surface ocean solas lower atmosphere study

Report for the year 2021 and future activities

SOLAS *'Korea'*

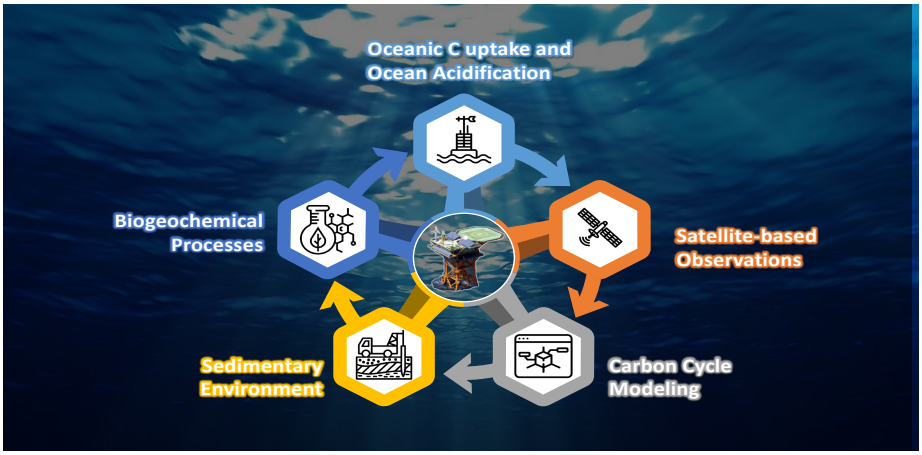
compiled by: 'Kitack Lee (Pohang University of Science and Technology and Eunil Lee (Korea Hydrographic and Oceanographic Agency)'

PART 1 - Activities from January 2021 to Jan/Feb 2022

1. Scientific highlight

East China Sea Biogeochemical Studies (2021-2025) funded by Korea Hydrographic and Oceanographic Agency, Korea:

The East China Sea is influenced by a mixture of the nutrient-rich Changjiang River water and ambient shelf seawater. Both the nutrient-induced growth of biology compensating the temperature-driven increase of surface CO_2 partial pressure from April to mid-August and the enhanced air-sea CO_2 flux by the winter cooling and high windspeeds from November to March transformed the East China Sea into the strong C sink. The study is designed to provide the observational and mechanistic lines of evidence for confirming "continental shelf C pump" theorized by Tsunogai et al. (1999)—a mechanism in the shallow waters of the continental shelves accumulating a significant amount of C (via reinforced cooling and promoted biological C uptake) to be transported from surface waters of the basin to the interior of the adjacent deep ocean. In the future, the increasing input of anthropogenic nutrients into the East China Sea is likely to make the region further the stronger C sink. However, the magnitude and directionality of C sink by the East China Sea remain largely unknown.

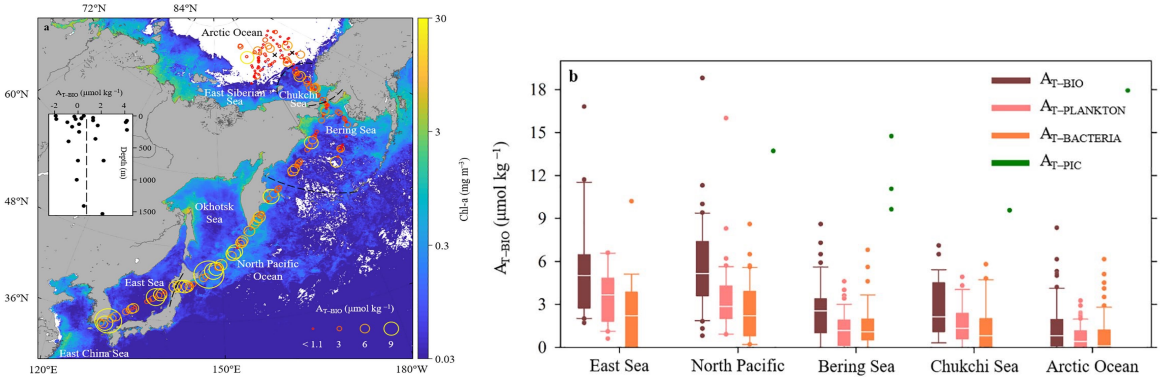


A multi-disciplinary research project was funded for 2021-2025 by Korea Hydrographic and Oceanographic Agency. Two overarching goals of this project will be perused through concerted efforts by five research teams: Kitack Lee and Jung-Sung Kug from Pohang University of Science and Technology; Byung-Joo Choi from Chonnam National University; and Kyung-Ae Park from Seoul National University. Upon the completion of this 5-year project, two research outcomes will be produced. First, the magnitude and directionality of C sink by the East China Sea are obtained. Second, the major drivers of changes in the East China Sea C sink are identified. This project consists of direct observations and modeling studies.

