)**
- **Chl (SeaWiFS/MODIS)**
- **MLD/Density (MOAA-GPV ←- Argo)**
- **Nitrate (WOD/JODC/JAMSTEC)**

A dark blue world map is centered in the background of the slide. The map shows the outlines of the continents in a slightly lighter shade of blue. The word "Results" is superimposed over the center of the map.

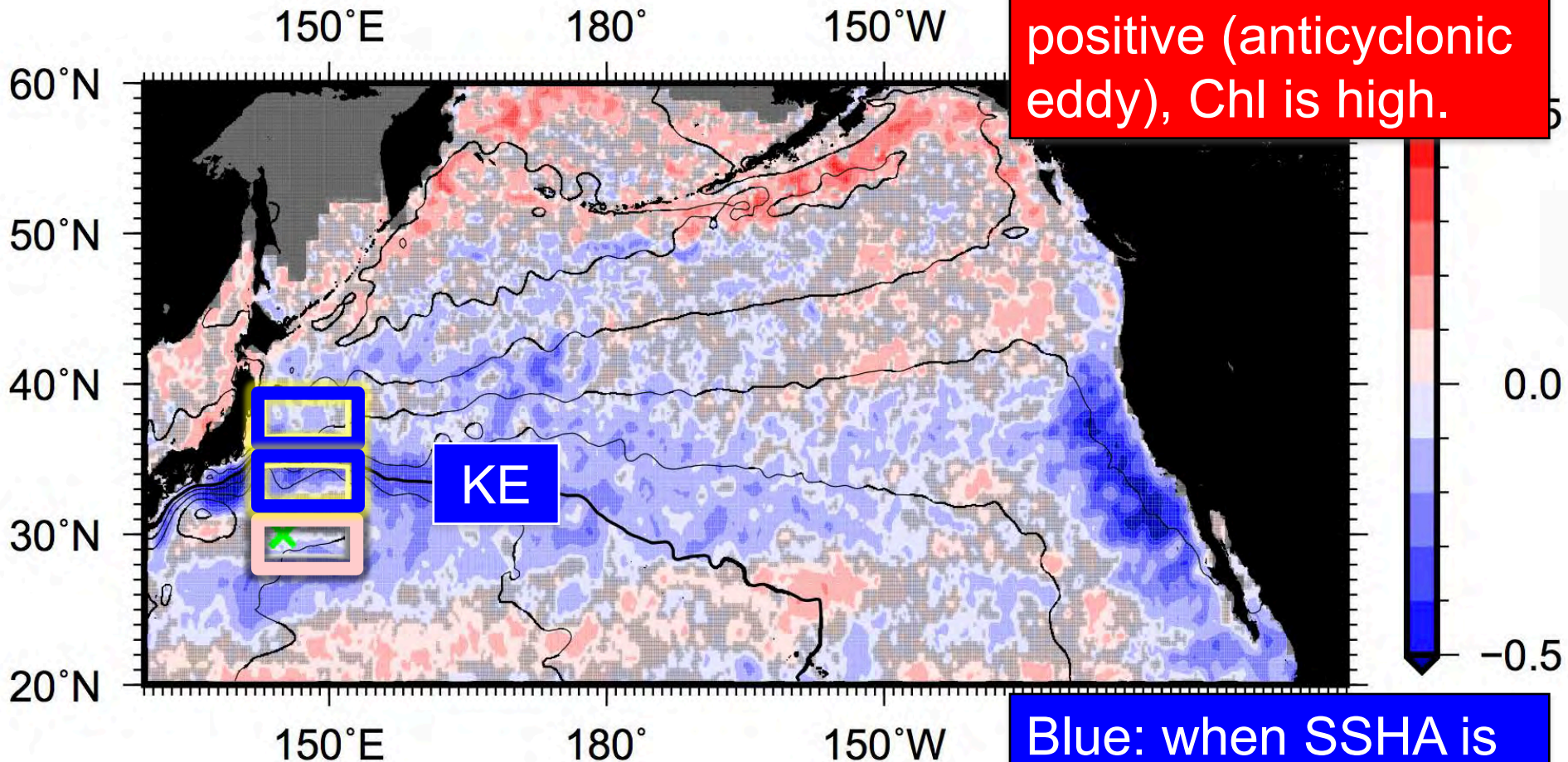
# Results



# Correlation between SSHA and Chl

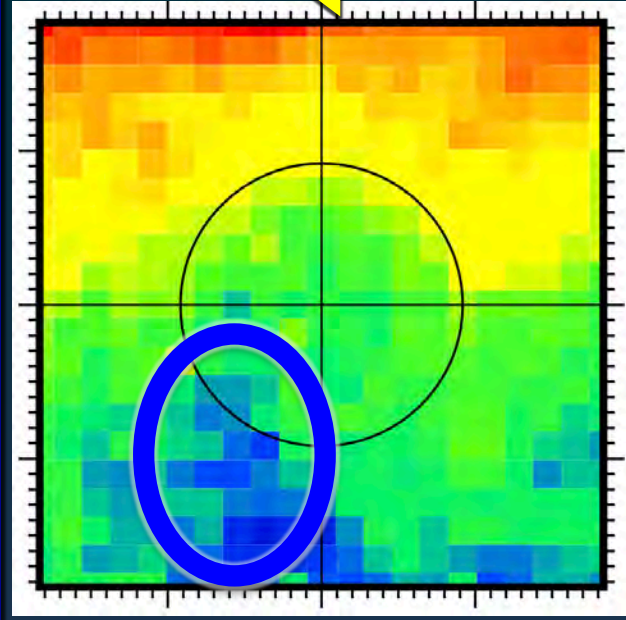
