

Report for the year 2016 and future activities

SOLAS China

compiled by: Minhan Dai, Huiwang Gao

This report has two parts:

- **Part 1:** reporting of activities in the period of January 2016 – Jan-Feb 2017
- **Part 2:** reporting on planned activities for 2017/2018 and 2019.

The information provided will be used for reporting, fundraising, networking, strategic development and updating of the live web-based implementation plan.

IMPORTANT: *May we remind you that this report should reflect the efforts of the SOLAS community in the entire country you are representing (all universities, institutes, lab, units, groups, cities)!*

PART 1 - Activities from January 2016 to Jan/Feb 2017

1. Scientific highlight

Describe one scientific highlight with a title, text (max. 200 words), a figure with legend and full references. Please focus on a result that would not have happened without SOLAS, and we are most interested in international collaboration. (If you wish to put more than one, feel free to do so).

This report focuses on studying generation and/or evolution of sea-salt aerosols (SSA) on basis of measurements in the Northwest Pacific Ocean (NWPO), the marginal seas of China, at sea-beach sites and a semi-urban coastal site in 2012-2015. From measurements in the NWPO, we obtained the smallest generation function of the super-micron SSA mass ($[M_{SSA}]$) by the local wind comparing to those previously reported. Vessel-caused wave-breaking was found to greatly enhance generation of SSA and increase $[M_{SSA}]$, which was subject to non-natural generation of SSA. However, naturally enhanced generation of SSA was indeed observed in the marginal seas and at the sea-beach site. The two enhancement mechanisms may explain the difference among this and previous studies. Size distributions of super-micron SSA exhibited two modes, i.e., 1-2 μm mode and $\sim 5 \mu\text{m}$ mode. The 1-2 μm mode of SSA was enhanced more and comparable to the $\sim 5 \mu\text{m}$ mode under the wind speed $> 7 \text{ m/s}$. However, the smaller mode SSA was largely reduced from open oceans to sea-beach sites with reducing wind speed. The two super-micron modes were comparable again at a semi-urban coastal site, suggesting that the smaller super-micron mode SSA may play more important roles in atmospheres.

