IMBeR
Integrated Marine Biosphere Research

SKLEC

The 8th China-Japan-Korea IMBeR Symposium and Training Course

Marine Biogeochemical Sciences for the Sustainability of the West Pacific Biosphere

17-19 September 2018
Shanghai, China

Organised by

Integrated Marine Biosphere Research project (IMBeR)
East China Normal University (ECNU)
State Key Laboratory of Estuarine and Coastal Research (SKLEC), ECNU

Cooperation Periodicals

Anthropocene Coasts
Acta Oceanologica Sinica

東京大学 THE UNIVERSITY OF TOKYO

東海大学

気象庁 Japan Meteorological Agency

KIOST KOREA INSTITUTE OF OCEAN SCIENCE & TECHNOLOGY

WELCOME AND ACKNOWLEDGEMENTS

Welcome from SKLEC

Ladies and gentlemen,

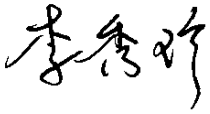
Welcome to participate the China-Japan-Korea IMBeR Symposium!

As the host of IMBeR Regional Project Office, the State Key Laboratory of Estuarine and Coastal Research is happy to see this event comes back to Shanghai again, and will expand into the IMBeR West Pacific Symposium Meeting.

The State Key Laboratory of Estuarine and Coastal Research is the leading Chinese Research Institute on matters concerning the Land-Sea interface. Now it is expanding the research scope to marine sciences, with special focus on marginal seas. We conduct world-class interdisciplinary research on estuarine, coastal and marine systems through the application of theoretical and applied approaches to solve the challenges arising from natural and anthropogenic pressures at the land-ocean interface.

We are moving to the new campus in this month. Therefore, we don't have enough time and enough hands to prepare for this meeting. Please forgive us if the meeting arrangement has some inconveniences.

Finally, I wish you enjoy a successful meeting, and enjoy your stay in Shanghai!



Professor Xiuzhen Li

On behalf of the State Key Laboratory of Estuarine & Coastal Research

East China Normal University, Shanghai, 200062, China

Welcome from IMBeR

Dear Colleagues,

It is my great pleasure to welcome you to the *8th China-Japan-Korea IMBeR Symposium*. IMBeR is very proud of this conference series and your participation is central to its continued success. The symposium presents a wonderful opportunity to share research and to forge collaborations across the West Pacific Region. This is evidenced by the increasing network of researchers engaged in IMBeR endorsed projects in the region. As the extent of human impact on the marine biosphere becomes increasingly recognised, our collective research as ocean scientists has never been more important.

The symposium was made possible thanks to the support, sponsorship, and hard work of many people and organisations. I would like to thank the East China Normal University (ECNU) and the State Key Laboratory of Estuarine and Coastal Research (SKLEC) for sponsorship of the symposium and their hosting and sponsorship of the IMBeR Regional Project Office (RPO) in Shanghai. I am also grateful for the contributions of the symposium's Scientific and Organizing Committees, with special mentions to Professors Shu Gao, Jing Zhang, Ying Wu, Xiuzhen Li and the whole team in SKLEC, and the extraordinary efforts of Mrs. Fang Zuo who coordinated the organisation of the symposium from the IMBeR RPO.

In order to embrace the spirit of the regional community of ocean scientists, we are happy to announce that the next symposium in this series will be held in Thailand in 2020, and will be called the *IMBeR West Pacific Symposium*.

I would like to wish you all a very successful symposium, and I hope that you enjoy your time at SKLEC/ECNU and in Shanghai.