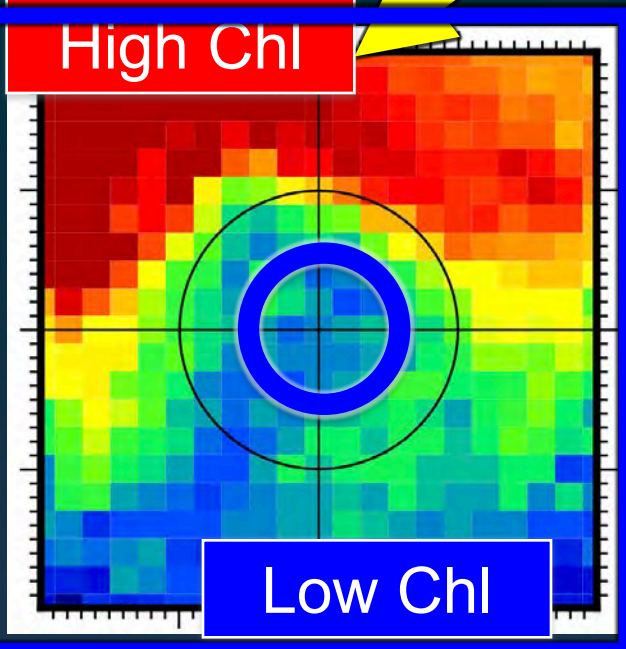
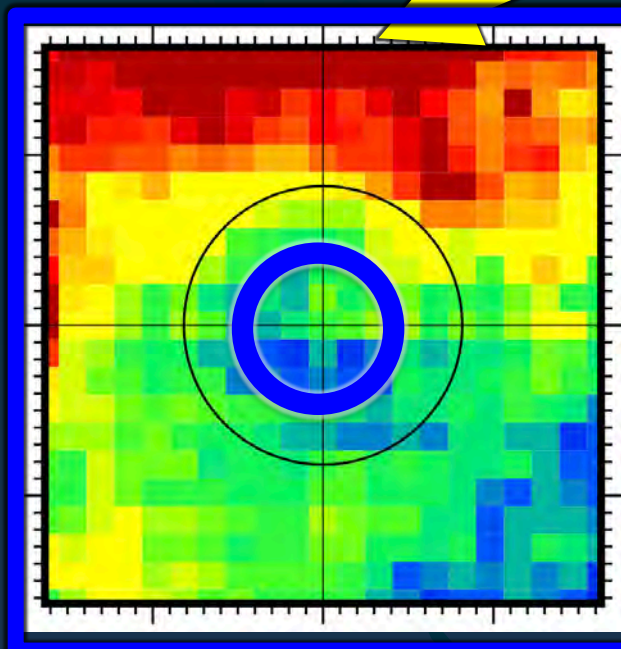
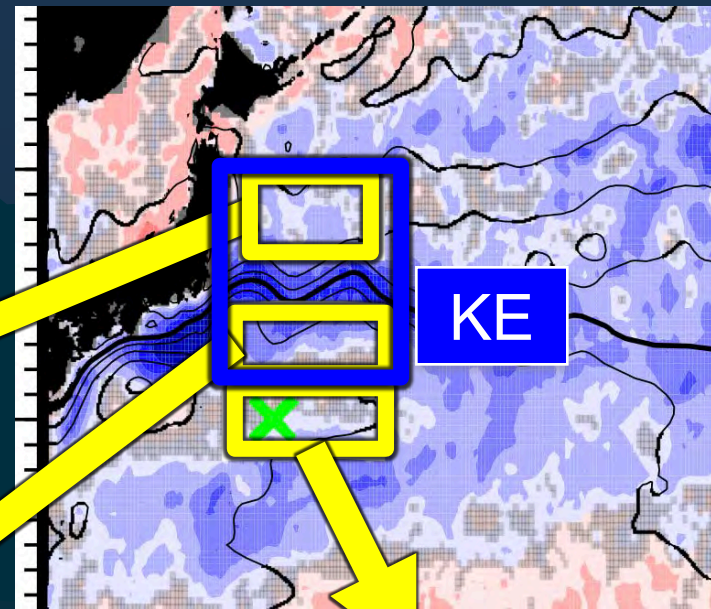
Red: when SSHA is positive (anticyclonic eddy), Chl is high.

