

Report for the year 2019 and future activities

SOLAS Japan

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This report has two parts:

- **Part 1:** reporting of activities in the period of January 2019 - Jan/Feb 2020
- **Part 2:** reporting on planned activities for 2020 and 2021.

The information provided will be used for reporting, fundraising, networking, strategic development and updating of the live web-based implementation plan. As much as possible, please indicate the specific SOLAS 2015-2025 Science Plan Themes addressed by each activity or specify an overlap between Themes or Cross-Cutting Themes.

- 1 Greenhouse gases and the oceans;
 - 2 Air-sea interfaces and fluxes of mass and energy;
 - 3 Atmospheric deposition and ocean biogeochemistry;
 - 4 Interconnections between aerosols, clouds, and marine ecosystems;
 - 5 Ocean biogeochemical control on atmospheric chemistry;
- Integrated studies of high sensitivity systems;
Environmental impacts of geoengineering;
Science and society.

IMPORTANT: *This report should reflect the efforts of the SOLAS community in the entire country you are representing (all universities, institutes, lab, units, groups, cities).*

First things first...Please tell us what the IPO may do to help you in your current and future SOLAS activities. ?

PART 1 - Activities from January 2019 to Jan/Feb 2020

1. Scientific highlight

Atmospheric deposition is a source of potentially bioavailable iron (Fe) and thus can partially control biological productivity in large parts of the ocean. However, the explanation of observed high aerosol Fe solubility compared to that in soil particles is still controversial, as several hypotheses have been proposed to explain this observation. In *Ito et al. (2019)*, a statistical

analysis of aerosol Fe solubility estimated from four models and observations compiled from multiple field campaigns suggests that pyrogenic aerosols are the main sources of aerosols with high Fe solubility at low concentration. Additionally, they found that field data over the Southern Ocean display a much wider range in aerosol Fe solubility compared to the models, which indicate an underestimation of labile Fe concentrations by a factor of 15. Their findings suggest that pyrogenic Fe-containing aerosols are important sources of atmospheric bioavailable Fe to the open ocean and crucial for predicting anthropogenic perturbations to marine productivity.

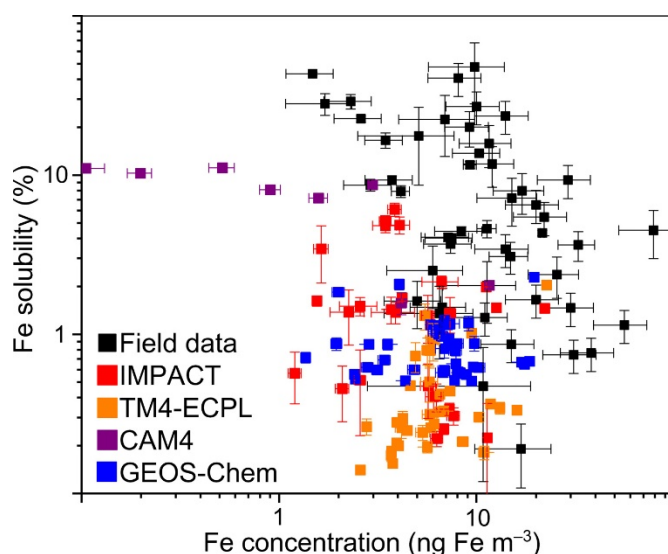


Figure: Fe solubility versus Fe concentration (ng m⁻³) for field data (black squares), IMPACT (red squares), TM4-ECPL (orange squares), CAM4 (purple squares), and GEOS-Chem (blue squares) over the Southern Ocean (>45°S) (Ito et al., 2019).

Citation: A. Ito et al. Pyrogenic iron: The missing link to high iron solubility in aerosols, *Science Advances*, 5, eaau7671, doi: 10.1126/sciadv.aau7671 (2019).

2. Activities/main accomplishments in 2019 (e.g., projects; field campaigns; workshops and conferences; model and data intercomparisons; capacity building; international collaborations; contributions to int. assessments such as IPCC; collaborations with social sciences, humanities, medicine, economics and/or arts; interactions with policy makers, companies, and/or journalists and media).