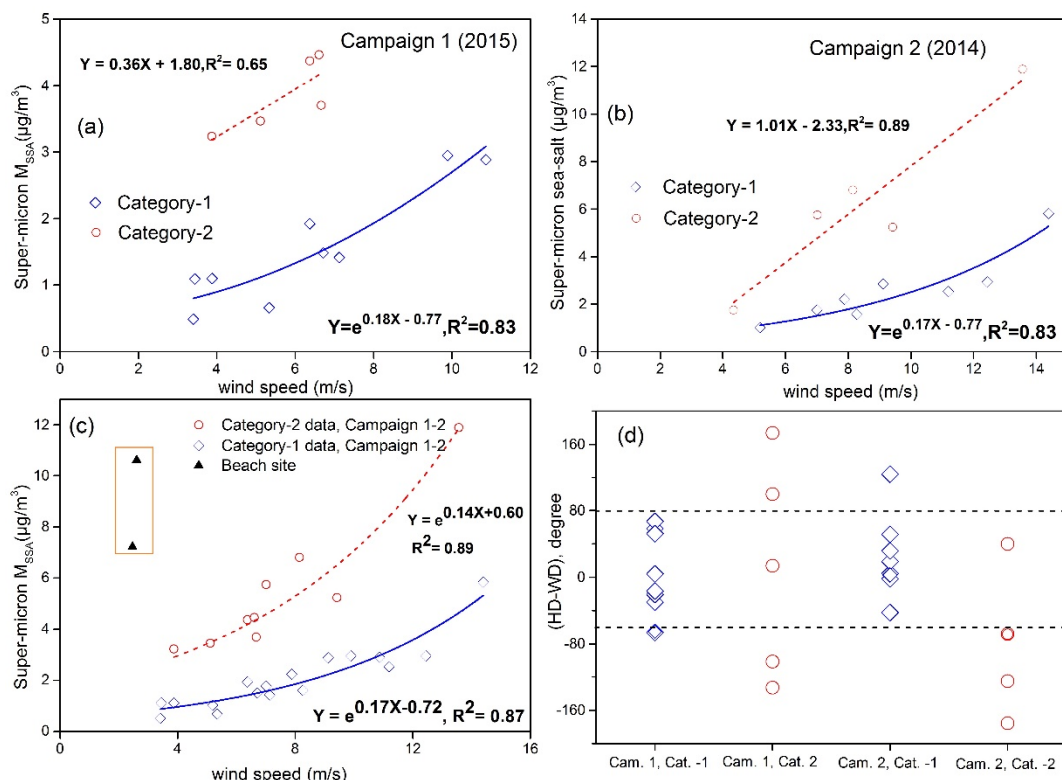


Figure: The relationship between super-micron MSA and wind speed, (a)-(b): the estimated MSA values in super-micron particles against the wind speed in the Campaign 1-2 (the NWPO campaign, including roundtrip samples); (c) the estimated super-micron MSA in category-2 data of campaign 1-2 against the wind speed; (d): wind direction (WD) relative to vessel's heading direction (HD), i.e., HD-WD.

Citation: Feng, L. et al. Insight into Generation and Evolution of Sea-Salt Aerosols from Field Measurements in Diversified Marine and Coastal Atmospheres. Sci. Rep. 7, 41260; doi: 10.1038/srep41260 (2017).

2. Activities/main accomplishments in 2016 (projects, field campaigns, events, model and data intercomparisons, capacity building, international collaborations, contributions to int. assessments such as IPCC, interactions with policy makers or socio-economics circles, etc.)

2.1 Cruise and field experiment

The air-sea CO_2 fluxes and carbonate system in the northern South China Sea were investigated based on large-scale observations of a cruise conducted onboard R/V *Dongfanghong II* during May 17-June 2, 2016. This cruise was supported by NSFC through its Shiptime of Sharing Program (NORC2015-05). Data are used to evaluate the effect of El Nino on the intrusion of Kuroshio, which might affect the CO_2 fluxes in this regime.

Three CO_2 and ocean acidification monitoring buoys have been deployed since 2012 in the inner-shelf (122.8°E , 31°N) and the outer shelf (124°E , 31°N) of the East China Sea and the Pearl River plume region (113.975°E , 21.958°N). Monitored parameters include current, surface water and air $p\text{CO}_2$, SST, SSS, velocity, DO, pH, Chl a and CDOM. Data are continuously transmitted back in real-time to the land-based data center and are used to evaluate regional carbon

models.

2.2 Projects

- 1) CHOICE-C II, the renewed SOLAS-Endorsed Project: CHOICE-C, passed its mid-term evaluation by the Ministry of Science and Technology (MOST) of China.
- 2) A new project entitled “Biogeochemical processes and climate effect of marine biogenic trace gases in the east marginal seas of China” was funded through the National Key Research and Development Program. The project is for July 2016 to June 2021 with a budget of 25.86 million CNY. The leading PI is Dr. Guipeng Yang from the Ocean University of China. The research contents include spatio-temporal variation trends and sea-to-air fluxes of biogenic trace gases in the east marginal seas of China, biogeochemical cycling processes and ecological responses of marine biogenic trace gases, role and mechanism of microorganisms in marine biogenic gases cycle, emission and transformation of marine biogenic gases in atmosphere and their effect on climate.
- 3) Project entitled “Atmospheric deposition and its impact on marine primary production and nitrogen cycle” was funded by Major national scientific research program for 5 years from 2013 to 2018. This project focuses on atmospheric deposition of nitrogen and its contribution to primary production, key processes of marine nitrogen cycles, marine biogenic aerosol and its impact on climate.

