

## Report for the year 2016 and future activities

### SOLAS Japan

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*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.*

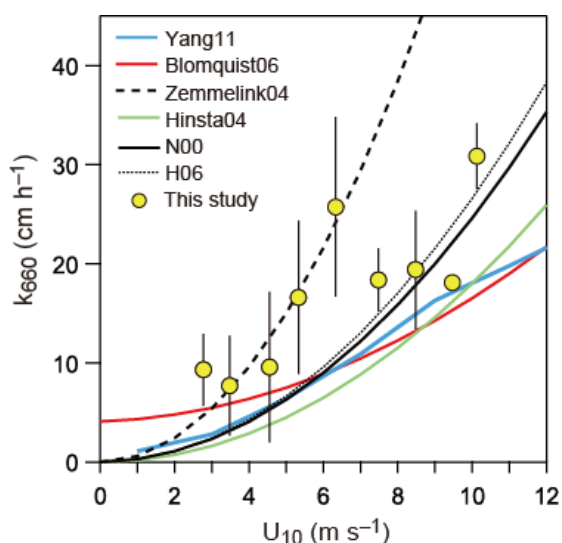
**IMPORTANT:** May we remind you that this report should reflect the efforts of the SOLAS community in the entire country you are representing (all universities, institutes, lab, units, groups, cities)!

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

#### 1. Scientific highlight

#### Sea-to-air flux of dimethylsulfide in the Pacific by PTR-MS/GF technique

Exchange of dimethylsulfide (DMS) between the surface ocean and the lower atmosphere was examined by using our new system of Proton Transfer Reaction-Mass Spectrometry coupled with Gradient Flux (PTR-MS/GF). We deployed the PTR-MS/GF system and observed vertical gradients of atmospheric DMS just above the sea surface during three cruises by R/V *Hakuho Maru* in the subtropical and transitional South Pacific Ocean and the subarctic North Pacific Ocean. In total, we obtained 370 in situ profiles, and of them we used 46 data sets to calculate the sea-to-air flux of DMS. The DMS flux determined was in the range from 3.2 to 32  $\mu\text{mol m}^{-2} \text{d}^{-1}$  and increased with wind speed and biological activity, in reasonable accordance with previous observations in the open ocean. The gas transfer velocity of DMS derived from the PTR-MS/GF measurements was in good agreement with that derived with dual tracer experiments using insoluble gases, but tended to be higher than that determined by eddy covariance techniques and the NOAA/COARE model. This highlights the need of making simultaneous measurements by both the GF and EC techniques to further discuss about their methodological differences.



**Figure** Comparison of  $k_{660}$  between the GF and EC methods. The  $k$  values in this study ( $\bullet$ ) are binned at  $1 \text{ m s}^{-1}$  intervals. Error bars correspond to the standard deviations for the mean values within each bin. Curves indicate  $k$  values predicted by parameterizations with insoluble gases [Nightingale et al., 2000 (N00); Ho et al., 2006 (H06)], the EC observations [Yang et al., 2011 (Yang11)], the NOAA/COARE model ( $A=1.3$ ,  $B=1.0$ ) [Blomquist et al., 2006 (Blomquist06)], and the GF observations [Hinsta et al., 2004 (Hinsta04), Zemmeling et al., 2004 (Zemmeling04)].

Y. Omori, H. Tanimoto, S. Inomata, T. Iwata, S. Kameyama, M. Uematsu, T. Gamo, H. Ogawa, K. Furuya, Sea-to-air flux of dimethylsulfide in the South and North Pacific Ocean as measured by Proton Transfer Reaction-Mass Spectrometry coupled with Gradient Flux (PTR-MS/GF) technique. (JGR-Atmos., in revision).

