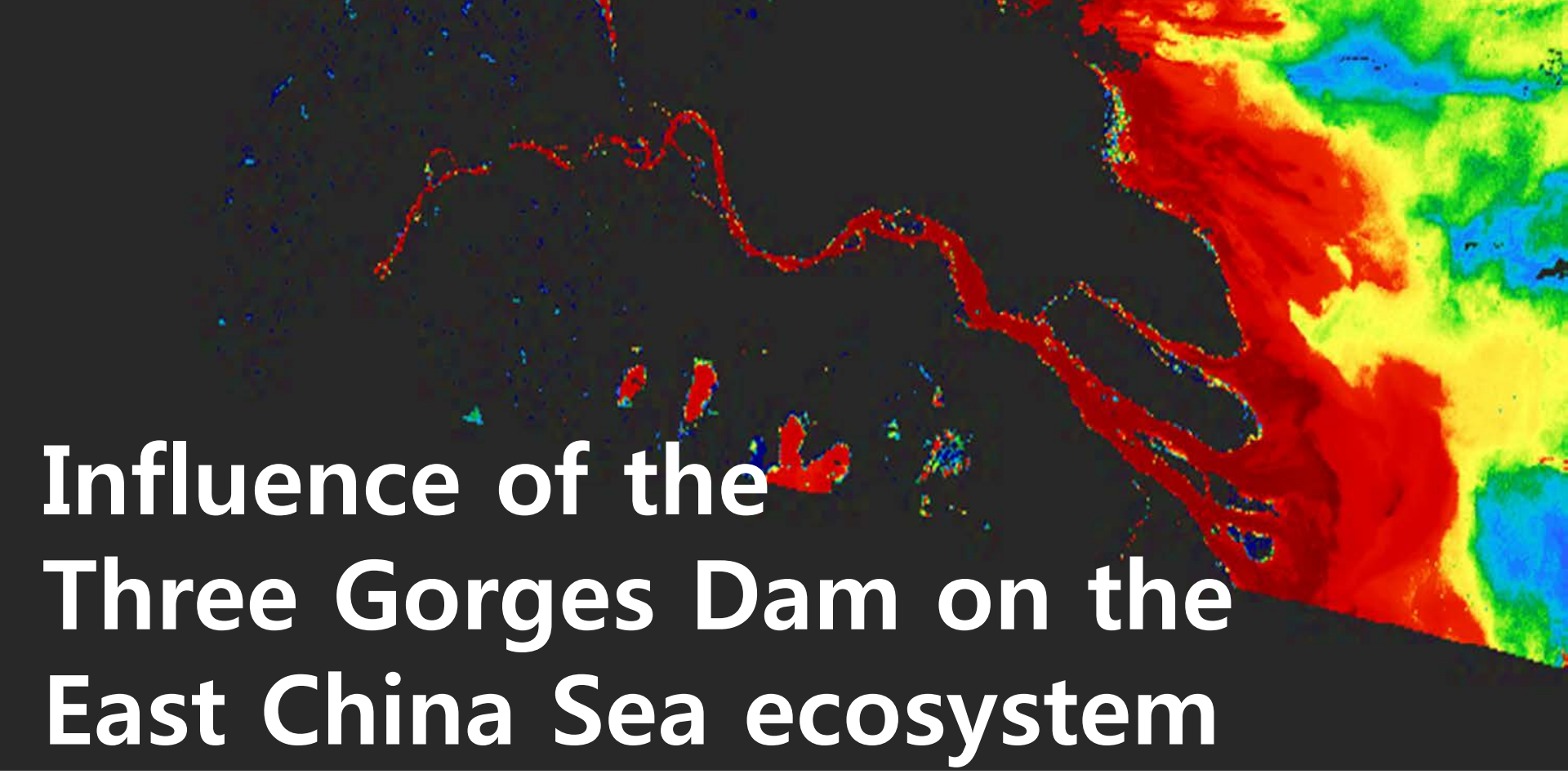

# Influence of the Three Gorges Dam on the East China Sea ecosystem

**Christina Eunjin Kong***, **Sinjae Yoo, and Chan Joo Jang**

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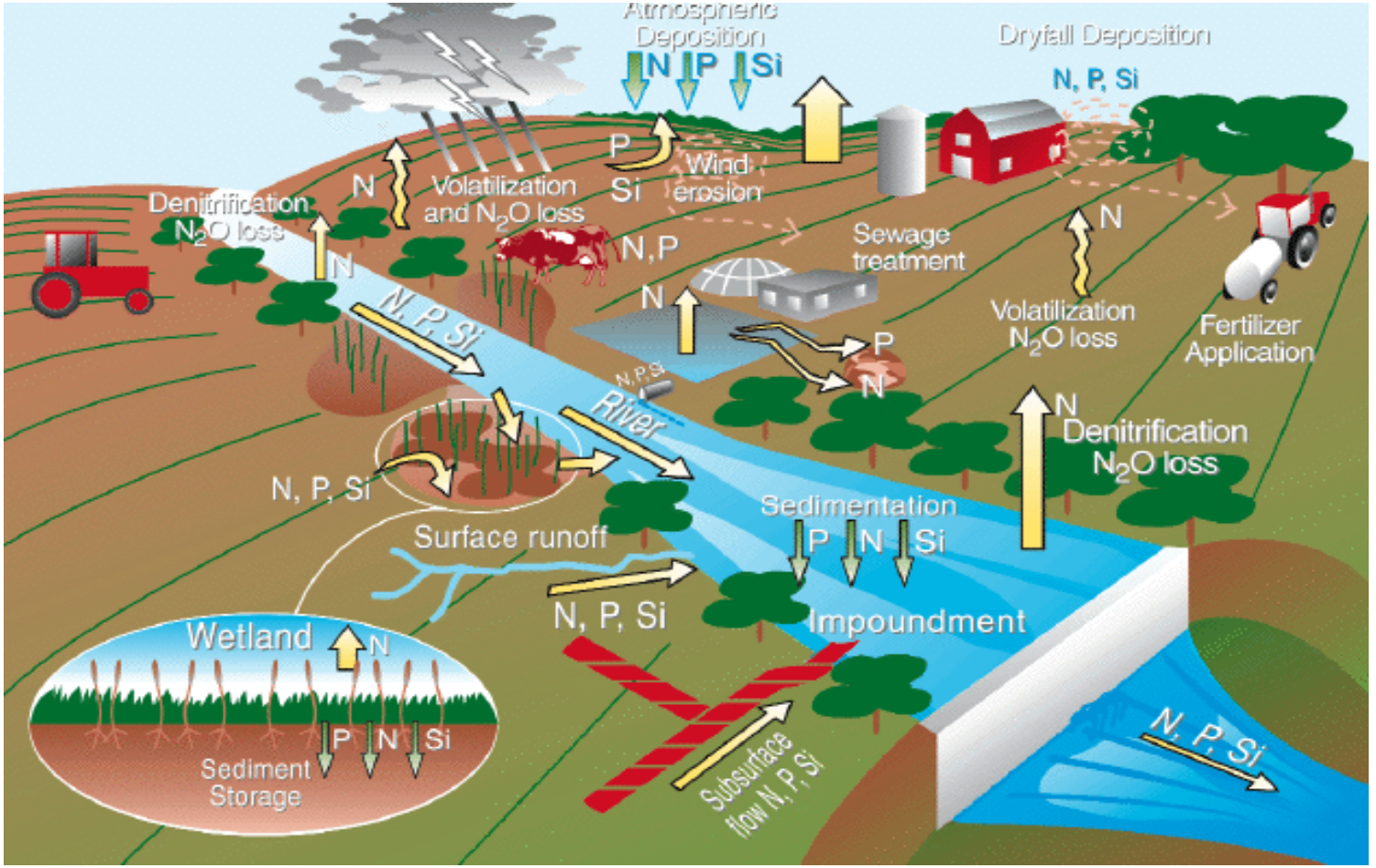
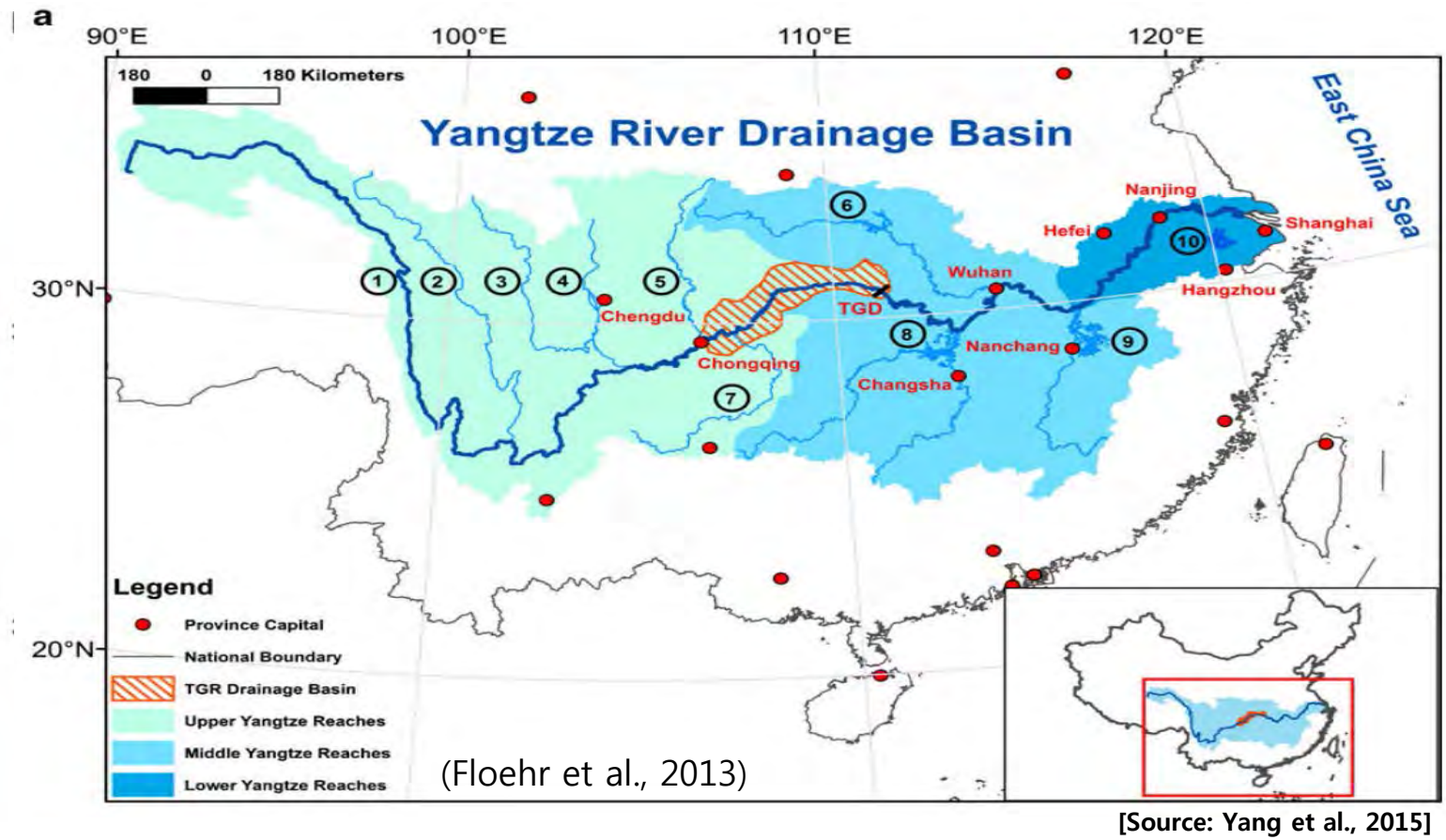
Department of Convergence Study on the Ocean Science and Technology

