Water Quality Characteristics of Ions Originating from Sea water and Man-made in The lower Chao Phraya River, Thailand

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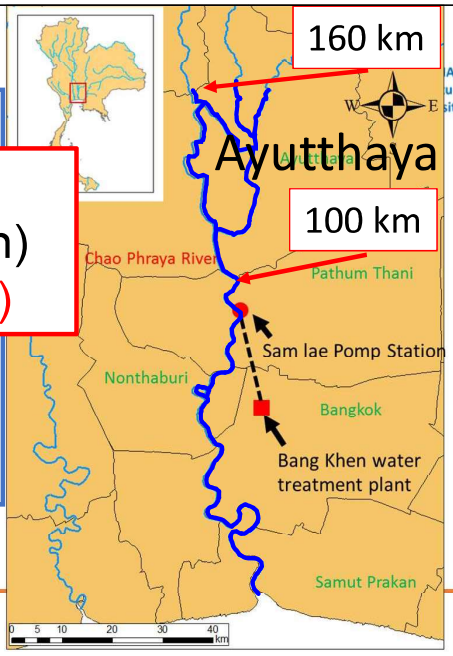
Introduction

- They have a Bang Khen water
  Brackish water area is 100～160 km (Ayutthaya province from the river mouth)
  Because of a gentle river slope(1/50000)
  province.
- Currently these facilities exist in the brackish water area.



Past researches

- Kobayashi(1958)

Water quality has been studied for long periods in Thailand; Kobayashi conducted water quality analyses in 1956 for 31 month l y , constituting the most comprehensive study of Thailand's water quality to date.

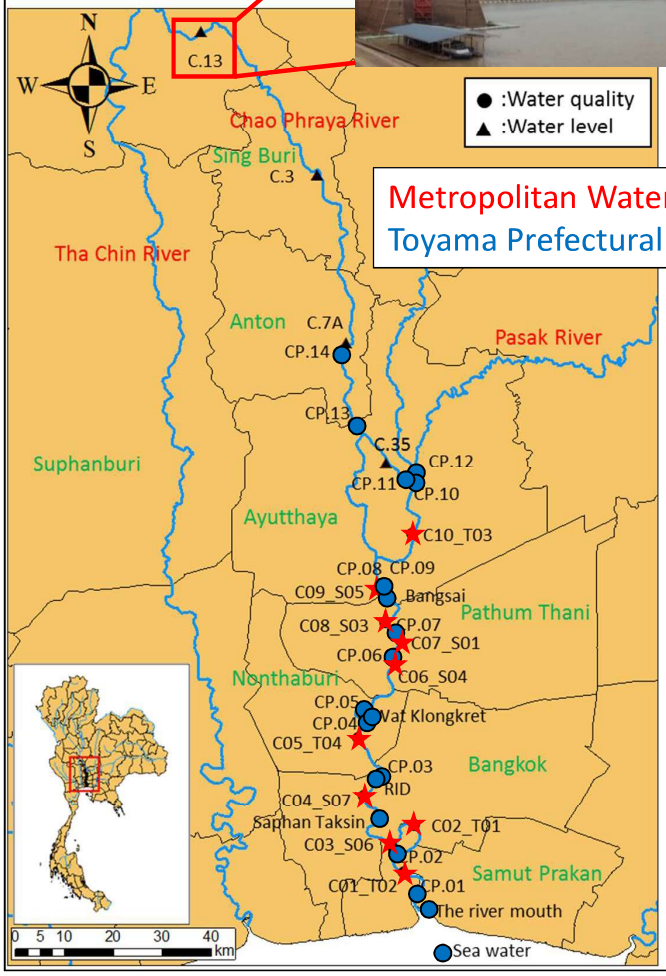
- Wongsa(2015)

Sea-level rise due to climate change has increased salinity intrusion in the Chao Phraya River.