The SOLAS-Japan community launched Local Organizing Committee (LOC) and hold the SOLAS Open Science Conference in Sapporo from 21 to 25 April, 2019. (LOC members: Jun Nishioka, Yuzo Miyazaki, Sohiko Kameyama, Yutaka Watanabe, Masahiko Fujii, and Takeshi Yoshimura)

-Jun Nishioka organized the SOLAS Science Steering Committee meeting in Jyozankei, Sapporo, from 26 to 28 April, 2019.

-Japanese SOLAS organizing committee meeting was held at the University of Tokyo in Tokyo on 17 September 2019.

-Japanese SOLAS organizing committee has contributed to Japanese Future Earth (FE) activity.

1) A presentation titled "SOLAS-relevant researches led by Japanese scientific community" was made by Yuzo Miyazaki and Jun Nishioka at the FE symposium organized by the Science Council of Japan in Tokyo on 7 August 2019.

2) Yuzo Miyazaki and Yoko Iwamoto attended the FE Japan summit organized by FE Japan committee in Tokyo on 19 December 2019.

Theme 1: Greenhouse gases and the oceans

Cruise/Field campaigns

-NIES Volunteer Observing Ship Program using cargo ships (Atmosphere/Ocean Greenhouse Gas Observation: Japan-North America, Japan-Oceania; Atmosphere Greenhouse Gas/Aerosol Observation: Japan-Southeast Asia)

-R/V Mirai, underway pCO₂ and CH₄ observation in the Arctic Ocean (P.I. Murata), Sep. 2019

-R/V Mirai, underway pCO₂ observation in the Indian Ocean and the Southern Ocean (P.I. Murata), De.2019-Jan.2020.

-Oceanic observation in Southern Ocean by Kaiyo-maru (KY18-4) for air-sea CO₂ flux measurement (December 2018-March 2019)

International collaboration

-RECCAP2 (Regional Carbon Cycle Assessment and Processes phase 2; Co-char Patra, Mar. 2019-

Theme 3: Atmospheric deposition and ocean biogeochemistry

Meetings/international collaboration/workshop

-Workshop on atmospheric deposition of aerosols and their effects on biogeochemical cycles and climate, Nagoya, on 23-24 December 2019 (Organized by Akinori Ito and Michihiro Mochida)

Theme 4: Interconnections between aerosols, clouds, and marine ecosystems

Cruise/field campaigns

-Aerosol, seawater and microlayer observation during the R/V Toyoshio Maru cruise in the western part of the Seto Inland Sea, on 8-12 July 2019. (PI: Y. Iwamoto and K. Takeda)

Theme 5: Ocean biogeochemical control on atmospheric chemistry

Meetings/international collaboration/workshop

-Oxygenated Compounds in the Tropical Atmosphere– Variability and Exchanges (OCTAVE) Intensive Field Campaign Workshop, Brussels, on 16-17 May 2019 (Organizers: T. Stavrakou, J. Brioude, Presentation: Y. Miyazaki)

Cross-Cutting Theme:

Field campaign/Laboratory Experiment

-Sea ice experiment in Saroma-ko Lagoon, Hokkaido, Japan for sea ice gas exchange process and light measurement above/under the sea ice in February 2019 (with scientists from France).

-Sea ice tank experiment in Roland von Glasow air-sea-ice chamber (University of East Anglia) for sea ice storage and exchange process for gas in January 2020 (with scientists from UK, Canada, Belgium, Japan).

General SOLAS

Cruise/field campaigns

-Shinsei-Marun KS-19-11 cruise at the Sea of Japan in June 2019. (Chief scientist: Urumu Tsunogai)

-Seisui-Marun SE-19-15 cruise at Ise Bay, Japan in September 2019. (Chief scientist: Fumiko Nakagawa)

-Shinsei-Marun KS-19-21 cruise at the Sea of Japan in October 2019. (Chief scientist: Urumu Tsunogai)

Meetings/international workshop

-Early Career Scientist Day in SOLAS Open Science Conference in Sapporo on 21 April 2019: Organized by M. Lizzote, S. Kameyama, and Y. Iwamoto

--"Biogeochemical linkages between the surface ocean and atmosphere" session at Japan Geoscience Union (JpGU) meeting 2019, in May 2019 (Conveners: Y. Miyazaki, J. Nishioka, K. Suzuki, Y. Iwamoto)

