台灣北部海域大氣中溶解性無機氮與無機磷之通量研究

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摘要

The relative studies have reported that the water soluble ions transported from the land to the ocean via the atmosphere are one of the main factors which affect the biogeochemical process in the upper ocean. Water soluble ion cycling in the upper ocean is, however, poorly understood (Chen et al., 2006). Therefore, this information is extremely valuable to assist biogeochemical cycle for the East China Sea.

The sampling site was located on the roof of a building at the National Taiwan Ocean University (25.09' N; 121.46' E) looking over the East China Sea. The roof is 25 m height from ground level (57 m from sea level) and 40 m away from any main highway. A high volume air sampling systems (TE-5170; TISCH) was used to collect total suspended particle (TSP). The sampling period lasted from January to December 2005. In total, 154 TSP samples were collected during the sampling period. In this study, dissolved inorganic nitrogen (DIN) which was the sum of nitrate, nitrate and ammonium, and dissolved inorganic phosphorus (phosphate) were analyzed by using colorimetric method.

The overall mean DIN and DIP concentration in air during the 2005 study period were 236±212 nmol m^{-3} and 0.56±0.56 nmol m^{-3}, respectively. Due to the changing of oceanic and continental source strengths, the concentration distributions of both inorganic nutrient species were clearly influenced by the seasonal variation in the study area. However, the concentration ranges were similar to the Mediterranean coastal area (DIN = 215 nmol m^{-3}; DIP = 0.72 nmol m^{-3}) where is also affected by both aeolian dust and anthropogenic input (Carbo et al., 2005). Besides, the DIN/DIP ratio exceeds by a factor of up to 33 the N/P ratio observed in the East China Sea seawater (14-16；Gong et al., 2000).

The dry deposition flux, F, was calculated by multiplying the concentration of the analyte in air, C, by a depositional velocity, V_d, using the following equation:

$$F = C \times V_d$$

In this study fluxes were calculated using V_d depending on the nutrient, since the nutrients are known to be associated with different particle fractions. V_d values used

for phosphate, nitrate and ammonium, 2.0, 1.2 and 0.6 cm s^{-1}, respectively (Duce et al., 1991; Carbo et al., 2005). Measured annual fluxes of DIN and DIP average 65.8 mmol m^{-2} yr^{-1} and 321 μmol m^{-2} yr^{-1}, respectively.

References

Carbo, P., Krom, M.D., Homoky, W.B., Benning, L.G., Herut, B. (2005) Impact of atmospheric deposition on N and P geochemistry in the outheastern Levantine basin. Deep-Sea Research II, 52, 3041-3053.

Chen, H.Y., Fang, T.H., Preston, M.R., Lin, S. (2006) The characterization of phosphorus in the aerosol of a coastal atmosphere: using a sequential extraction method and the implications for marine nutrient cycles. Atmospheric Environment, 40, 279-289.

Duce, R. A., Liss, P. S., Merrill, J. T., Atlas, E. L., Buat-Menard, P., Hicks, B. B., Miller, J. M., Prospero, J. M., Arimoto, R., Church, T. M., Ellis, W., Galloway, J. N., Hansen, L., Jickells, T. D., Knap, A. H., Reinhardt, K. H., Schneider, B., Soudine, A., Tokos, J. J., Tsunogai, S., Wollast, R., Zhou, M. (1991) The atmospheric input of trace species to the world ocean. Global Biogeochemical Cycles, 5, 193-259.

Gong, G.C., Shiah, F.K., Liu, K.K., Wen, Y.H., Liang, M.H. (2000) Spatial and temporal variation of chlorophyll a, primary productivity and chemical hydrography in the southern East China Sea. Continental Shelf Research, 20, 411-436.