Purpose of this study

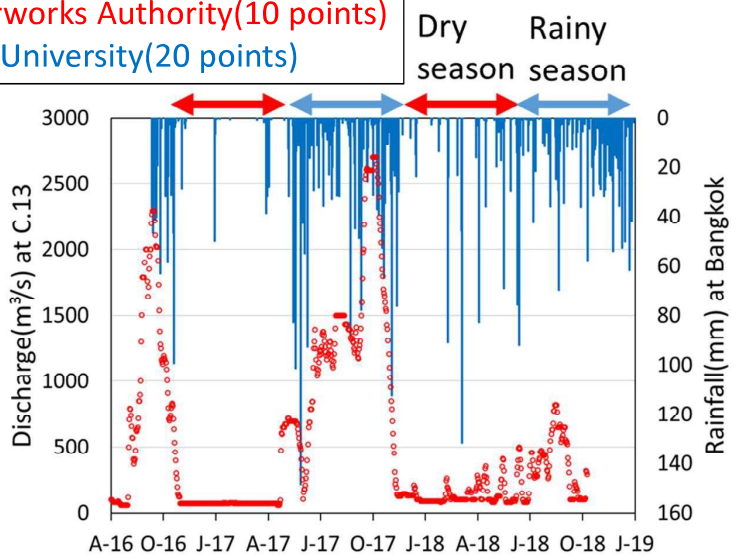
- Research on ions originating from sea water and man-made has not yet been conducted.
- Seasonal and longitudinal change of electric conductivity, ions originating from sea water (Na^+, K^+, Mg^{2+}, Cl^-, Ca^{2+}, SO_4^{2-} and HCO_3^-) and man-made (NO_3^-) at the surface and the riverbed water by field observations during the rainy season and the dry season for two years.

Study area



Metropolitan Waterworks Authority(10 points)
Toyama Prefectural University(20 points)

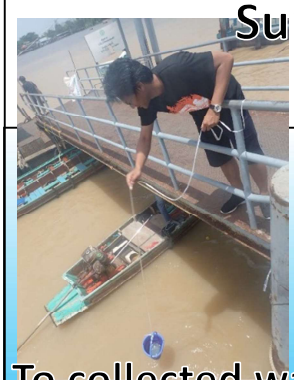
During, rainy season Chao Phraya Dam has large discharge volume, while in the dry season it release a low level of discharge.



We conducted observation at 30 points in Nov.2016, Mar.2017, Aug.2017, Nov.2017, Apr.2018 and Jun.2018

Water quality observation and sampling

Surface layer

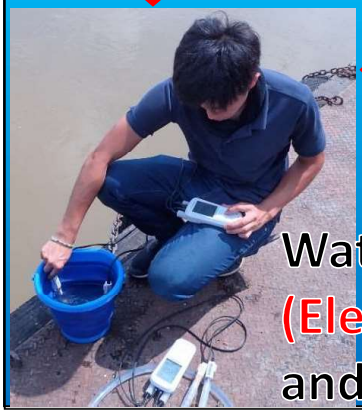


To collected water by a bucket

Riverbed layer

To Measured the depth by Ultrasonic waves

To pumped up water by pump



Water quality field measurement
(Electric conductivity, pH, water temperature)
and sampling

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Water quality analysis methods

Electric conductivity(EC)