2.3 Infrastructure

- A 78-m long new research vessel with the capacity of SOLAS and trace metal researches was launched by Xiamen University on May 8th, 2016 and is under sea trials from December 30, 2016. The vessel will be formally delivered to Xiamen University in early 2017 after sea worthiness trials.
- A new research vessel Dong Fang Hong 3 of Ocean University of China is under construction.

2.4 Workshop organized

- AOGS Annual Assembly, Beijing, China, July 31-August 5, 2016.
- International SOLAS SSC meeting, Qingdao, China, October 24-26, 2016.
- SOLAS in Asia: A Future SOLAS Symposium, Qingdao, China, October 27-28, 2016.
- CHOICE-C II mid-term review meeting, Xiamen, China, July 26-27, 2016.
- Ocean Acidification research in China: an international workshop, Shanghai, China, April 28-29, 2016.
- The third Xiamen Symposium on Marine Environmental Sciences (3rd XMAS), Xiamen, China, January 9-11, 2017.

2.5 International interactions and collaborations

- Minhan Dai, Observational challenges: from global to local, May 3-7, 2016, the 4th Oceans in a High CO₂ World Symposium, Hobart, Tasmania, Australia (Plenary Talk).
- Minhan Dai, SOLAS in Asia, Jan 23-25, 2017, The 5th workshop on Future Earth in Asia, Kyoto, Japan.
- The State Key Laboratory of Marine Environmental Science (Xiamen University) participates in the IAEA interregional project “Supporting a Global Ocean Acidification Observing Network towards Increased Involvement of Developing States”.

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

The 5th Xiamen University Ocean Sciences Open House was held on November 13, 2016, Zhou-Long-Quan Building, Xiang'An Campus, Xiamen University, China.

3. Top 5 publications in 2016 (only PUBLISHED articles) and if any, weblinks to models, datasets, products, etc.

- Feng, L, Shen, H, Zhu, Y, Gao, H, Yao, X, 2017, Insight into Generation and Evolution of Sea-Salt Aerosols from Field Measurements in Diversified Marine and Coastal Atmospheres, *Scientific Reports*, 7, 41260; DOI: 10.1038/srep41260.
- Guo, T, Li, K; Zhu, Y J, Gao, H W, Yao, X H, 2016, Concentration and size distribution of particulate oxalate in marine and coastal atmospheres - Implication for the increased importance of oxalate in nanometer atmospheric particles, *Atmospheric Environment*, 142, 19-31, DOI: 10.1016/j.atmosenv.2016.07.026
- Lin, H, Dai, M H, Kao, S -J, Wang, L, Roberts, E, Yang J -Y T, Huang, T, He, B, 2016, Spatiotemporal variability of nitrous oxide in a large eutrophic estuarine system: The Pearl River Estuary, China, *Marine Chemistry*, 182, 14-24, DOI: 10.1016/j.marchem.2016.03.005.
- Luo, L, Yao, X H, Gao, H W, Hsu, S C, Li, J W, Kao, S J, 2016, Nitrogen speciation in various types of aerosols in spring over the northwestern Pacific Ocean. *Atmospheric Chemistry and Physics*, 16, 325–341, DOI: 10.5194/acp-16-325-2016.
- Yu, P R, Hu, Q J; Li, K; Zhu, Y J; Liu, X H ; Gao, H W ; Yao, X H.,2016, Characteristics of dimethylammonium and trimethylammonium in atmospheric particles ranging from supermicron to nanometer sizes over eutrophic marginal seas of China and oligotrophic open oceans, *Science of the Total Environment*, 572, 813-824, DOI: 10.1016/j.scitotenv.2016.07.114.

For journal articles please follow the proposed format:

Author list (surname and initials, one space but no full stops between initials), year of publication, article title, full title of journal (italics), volume, page numbers, DOI.

