surface ocean solas lower atmosphere study

Report for the year 2020 and future activities

SOLAS China

compiled by: Huiwang Gao, Xianghui Guo, Chao Zhang, Yan Yang

This report has two parts:

- Part 1: *reporting of activities in the period of January 2020 - Jan/Feb 2021*
- Part 2: *reporting on planned activities for 2021 and 2022.*

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 2020 to Jan/Feb 2021

1. Scientific highlight

*Describe one scientific highlight with a title, text (**max. 300 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 results of international collaborations. (If you wish to include more than one highlight, feel free to do so).*

Title: High-frequency time-series autonomous observations of sea surface pCO_2 and pH

Large uncertainties associated with estimations of coastal air-sea CO_2 fluxes, which often possess highly dynamic ranges, are largely due to the poor spatial, and especially the temporal, coverage of field observations. Carbon dioxide partial pressure (pCO_2) in surface water was continuously measured every three hours from July 2012 to June 2013 using an autonomous pCO_2 system (MAPCO$_2$) deployed on a moored buoy on the East China Sea shelf (31°N, 124.5°E). Sea surface pCO_2 and pH had the largest variations in summer, ranging from 215 to 470 µatm, and 7.941 to 8.263 (averagely 8.084±0.080), respectively. They varied little in winter, ranging from 328 to 395 µatm, and 8.003 to 8.074 (averagely 8.052±0.010), respectively. The seasonal average sea surface pCO_2 was respectively 335±70, 422±43, 362±11 and 311±59 µatm in summer, autumn, winter and spring, and was overall undersaturated with respect to atmosphere on a yearly basis. Although the average pCO_2 in summer was below the atmospheric level, the net CO_2 flux has suggested a CO_2 source status due to the influence of typhoons. The time-series observation thus demonstrated the significant, even dominant impact of episodic typhoon events on surface ocean CO_2 chemistry and air-sea CO_2 gas exchange, which would be impossible to capture by shipboard observation. The high wind stress and curl associated with the northward movement of typhoon induced complex sea surface water movement, vertical mixing, and subsequent biological drawdown, which differed in pre-onset and post-typhoon stages. Based on our estimates, the degassing fluxes during typhoon reached as high as 82 and 242 mmol m^{-2} CO_2 in summer and autumn, respectively, accounting for twice as large as the summer CO_2 sink during non-typhoon period, and 28% of the total CO_2 source in autumn.

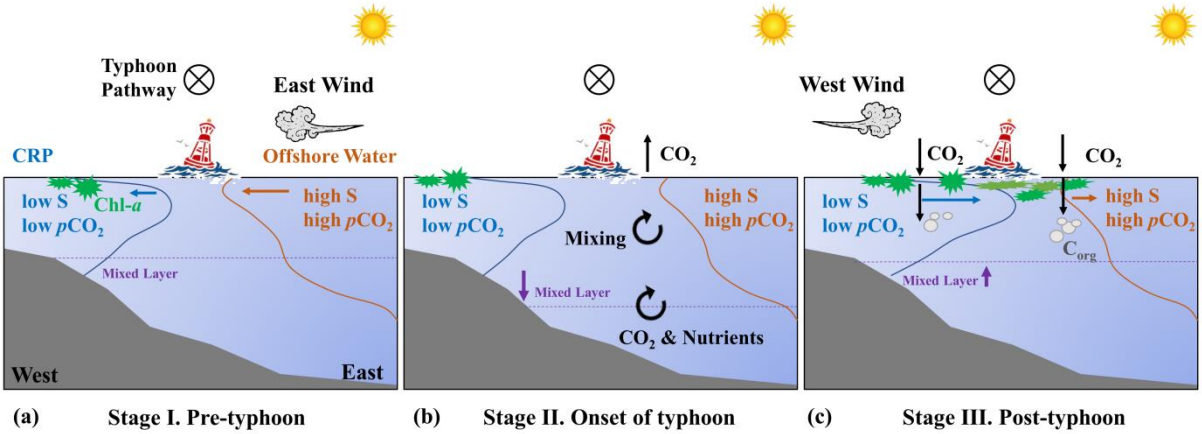

Figure: Dynamics of wind and surface ocean during three stages of typhoon at the buoy site. Circled cross denotes the direction (into the page) of typhoon pathway. Green shapes represent phytoplankton and Chl-*a*, grey circles represent biological-sequestered organic carbon (C_{org}). Stage I: east wind prevails and drives the westward movement of offshore surface water; Stage II: strong wind promotes vertical mixing and hence CO_2 outgassing; Stage III: west wind prevails and drives the eastward movement of CRP, meanwhile, the reinvigoration of primary production draw downs CO_2 from the atmosphere.