Seawater origin

Na^+ K^+ Mg^{2+} Cl^- Ca^{2+} SO_4^{2-} HCO_3^-

Human origin

NO_3^-

Atmosphere

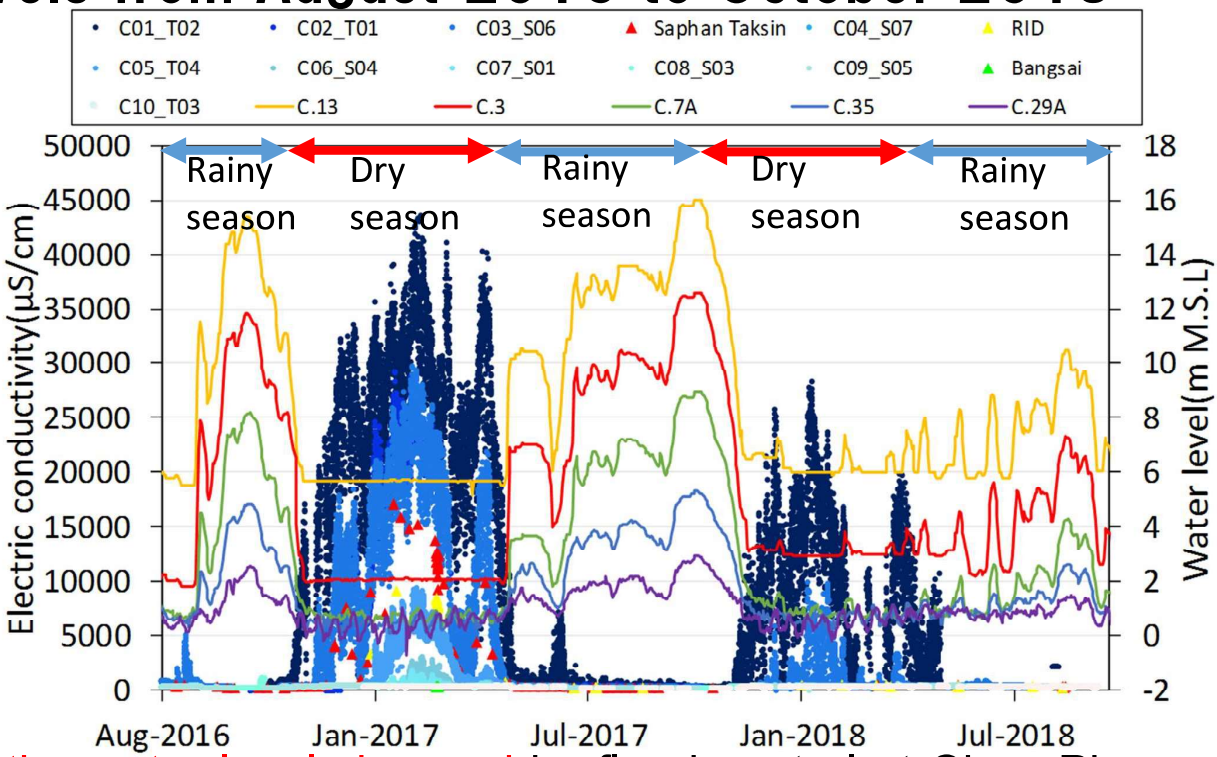
Urination

Fertilizer

Ion chromatograph

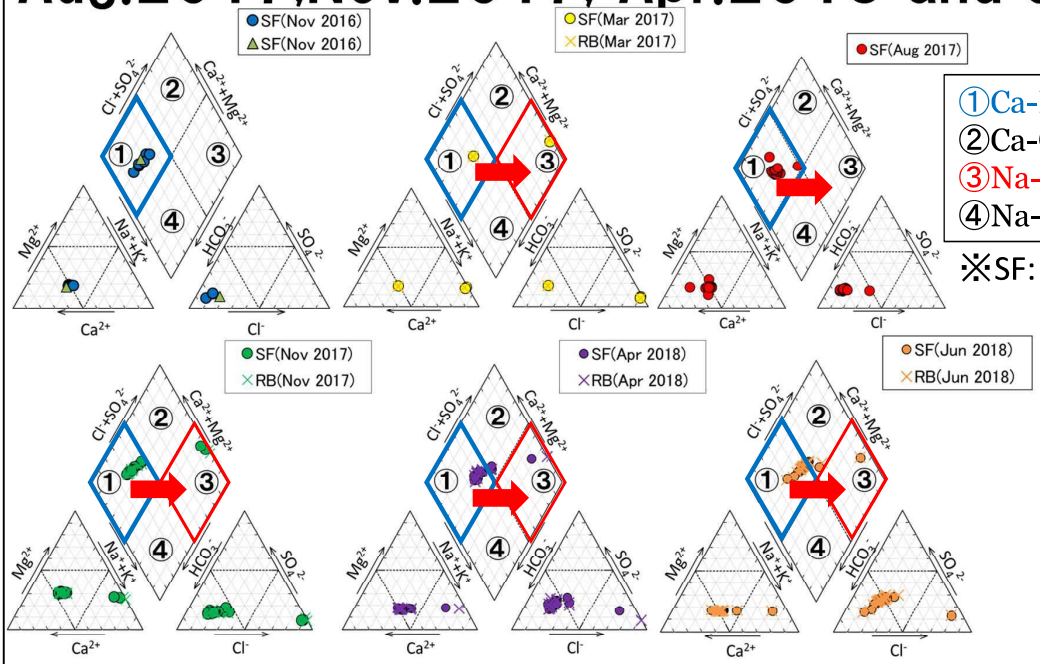
Alkalinity titration

Time series of electric conductivity and water levels from August 2016 to October 2018



