Atmospheric deposition promote DOP utilization by phytoplankton in the marginal seas of Pacific Ocean

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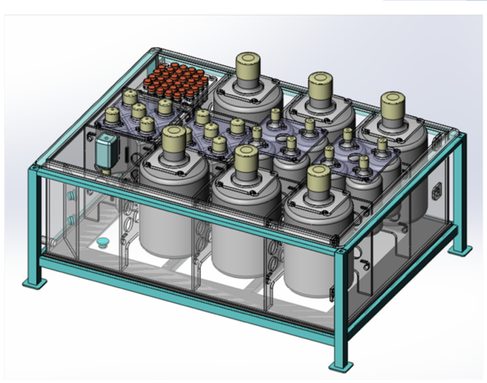
Introduction

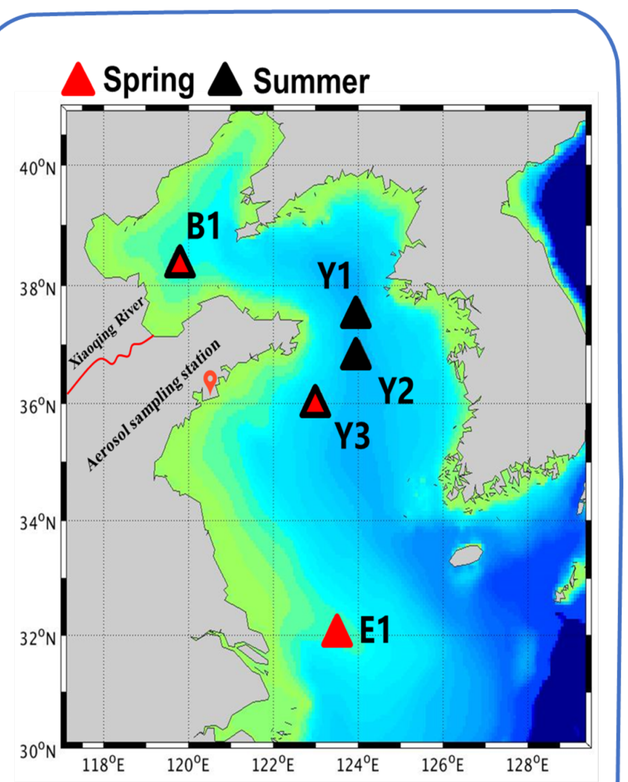
- Vulnerable to atmospheric deposition and riverine input, P limitation in the marginal seas of Northwest Pacific Ocean is getting worse in recent years.
- Studies have shown that phytoplankton can alleviate P limitation through utilize DOP;
- Impact of atmospheric deposition on DOP utilization by phytoplankton in marginal seas and its mechanism is unknown.

Methodology

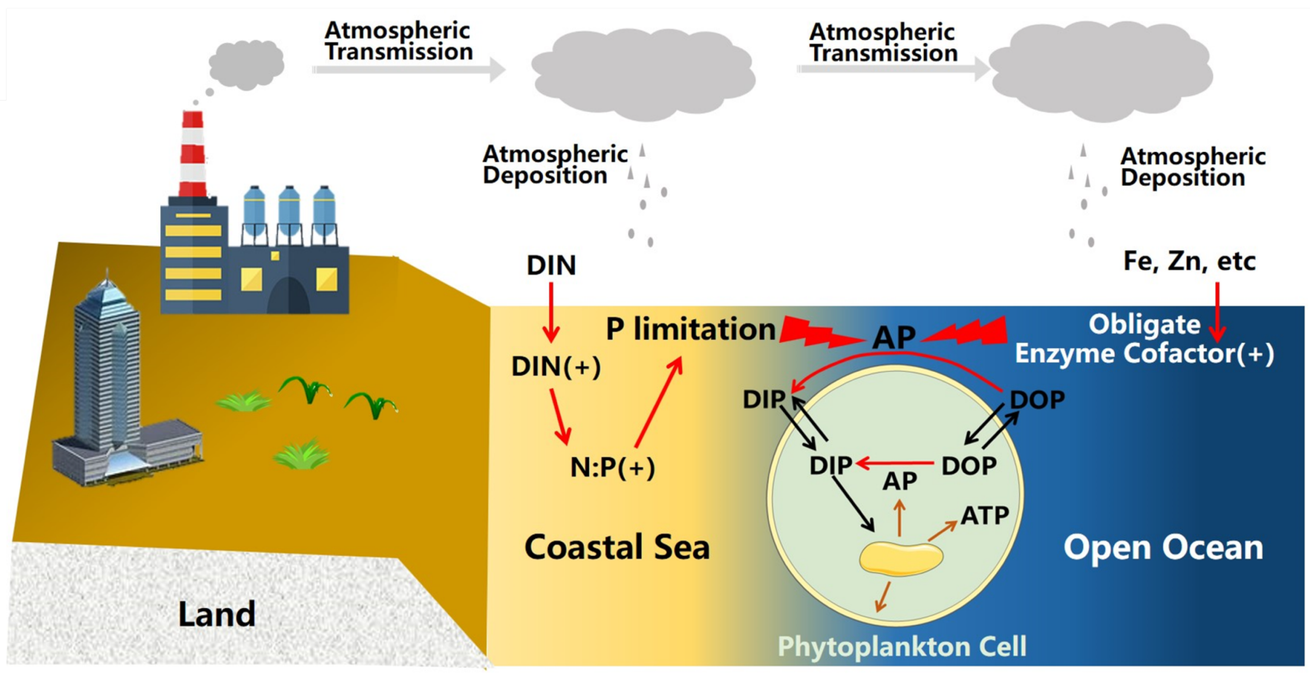
Seven on-board microcosm experiments were carried out in the marginal seas of Northwest Pacific Ocean in 2018 and 2019.