3. Top 5 publications in 2019 (only PUBLISHED articles) and if any, weblinks to models, datasets, products, etc.

Ito, A., S. Myriokefalitakis, M. Kanakidou, N. M. Mahowald, R. A. Scanza, D. S. Hamilton, A. R. Baker, T. Jickells, M. Sarin, S. Bikkina, Y. Gao, R. U. Shelley, C. S. Buck, W. M. Landing, A. R. Bowie, M. M. G. Perron, C. Guieu, N. Meskhidze, M. S. Johnson, Y. Feng, J. F. Kok, A. Nenes, R. A. Duce (2019) Pyrogenic iron: The missing link to high iron solubility in aerosols, *Science Advances*, 5, eaau7671, doi: 10.1126/sciadv.aau7671.

Friedlingstein, P., Jones, M. W., O'Sullivan, M., Andrew, R. M., Hauck, J., Peters, G. P., Peters, W., Pongratz, J., Sitch, S., Le Quéré, C., Bakker, D. C. E., Canadell, J. G., Ciais, P., Jackson, R. B., Anthoni, P., Barbero, L., Bastos, A., Bastrikov, V., Becker, M., Bopp, L., Buitenhuis, E., Chandra, N., Chevallier, F., Chini, L. P., Currie, K. I., Feely, R. A., Gehlen, M., Gilfillan, D., Gkritzalis, T., Goll, D. S., Gruber, N., Gutekunst, S., Harris, I., Haverd, V., Houghton, R. A., Hurtt, G., Ilyina, T., Jain, A. K., Joetzjer, E., Kaplan, J. O., Kato, E., Klein Goldewijk, K., Korsbakken, J. I., Landschützer, P., Lauvset, S. K., Lefèvre, N., Lenton, A., Lienert, S., Lombardozzi, D., Marland, G., McGuire, P. C., Melton, J. R., Metzl, N., Munro, D. R., Nabel, J. E. M. S., Nakaoka, S.-I., Neill, C., Omar, A. M., Ono, T., Peregon, A., Pierrot, D., Poulter, B., Rehder, G., Resplandy, L., Robertson, E., Rödenbeck, C., Séférian, R., Schwinger, J., Smith, N., Tans, P. P., Tian, H., Tilbrook, B., Tubiello, F. N., van der Werf, G. R., Wiltshire, A. J., and Zaehle, S. (2019) Global Carbon Budget 2019, *Earth Syst. Sci. Data*, 11, 1783–1838, <https://doi.org/10.5194/essd-11-1783-2019>.

Bui, O.T.N., S. Kameyama, Y. Kawaguchi, S. Nishino, U. Tsunogai, H. Yoshikawa-Inoue (2019) Influence of warm-core eddy on dissolved methane distributions in the southwestern Canada Basin during late summer/early fall 2015. *Polar Science*, Vol. 22, doi:10.1016/j.polar.2019.100481.

Thomas J. L., Stutz J. P., Frey M. M., Bartels-Rausch T., Altieri K., Baladima F., Browse J., Dall'Osto M., Marelle L., Mougnot J., Murphy J. G., Nomura D., Pratt K., Willis M., Zieger P., Abbatt J., Douglas T. A., Facchini, M. C., France J., Jones A. E., Kim K., Matrai P. A., McNeill V. F., Saiz-Lopez A., Shepson P., Steiner N., Law K. S., Arnold S. R., Delille B., Schmale J., Sonke J., Dommergue A., Voisin D., Melamed M. L., Gier J. (2019) Fostering multidisciplinary research on interactions between chemistry, biology, and physics within the coupled cryosphere-atmosphere system. *Elementa-Science of the Anthropocene*, 7(1), p.58. DOI: <http://doi.org/10.1525/elementa.396>.

Yoshizue, M., Iwamoto, Y., Adachi, K., Kato, S., Sun, S., Miura, K., Uematsu, M (2019) Individual particle analysis of marine aerosols collected during the North-South transect cruise in the Pacific Ocean and its marginal seas, *Journal of Oceanography*, 75, 513-524.

4. Did you engage any stakeholders/societal partners/external research users in order to co-produce knowledge in 2019? If yes, who? How did you engage?

None.