As the water level changed by flood control at Chao Phraya Dam between rainy and dry season, there was a characteristic seasonal change in electric conductivity throughout the year. 7

Trilinear diagram in Nov.2016, Mar.2017, Aug.2017,Nov.2017, Apr.2018 and Jun.2018

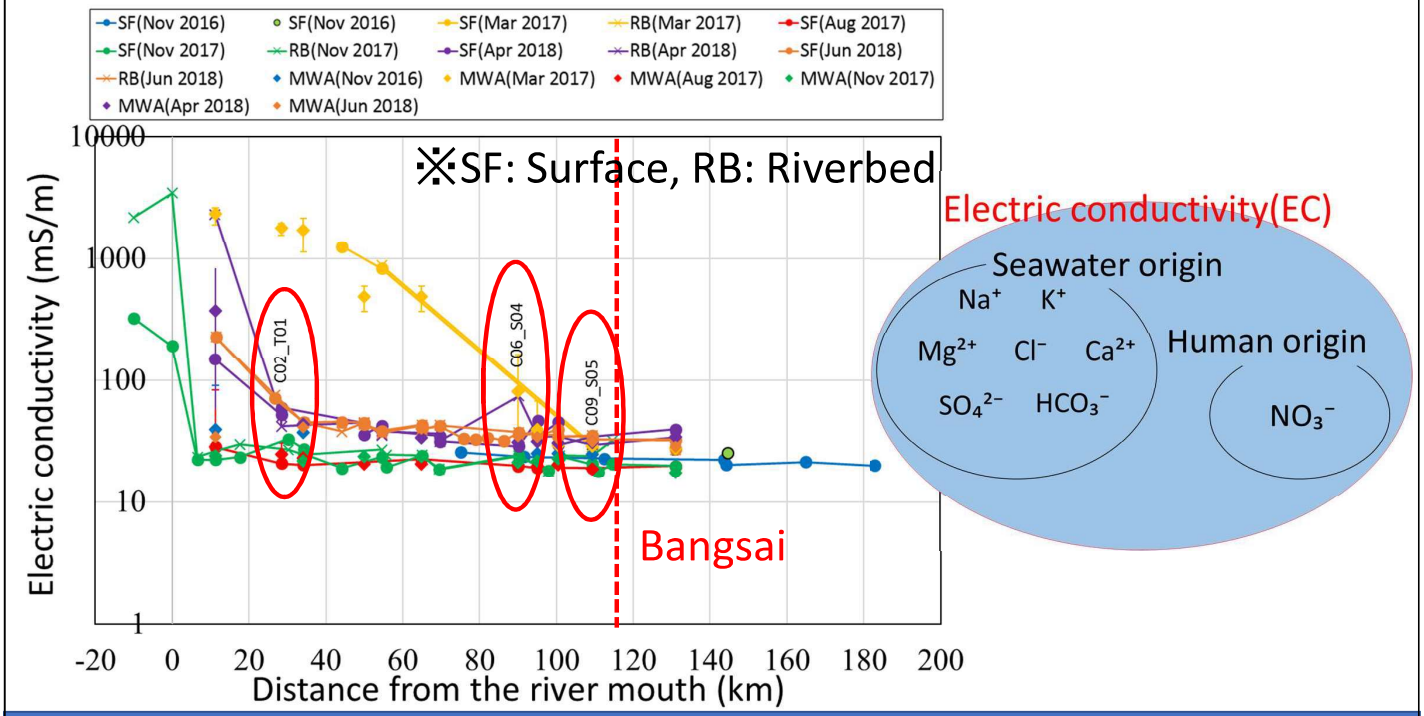


①Ca-HCO_3(River water)
②Ca-Cl・Ca-SO_4(Fossil water)
③Na-Cl・Na-SO_4(Sea water)
④Na-HCO_3(Stagnant water)