2. Activities/main accomplishments in 2021 (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, social sciences, and media).

Contribution of marine phytoplankton and bacteria to alkalinity: an uncharacterized component (published in GRL 2021)

In seawater thermodynamic calculations involving measured alkalinity, estimates of alkalinity contributed by bicarbonate and carbonate ions only are needed, and are made by correcting measured alkalinity values for contributions from borate and hydroxide ions, and from other minor chemical species. Among those minor components, contributions from phytoplankton and bacteria cells are an uncharacterized component of measured alkalinity. The contributions of phytoplankton and bacteria cells to alkalinity (A_T) were measured in seawater samples obtained from 205 locations including the East Sea, the North Pacific Ocean, the Bering Sea, the Chukchi Sea, and the Arctic Ocean. We attributed the differences in A_T values measured for unfiltered versus filtered samples to A_T components contributed by phytoplankton (retained on a 0.7 μm filter) and by phytoplankton and bacteria combined (A_{T-BIO}; retained on a 0.45 μm filter). The A_{T-BIO} values reached 10–19 μmol kg^{-1} in the East Sea and the North Pacific Ocean, and progressively decreased to a level of 1 μmol kg^{-1} with distance towards the Arctic Ocean. The study shows that the A_{T-BIO} values are non-negligible in coastal and open ocean environments and need to be considered when assessing the accuracy of carbon parameters calculated using the thermodynamic models that use measured A_T as an input parameter. We recommend that A_T be measured using filtered seawater samples, particularly in productive ocean regions, because the influence of A_{T-BIO} on the calculated parameters is considerably greater than the measurement precision. We note that discretion is needed when deciding whether to perform seawater filtration in less productive ocean environments, where seawater filtration may not greatly benefit.



3. Top 5 publications in 2021 (only PUBLISHED articles) and if any, weblinks to models, datasets, products, etc.

Lee, C. H.; Lee, K.; Ko, Y. H.; Lee, J. S., 2021, Contribution of marine phytoplankton and bacteria to alkalinity: an uncharacterized component, Geophysical Research Letters, 48, 19, DOI: e2021GL093738

Na, T.; Hwang, J.; Kim, S. Y.; Jeong, S.; Rho, T.; Lee, T, 2022, Large increase in dissolved organic carbon in the East Sea (Japan Sea) from 1999 to 2019, Frontiers in Marine Science, 108, DOI: 10.3389/fmars.2022.825206

Mo, A.; Yang, E. J.; Kang, S. H.; Kim, D.; Lee, K.; Ko, Y. H.; ... & Kim, T. W., 2022, Impact of Sea Ice Melting on Summer Air-Sea CO_2 Exchange in the East Siberian Sea, Frontiers in Marine Science, DOI: 10.3389/fmars.2022.766810

Jang, S.; Park, K. T.; Lee, K.; Yoon, Y. J.; Kim, K.; Chung, H. Y.; … & Hermansen, O., 2021, Large seasonal and interannual variations of biogenic sulfur compounds in the Arctic atmosphere (Svalbard; 78.9°N, 11.9°&E), Atmospheric Chemistry and Physics, 21(12), 9761-9777, DOI:10.5194/acp-21-9761-2021

Moon, J.-Y.; Lee, K.; Lim, W.-A.; Lee, E.; Dai, M.; Choi, Y.-H.; ... & Chae, J., 2021, Anthropogenic nitrogen is changing the East China and Yellow seas from being N deficient to being P deficient, Limnology and Oceanography, 66(3), 914-924, DOI: 10.1002/lno.11651

4. Did you engage any stakeholders/societal partners/external research users in order to co-produce knowledge in 2017? If yes, who? How did you engage?

PART 2 - Planned activities for 2018/2019 and 2020

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

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

3. Funded national and international projects / activities underway.

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

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

Comments