Citation: Yingxu Wu, Minhan Dai, Xianghui Guo, Jinshun Chen, Yi Xu, Xu Dong, Junwei Dai and Zhirong Zhang, 2020. High-frequency time-series autonomous observations of sea surface pCO_2 and pH. Limnology and Oceanography. doi: 10.1002/lno.11625.

Title: Methane production in oxic seawater of the western North Pacific and its marginal seas

Methane (CH_4) is an important greenhouse gas in addition to carbon dioxide. The oceans are natural sources of atmospheric CH_4, but the origin of excess CH_4 at the surface remains enigmatic. A series of laboratory and field incubation experiments were conducted in the western North Pacific (WNP) and its marginal seas (i.e. Yellow Sea and South China Sea) to identify the contribution of methylphosphonate (MPn) degradation to the CH_4 supersaturation in the upper water column of the oceans and the microbes associated with MPn-driven CH_4 production. In the coastal seawaters of the Yellow Sea, CH_4 was observed to accumulate after MPn enrichment with high MPn-to-CH_4-conversion efficiency (~60%). Dissolved inorganic phosphorus (Pi) did not effectively restrict the microbial utilization of MPn in the eutrophic coastal waters. The results of 16S rRNA gene sequencing showed that the *Vibrio* species were the dominant bacteria in the MPn-amended treatments, with the relative abundance of 73% at 24-h and 57% at 48-h as compared to less than 0.04% in the initial bulk seawaters. Moreover, several *Vibrio* isolates isolated from the coastal waters

were found to produce CH_4 while growing in culture using MPn as the sole phosphorus (P) source, thus indicating that *Vibrio* spp. are capable of cleaving MPn for P acquisition and might be the major contributors to the MPn-dependent CH_4 production. In the oligotrophic areas, such as the South China Sea and WNP, CH_4 production from MPn metabolism was also observed in the surface seawaters. In contrast to coastal waters, this pathway in the oligotrophic areas was regulated by Pi availability. This work confirms that aerobic CH_4 formation from MPn degradation can occur in both the eutrophic coastal waters and the oligotrophic oceans driven by the MPn-utilizing microorganism (especially heterotrophic bacteria), which could have a significant impact on our understanding of the CH_4 and P cycle in the global oceans.