※SF: Surface, RB: Riverbed

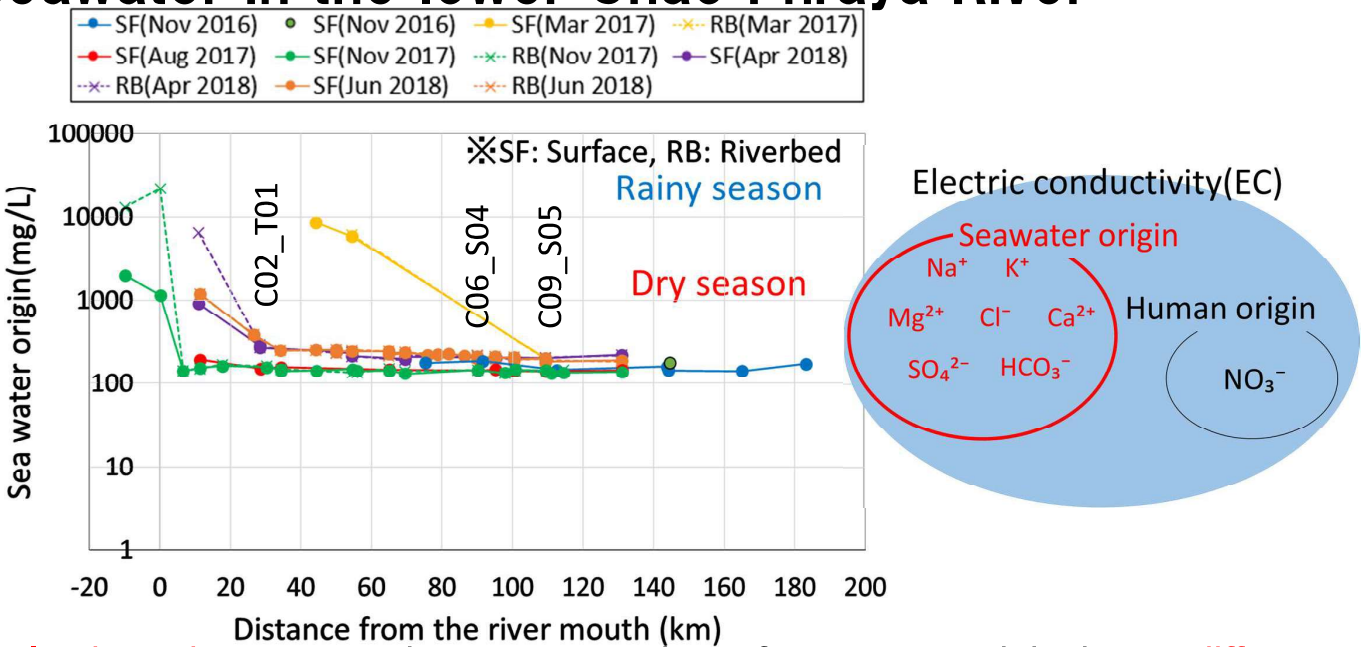
- Most of the upstream points show ①Ca-HCO_3 is characteristic of river water.
- Several of the downstream points show ③Na-Cl・Na-SO_4 is characteristic of sea water.
- As moving from upstream to downstream, the main ions have longitudinal features that change from ②Ca-Cl・Na-SO_4 to ①Ca-HCO_3. 8

Longitudinal change of electric conductivity in the lower Chao Phraya River



We focused on ions originating from seawater and man-made origin

Longitudinal change of ions originating from seawater in the lower Chao Phraya River



- In the rainy season ion concentration of seawater origin is no difference between surface and riverbed layer at a point 10 km more away from the river mouth.
- In the dry season the ion concentration of seawater origin is no difference between surface and riverbed layer at a point 20 km more away from the river mouth.