# Flow of nutrient and sediment discharge from river to adjacent seas




[Source: Environmental Health Perspective, n.d.]

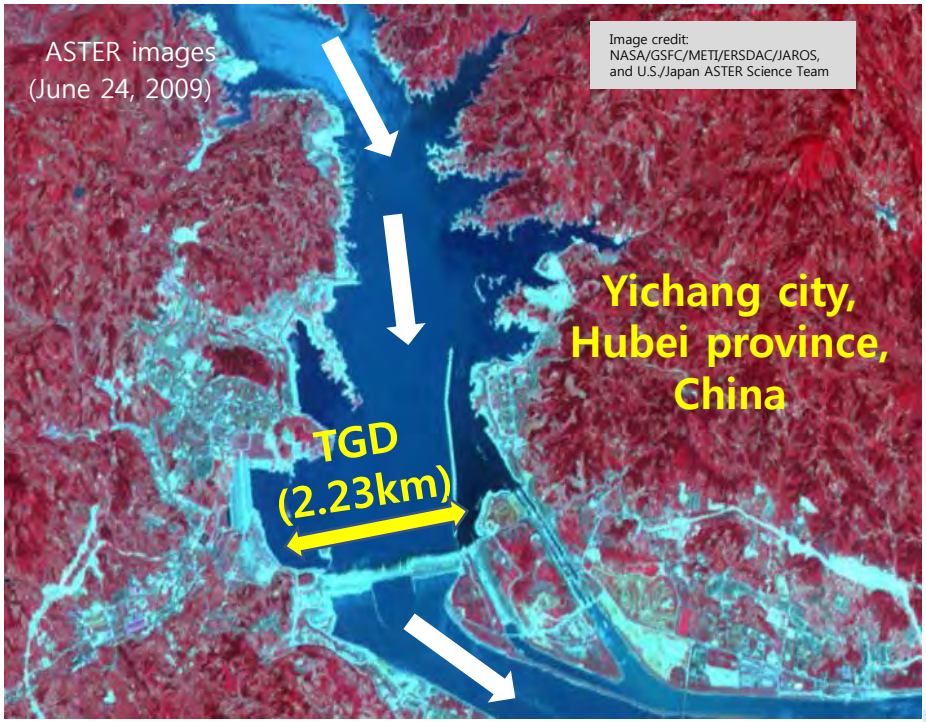
# Changjiang River (*Yangtze River*)




[Source: Yang et al., 2015]

- **5th largest river in terms of water discharge (6,300 km)**
- **Home to 400 million Chinese people - 1/3 Chinese population**
- **Accounts for 40 % of China's freshwater resources – Industrial & agricultural** (i.e. 70% of the country's rice production)
- **The river eventually empties into the East China Sea at the city of Shanghai.**

# Three Gorges Dam (TGD)




## *World's largest hydropower project*

**Impoundment began in 2003**
**Completed in 2006**
**Operated at a full capacity in 2009**

- Dam Height: 185 m
- Dam length: 2.23 km
- Cost of the project: $40 billion
- Storage capacity: 39.3 $km^3$
- Generation Capacity: 18,200 MW


**However, due to TGD project:**

- Over 1.3 million people were displaced
- Number of cities and towns flooded
  (13 cities, 140 towns, and 1350 villages)
- High risk of environmental problem

[Gao et al., 2013; Jet Proposal Laboratory, 2012; International Hydropower Association, n.d.]

# Phases in TGD Project

## I. Initial impoundment (June, 2003)

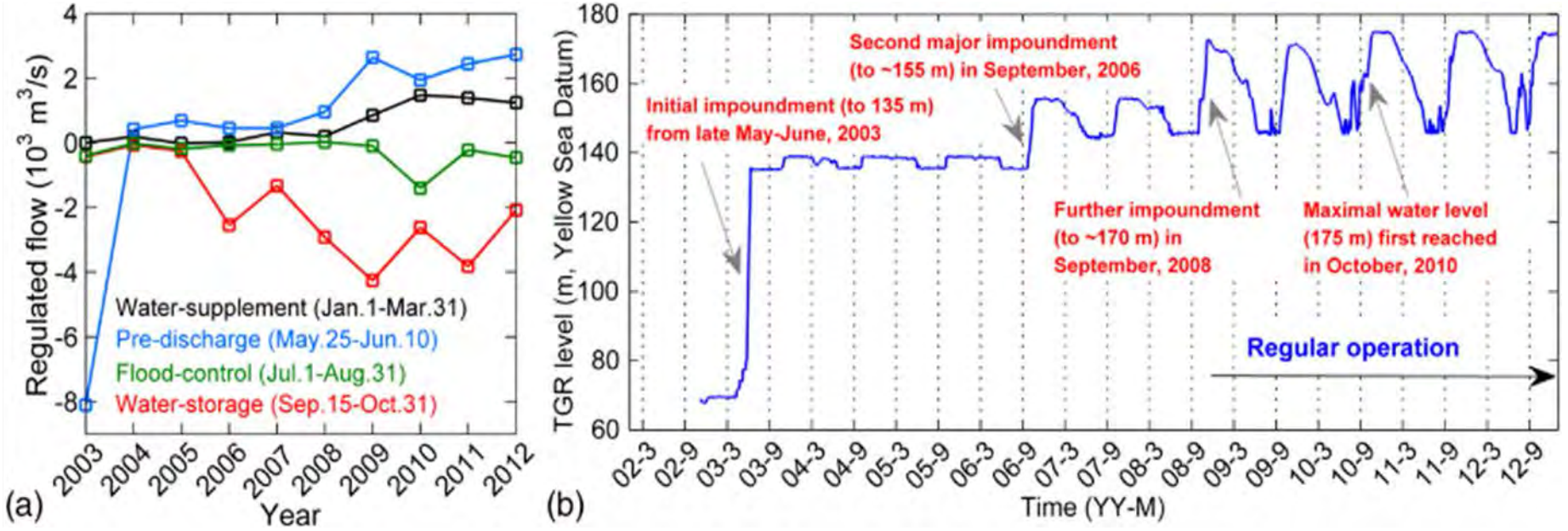
## II. Transitional phase (July 2003 - Aug. 2008)

- TGD did not operate regularly & water level was limited (135 – 155 m)