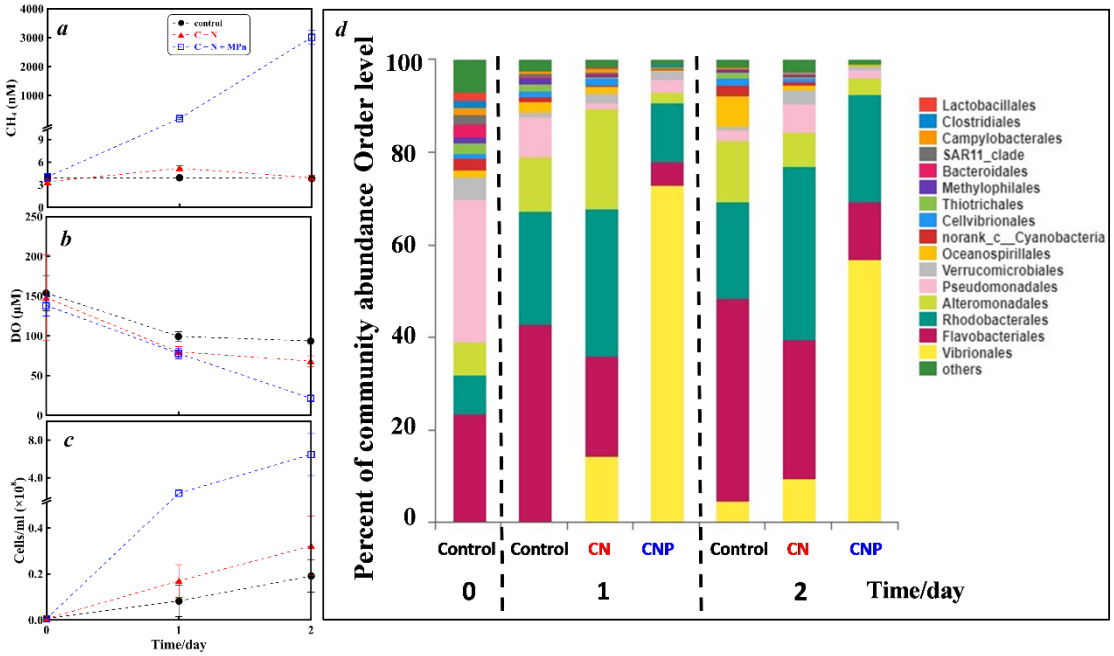

Figure: CH_4 production and microbial assemblage in coastal waters amended with MPn. (a) CH_4 production over time; (b) oxygen (DO) consumption over time; (c) cell densities; and (d) changes in microbial composition. Abundance (mean of triplicates) expressed as the percentage of reads assigned to each taxon divided by the total reads in each database (combined results of the extraction from 3-μm and 0.22-μm membranes). Taxonomic classification is shown at the order level. Taxonomic groups that represent < 1% of the total assigned reads have been included in "others".

Citation: Wangwang Ye, Xiaolei Wang, Xiaohua Zhang, and Gui-Ling Zhang*, 2020. Methane production in oxic seawater of the western North Pacific and its marginal seas. Limnology and Oceanography. 65(10): 2352–2365. doi: 10.1002/lno.11457.

Title: High production of soluble Iron promoted by perosol acidification in fog

The current poor understanding of soluble iron (Fe) yield in atmospheric aerosols leaves two observational facts having not yet been correctly simulated in numerical models: the high Fe solubility in aerosols with low Fe content and, hence, the wide range of observed Fe solubility. Our observation at Qingdao, a coastal city of China, revealed that soluble Fe was produced along with aerosol acidification much more efficiently in fog than under other weather conditions. The median Fe solubility in fog aerosols, 5.81%, was 3.3 times of that in haze aerosols, 5.2 times of that in clear days, and 21.5 times of that in dust aerosols. Involving fog processing in models may reduce the discrepancy in the atmospheric flux of soluble Fe to the ocean between numerical simulations and field observations.

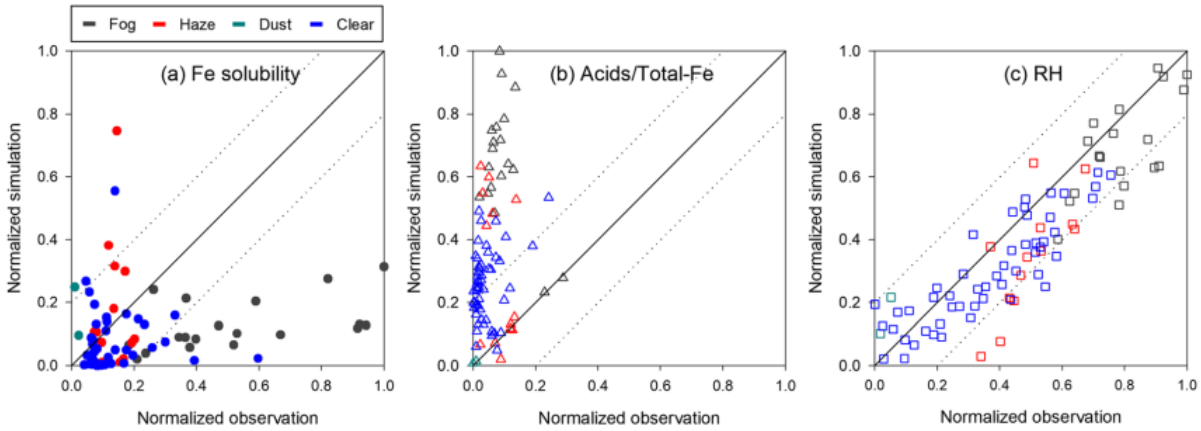

Figure: Min - max normalized scatterplots of observations versus simulations for (a) Fe solubility (r = 0.19, p = 0.08), (b) Acids/Total Fe (r = 0.66, $p < 0.01$), and (c) RH (r = 0.92, $p < 0.01$). The solid line in each panel shows the 1:1 ratios, and the two dotted lines represent ±20% deviation between the observed and simulated values.

Citation: Jinhui Shi*, Yang Guan, Akinori Ito, Huiwang Gao, Xiaohong Yao, Alex R. Baker, and Daizhou Zhang*, 2020. High production of soluble iron promoted by aerosol acidification in fog. Geophysical Research Letters. 47: e2019GL086124. doi: 10.1029/2019GL086124.