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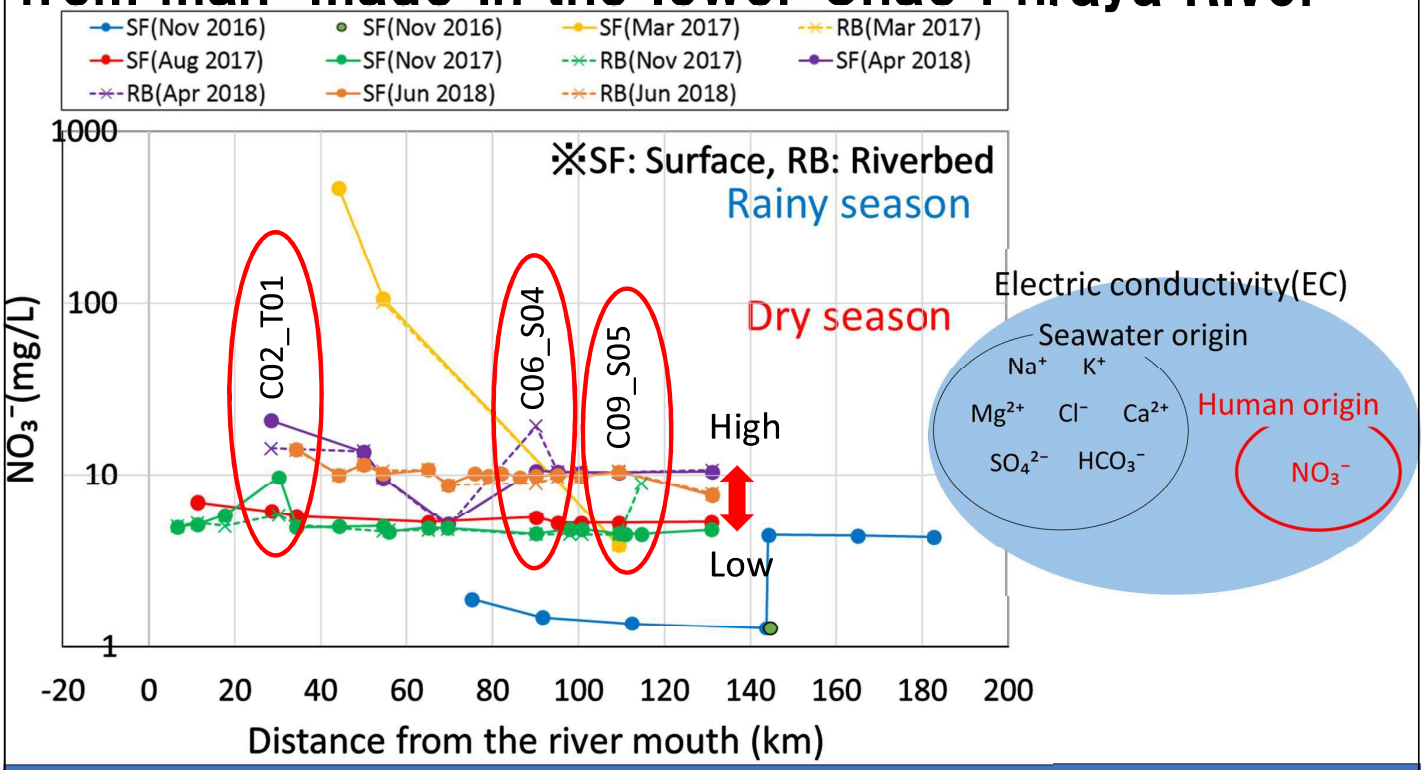
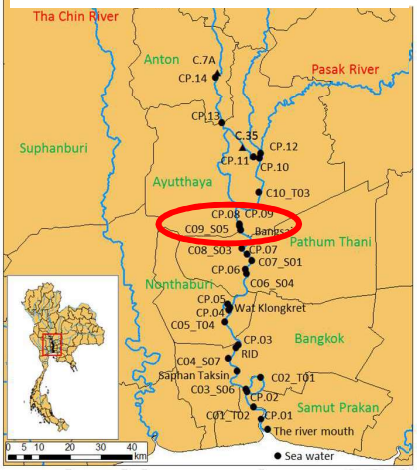