## III. Regular operation (Since Sept. 2008)

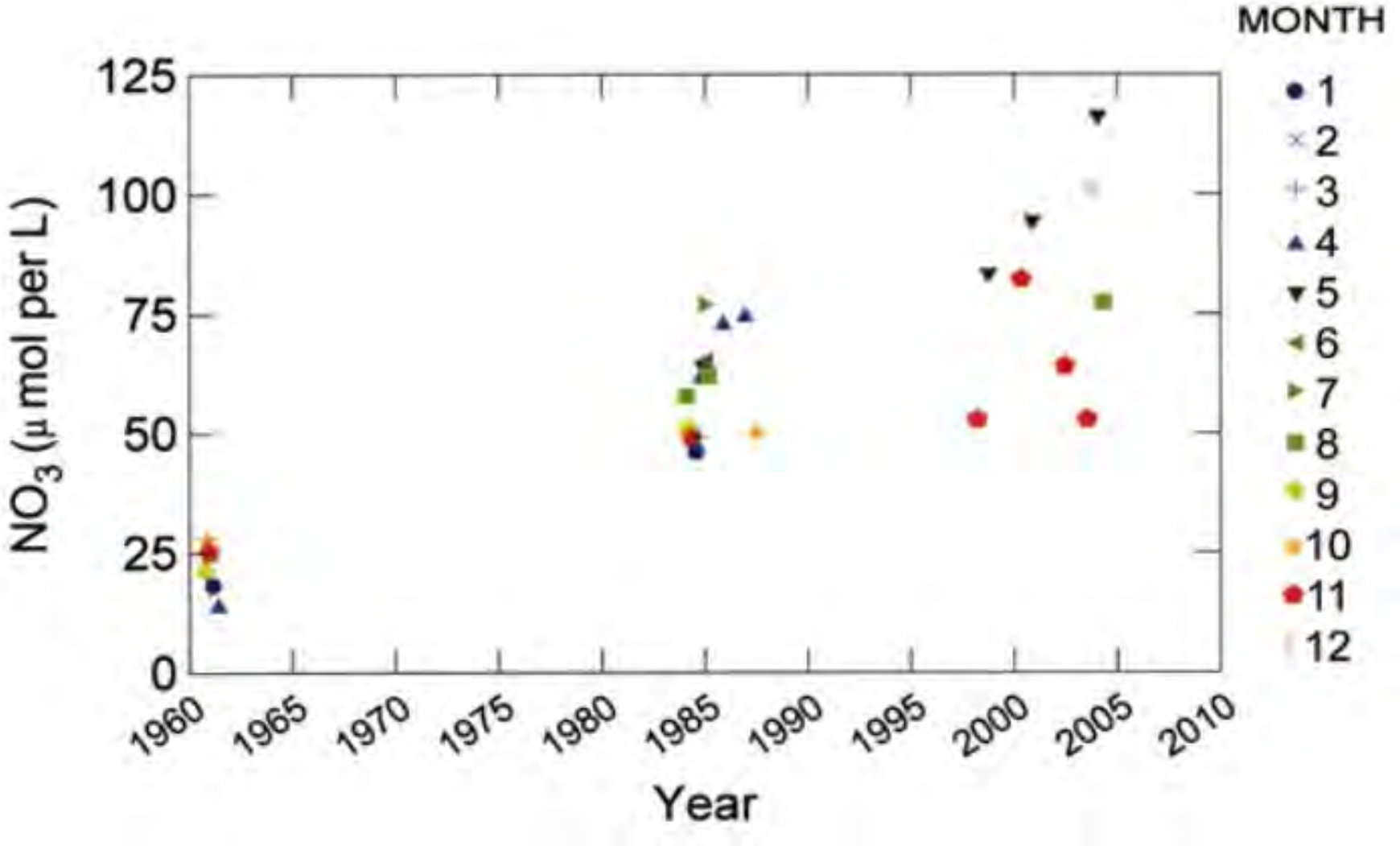
- **(Sept. 2008)** TGD operating at full capacity (175 m)

## Water levels (m) of TGD



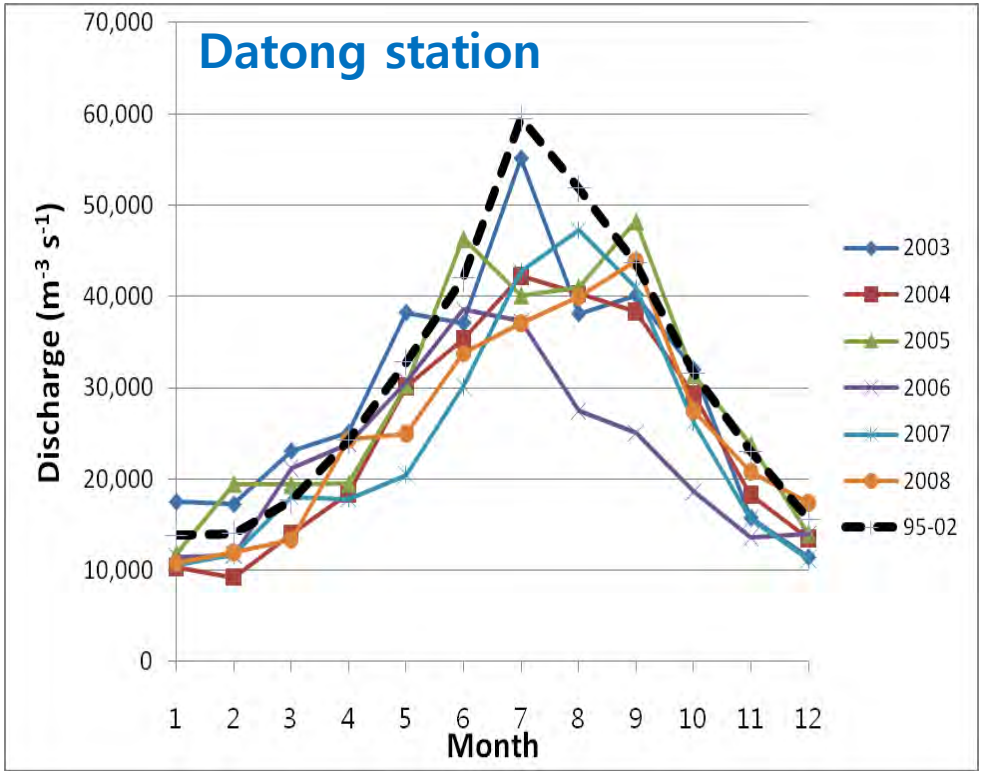

[Gao et al., 2013; Wang et al., 2013]

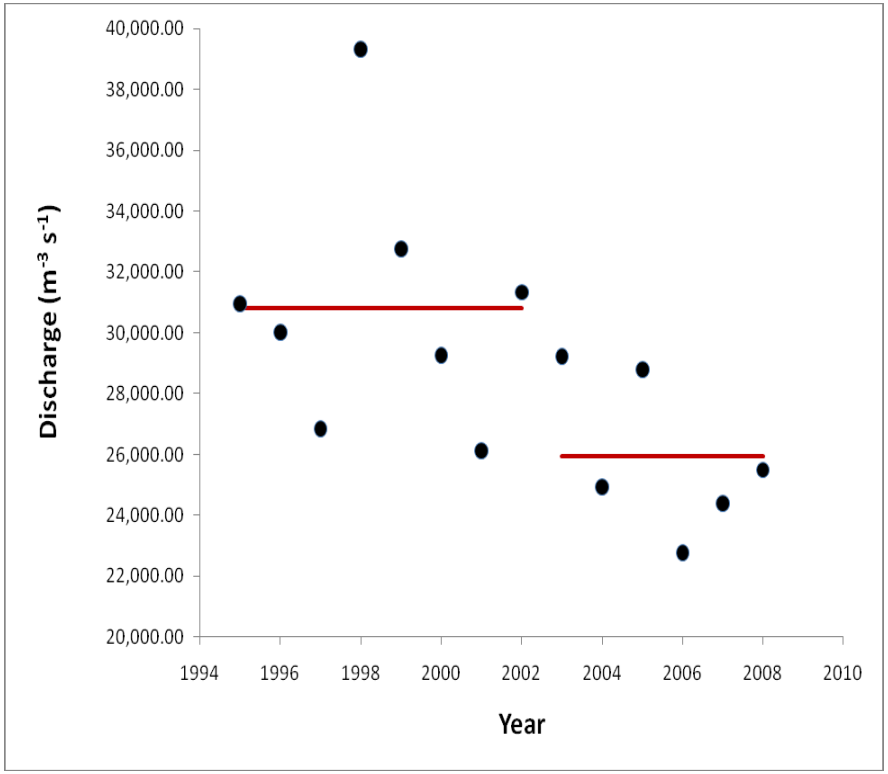
# Nitrate concentration at the mouth of the Changjiang River




[Yoo et al., 2010]

# Influence of TGD on the Chanjiang River Discharge (CRD)



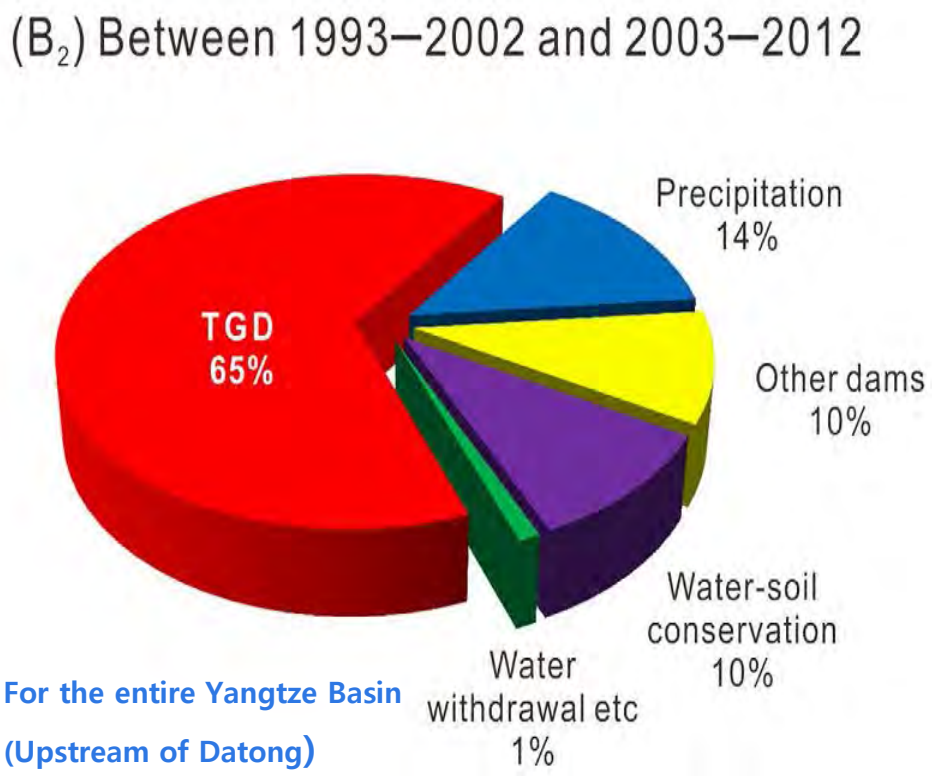




- Average water discharges decreased from 1995-2002 to 2003-2008 period by 16.9% (Yoo et al., 2010).