PART 2 - Planned activities for 2019/2020 and 2021

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

(No specific order)

-Arctic Challenge for Sustainability (ArCS) Project 2, 2020-2025 (Scientists involved: Sumito Matoba, Yuzo Miyazaki, Daiki Nomura, Sayaka Yasunaka, and many others)

-MOSAIC expedition (leg5: from June to August 2020) (Daiki Nomura)

-R/V Hakuho-maru KH-20-2 cruise, Chemical and biogeochemical transfer of marine organic aerosols from the sea surface to the atmosphere in the Kuroshio current over the western North Pacific, July 2020 (PI: Yuzo Miyazaki, Youhei Yamashita, Koji Suzuki).

-Seisui-Maruru cruise (Chief scientist: Fumiko Nakagawa) at Ise Bay, Japan in September 2020.

-NIES Volunteer Observing Ship Program using cargo ships (Atmosphere/Ocean Greenhouse Gas Observation: Japan-North America, Japan-Oceania; Atmosphere Greenhouse Gas/Aerosol Observation: Japan-Southeast Asia)

-Sampling of aerosol and reactive oxygen species in seawater during R/V Toyoshio Maru cruise in Seto Inland Sea, Japan, 6-10 July 2020 (PI: Y. Iwamoto and K. Takeda)

-Influence on Marine ecosystem at western North Pacific by Atmospheric Chemical Trace Species from East Asia (IMPACT-SEA) (PI: F. Taketani and K. Nagashima)

- R/V Mirai cruise in Apr. 2020
- R/V Mirai cruise in Feb-Mar 2021

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

(No specific order)

-SOLAS related session "*Atmospheric nutrient deposition and microbial community responses, and predictions for the future in the North Pacific Ocean*" will be held in PICES annual meeting in Qingdao in Oct. 2020, which will be organized by Jun Nishioka with three other co-conveners.

-SOLAS related session in JpGU-AGU Joint Meeting 2020, Chiba, 25 May 2020 (Conveners: S. Kameyama, Y. Iwamoto, M. N. Aita, D. Sasano)

-ISAR6 S1_MOSAIC session in March 2020 (Daiki Nomura)

-Institute of Low Temperature Science (ILTS) Workshop on Biogeochemical Interactions between Ocean and Atmosphere, Sapporo, in 2020 (Organizer: A. Ito, Y. Miyazaki, J. Nishioka)

3. Funded national and international projects/activities underway.

(No specific order)

-Arctic Challenge for Sustainability (ArCS) Project 2, 2020-2025 (Scientists involved: Sumito Matoba, Yuzo Miyazaki, Daiki Nomura, Sayaka Yasunaka, and many others)

-A Grant-in-Aid for Scientific Research (A) granted by the Japan Society for the Promotion of Science (JSPS), 17H00780, PI: Urumu Tsunogai

-A Grant-in-Aid for challenging Exploratory Research granted by the Japan Society for the Promotion of Science (JSPS), 19K22908, PI: Urumu Tsunogai.

-Global Environmental Research Coordination System from Ministry of the Environment of Japan

-A Grant-in-Aid for Scientific Research (A) granted by the Japan Society for the Promotion of Science (JSPS), 18H04143, PI: Yugo KANAYA, FY2018-2020, Origins and ice nucleating abilities of bioaerosols in the marine atmosphere: Links among ecosystems, chemical substances, and clouds explored with fluorescence properties

-A Grant-in-Aid for Scientific Research (B) granted by the Japan Society for the Promotion of Science (JSPS), 19H04233, PI: Yuzo Miyazaki, FY2019-2021, Organic nitrogen aerosols in the marine atmosphere: What is a key factor of marine microbial activity controlling the formation?

-Long-term observations of the impacts of climate change on air quality and oceanic deposition in the Asia-Pacific regions, Ministry of Environment, PI: Hiroshi Tanimoto, 2018-2022.

4. Plans / ideas for future national or international projects, programmes, proposals, etc. (please indicate the funding agencies and potential submission dates).

-The SOLAS-Japan National Committee has been discussing the linkage with and possible contribution to Future Earth in collaboration with the National Committees of IGAC, iLEAPS, etc.

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

-NIES has participated the activity of Surface Ocean CO₂ Atlas (SOCAT) since 2007.

Comments