2. Activities/main accomplishments in 2020 (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).

■ Cruises and field experiments

1) Time-Series

Time	Location	Parameters investigated	Theme
6 Jul. – 16 Aug. and 10 Oct. – 4 Nov., 2020	Hua'niao Island (122.67° E, 30.86° N) in coastal East China Sea	Parameters investigated include aerosol chemical compositions, aerosol optical properties, trace gases, airborne microorganisms	3-5
16-31 May, 2020	Dongshan Bay	Parameters related to the air-sea CO_2 fluxes and carbonate system were collected	1

2) Cruises

ID	Time	Location	Activities	Theme
1	Apr., 2020	East China Sea and Yellow Sea	Parameters investigated include Dissolved CH_4, N_2O, pCO_2	1, 3
2	May, 2020	Western North Pacific	Parameters investigated include Dissolved CH_4, N_2O, pCO_2	1, 3
3	May-Jun., 2020	Bohai Sea and Yellow Sea	Parameters investigated include chemical compositions of aerosols, alkaline phosphatase activities and marine phytoplankton	3-5

4	Jul.-Aug., 2020	Bohai Sea and Yellow Sea	Parameters investigated include chemical compositions of aerosols, alkaline phosphatase activities and marine phytoplankton	3-5
5	Jul.-Aug., 2020	North western Pacific	Seawater, particles, and aerosol samples were collected in this cruise for the determination of trace elements and isotopes (TEIs) with multi-disciplinary, multi-platform and multi-equipment observation and sampling technology. Two cruises were supported by a "Ocean Desert" Major Project led by Dr. Minhan Dai sponsored by the National Natural Science Foundation of China (No. 41890800) and also endorsed as GEOTRACES Process Study with a code of GPpr15.	1 & 2 & 3 & Environmental impacts of geoengineering
6	Dec.,2020-Feb., 2021			

■ **Selected Projects**

- National Key Research and Development Program of China: Biogeochemical Processes and Climate Effect of Marine Biogenic Trace Gases in the East Marginal Seas of China (2016-2021). Leading PI: Guipeng Yang at Ocean University of China. (Theme 1)
- National Key Research and Development Program of China: The Migration and Transformation of Marine Biogenic Active Gases in the Atmosphere and Their Climate Effects (2016-2021), Leading PI: Ying Chen at Fudan University. (Theme 3 & 4)
- National Key Research and Development Program of China: Vertical Observation of Aerosol Particles and their Characteristics at Single Particle Level within Marine Boundary Layer at Coastal Areas (2018-2021), leading PI: Bingbing Wang at Xiamen University. (Theme 4)
- NSFC Innovative Research Group: Nitrogen Cycle under Global Change (2018-2023), Leading PI: Shuh-Ji Kao at Xiamen University. (Theme 1)
- NSFC Key Project: Source and Sink of Volatile Halogenated Organic Compounds in the East China Sea and the Yellow Sea and Their Influences on the Environment (2019-2023), PI: Guipeng Yang at Ocean University of China. (Theme 1)
- NSFC Major Project: CARBON Fixation and Export in the Oligotrophic Ocean (Carbon-FE) (2019-2023), Leading PI: Minhan Dai at Xiamen University. (Theme 1 & 2 & 3 & Environmental impacts of geoengineering)
- NSFC-Shandong Joint Fund Project: Impacts of Atmospheric Deposition on Water Quality and Ecosystem in the Coastal Waters of Shandong Province (2020-2023), Leading PI: Huiwang Gao at Ocean University of China. (Theme 3)
- NSFC General Project: Variation of Abundance and Community Structure of Airborne Microorganisms and Affecting Mechanism over the East China Sea (2018-2022), Leading PI: Ying Chen at Fudan University. (Theme 3 & 4)
- NSFC General Project: Effects of Multiphase Reactions for Atmospheric Organic Acid on Deposition Ice Nucleation Efficiency of Particles (2018-2021), leading PI: Bingbing Wang at Xiamen University. (Theme 3)
- NSFC General Project: Characteristics of Atmospheric Deposition Dominated by Haze Weather and Its Effect on Phytoplankton Growth in the Bohai and Yellow Sea (2019-2022), Leading PI: Huiwang Gao at Ocean University of China. (Theme 3)
- NSFC General Project: Study on the Source, Distribution, Transformation and Removal of COS and CS2 in the Continental Shelf Seas of Eastern China (2020-2024), PI: Guipeng Yang from Ocean University of China. (Theme 1)
- NSFC General Project: Influences of Hydrodynamics on the Spatial Distribution and Long-term Variations of Persistent Halogenated Hydrocarbons in the Bohai, Yellow, and East China Seas (2020-2023), Leading PI: Xinyu Guo at Ocean University of China. (Theme 1)
- NSFC Youth Project: Utilizing Ultrahigh Resolution Mass Spectrometry and Molecular Markers

to Characterize the Molecular Composition and Fate of Atmospheric Dissolved Organic Carbon in the South China Sea (2018-2020), Leading PI: Hongyan Bao at Xiamen University. (Theme 3)