[Yoo et al., 2010]

# Changes to the sediment flux

## Contribution factors on reduction in sediment flux




**Mean annual sediment flux from the Chanjiang river to the adjacent sea decreased 55% compare to the Pre-TGD period.**
[Yang et al., 2015]

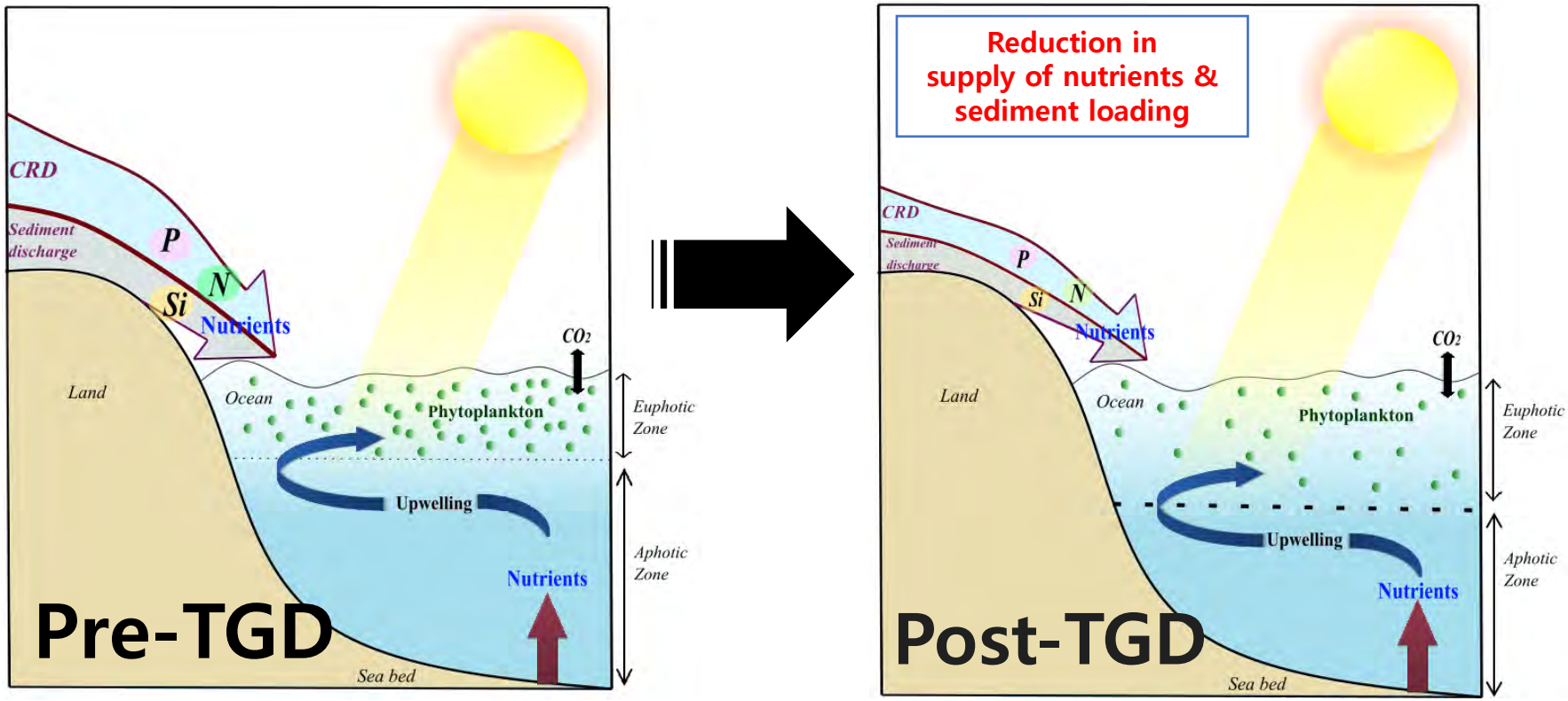
**Common concerns were reduction in the river discharge and sediment flux in the ECS.**

# Hypothesized impact of TGD to the ECS ecosystem

**Comment on "Reduction of primary production and changing of nutrient ratio in the East China Sea: Effect of the Three Gorges Dam?" by Gwo-Ching Gong et al.**

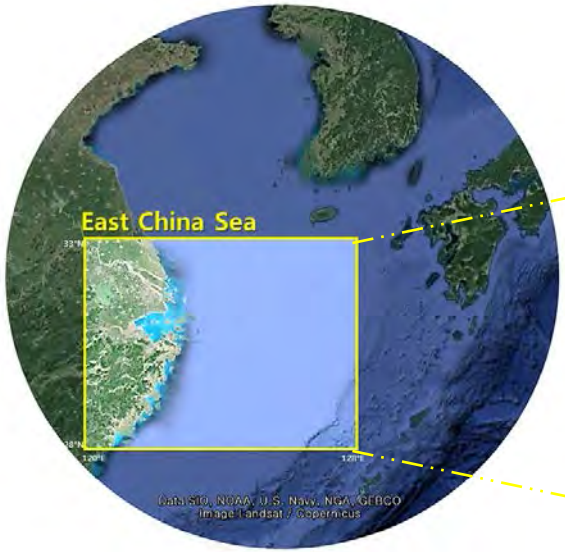
Jinchun Yuan,[1] Linda Hayden,[1] and Michael Dagg[2]

Received 7 December 2006; revised 2 January 2007; accepted 6 June 2007; published 28 July 2007.

