The Preliminary Study on Effect of Asian Dust on Phytoplankton Community in Yellow Sea in spring

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Abstract: Asian Dust is a profound topic of the climatic and environmental studies. Asian dust may be involved in climatic feedback mechanisms with its biogeochemical effects. In order to study the effect of dust on phytoplankton community in Yellow Sea qualitatively, two research surveys were carried out in Yellow Sea just after dust storm passed in 2006. According to the study on the flux of dust aerosol and the dissolved inorganic nitrogen composition of aerosol, it is suggested that the effect of dust on North Yellow Sea was higher than that on South Yellow Sea. The preliminary results showed that the Asian dust could stimulate the growth of phytoplankton in Yellow Sea in spring. It was found out that in North Yellow Sea where Asian dust passed, there was a high value area of phytoplankton abundance. Dust is widely recognized as a major source of Fe. Marine phytoplankton may be affected by the nutrient-rich dust particles deposited into the oceans through complicated processes.

1 Background and Introduction

The transport from atmosphere is a more important pathway than that from rivers for certain elements and compounds in the remote ocean and coastal water. The desert and those arid/semi-arid areas in the northwest of China and the Loess Plateau are the sources of those aerosols over the Pacific. Atmospheric iron can stimulate the productivity in sea water. The dust storms must now be seen as repeated sources of pollution elements as well as soil elements to Yellow Sea and, farther out, to the North Pacific Ocean and even to the USA. The long-range transport of aerosols, especially the dust storm, from China and the positive feedbacks of iron in atmosphere might be one of the important mechanisms that would affect the primary productivity in sea water. It can be seen clearly that dry deposition such as dust storms contributes large amounts of nitrogen to watersheds. In some areas the amount of nitrogen in dry deposition is as large as that in wet deposition or precipitation in spring. To improve the understanding of impacts of nutrient-rich dust particles on marine ecology system, the feedback of marine ecosystem to dust deposition two research surveys were done in Yellow Sea in spring in 2005 and 2006.

2 Results and discussion

2.1 The study on the flux of dust aerosol and the dissolved inorganic nitrogen composition of aerosol.

From our study in 2002 dust aerosol flux to the sea in Yellow Sea was highest, over1600mg/m^2/5d (Fig.1 and Table 1). The flux in South China Sea was lowest , only about 2 % of that in Yellow Sea. And the effect of dust aerosol on Yellow Sea was continuous in all spring. The single dust storm could increase the concentration of dust aerosol in sea atmosphere in Yellow Sea. The particles concentration in sea atmosphere in Yellow Sea in 2006 was higher than that of in 2005. The concentration of nitrate and ammonium salt had the similar trend. Nitrate and ammonium was 2~10% of total particle concentration and the main contributor of inorganic nitrogen(Table 2).

Fig. 1 Dust depositon flux between 18th-22th in March in 2002

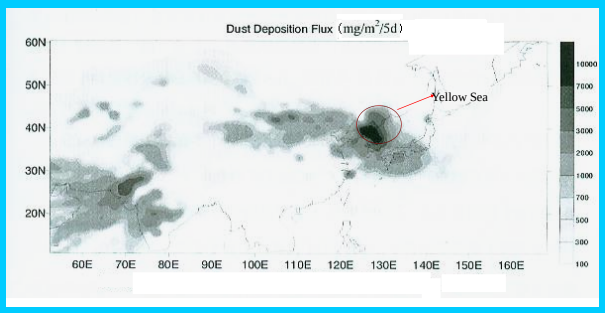


Table 1 Dust depositon flux between 18th-22th in March in 2002

Sea area	Bohai Sea	Yellow Sea	East China Sea	South China Sea
Area (10^4km^2)	8	40	75	356
Dry deposition Flux (mg/m^2/5d)	615.31	1669.13	235.49	38.56
Wet deposition Flux(mg/m^2/5d)	172.66	639.18	153.95	7.81
Total deposition Flux(mg/m^2/5d)	787.96	2308.30	389.43	46.37

Table 2 The concentraion of inorganic nitrogen in atmosphere in Yellow Sea

	Concentration of particles (ug/m^3)	Nitrate (ug/m^3)	Ammonium salt (ug/m^3)
2005 March	80.00~130.00	4.00~11.00	5.00~10.00
2006 April	44.00~300.00	2.00~29.00	3.00~13.00

2.2 The effect of dust on the phytoplankton growth

From satellite cloud pictures it showed that North Yellow Sea was more affected by dust storm in 2006 and 2007(Fig.2 and 3). Phytoplankton abundance in North Yellow Sea in 2005 and 2006 was larger than that in other sea area in Yellow Sea. It may be relative to continual occurrence of dust storm in spring in recent several years (Fig.4). The patchiness distribution pattern of phytoplankton is very clear in Yellow Sea. The high value areas were situated in coastal water of Liaoning Province, coastal water near Qingdao and from Dasha Fishing Ground to the north of Changjiang Estuary. During the research survey in 2006 it just met two dust storms (Fig.2). The preliminary results showed that the dust may be one of main factors that could stimulate the growth of phytoplankton in Yellow Sea, especially in North Yellow Sea. Further study must be done to approve the results.

Fig. 2 The satellite cloud pictures of two dust storms in research survey in April in 2006

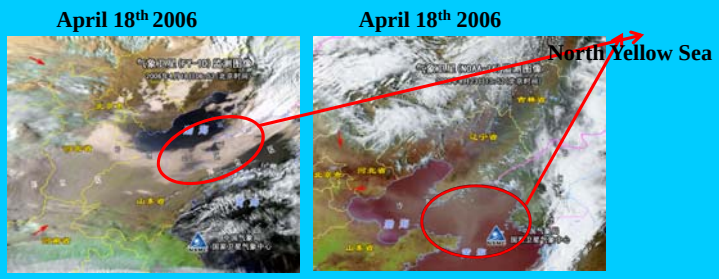


Fig. 3 The satellite cloud picture of two dust storms in research survey in May in 2007

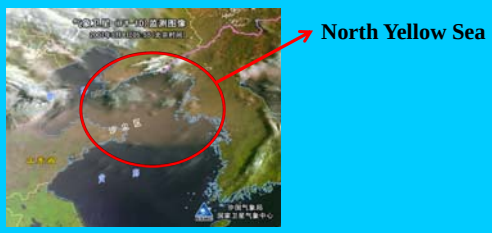
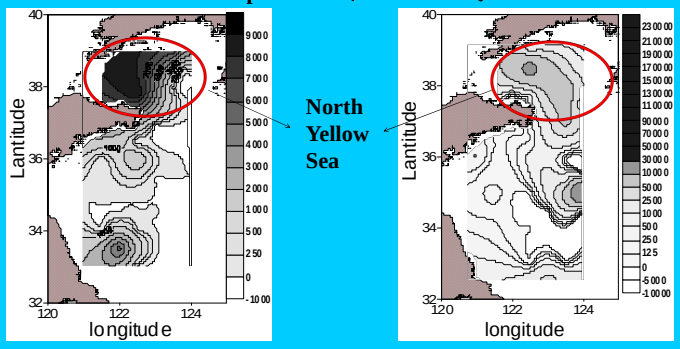


Fig. 4 Spatial distribution of phytoplankton abundance in March 2005 and April 2006 （×10^{4}cell/m^3）



3 Conclusion

The preliminary results showed that the Asian dust could stimulate the growth of phytoplankton in Yellow Sea in spring. It was found out that in North Yellow Sea where Asian dust passed, there was a high value area of phytoplankton abundance.