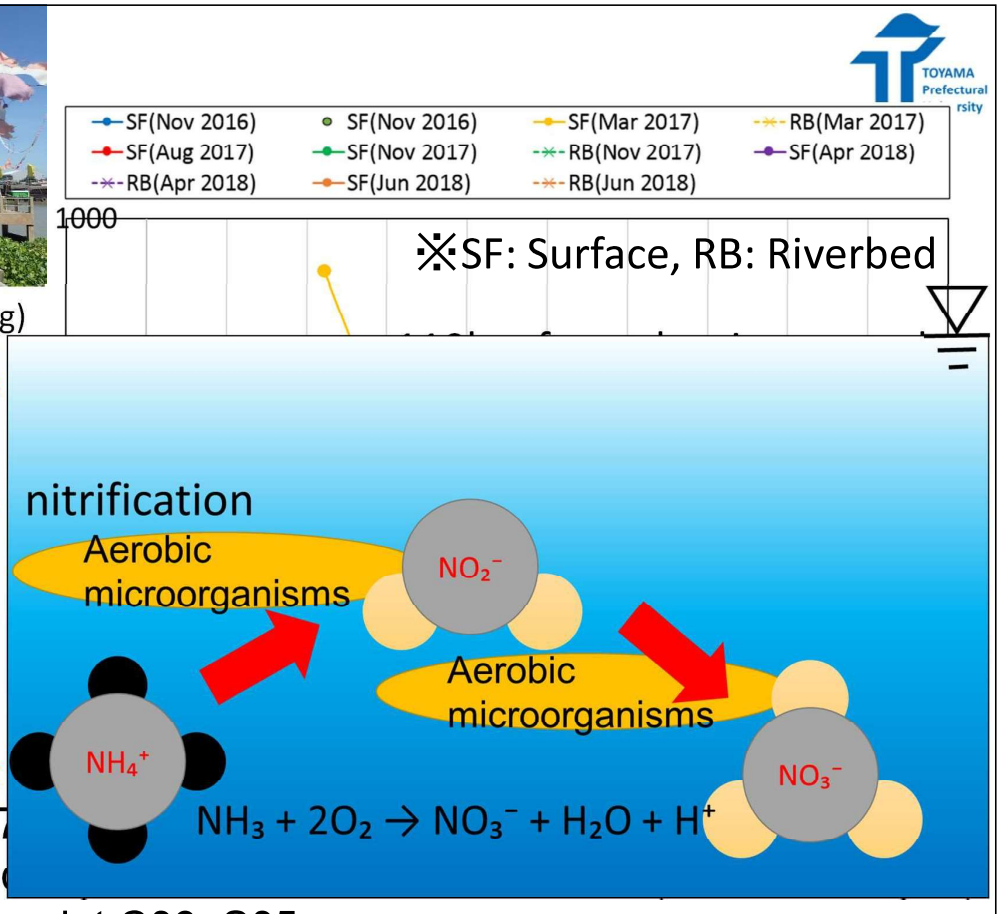
Longitudinal change of ions (NO_3^-) originating from man-made in the lower Chao Phraya River