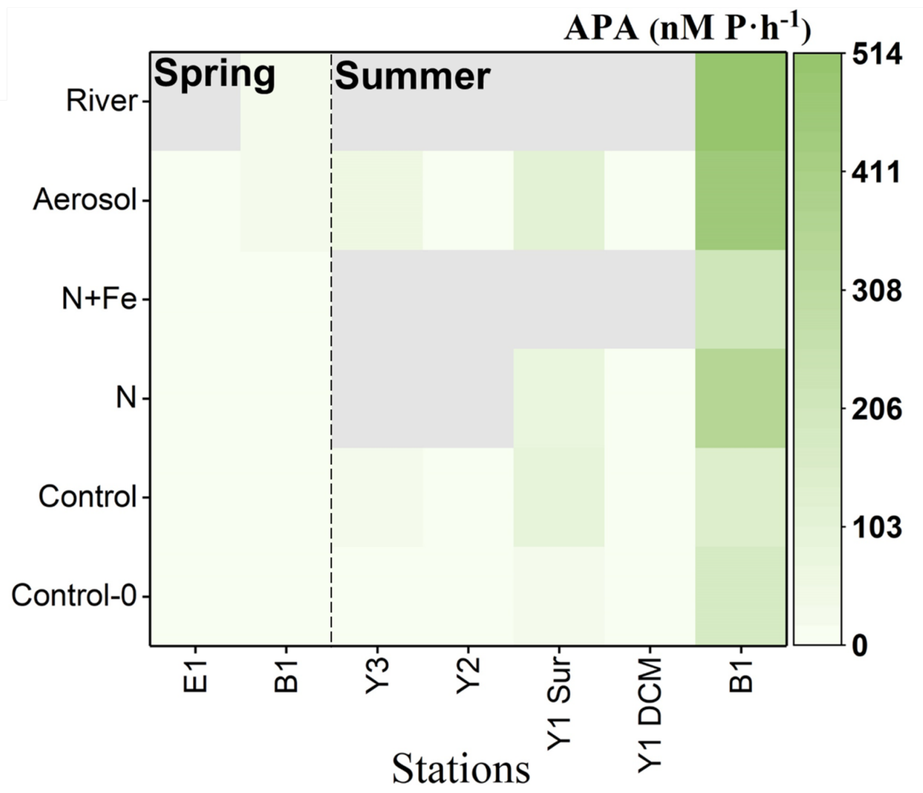
Chl-a, nutrients, DOP, and alkaline phosphatase activity (APA) were measured