Blue: when SSHA is positive (anticyclonic eddy), Chl is low.



# Chl composite around eddies

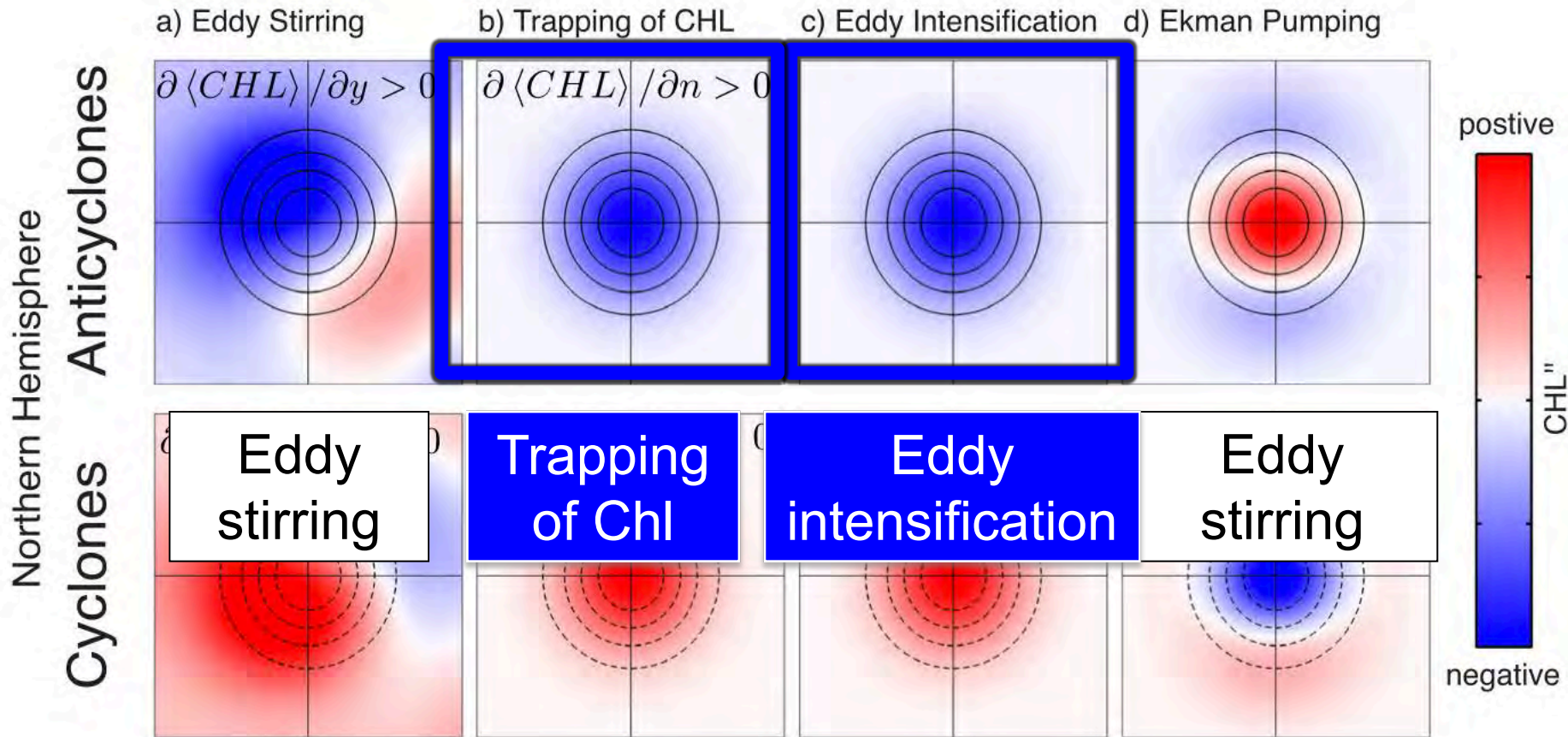
Anticyclonic eddies in October



What causes these relations?



# Mechanisms by Which Mesoscale Eddies Influence Phytoplankton Spatial Structure



Gaube et al.

(2014)

Anticyclonic eddy

Sea Surface

Chl can be low.

Isopycnals



Downwelling due to eddy intensification can explain low Chl at the eddy center.

Trapping of Chl can also explain low Chl at the anticyclonic-eddy center.

Pinet (2010)