Difference between surface and riverbed layer at three points.

C09_S05(Tambon Pho Taeng)





- In November 201
  layer water showe
  upstream from the point C09_S05.
- This is thought to be due to the nitrification effect caused by aerobic microorganisms.

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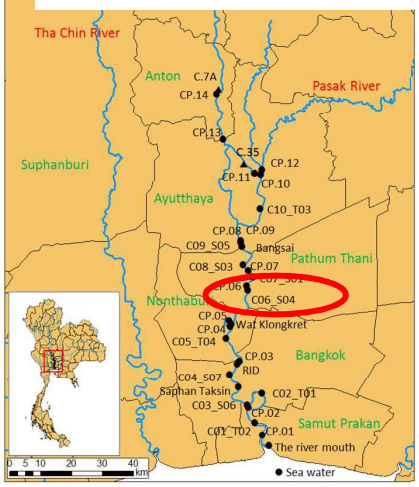
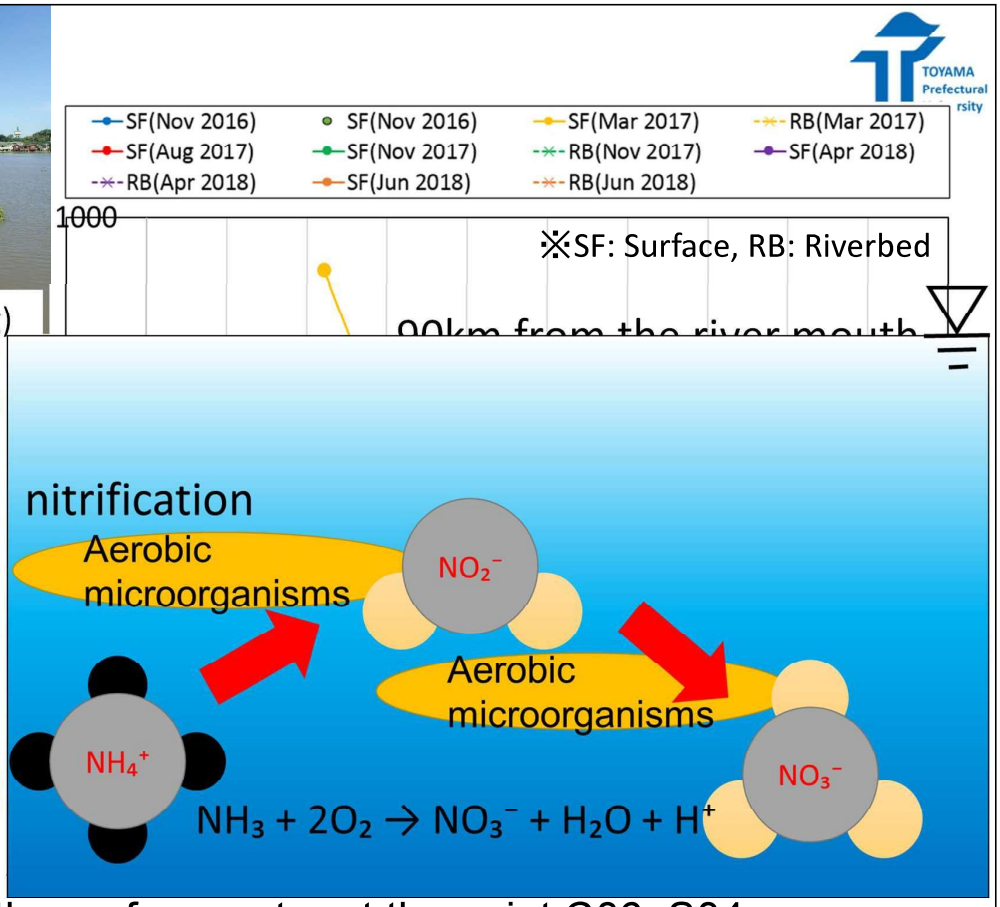
C06_S04 (Ban Cham Rang)





- In April 2018 (dry higher value than the surface water at the point C06_S04.
- This is thought nitrification by aerobic microorganisms or influence of nitrogen oxides by use of automobiles.

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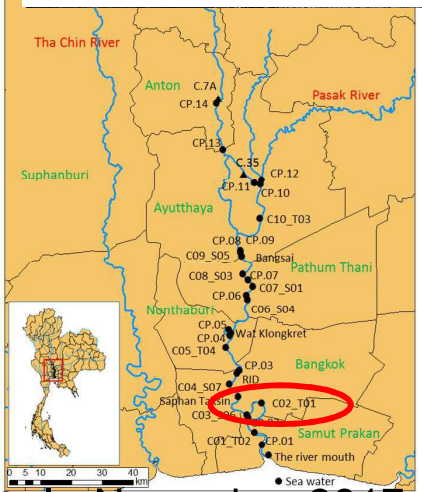
C02_T01 (Khlong Toei Port)



- In November 2017 (e
NO_3^- in the surface
layer water at the poi
- This is thought denitrification reaction caused by anaerobic microorganisms or nitrogen oxide was generated and flowed by ships.

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Conclusions

- The electric conductivity varied between seasons in a characteristic manner between the rainy and dry season.

- The sea water enters all layers of the river, as indicated by the fact that the concentrations of ions originating from sea water were the same at both the surface and the riverbed layer.

- The concentrate of NO_3^- varied between seasons in a characteristic manner between the rainy and dry season and the location features of the riverbed layer and the surface layer water could be confirmed according to the location.

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