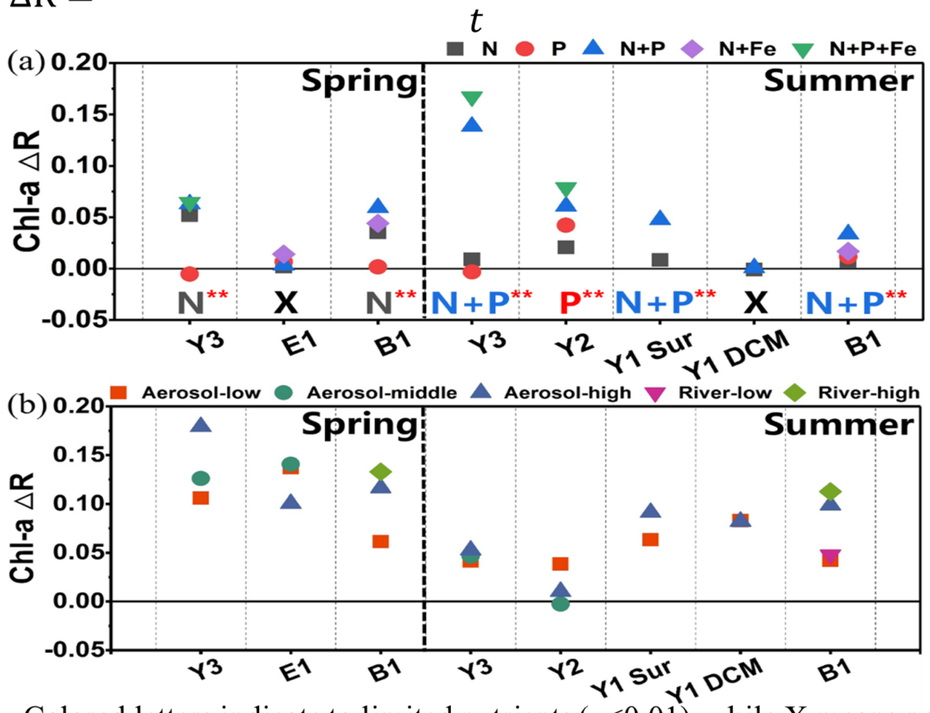
Results and Discussion





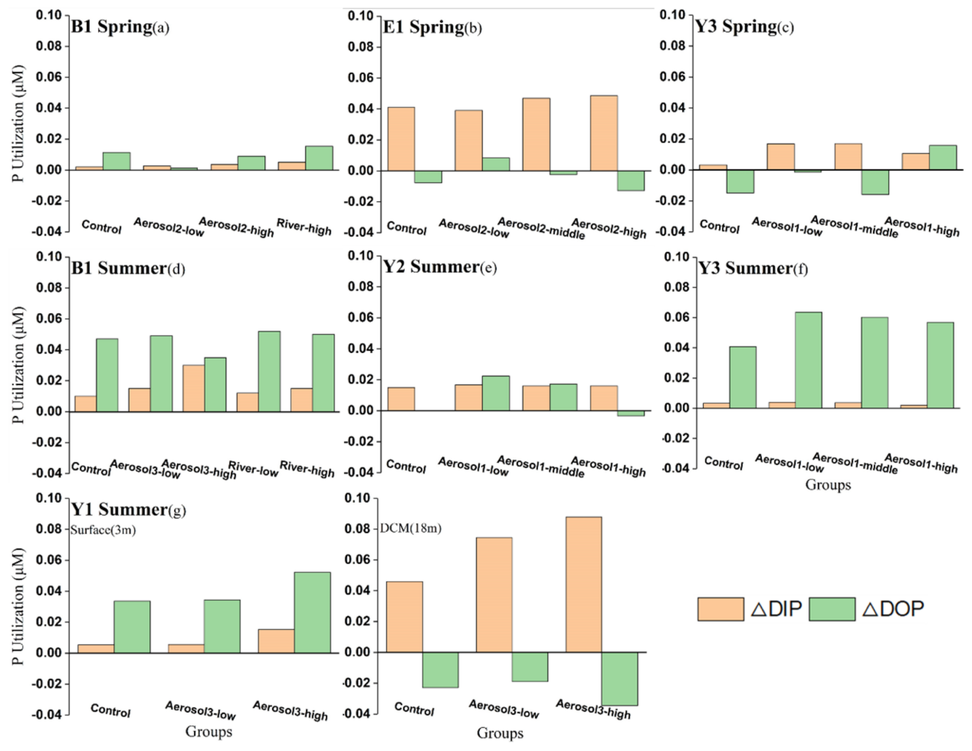
Ⅰ. Response of Chl-a to nutrients and atmospheric aerosol enrichment

$$\Delta R = \frac{\log_{10}(\text{avg Chl } a \text{ treatment}/\text{avg Chl } a \text{ control})}{t}$$



Colored letters indicate to limited nutrients (p<0.01), while X means no significant limit nutrient.

Ⅱ. DOP usage amount by phytoplankton



ΔDIP and ΔDOP represent the reduction of DIP and DOP concentration during incubation, respectively

Conclusions

- Atmospheric deposition can promote phytoplankton growth in the marginal seas of Northwest Pacific Ocean through input N in spring, and through promote DOP utilization by phytoplankton in summer;
- Atmospheric deposition can induce phytoplankton to utilize DOP and make it surpassed DIP to become the main P nutrient, or further promote DOP utilization where DOP is already the dominate P nutrient;
- Atmospheric deposition can promote DOP utilization mainly through input obligate enzyme cofactor (Fe, Zn, Al. etc) in the open ocean, while mainly through input a lot of DIN which can cause severe P limitation in the marginal seas.