4. Did you engage any stakeholders/societal partners/external research users in order to co-produce knowledge in 2016? If yes, who? How did you engage?

PART 2 - Planned activities from 2017/2018 and 2019

1. Planned major field studies and collaborative laboratory and modelling studies, national and international (incl. all information possible, dates, locations, teams, work, etc.)

Cruises:

- 1) There will be a cruise focusing on the water exchange of Luzon Strait during July 2017. The parameters related to the air-sea CO₂ fluxes and carbonate

system will be collected onboard R/V Dongfanghong II. This cruise will be supported by NSFC Open Research Cruise, which is funded by Shiptime Sharing Project of NSFC.

- 2) There will be a summer cruise conducted onboard R/V TAN KAH KEE in the Southern South China Sea, from where there are sparse data on the carbon budget and ocean acidification. This cruise will be supported by CHOICE-C II project funded by the Ministry of Science and Technology (MOST) of China.

2. Events like conferences, workshops, meetings, schools, capacity building etc. (incl. all information possible)

3. Funded national and international projects / activities underway (if possible please list in order of importance and indicate to which part(s) of the SOLAS 2015-2025 Science Plan and Organisation (downloadable from the SOLAS website) the activity topics relate – including the core themes and the cross cutting ones)

CHOICE-C (Carbon cycling in China Seas-budget, controls and ocean acidification) project was renewed by the Ministry of Science and Technology (MOST) of China for another 5 years from January 2015 to December 2019. This renewed project is termed as CHOICE-C II with a budget of 25 million CNY. Through comparative study of carbon cycling in River-Dominated-Ocean-Margins (RioMars, the northern South China Sea shelf being a case) and the Ocean-Dominated-Ocean-Margin (OceMars, the South China Sea basin being a case), CHOICE-C II is focusing on the carbon cycle in South China Sea in terms of its budget, controls and global implications. It is related to Theme 1: Greenhouse gases and the oceans of the SOLAS 2015-2025 science plan.

National Key Research and Development Program: Biogeochemical processes and climate effect of marine biogenic trace gases in the east marginal seas of China. Leading PI: Gui-Peng Yang. Institution: Ocean University of China. Budget: 25.86 million CNY. Research Duration: 5 years (2016.7-2021.6). It is related to Theme 2: Air-sea interface and fluxes of mass and energy.

Major national scientific research program: Atmospheric deposition and its impact on marine primary production and nitrogen cycle (2013-2018), leading PI: Huiwang Gao. It is related to Theme 3: Core Theme 3: Atmospheric deposition and ocean biogeochemistry.

4. Plans / ideas for future projects, programmes, proposals national or international etc. (please precise to which funding agencies and a timing for submission is any)

- Proposal entitled “Transient enhancement and decoupling of carbon export vs opal in cyclonic eddies: overprints of submesoscale interactions and eddy evolution” has been submitted to the National Natural Science Foundation of China in March 2017. This proposal chose a prominent cyclonic eddy in the Northwest Pacific Ocean off Taiwan in spring (Eddy SILICON) to examine the eddy evolution and its submesoscale variability and how these spatial-temporal variability modulate the exports of carbon and opal and their coupling. Through intensive and high spatial-temporal resolved field observations and numerical modeling, following critical questions are to be

answered: (1) How do submesoscale processes of a cyclonic eddy modulate the spatial variability of carbon and opal exports? (2) how does eddy evolution affect carbon and opal exports? (3) Are the exports of carbon and opal coupled or decoupled on the spatial scale during the submesoscale variability and on the temporal scale during eddy evolution? The proposed research is crucial in better understanding the biological carbon pump and its role in the global carbon cycle.

- Proposal on colimitation and utilization of major and micro/trace nutrients & export production in the West Philippine Sea will be submitted in April to the Joint China-German Research Projects which is funded by the German Research Foundation and the National Natural Science Foundation of China.

5. Engagements with other international projects, organisations, programmes etc.

Comments