**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.)**

Field campaign:

- February 2016: Southern Sea of Okhotsk, ice breaker SOYA, Surface Ocean CO<sub>2</sub>, VOC and Fe dynamics and flux (On board: Daiki Nomura, Naoya Kanna) (Team: Jun Nishioka, Atsushi Ooki, Daiki Nomura, Naoya Kanna, Yohei Yamashita).
- March 2016: Saroma-ko Lagoon, Hokkaido, Japan. Intercalibration experiment for sea ice research with Belgium Scientists (On ice: Daiki Nomura, Francois Fripiat) (Team: Daiki Nomura, Francois Fripiat, Arnout Roukaerts).
- Summer 2016: NIES-Hokkaido Univ-KOPRI joint field work on Arctic observation (H. Tanimoto, S. Kameyama, joint with Jinyoung Jung at KOPRI).
- Summer 2016: Australian cruise around the coastal Great Barrier Reef with Japanese contribution on seawater measurements of VOCs (contributors: H. Tanimoto, Y. Omori).
- Seisui-maru SE16-17 cruise in Ise Bay and Mikawa Bay (chief scientist: Urumu Tsunogai)
- July 2016: Aerosol observation during R/V Shinsei-maru cruise (KS-16-8 led by S. Kawagucci), Izu-Ogasawara region of the western North Pacific.
- August-October 2016: Aerosol and gas observation in Arctic Ocean cruise by R/V Mirai (MR16-06) as part of the ArCS project.
- October-November 2016: "Observation of the sea surface microlayer and sea spray aerosols in the neritic water of Tsukumo Bay" (by K. Hamasaki, S. K. Wong, Y. Iwamoto et al.).
- November-December 2016: Aerosol and gas observation in Western Pacific cruise by R/V Mirai (MR16-08).
- Deployment of 7 drifting buoys with pCO<sub>2</sub> sensor in the South Pacific during R/V Mirai cruise (MR16-09 by A Murata).
- 2016, Feb, Mar, Apr, May, Jun, Aug, Oct, Dec, Usio-maru (Hokkaido Univ) cruise, Area: Funka Bay, Hokkaido, Japan, Research: Inorganic - organic iodine speciation in coastal seawater (by Ooki).

Projects:

- The NIES (National Institute for Environmental Studies) VOS program using cargo ships for atmospheric/oceanic CO<sub>2</sub> observations in the North Pacific and the south-eastern Asia (atmospheric only), and frequent and accurate observations of marine phytoplankton pigments and light regimes (by S. Nakaoka, H. Tanimoto, Y. Tohjima, K. Suzuki, Y. Nojiri, et al).
- 2016 NIES VOS program, and collaboration with international partners including IOS (Institute of Ocean Science, Canada), CSIRO (Commonwealth Scientific and Industrial Research Organisation, Australia), NIWA (National Institute for Water and Atmosphere, New Zealand) on data sharing and joint analysis.

International collaborative study:

- A study on efficient heterogeneous activation of sea-salt bromide to the gas-phase by the integrated analysis of TORERO halogen radical and aerosol bromide observations (by R. Volkamer, Y. Miyazaki, et al.).

- Lannuzel, D., M. Vancoppenolle, P. van der Merwe, J. de Jong, K. M. Meiners, M. Grotti, J. Nishioka, V. Schoemann, 2016, Iron in sea ice: Review and new insights, *Elementa: Science of the Anthropocene*, 4: 000130, doi: 10.12952/journal.elementa.000130.

Workshop:

- June 2016: Goldschmidt 2016, Yokohama. 12f: Marine Biogeochemistry at a Range of Scales: The Global Ocean and Polar Atmosphere-Sea Ice-Ocean Systems (Convenors: Daiki Nomura, Martin Vancoppenolle, Markus Frey, Delphine Lannuzel, Jun Nishioka) (Presentation: e.g., Yukihiro Nojiri and Sumito Matoba).
- July 2016: Data management workshop for Hakuho-maru KH-15-1 cruise, biogeochemical linkage between the ocean and the atmosphere (convenors: Jun Nishioka, Koji Suzuki).
- August 2016, Atmosphere-ice interaction workshop, Sapporo, Japan (Convenors: Sumito Matoba, Keiichiro Hara) (Presentation: e.g., Daiki Nomura).

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

Ueda, S., K. Miura, R. Kawata, H. Furutani, M. Uematsu, Y. Omori, and H. Tanimoto, 2016, Number–size distribution of aerosol particles and new particle formation events in tropical and subtropical Pacific Oceans, *Atmos. Environ.*, 142, 324-339.