- NSFC Youth Project: Impact of Atmospheric Deposition on the Utilization of Dissolved Organic Phosphorus by Phytoplankton in the Yellow Sea (2020-2022), Leading PI: Chao Zhang at Ocean University of China. (Theme 3)

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■ **Infrastructure**

- New deep-sea research vessel (Dong-Fang-Hong 3, delivered to Ocean University of China in 2019) with the capacity of SOLAS researches has carried out scientific expeditions in the western Pacific ocean in 2020.

- Xiamen University launched Dongshan Swire Marine Station (D-SMART) which locates in Dongshan Island, 140 km from Xiamen in 2017. D-SMART continued to improve its infrastructure in 2020. The seawater system has witnessed key progress, the behavior laboratory has been launched, and the atmospheric observation equipment has been deployed, to incrementally build up the land-ocean, ocean-atmosphere multi-interface observation systems.

■ **International interactions and collaborations**

1) Conference presentations

- Minhan Dai, Upper Ocean Biogeochemistry in the Oligotrophic Ocean, CAS-EurASc Frontier Forum on Marine Sciences and Technologies, 20-21 Oct., 2020, Shanghai, China (Keynote speech)

- Ying Chen, Linking methanesulfonic acid in marine aerosols to sea surface phytoplankton biomass, The 26th Conference on Atmospheric Environmental Science and Technology of China, Session 8 – Marine aerosol, 8 Dec. 2020, Beijing, China (Oral talk)

- Yang Gao, Elucidating the role of climate and emission in modulating the atmospheric nitrogen deposition over the North Pacific Ocean, PICES-2020 Annual meeting, 26 – 30 Oct. 2020 (Live oral)

- Qing Wang, Impact of atmospheric deposition on phytoplankton community structure in the Yellow Sea, PICES-2020 Annual meeting, 26 – 30 Oct. 2020 (Live oral)

- Shengqian Zhou, Ying Chen, Shan Huang, Guipeng Yang, Honghai Zhang, Adina Paytan, Hartmut Herrmann, Alfred Wiedensohler, Laurent Poulain, Haowen Li, Fanghui Wang, Yucheng Zhu, Tianjiao Yang, On the relationship between aerosol methanesulfonate and surface phytoplankton biomass in the mid-latitude oceans of the Northern Hemisphere, PICES-2020 Annual meeting, 26 – 30 Oct. 2020 (E-poster)

- Haowen Li, Ying Chen, Shengqian Zhou, Fanghui Wang, Tianjiao Yang, Yucheng Zhu, Qingwei Ma, Change of dominant phytoplankton groups in the eutrophic coastal sea due to atmospheric deposition, PICES-2020 Annual meeting, 26 – 30 Oct. 2020 (E-poster)

2) Conference & meetings organized

- The 5th Xiamen Symposium on Marine Environmental Sciences (XMAS-V) was held online and onsite in Xiamen from Jan. 11 to 14, 2021. XMAS-V focused on how Multidisciplinary Sciences Can Serve a Sustainable and Healthy Ocean. The symposium consisted of different, interconnected sessions covering physical oceanography, marine biogeochemistry, biological oceanography, and marine ecotoxicology along with workshops for emerging topics in marine environmental sciences such as how to achieve the goals outlined in the United Nations Decade of Ocean Science for Sustainable Development (2021-2030). A Special Forum on the Decade was held in hybrid mode as part of XMAS-V. The Forum was organized to promote the Decade through insightful talks and in-depth discussions with international and regional representatives who have been actively involved in the planning of the Decade.

- Huiwang Gao and Guiling Zhang along with other three scholars from different countries convened the topic session “Atmospheric nutrient deposition and microbial community

responses, and predictions for the future in the North Pacific Ocean" in PICES-2020 Annual meeting 2020.