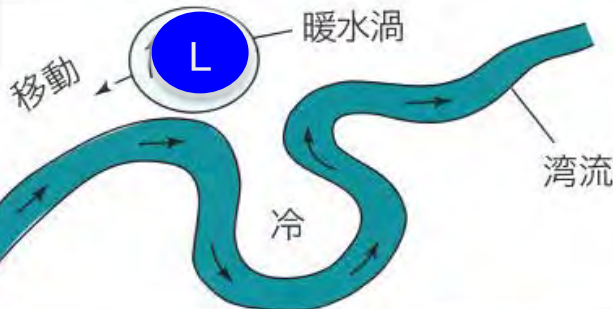
Week 1

High Chl

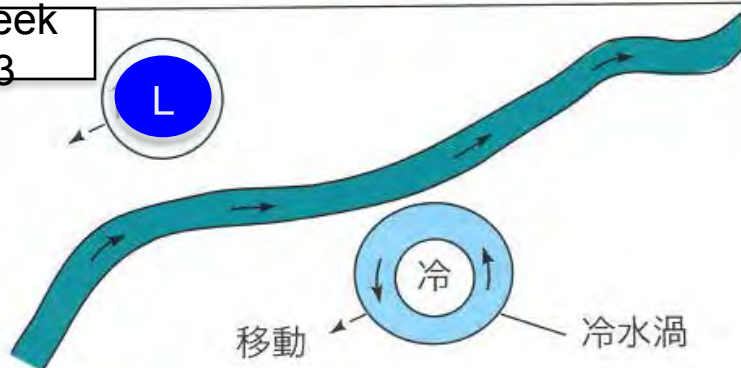
KE

Low Chl

Week 2



Week 3



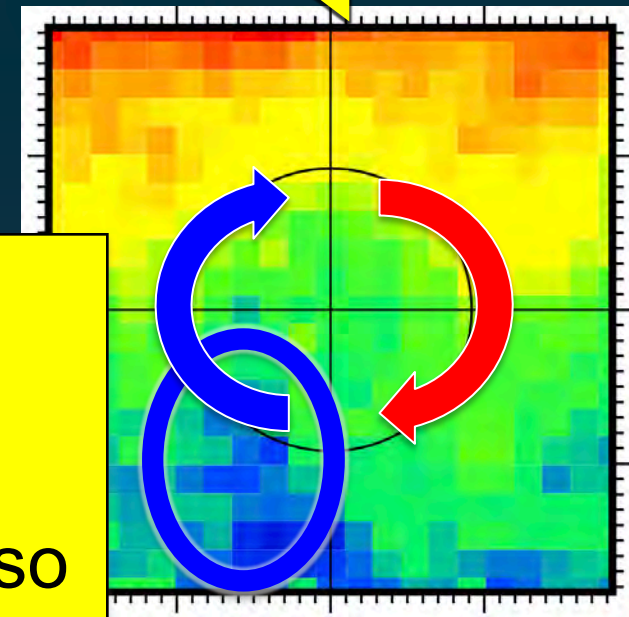
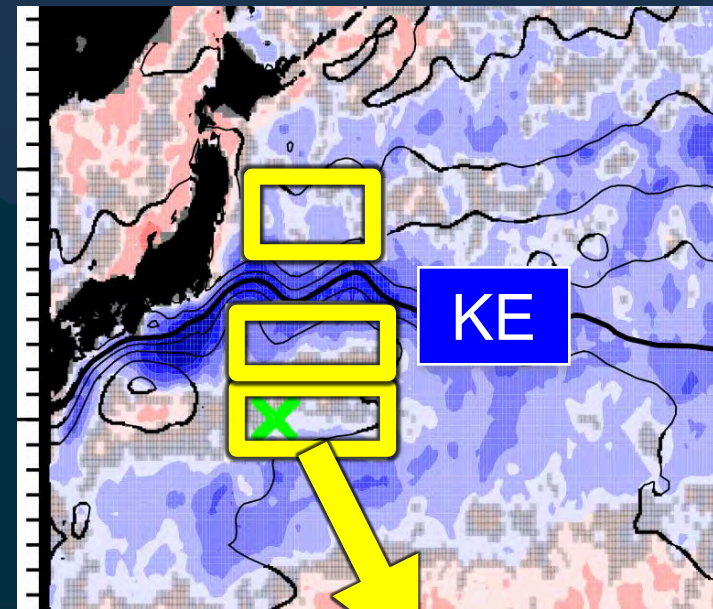
# Chl composite around eddies

Anticyclonic eddies in October

The Chl distribution is consistent with eddy advection

In this area, eddies do not originate from KE, therefore

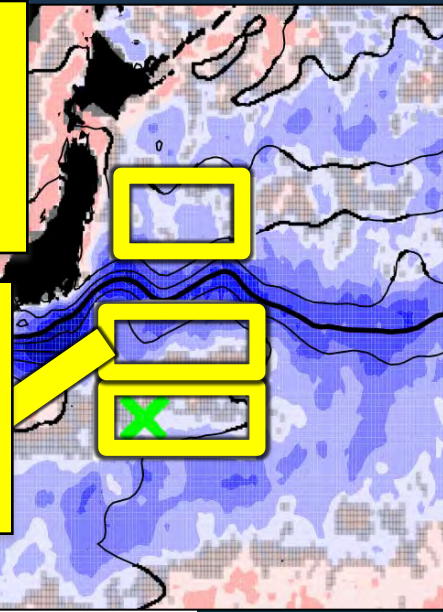
- Trapping of Chl hardly occurs
- Effect of eddy intensification is also weak because eddies are weak.