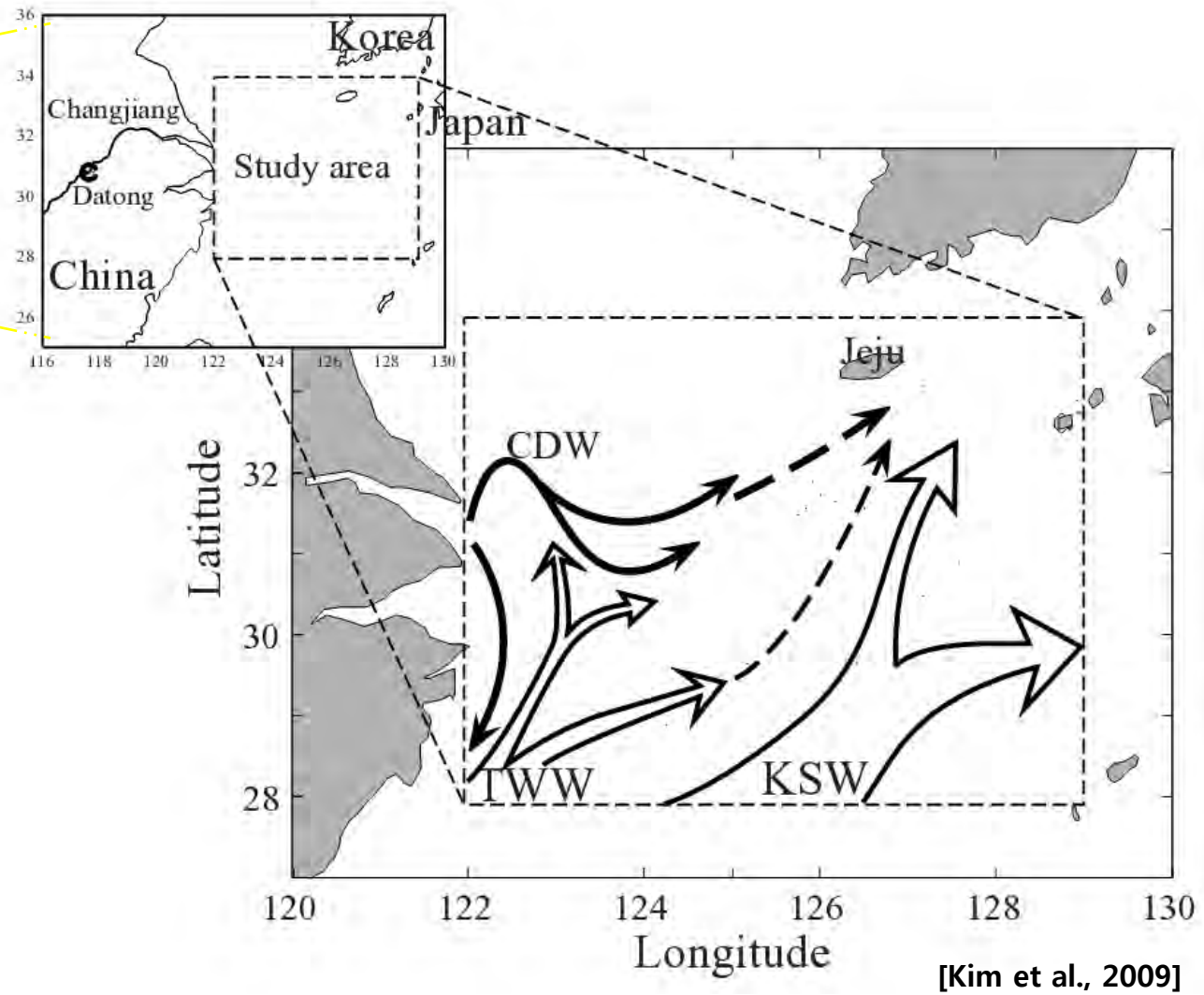


# Study Area

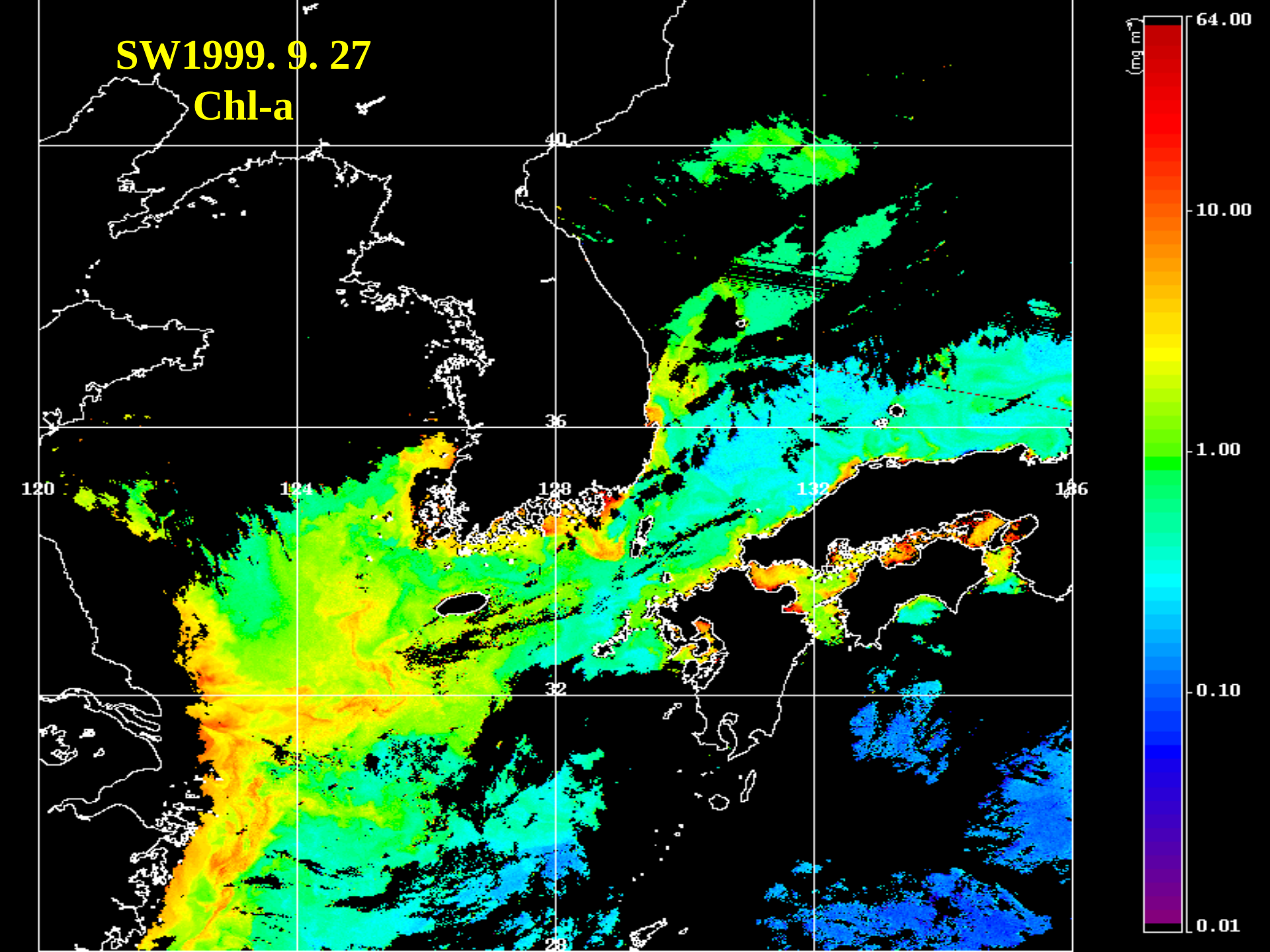
*(East China Sea)*




**[28-33°N, 120-128°E]**




[Kim et al., 2009]

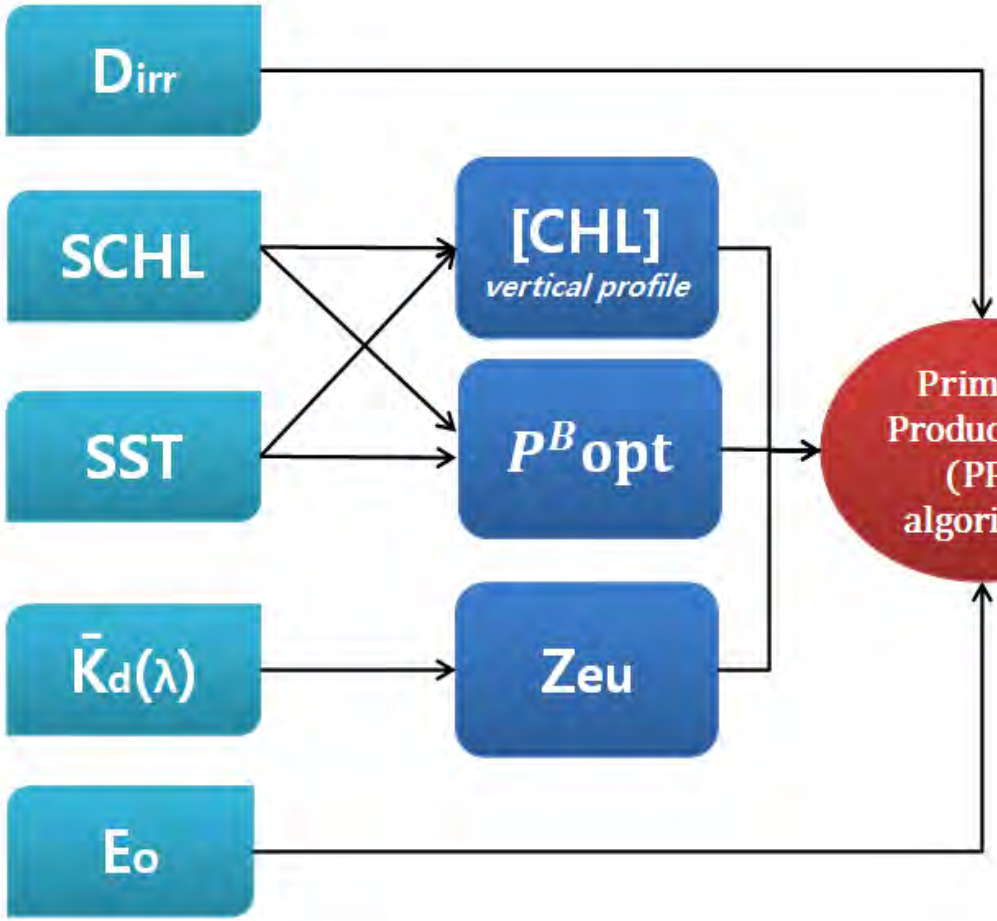

SW1999. 9. 27
Chl-a
40
36
32
28
120
124
128
132
136
(mg m)
64.00
10.00
1.00
0.10
0.01

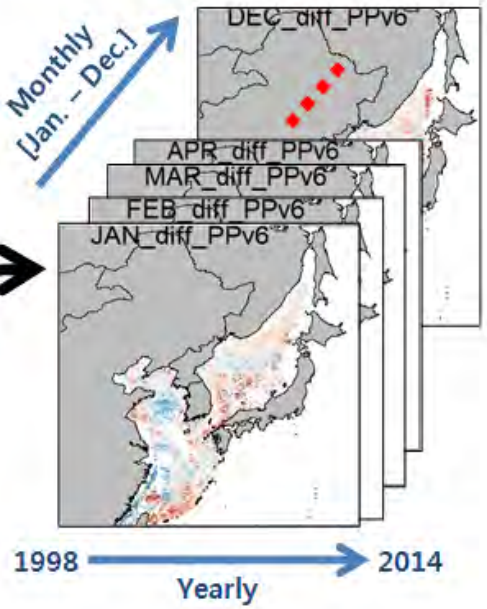
# Data and Methodology:

*Key variable in PP estimation*

**Satellite data**

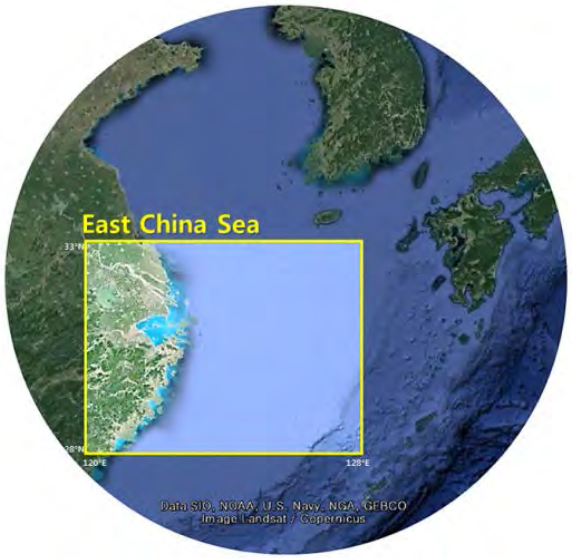
- *SeaWiFS &MODIS/aqua merged*
- *Resolution: 9 km*
- *Year:1998-2014*



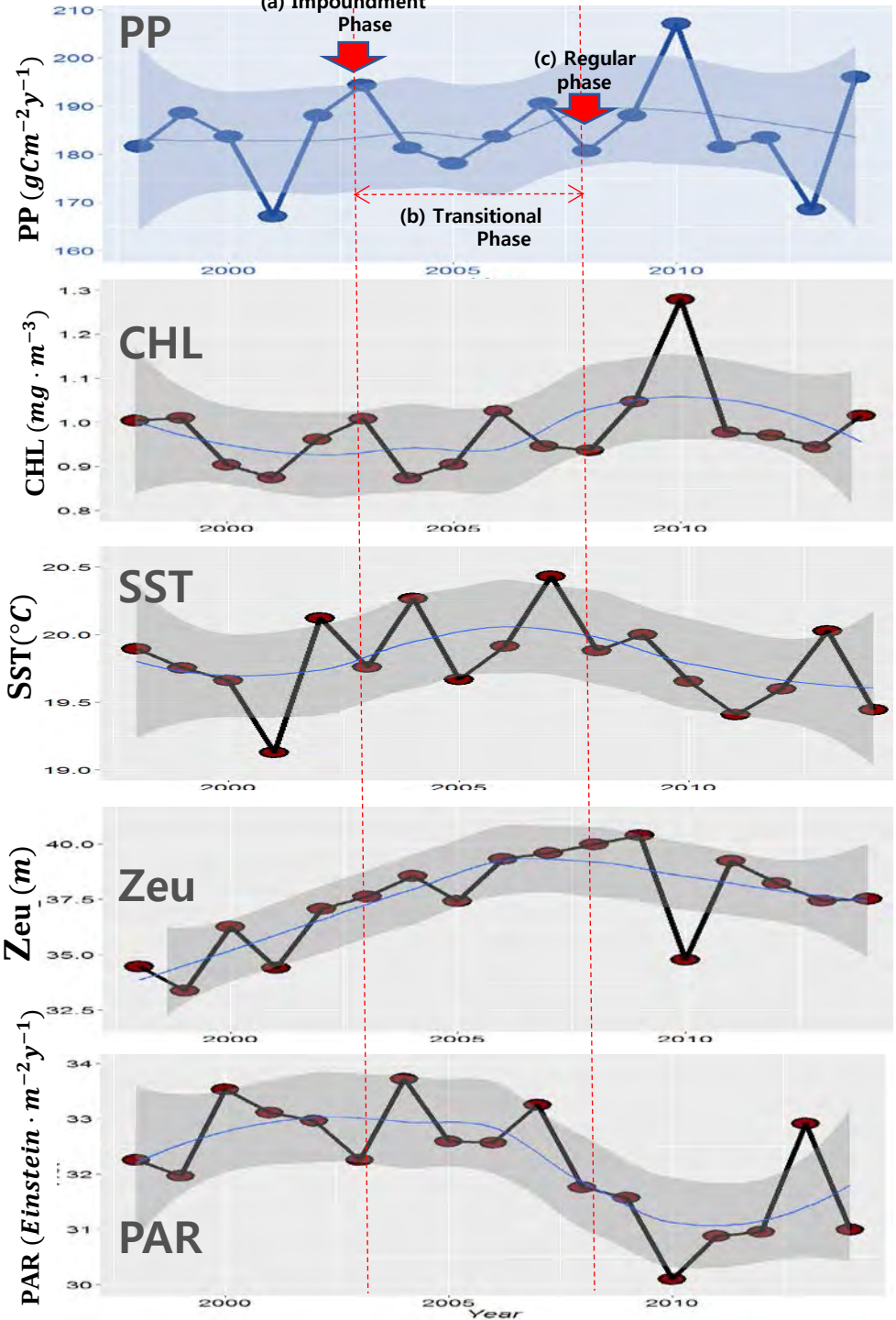

**Where,**

- **K(λ):** Attenuation coefficient of water body ($m^{-1}$)
- **SCHL:** Sea surface chlorophyll-a concentration ($mg \cdot m^{-3}$)
- **Zeu :** Euphotic depth ($m$)
- **$D_{irr}$ :** Photo-period ($hr$)
- **$P^B opt$**: Photosynthetic rate (mg·C($mg{\cdot}Chl^{-1})hr^{-1}$)
- **Eo:** PAR above the sea surface ($mol \cdot quanta \cdot m^{-2}$)
- **SST:** Sea surface temperature (°C)



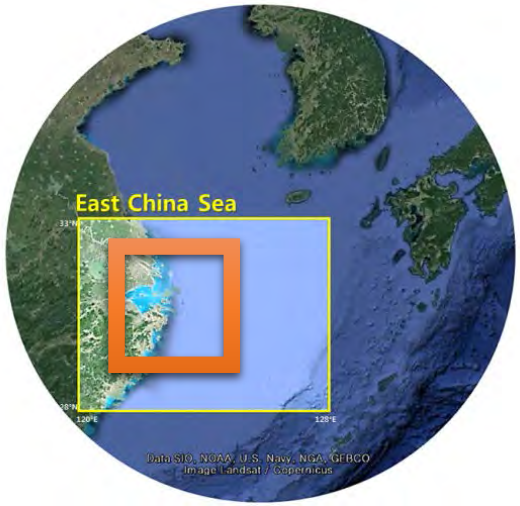

# East China Sea (1998-2014)

[28-33°N, 120-128°E]

