Asian Dust and Ocean EcoSystem (ADOES)

compiled by Hui-wang Gao and Mitsuo Uematsu

Notes:
Reporting Period is January 2012 – December 2012
Information will be used for: reporting, fundraising, networking, strategic development & outreach

1. Scientific highlights

Describe 1 or 2 ***published*** *scientific highlights with a title, a text (max 200words), a figure with legend and* ***full references*** *for each highlight.*

1) Direct observation evidences for the Asian dust input of nutrients in triggering a spring bloom

Dust deposition can deliver new nutrients to the surface water and support primary productivity, but study of the impact of dust supply on ocean biota based on direct monitoring is rare. We captured two Asian dust storms accompanied by precipitation that were probably responsible for the observed algal bloom over the Yellow Sea. A new approach was used to estimate the deposition flux of the nutrients into the surface waters, based on the concentrations, solubility, size distributions of nutrients in the aerosols as well as simultaneous observations in the ocean. Our data indicated that atmospheric deposition dominated the supply of new nutrients to the surface water in the central Yellow Sea during the dust events. Calculated dust-derived N and Fe supplies can satisfy the bloom phytoplankton needs at the initiation of the bloom. The calculated dust-derived P input was slightly less than the estimated upward fluxes of PO_4^{3-}, and the sum of the two sources satisfied about 25% of P demand of the phytoplankton at the initiation of the bloom. Granger causality test results further supported that dust-derived nutrients deposition was the cause for the observed bloom with a lag of 3-5 days.

Shi, J.H., Gao, H.W., Zhang, J., Tan, S.C., Ren, J.L., Liu, C.G., Liu, Y., Yao, X., 2012. Examination of causative link between a spring bloom and dry/wet deposition of Asian dust in the Yellow Sea, China. Journal of Geophysical Research, 117, D17304, doi:10.1029/2012JD017983.

2) Iron speciation and mixing in single aerosol particles from the Asian continental outflow

Bioavailable iron from atmospheric aerosol is an essential nutrient that can control oceanic productivity, thereby impacting the global carbon budget and climate. Particles collected on Okinawa Island during an atmospheric pollution transport event from China were analyzed using complementary single particle techniques to determine the iron source and speciation. Comparing

the chemical composition and spatial distribution of iron within ambient particles and standard Asian mineral dust, it was determined that field-collected atmospheric Fe-containing particles have numerous sources, especially anthropogenic sources such as coal combustion. Fe-containing particles were found to be internally mixed with secondary species such as sulfate, soot, and organic carbon. The mass weighted average Fe(II) fraction (defined as Fe(II)/[Fe(II) + Fe(III)]) was determined to be 0.33 ± 0.08. Within the experimental uncertainty, this value lies close to the range of 0.26–0.30 determined for representative Asian mineral dust. Previous studies have indicated that the solubility of iron from combustion is much higher than that from mineral dust. Therefore, chemical and/or physical differences other than oxidation state may help explain the higher solubility of iron in atmospheric particles.

Moffet, R. C., H. Furutani, T. C. Rödel, T. R. Henn, P. O. Sprau, A. Laskin, M. Uematsu, and M. K. Gilles. 2012. Iron speciation and mixing in single aerosol particles from the Asian continental outflow. J. Geophys. Res., 117, D07204, doi:10.1029/2011JD016746.

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

Two multiple-discipline survey cruises have been performed in the marginal seas including the Yellow Sea and the East China Sea in the spring and the fall of 2012. Simultaneous measurements included high time resolution particle number concentration spectra and chemical composition, filter particle samples from 10 nm to 18 μm.

Most of the research cruises for coastal and marginal seas were focused on the oceanic region of the off Fukushima. Many ADOES members in Japan devoted the investigation for ocean radioactive material contamination.

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

4. Top 10 publications in 2012 (Reports, <u>ACCEPTED</u> articles, models, datasets, products, website etc)

1) Shi, J.H., Gao, H.W., Zhang, J., Tan, S.C., Ren, J.L., Liu, C.G., Liu, Y., Yao, X., 2012. Examination of causative link between a spring bloom and dry/wet deposition of Asian dust in the Yellow Sea, China. Journal of Geophysical Research, 117, D17304, doi:10.1029/2012JD017983.

2) Yang Gui-Peng, Zhuang Guang-Chao, Honghai Zhang, Yuan Dong, Jian Yang, 2012. Biogeochemistry of dimethylsulfide and dimethylsulfoniopropionate in the Yellow Sea and the East China Sea during spring: spatio-temporal variability and controlling. Marine Chemistry 138-139: 21-31.

3) Zhen He, Gui-Peng Yang, Xiao-Lan Lu, 2012. Distributions and sea-to-air fluxes of volatile halocarbons in the East China Sea in early winter. Chemosphere 90: 747-757.

4) Yao and Zhang, Chemical processes in sea-salt chloride depletion observed at a Canadian rural coastal site. Atmospheric Environment, 46, 189-194, 2012.

5) Tan, S.C., Shi, G.Y., Gao, H.W., Yao, X. 2013. Variability in the Correlation between Asian Dust Storms and Chlorophyll a Concentration from the North to Equatorial Pacific. PLOS ONE, accepted.

6) Shi, J.H., Gao, H.W., Tan, S-C., Yao, X., Ren, J.L. 2013. Concentration, solubility and deposition flux of atmospheric particulate nutrients over the Yellow Sea. Deep Sea Research (II). accepted

7) Wang, L., Qi, J.H., Gao, H.W., Shi, J.H. 2013. Source apportionment of particulate pollutants in the atmosphere over the Northern Yellow Sea. Atmospheric Environment, accepted

8) Feng Wu, Daizhou Zhang, Junji Cao, Hongmei Xu, Zhisheng An. 2012. Soil-derived sulfate in atmospheric dust particles at Taklimakan desert. Geophys. Res. Lett. 39, L24803, doi:10.1029/2012GL054406.

9) Jung, J., Furutani, H. and Uematsu, M. 2011. Atmospheric inorganic nitrogen in marine aerosol and precipitation and its deposition to the North and South Pacific Oceans. Journal of Atmospheric Chemistry, 68, 157–181, I 10.1007/s10874-012-9218-5.

10) Moffet, R. C., Furutani, H., Rödel, T. C., Henn, T. R., Sprau, P. O., Laskin, A., Uematsu, M., Gilles, M. K. 2012. Iron speciation and mixing in single aerosol particles from the Asian continental outflow. Journal of Geophysical Research, 117, D07204, doi.org/10.1029/2011JD016746.

5. International interactions and collaborations (including contributions to international assessments such as the IPCC, links with observation communities etc)

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

The Joint 7th Workshop on Asian Dust and Ocean EcoSystem (ADOES) with Asian SOLAS will be planned in 2013.

JST–MOST Joint Workshop Climate Change ~ Progress reports of Japan-China research cooperative program will be held in Tokyo Japan on March 4, 2013. Huiwang Gao and Mituso Uematsu will present ADOES/METMOP activity and discuss the future plans.

7. Other comments