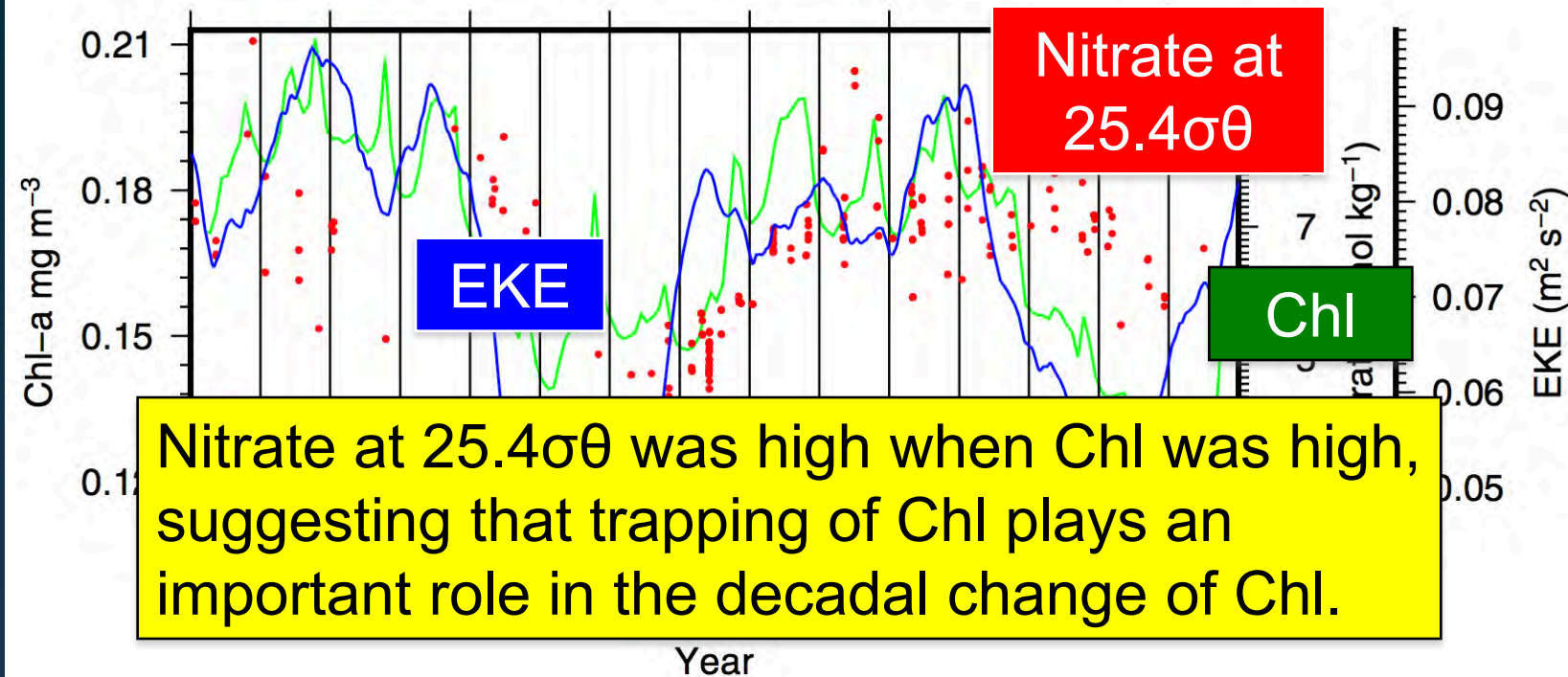


EKE and Chl changed almost simultaneously in the decadal timescale, suggesting eddies control decadal variation of Chl.

Large scale Rossby wave can also control Chl by changing depth of nutricline, but our additional analysis of densities denied the mechanism in KE.



(a) Chl-a and EKE



# Summary

- We investigated the relationship between Chl and eddies.
- Around KE, high (low) Chl was observed in the cyclonic (anticyclonic) eddy core.
- Far south of KE, such relation was not observed.
- Decadal-scale changes of Chl around KE were strongly affected by eddy activity.



After the coffee break I will have a brief presentation on the **Terms of Reference (ToR)** for the new PICES working group on meso. and submeso. processes.

The main target of the working group at this stage (should be revised) is the **intercomparison of eddies in the PICES region.**

**I'd really like you to come back after the coffee break and discuss the ToR.**

A faint, light-colored world map is visible in the background, centered behind the text. The map shows the continents of North America, South America, Europe, Africa, Asia, and Australia.

**Thank you.**