Tsunogai, U., T. Miyauchi, T. Ohyama, D.D. Komatsu, F. Nakagawa, Y. Obata, K. Sato, and T. Ohizumi, 2016, Accurate and precise quantification of atmospheric nitrate in streams draining land of various uses by using triple oxygen isotopes as tracers. *Biogeosciences*, 13, 3441-3459, doi:10.5194/bg-13-3441-2016.

Yasunaka, S., A. Murata, E. Watanabe, M. Chierici, A. Fransson, S. van Heuven, M. Hoppema, M. Ishii, T. Johannessen, N. Kosugi, S.K. Lauvset, J. T. Mathis, S. Nishino, A.M. Omar, A. Olsen, D. Sasano, T. Takahashi, R. Wanninkho, 2016, Mapping of the air-sea CO<sub>2</sub> flux in the Arctic Ocean and its adjacent seas: Basin-wide distribution and seasonal to interannual variability, *Polar Science*, 10, 323 – 334.

Miyazaki, Y., S. Coburn, K. Ono, D. T. Ho, B. R. Pierce, K. Kawamura, and R. Volkamer, 2016, Contribution of dissolved organic matter to submicron water-soluble organic aerosols in the marine boundary layer over the eastern equatorial Pacific, *Atmos. Chem. Phys.*, 16, 7695–7707, doi:10.5194/acp-16-7695-2016.

Chen, Q., Y. Miyazaki, K. Kawamura, K. Matsumoto, S. Coburn, R. Volkamer, Y. Iwamoto, S. Kagami, Y. Deng, S. Ogawa, S. Ramasamy, S. Kato, A. Ida, Y. Kajii, and M. Mochida, 2016, Characterization of chromophoric water-soluble organic matter in urban, forest and marine aerosols by HR-ToF-AMS analysis and excitation–emission matrix spectroscopy, *Environ. Sci. Tech.*, 50, 10351–10360, DOI: 10.1021/acs.est.6b01643.

**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?**

None

## 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.)

#### Field campaign:

- Seisui-maru (Mie University) cruise in Ise Bay and Mikawa Bay area (chief scientist: Urumu Tsunogai).
- Summer 2017: NIES-Hokkaido Univ-KOPRI joint field work on Arctic observation (H. Tanimoto, S. Kameyama, joint with Jinyoung Jung at KOPRI).
- Underway measurement of sea surface CO<sub>2</sub> and CH<sub>4</sub> during R/V Mirai cruise (ArCS project; by A Murata).
- February 2017: Southern Sea of Okhotsk, ice breaker SOYA, Surface Ocean CO<sub>2</sub>, VOC and Fe dynamics and flux (On board: Daiki Nomura, Jun Nishioka) (Team: Daiki Nomura, Jun Nishioka, Atsushi Ooki, Yohei Yamashita).
- August-September 2017: NABOS-II (Nansen and Amundsen Basins Observational System) Cruise. East Siberian Sea and Laptev Sea, Arctic Ocean, ice breaker Akademik Tryoshnikov, Surface Ocean and sea ice CO<sub>2</sub>, CH<sub>4</sub>, VOC, CDOM and flux (On board: Daiki Nomura, Mats Granskog) (Team: Daiki Nomura, Atsushi Ooki, Ellen Damm, Mats Granskog, Osamu Yoshida, Ilka Peeken, Toru Hirawake).
- Fall 2019- Fall 2020: MOSAiC (Multidisciplinary drifting Observatory for the Study of Arctic Climate) Cruise. Arctic Ocean, ice breaker Polarstern. Surface Ocean and sea ice CO<sub>2</sub>, CH<sub>4</sub>, VOC, CDOM and flux (On board (one of leg): Daiki Nomura, Mats Granskog) (Team: Daiki Nomura, Atsushi Ooki, Ellen Damm, Mats Granskog, Brice Loose, Jun Inoue).
- 2017 Jun-Jul: Oshoro-maru (Hokkaido Univ.) cruise, Response and biodiversity status of the Arctic ecosystems under, Subarctic N Pacific and Bering sea, environmental change, (PI: A. Ooki).
- June-Aug. 2017: Hakuho-maru KH-17-3 cruise, Fe dust input and the Mg biogeochemical linkage between the ocean and the atmosphere (PI: Y. Takahashi et al.).
- Aug.-Sep. 2017: Hakuho-maru KH-17-4 cruise, Observation of the sea surface microlayer and sea spray aerosols in the subtropical North Pacific Ocean, as part of NEOPS cruise (PI: K. Hamasaki, Y. Iwamoto, Y. Miyazaki).
- Oct.-Dec. 2017: Hakuho-maru KH-17-3 cruise, The biogeochemical linkage between the ocean and the atmosphere (PI: Y. Kondo et al.).

