Annual Report for the year 2013:

SOLAS Task Team: ADOES

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Notes:
Reporting Period is January 2013 – December 2013
Information will be used for: reporting, fundraising, networking, strategic development & outreach

1. Scientific highlights

1）Atmospheric deposition of trace metals to the western North Pacific Ocean observed at coastal station in Japan

To understand the atmospheric input of trace metals to surface seawaters, the total deposition samples were collected simultaneously from three coastal stations in Japan. The trace metal concentrations (Al, Sc, Ti, Mn, Fe, Co, Ni, Cu, Zn, Cd, Pb, and Th) were then determined for particulate and dissolved fractions using a high-resolution ICP-MS. The observed total Fe flux (average, 194 μg/m^2/day) at the northern station (Kushiro, KU), which is close to HNLC region of western North Pacific, was within the lower limit of the previous estimation for coastal area of Japan based upon a model. Except for Sc and Fe, all the elements showed an increasing tendency toward dissolution with decreasing the pH from 5.7 to 3.4 [Fig]. At the southern station (Cape Hedo, HE), the tendency toward dissolution of Ti, Mn, Zn, Cd, Pb and Th was twice higher than that at the other two stations. A higher dissolved fraction of these metals was observed with higher enrichment factors at the HE station, which implies an anthropogenic effect on the dissolution of trace metals. In order to elucidate the relationship between anthropogenic sources and this dissolution tendency of Al and Fe, we calculated the Sc-normalized enrichment factors ($_{Sc}$EF). The relationship between the $_{Sc}$EF and the dissolution tendency indicated a higher dissolution tendency of Al or Fe in the sample having a higher $_{Sc}$EF. These results indicated that in addition to low pH condition the variation of the source control the tendency toward dissolution of metals in the deposition samples.

1. Okubo, A., Takeda, S., Obata, H. (2013) Atmospheric deposition of trace metals to the western North Pacific Ocean observed at coastal station in Japan. Atmospheric Research, 129-130: 20-32.

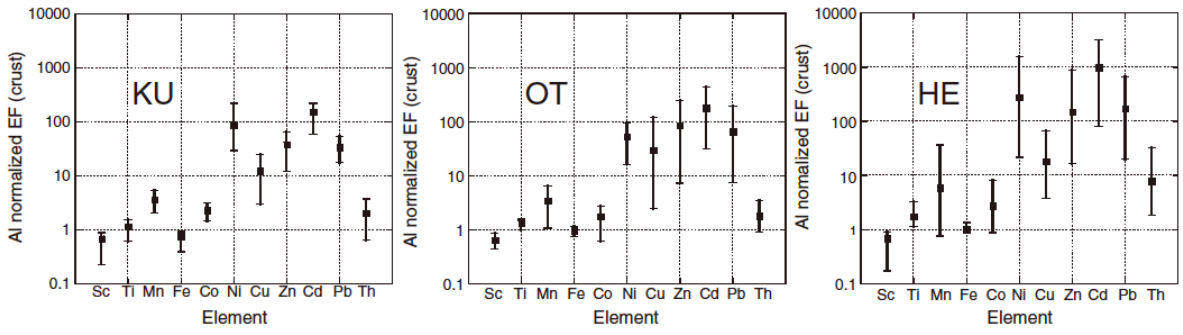

Figure: *Al-normalized enrichment factors of trace metals at each station (KU: Kushiro, OT: Otsuchi, HE: Hedo). The square mark denotes the averaged value.*

2) Promotion and inhibition effects of atmospheric deposition in a marginal sea of China

Increasing anthropogenic atmospheric deposition of nutrients, trace metals and toxic substances to

oceans may synergistically enhance or inhibit some specific phytoplankton growth, subsequently modulating primary productivity. In the spring of 2011, on-board incubation experiments were performed in the Southern Yellow Sea to explore the responses of phytoplankton to various combinations of added substances. We simulated atmospheric input by artificially adding Asian dust, rainwater, nitrogen (dissolved inorganic N), phosphorus (P) and iron (Fe). The addition of a large amount of Asian dust increased both the maximum concentration of chlorophyll a (Chl a) and the conversion efficiency index of N into Chl a (CEI) by ~40 % and ~30 %, respectively, compared to the control, indicative of promoting growth of the phytoplankton. However, no promotion effect on phytoplankton growth was observed when the addition of Asian dust was reduced to 10 % of the original amount. The addition of rainwater increased the maximum concentration of Chl a by ~40 % but decreased the CEI by ~40 %, indicating inhibition coexisting with promotion of some phytoplankton species.

Liu et al. Journal of Geophysical Research- biogeoscience, 118, DOI: 10.1002/2013JG00232, - 2013.

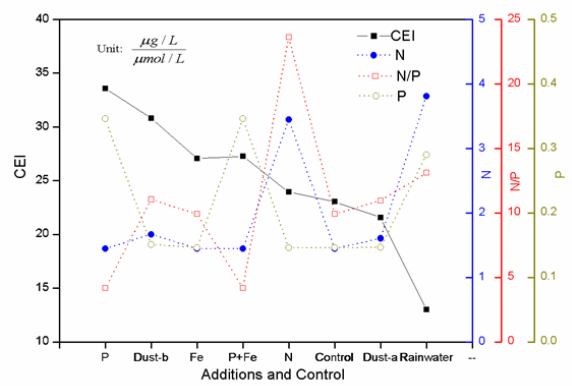

Figure: The conversion efficiency index of N conversion to Chl a in different addition experiments.