3) Contribution to international initiatives

- Minhan Dai was elected Co-Chair to the Surface Ocean Lower Atmosphere Study (SOLAS).
- The SOLAS Nodal Project Office based at State Key Lab of Marine Environmental science, Xiamen University was elevated into a full International Project Office (IPO) in January 2021.
- Minhan Dai as one of the major authors participate in drafting the white paper of Integrated Ocean Carbon Research (IOC-R) "A vision of Coordinated Ocean Carbon Research and Observations for the Next Decade". IOC-R is a formal IOC working group that was formed in 2018 in response to the UN Decade of Ocean Science for Sustainable Development 2021-2030, "the Decade". The IOC-R focusses the ocean carbon cycle component of the Implementation Plan by addressing key issues in ocean carbon research through a combined strategy of research and observational goals.
- Minhan Dai is engaged in REgional Carbon Cycle Assessment and Processes-2 (RECCAP2) which is an activity of the Global Carbon Project with a number of partners. The objectives of RECCAP2 are: 1) to quantify anthropogenic greenhouse gas emissions, 2) to develop robust observation-based estimates of changes in carbon storage and greenhouse gas emissions and sinks by the oceans and terrestrial ecosystems, distinguishing whenever possible anthropogenic vs. natural fluxes and their driving processes, 3) to gain science-based evidence of the response of marine and terrestrial regional GHG (CO_2, CH_4, N_2O) budgets to climate change and direct anthropogenic drivers. To address these objectives, RECCAP2 will design and perform a set of global syntheses and regional GHG budgets of all lands and oceans, and explore mechanisms by which to deliver regular updates of these regional assessments based on scientific evidence, considering uncertainties, understanding of drivers, and retrospective analysis of recent trends. RECCAP2 is expected to accomplish most of the work over 2019-2020 with publication of all papers by 2021.
- Minhan Dai is a member of the Expert Group of the High Level Panel for a Sustainable Ocean Economy (HLP). HLP is a unique initiative of 14 serving heads of government committed to catalysing bold, pragmatic solutions for ocean health and wealth that support the UN Sustainable Development Goals and build a better future for people and the planet. The HLP has commissioned a series of 'Blue Papers' to explore pressing challenges at the nexus of the ocean and the economy. Lead by Jan-Gunnar Winther and Minhan Dai, Blue Paper #14 on Integrated Ocean Management was published in 2020. This paper demonstrates that delivering much needed long-term ocean health and wealth can be achieved using integrated ocean management. A perspective article associated with the Blue Paper was published in Nature Ecology & Evolution in August.
- Minhan Dai is the co-chair of Organizing Committee of OceanObs'29 which will be organized in Qindao, China. The OceanObs conferences are held once every 10 years for the scientific, technical, and operational communities involved in the planning, implementation, and use of ocean observing systems.
- Xianghui Guo, Member, Session of Carbon and Climate (S-CC), North Pacific Marine Science Organization (PICES)

4) International collaborations

- Ocean University of China and University of East Anglia have established a sustained and stable relations of collaborations, covering the exchange of undergraduate and graduate students, and hold a seminar concerning to marine environmental science each year.
- Institute of Atmospheric Sciences (Fudan University) made collaborations with Leibniz Institute for Tropospheric Research in Germany and integrated their atmospheric methanesulfonate measurements over the Atlantic Ocean into the analysis towards the linkage between atmospheric methanesulfonate and sea surface phytoplankton.

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

- "Surf the Seas"-Ocean Science Day was held online by Xiamen University on 22 Nov. 2020. "Surf the Seas"- Livestream broadcast brought 9,500 viewers into the labs and more far flung locations, giving them an intimate look into the world of ocean science and what research

actually looks like. Fourteen labs and research groups worked to develop their content and make sure it was engaging, providing viewers with a unique point of view on ocean science and environmental change, one they perhaps have not had before.

- Launched on 1 Nov., 2019, the 70.8 Media Lab was jointly established by the Xiamen University Faculty of Earth Science and Technology and Sina Xiamen. The 70.8 Media Lab take the responsibility and mission of science communication, continuously disseminating marine scientific knowledge to society and the public through various means, and promoting public awareness on the ocean.

