Impact of Water-Sediment Regulation Scheme on seasonal and spatial variations of biogeochemical factors in the Yellow River Estuary

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Yellow River

- Second longest in China
- Highest sediment content in the world
- More than 1000Mt/yr delivered to the sea and about 1/3 of them deposited in the lower Yellow River

Suspended river
Background

Water-Sediment Regulation Scheme
Sampling and analysis

WSRS from 19th June to 12th July, 2013

10th - 14th April (spring), 22nd - 28th June (summer, early phase of WSRS), 25th - 31st July (late phase of WSRS) and 26th - 27th September (early autumn)

Nutrients, Chl-a, TSM, temperature, Salinity
Impacts on spatial variations

The residual current variations before and after the WSRS (Song et al., 2018)
Impacts on spatial variations

a: April  
b: June   
c: July   
d: September

~20 km

>40 km

e: April  
f: June   
g: July   
h: September

a: April  
b: June   
c: July   
d: September

TSM (mg/L)

<10  10-15  15-20  20-30  30-40  40-50  50-100  100-150  150-200  200-250  250-300  300-500  500-1000  1000-1500  >1500
Impacts on spatial variations

June

July

DON (μM)
Impacts on spatial variations

June

July

- Influence of various parameters on spatial variations
- Analysis of data for June and July
- Comparative study of April, June, July, and September

Chl-a, NH₄⁺, PO₄²⁻, DIN, TSM, SS, NO₂, Si(OH)₄/DIN, Si(OH)₄/PO₄²⁻, DON/DOP, DOP, ST, DIN/PO₄²⁻
Impacts on spatial variations
Impacts on seasonal variations

2013

http://www.yellowriver.gov.cn/nishagonggao/2013

2 months prior to the normal high flow season

Liu et al., 2011
Impacts on seasonal variations

- **NO$_3^-$**, DON, DRSi
- **NO$_2^-$**
- **NH$_4^+$**, DIP, DOP

**Concentration (mM)**

- **PO$_4^{3-}$**, DOP
- **NO$_3^-$, DON, DRSi**
- **NO$_2^-$**
- **NH$_4^+$**
Nutrients source and impact factors

- Fresh water discharge
- Anthropogenic sources
- Weather

Impact factors:
- Sediment absorption/desorption
- Nitrification
- Nutrient species:
  - DIP
  - DOP
  - DRSP
  - NO₃
  - DON
Impacts on Chla

a: April

b: June

c: July

d: September

Chl-a (µg/L)
The WSRS of the Yellow River in 2013 shifted the seasonal patterns of nutrients in the estuary, and promoted the spread of nutrients to the east of Bohai Sea, relieve the P and Si limitation of the Bohai Sea.

Nutrient species in the Yellow River estuary could be divided into two major groups depending on their differences in seasonal and spatial distributions related to different sources and impact factors.

The seasonal patterns of Chl-a remained almost unchanged. Turbidity and freshwater flushing instead of nutrients depressed the growth of phytoplankton.
THANKS