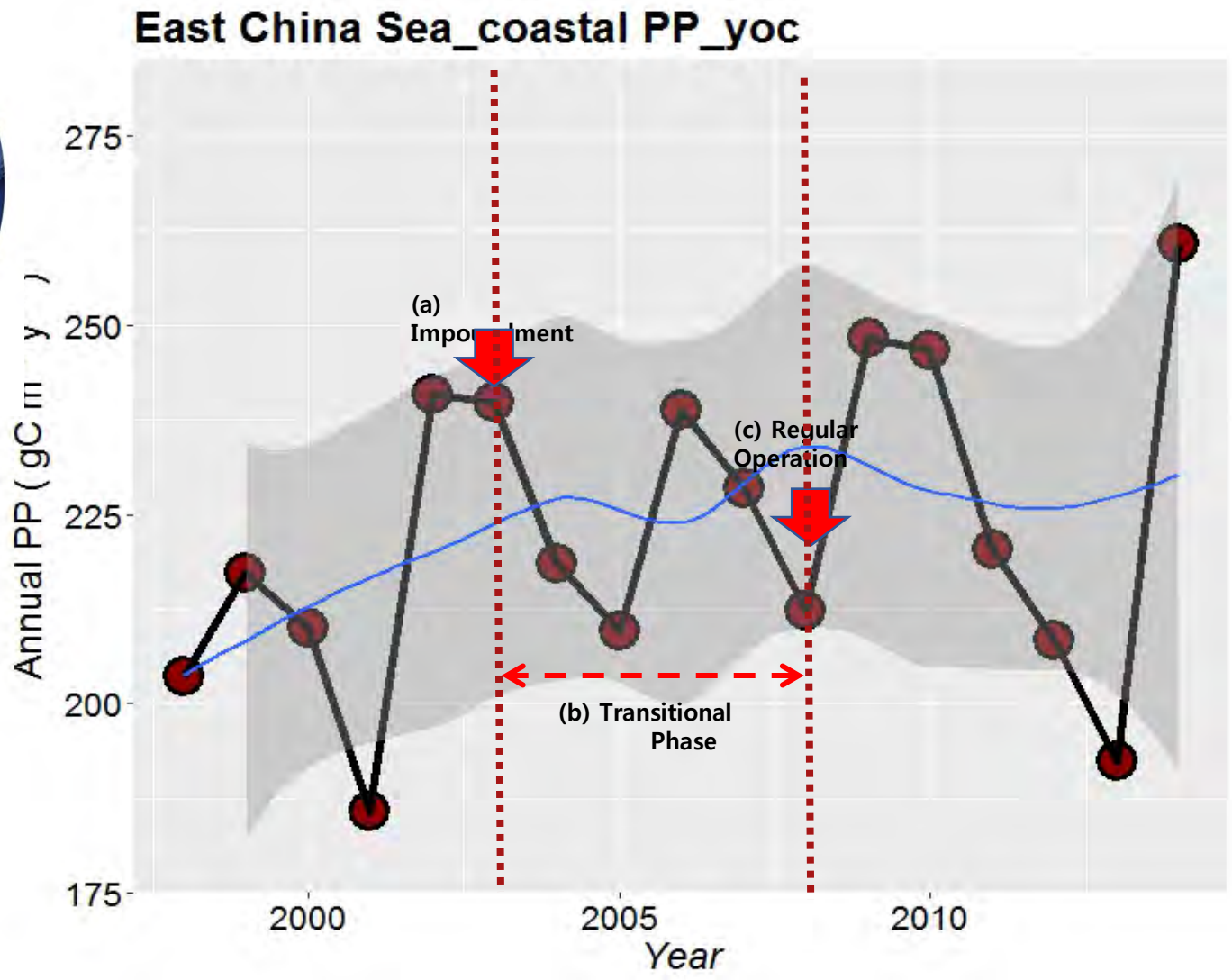


# Primary Productivity in the ECS

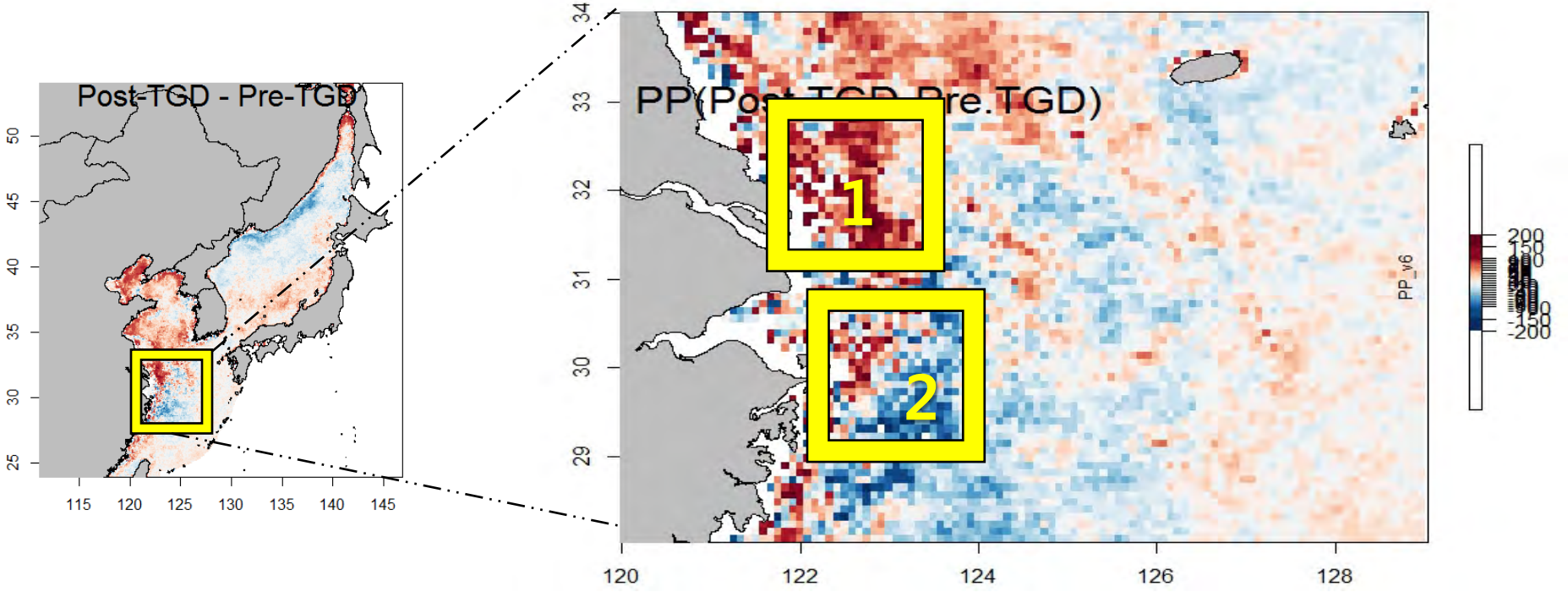
(*In the vicinity of Chanjiang River mouth*)

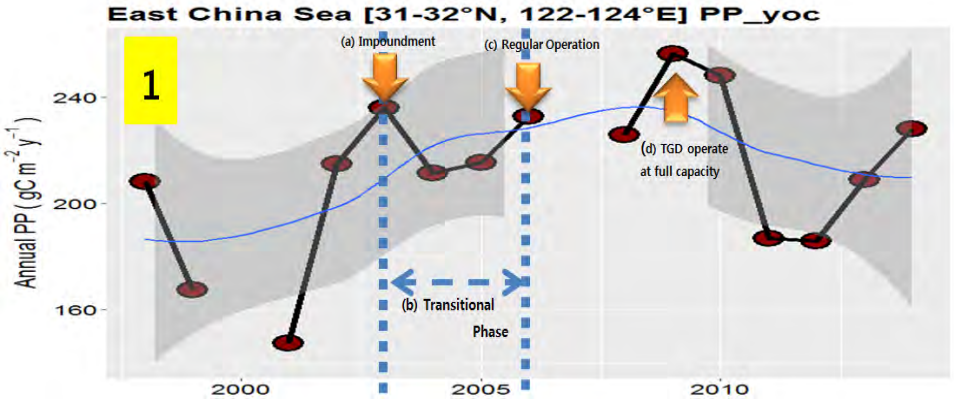


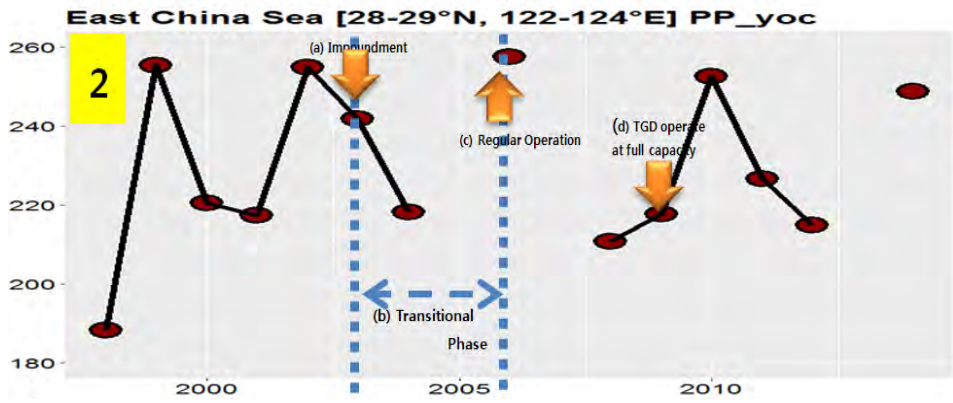

[29-32°N, 122-124°E]