#### International projects:

- Measurements of halogens and organics in the atmosphere at MAIDO Observatory on Réunion Island in collaboration with the University of Colorado Boulder (NSF fund), International collaborative study.
- NABOSS-II (<http://research.iarc.uaf.edu/NABOS2/>) (contributor: Daiki Nomura).
- ECV-Ice (Measuring Essential Climate Variables in Sea Ice), SCOR working group 152 (Co-chair: Daiki Nomura, François Fripiat, and Brent Else).
- CATCH (The Cryosphere and ATmospheric CHEmistry), IGAC (lead: Jennie Thomas, Thorsten Bartels-Rausch, Markus Frey) (Implementation member: D. Nomura).
- BEPSII (Biogeochemical Processes at Sea Ice Interfaces), SCOR working group 140, and now co-sponsored by CliC (Climate and Cryosphere) and SOLAS (Surface Ocean Lower Atmosphere Study). (Co-chair: Jacqueline Stefels and Nadja Steiner) (Associate Member: Jun Nishioka, Daiki Nomura).

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

#### Workshops:

- SOLAS session at Geochemical Society of Japan annual meeting, September 2017.

- Ocean and Atmosphere session at Japan Geoscience Union-AGU joint meeting, May 2017, Biogeochemical linkages between the ocean and the atmosphere during phytoplankton bloom (conveners: H. Tanimoto, Y. Miyazaki, K. Suzuki, J. Nishioka).

**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)**

National projects:

- Studies of ocean surface CO<sub>2</sub> partial pressure and nutrients mappings using international integrated databases (PI: S. Nakaoka), FY2014-2016.
- Long-term, comprehensive observation of long-lived greenhouse gases and short-lived climate pollutants in the Asia-Oceania Regions (PI: H. Tanimoto), FY2012-2016.
- Deployment of drifting buoys with pCO<sub>2</sub> sensor in the Pacific Ocean founded by the Ministry of Environment of Japan (PI: A Murata).
- Determination on the triple oxygen isotopes of tropospheric ozone, MEXT/JSPS Grant-in-Aid for Scientific Research funded to several SOLAS-relevant projects (PI: U. Tsunogai, FY2014-2016).
- Global observations of VOCs dissolved in the surface ocean using novel time- of-flight mass spectrometry, MEXT/JSPS Grant-in-Aid for Scientific Research funded to several SOLAS-relevant projects (PI: H. Tanimoto, FY2015-2018).
- Highly frequent and accurate observations of marine phytoplankton pigments and light regimes for the validation of SGLI/GCOM-C data (PI: Koji Suzuki)
- ArCS project (<http://www.arcs-pro.jp/en/index.html>) jointly teamed by NIPR, JAMSTEC, and Hokkaido University (Contributors: T. Hirawake, D. Nomura, A. Ooki, J. Nishioka, FY2015-2019).
- Microbiology of the sea surface microlayer and atmospheric aerosols: The frontier of linking biological activities and the climate"(Grant-in-Aid for Scientific Research) (PI: K. Hamasakai, FY2016-2019).

**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)**

- The SOLAS-Japan National Committee will discuss the transition to Future Earth in collaboration with other National Committees for IGAC, IMBER, LOICZ and GEOTRACES.

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

None

**Comments**

None