3. Top 5 publications in 2020 (only PUBLISHED articles) and if any, weblinks to models, datasets, products, etc.

1. Qian Li, Xianghui Guo*, Weidong Zhai, Yi Xu, and Minhan Dai, 2020. Partial pressure of CO_2 and air-sea CO_2 fluxes in the South China Sea: Synthesis of an 18-year dataset. Progress in Oceanography. 182: 102272. doi: 10.1016/j.pocean.2020.102272.
2. Tianjiao Yang, Ying Chen*, Shengqian Zhou, Haowen Li, Fanghui Wang, and Yucheng Zhu, 2020. Solubilities and deposition fluxes of atmospheric Fe and Cu over the Northwest Pacific and its marginal seas. Atmospheric Environment. 239. doi: 10.1016/j.atmosenv.2020.117763.
3. Jianlong Li, Sohiko Kameyama*, and Guipeng Yang*, 2020. In-situ measurement of trace isoprene and dimethyl sulfide in seawater and oceanic atmosphere based on room temperature adsorption-thermal desorption. Marine Chemistry. 222: 103787. doi: 10.1016/j.marchem.2020.103787.
4. Chao Zhang, Jingyi He, Xiaohong Yao, Yingchun Mu, Xinyu Guo, Xiaokun Ding, Yang Yu, Jinhui Shi, and Huiwang Gao*, 2020. Dynamics of phytoplankton and nutrient uptake following dust additions in the Northwest Pacific. Science of the Total Environment. 739: 139999. doi: 10.1016/j.scitotenv.2020.139999.
5. Tianfeng Guo, Zhigang Guo, Juntao Wang, Jialiang Feng*, Huiwang Gao, and Xiaohong Yao*, 2020. Tracer-based investigation of organic aerosols in marine atmospheres from marginal seas of China to the northwest Pacific Ocean. Atmospheric Chemistry and Physics. 20(8): 5055-5070. doi: 10.5194/acp-20-5055-2020.

4. Did you engage any stakeholders/societal partners/external research users in order to co-produce knowledge in 2020? If yes, who? How did you engage?

Lead by Xiamen University, proposal "Coastal Zones Under Intensifying Human Activities and Changing Climate: A Regional Programme Integrating Science, Management and Society to Support Ocean Sustainability (Coastal-SOS)" was submitted for UN Decade endorsement in Jan. 2021. This proposal partners cross-sectorial stakeholders, including leading academic institutions, industrial enterprises, foundations, and nongovernmental /intergovernmental organizations (NGO/IGOs) non-profit and non-governmental organizations from Eastern Asian countries, to enable the advancement of scientific understanding of critical coastal ocean health issues. The aim is to transform this scientific knowledge to provide solutions, including improved and integrated management strategies, and to empower industry towards adopting best practices in ocean usage.

PART 2 - Planned activities for 2021 and 2022

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

- There will be a regular spring cruise to the Northwest Pacific conducted by R/V Dong-Fang-Hong 3 in the next few years, which is closely related to themes 3-5 of SOLAS.
- NSFC Shiptime Sharing Project including four seasons will be carried out in China coastal seas, which covers five themes of SOLAS.
- Spring 2021 cruise of "Biogeochemical processes and climate effects of biogenic active gases in the eastern continental shelf of China", supported by the National Key Research and Development Program.
- Cruises for the investigation of seasonal variations of DMS, CO, volatile halocarbons, and non-methane hydrocarbons in the Changjiang River Estuary.

2. Events like conferences, workshops, meetings, summer schools, capacity building etc.

(incl. all information possible).

- International Scoping Workshop towards Integrated Research and Sustainability of the Coastal Ocean (Coastal-SOS) will be held in 2022. This workshop will gather an interdisciplinary community of scientists from geoscience, social economy, policy management, environmental ecology, model simulation, and other related fields for in-depth discussion on bold questions and solutions related to the coastal ocean. It will also promote opportunities where international collaboration can provide unique advantages of scope, scale, expertise, and facilities that enable advancement of scientific understanding of key coastal ocean issues towards sustainability.
- C1 biogeochemistry workshop will be held at Ocean University of China, August 2021, Qingdao.
- The 18th virtual Asia Oceania Geosciences Society (AOGS) annual meeting will be held on line in 01-08 August 2021.