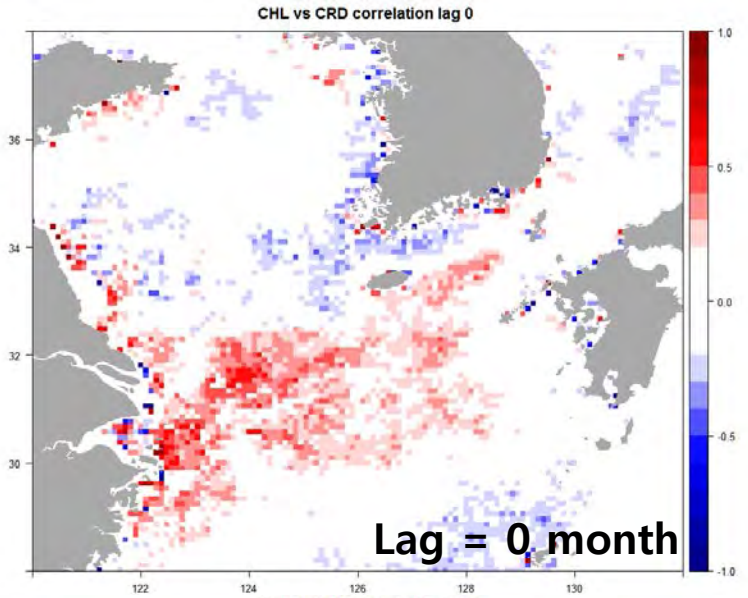
# Changes in PP: Pre-TGD vs. Post-TGD

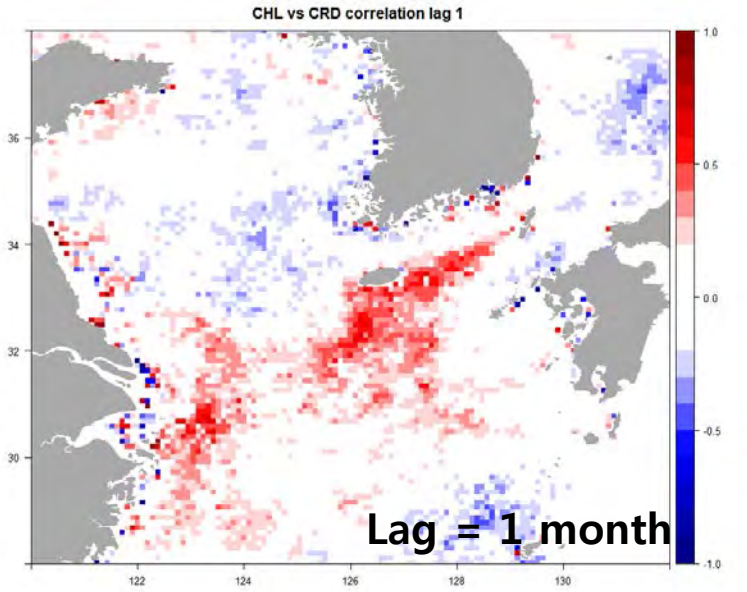


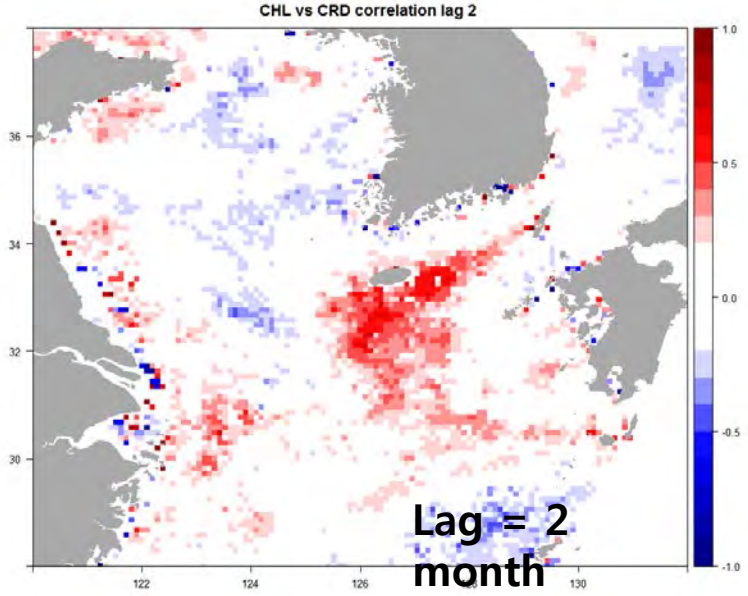



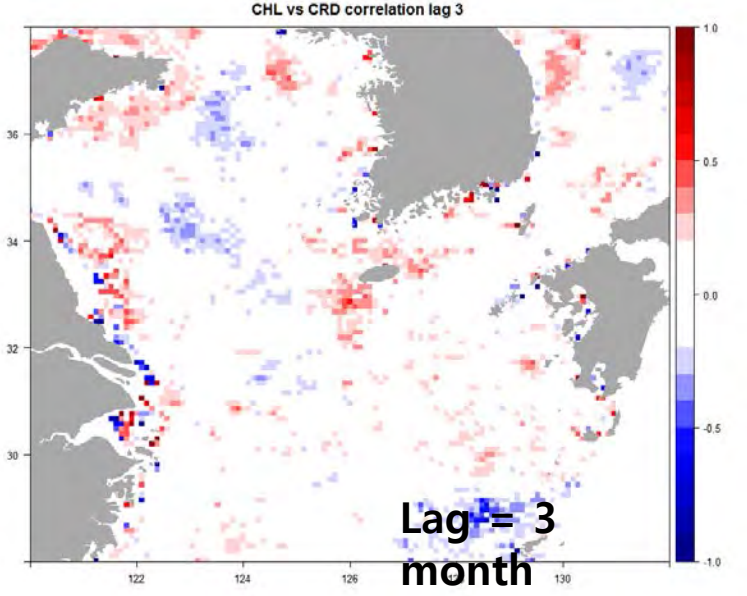



# Cross Correlation between the CRD and Chl-a anomalies (Pre-TGD:1998-2002)

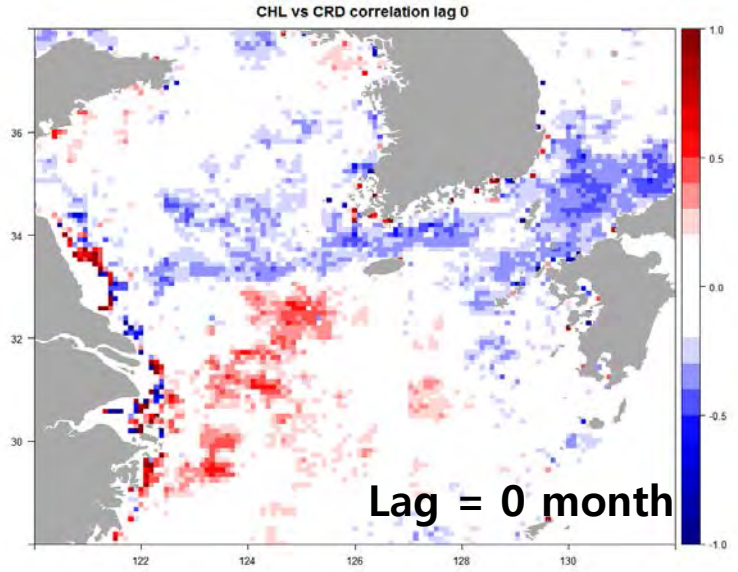


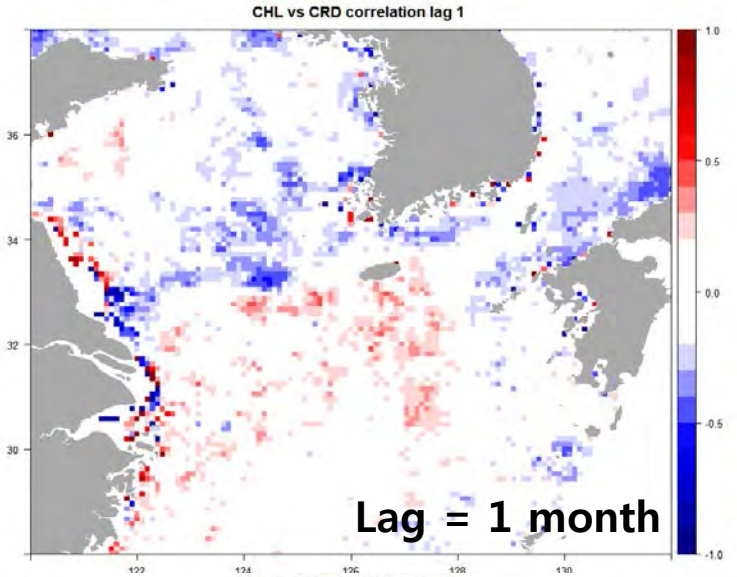



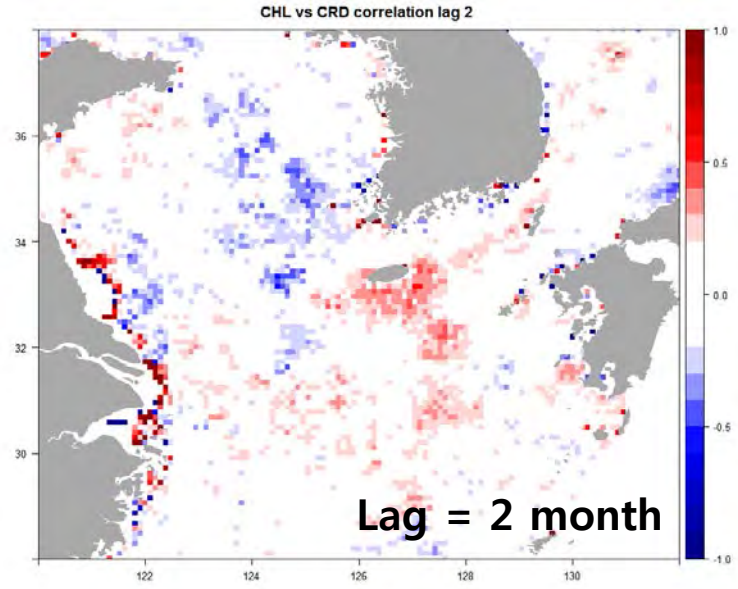



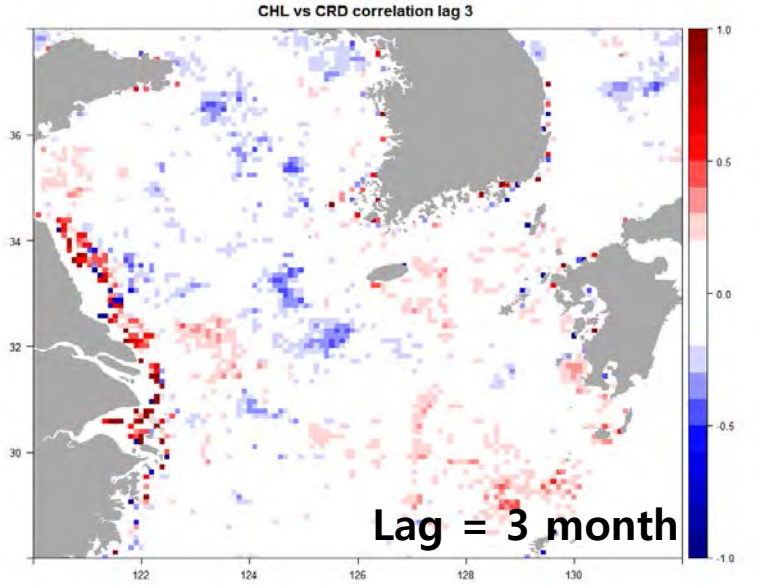



# Cross Correlation between the CRD and Chl-a anomalies (Post-TGD:2003-2007)



# Summary

1. Cross correlation between CRD and CHL anomalies showed the area of CRD influence was greatly reduced after the TGD operation.
2. However, time series of PP and CHL mean over the whole ECS did not show clear relationship with TGD operation.

*Thank you !*