2. International interactions and collaborations (including contributions to international assessments such as the IPCC, links with observation communities, links with policy makers or socio-economics circles, etc.)

1) We presented the ADOES activity poster for the celebration of the 50th Anniversary of the IOC/WESTPAC during the 27th Session of the IOC Assembly, 26th June - 5th July 2013.

2) Links with Canadian SOLAS: Major International Joint Research Project of Natural Science Foundation of China "Impacts of ocean acidification on estuary and nearshore marine ecosystems and biogeochemical processes of biogenic active gases (2014-2018)", 3.3 millions RMB. PI: Gui-Peng Yang from Ocean University of China ; Co-PI: Maurice Levasseur, from University of Laval, Canada.

3. Activities/main accomplishments (research projects, cruises, special events, workshops, remote sensing used, model and data intercomparisons etc)

1）JST–MOST Joint Workshop Climate Change cooperative program

Gao presented the ADOES/METMOP "Response of marine ecological system in the marginal seas to open ocean of the western North Pacific to climate change" activity and discussed the future plans.

2）National Basic Research Program of China funded by MOST "Atmospheric deposition and Its impact on marine primary production and nitrogen cycle (2014-2018)" , 15 millions RMB. PI: Huiwang Gao from Ocean University of China.

3）Several multiple-discipline survey cruises have been performed in the marginal seas including the Yellow Sea and the Northern Pacific in the spring of 2012. On board incubation of marine ecosystem were conducted to study the impact of dust addition.

4. Human dimensions (outreach, capacity building, public engagement etc)

5. Top 10 publications in 2013 (Reports, <u>ACCEPTED</u> articles, models, datasets, products, website etc)

1) Liu, Y., Zhang, T.R., Shi, J.H., Gao, H.W., Yao, X.H., 2013. Responses of chlorophyll a to added nutrients, Asian dust, and rainwater in an oligotrophic zone of the Yellow Sea: Implications for promotion and inhibition effects in an incubation experiment. Journal of Geophysical Research: Biogeosciences 118: 1-10, doi: 10.1002/2013JG002329.

2) Zhen, H., Yang G.P., Lu, X.L., 2013. Distributions and sea-to-air fluxes of volatile halocarbons in the East China Sea in early winter. Chemosphere 90: 747-757.

3) Zhang, T.R., Shi, J. H., Gao, H. W., Zhang, J., Yao, X.H., 2013. Impact of source and atmospheric processing on Fe solubility in aerosols over the Yellow Sea, China. Atmospheric Environment 75: 249-256.

4) Han, Y., Zhang, G.L., Zhao, Y.C., Liu, S.M., 2013. Distributions and sea-to-air fluxes of nitrous oxide in the coastal and shelf waters of the northwestern South China Sea. Estuarine Coastal and Shelf Science 133, 32-44. doi: 10.1016/ j.ecss.2013.08.001.

5) Zhu, L., Chen, Y., Guo, L., & Wang, F. , 2013. Estimate of dry deposition fluxes of nutrients over the East China Sea: The implication of aerosol ammonium to non-sea-salt sulfate ratio to nutrient deposition of coastal oceans. Atmospheric Environment, 69, 131–138. doi:10.1016/j.atmosenv.2012.12.028

6) Kameyama S, Tanimoto H, Inomata S, Inoue HY, Tsunogai U, Tsuda A, Uematsu M, Ishii M, Asano D, 2013, Strong relationship between dimethyl sulfide and net community production in the western subarctic Pacific. Geophysical Research Letter, 40, 3986–3990.

7) Kondo Y, Takeda S, Nishioka J, Sato M, Saito H, Suzuki K, Furuya K, 2013, Growth stimulation and inhibition of natural phytoplankton communities by model organic ligands in the western subarctic Pacific, Journal of Oceanography, 69,97-115.

8) Okubo A, Takeda S, Obata, H, 2013, Atmospheric deposition of trace metals to the western North Pacific Ocean observed at coastal station in Japan, Atmospheric Research, 129-130,20-32.

9) Tanimoto H, Kameyama S, Iwata T, Inomata S, Omori Y, 2013, Measurement of air-sea exchange of dimethyl sulfide and acetone by PTR-MS coupled with gradient flux technique, Environment Science and Technology, doi:10.1021/es4032562.

10) Jung J, Furutani H, Uematsu M, Kim S, Yoon S, 2013, Atmospheric inorganic nitrogen input via dry, wet, and sea fog deposition to the subarctic western North Pacific Ocean, Atmospheric Chemistry and Physics, 13, 411–428, doi:10.5194/acp-13-411-2013.

6. Goals, priorities and plans for future activities/events

1) At the end of the Western Pacific Air-Sea Interaction Study (W-PASS) project, a book "Linkages in biogeochemical cycles between surface ocean and lower atmosphere" will published in March 2014. The book will be available as an open access book on line.
2) A joint session on Status, trends and effects of climate, natural disturbances and anthropogenic stressors on ocean ecosystems(by Dr. Uematsu Mitsuo, Dr. Thamasak Yeemin, Prof. Dr. Huiwang Gao) at IOC-WESTPAC 9th international Scitific Symposium will be held in 2014, Vietnam.
3) A joint cruise to the Northern Pacific Ocean to investigate the marine nitrogen cycle under the impact of atmospheric deposition from March to April in spring.
4) The Joint 7th Workshop on Asian Dust and Ocean EcoSystem (ADOES) with Asian SOLAS will be hosted by Ocean University of China in 2014 to promote regional exchanges.

7. Other comments