3. Funded national and international projects/activities underway.

- National Key Research and Development Program of China: Biogeochemical Processes and Climate Effect of Marine Biogenic Trace Gases in the East Marginal Seas of China (2016-2021). Leading PI: Guipeng Yang at Ocean University of China.
- National Key Research and Development Program of China: The Migration and Transformation of Marine Biogenic Active Gases in the Atmosphere and Their Climate Effects (2016-2021), Leading PI: Ying Chen at Fudan University.
- National Key Research and Development Program of China: Vertical Observation of Aerosol Particles and their Characteristics at Single Particle Level within Marine Boundary Layer at Coastal Areas (2018-2021), leading PI: Bingbing Wang at Xiamen University.
- NSFC Major Project: CARBON Fixation and Export in the Oligotrophic Ocean (Carbon-FE) (2019-2023), Leading PI: Minhan Dai at Xiamen University. (Theme 1 & 2 & 3 & Environmental impacts of geoengineering)
- NSFC Key Project: Source and Flux of N_2O in the Euphotic Zone of the Northwestern Pacific (2021-2024), Leading PI: Shuh-Ji Kao at Xiamen University.
- NSFC Key Project: Source and Sink of Volatile Halogenated Organic Compounds in the East China Sea and the Yellow Sea and their Influences on the Environment (2019-2023), PI: Guipeng Yang at Ocean University of China.
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- NSFC General Project: Study on the Source, Distribution, Transformation and Removal of COS and CS2 in the Continental Shelf Seas of Eastern China (2020-2024), PI: Guipeng Yang from Ocean University of China.
- NSFC General Project: Influences of Hydrodynamics on the Spatial Distribution and Long-term

Variations of Persistent Halogenated Hydrocarbons in the Bohai, Yellow, and East China Seas (2020-2023), Leading PI: Xinyu Guo at Ocean University of China.

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

- Led by Xiamen University, proposal "Coastal Zones Under Intensifying Human Activities and Changing Climate: A Regional Programme Integrating Science, Management and Society to Support Ocean Sustainability (Coastal-SOS)" was submitted for UN Decade endorsement in Jan. 2021. This proposal partners cross-sectorial stakeholders, including leading academic institutions, industrial enterprises, foundations, and nongovernmental /intergovernmental organizations (NGO/IGOs) non-profit and non-governmental organizations from Eastern Asian countries, to enable the advancement of scientific understanding of critical coastal ocean health issues. The aim is to transform this scientific knowledge to provide solutions, including improved and integrated management strategies, and to empower industry towards adopting best practices in ocean usage.
- The proposal of integrated research on sustainability of the coastal ocean is to be submitted to NSFC for Major Project in Sep./Oct. 2022. The prospective proposal aims to address how land-sea-ocean-atmosphere/ecosystem-resource-environment-social economic system is coupled in the coastal ocean under dual stresses of climate change and human activities.

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

- Minhan Dai as one of the major authors participate in drafting the white paper of Integrated Ocean Carbon Research (IOC-R) "A vision of Coordinated Ocean Carbon Research and Observations for the Next Decade". IOC-R is a formal IOC working group that was formed in 2018 in response to the UN Decade of Ocean Science for Sustainable Development 2021-2030, "the Decade". The IOC-R focusses the ocean carbon cycle component of the Implementation Plan by addressing key issues in ocean carbon research through a combined strategy of research and observational goals.
- Huiwang Gao is the chair of Sino British Joint Research Centre, which aims to develop the collaboration between Ocean University of China and University of East Anglia.
- Minhan Dai is the co-chair of Organizing Committee of OceanObs'29 which will be organized in Qindao, China. The OceanObs conferences are held once every 10 years for the scientific, technical, and operational communities involved in the planning, implementation, and use of ocean observing systems.
- Xianghui Guo is a member of Session of Carbon and Climate (S-CC), North Pacific Marine Science Organization (PICES)
- Gui-Peng Yang is a full member of International SCOR Sea Surface Microlayer Working Group.
- Minhan Dai is engaged in REgional Carbon Cycle Assessment and Processes-2 (RECCAP2) which is an activity of the Global Carbon Project with a number of partners. The objectives of RECCAP2 are: 1) to quantify anthropogenic greenhouse gas emissions, 2) to develop robust observation-based estimates of changes in carbon storage and greenhouse gas emissions and sinks by the oceans and terrestrial ecosystems, distinguishing whenever possible anthropogenic vs. natural fluxes and their driving processes, 3) to gain science-based evidence of the response of marine and terrestrial regional GHG (CO_2, CH_4, N_2O) budgets to climate change and direct anthropogenic drivers. To address these objectives, RECCAP2 will design and perform a set of global syntheses and regional GHG budgets of all lands and oceans, and explore mechanisms by which to deliver regular updates of these regional assessments based on scientific evidence, considering uncertainties, understanding of drivers, and retrospective analysis of recent trends. RECCAP2 is expected to accomplish most of the work over 2019-2020 with publication of all papers by 2021.

Comments