Yours sincerely,

Professor Carol Robinson

Chair of IMBeR Scientific Steering Committee

Professor Marine Sciences, School of Environmental Sciences, University of East Anglia, Norwich, R47TJ, United Kingdom

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Introduction

Marine sciences researchers from China, Japan, and Korea have been worked actively at the frontier in the areas of Global Ocean Ecosystem Dynamics (GLOBEC) and Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) since early 1990s. Various scientific workshops and/or training activities have been taken among the three neighbor countries since then. Starting at 2002, the China-Japan-Korea GLOBEC/IMBER symposia have been an important venue for scientific exchange across focused marine science disciplines among the West Pacific region. With IMBER become the core project under Future Earth in 2016 and change its name as "IMBeR (Integrated Marine Biosphere Research)", IMBeR has been working on interdisciplinary research in the ocean, atmosphere, and continental shelf. This interdisciplinary approach will contribute to the combination of natural sciences and social sciences in order to achieve the greatest effect of ocean management and policy development and to achieve sustainable development of the ocean.

Topics

The 8th China-Japan-Korea IMBeR Symposium will focus on analyzing the impact of climate change and anthropogenic forcing on physical processes and biogeochemical cycles, ecosystem structure and functions, and fisheries in the West Pacific region, and how these complex interactions in combination, in turn, influences marine ecosystem and human society in a broad aspect.

The following topics could be included in this symposium:

1. Advances in observation and modelling of physical and biogeochemical processes in the West Pacific region
2. The response of marine ecosystems to natural and anthropogenic forcing: past, present and future
3. Responses of Society to global change in marine systems: ways forward

Scientific Committees

★ **Shu GAO** (State Key Laboratory of Estuarine and Coastal Research, East China Normal University, China)

★ **Jing ZHANG** (State Key Laboratory of Estuarine and Coastal Research, East China Normal University, China)

★ **Su Mei LIU** (Ocean University of China, China)

★ **Ying WU** (State Key Laboratory of Estuarine and Coastal Research, East China Normal University, China)

★ **Hui WU** (State Key Laboratory of Estuarine and Coastal Research, East China Normal University, China)

★ **Hiroaki SAITO** (The University of Tokyo, Japan)

★ **Hiroshi OGAWA** (The university of Tokyo, Japan)

★ **Masao ISHII** (Meteorological Research Institute, Japan Meteorological Agency, Japan)

★ **Sinjae YOO** (Korean Institute of Ocean Science and Technology, Korea)

★ **Se-Jong JU** (Korean Ocean Research and Development Institute, Korea)

★ **Yinji LI** (School of Marine Science and Technology, Tokai University, Japan)

★ **Suvaluck SATUMANATPAN** (Mahidol University, Thailand)

Organizing Committees

★ **Ying WU** (State Key Laboratory of Estuarine and Coastal Research, East China Normal University, China)

★ **Yinji LI** (School of Marine Science and Technology, Tokai University, Japan)

★ **Xiuzhen LI** (State Key Laboratory of Estuarine and Coastal Research, East China Normal University, China)

★ **Yi XU** (State Key Laboratory of Estuarine and Coastal Research, East China Normal University, China)

★ **Wei ZHENG** (State Key Laboratory of Estuarine and Coastal Research, East China Normal University, China)

★ **Fang ZUO** (IMBeR Regional Project Office, China)

★ **Xiaona WANG** (IMBeR Regional Project Office, China)

Organizers and Sponsors

East China Normal University

Founded in Shanghai in October 1951, East China Normal University (ECNU) is one of the most prestigious universities in China and is supported by the national programs "Project 211" and "Project 985". Since China opened up the world in 1978, ECNU has developed at breathtaking pace into a comprehensive research university. ECNU attaches great importance to the internationalization of its development and enjoys a wide influence and an excellent reputation around the world. The university has established exchange and cooperative partnerships with more than 200 internationally renowned universities.

The conference gratefully acknowledges the support of East China Normal University.

For more information, please visit: http://english.ecnu.edu.cn/

State Key Laboratory of Estuarine and Coastal Research (SKLEC)

East China Normal University (ECNU), Shanghai, China hosts and treasures the well-known State Key Laboratory of Estuarine and Coastal Research (SKLEC). The laboratory was established by the State Planning Commission of China in 1989 and went into operation in December 1995. Presently SKLEC employs 58 fulltime faculty and staff members in laboratory. There are three main research streams of SKLEC: Estuarine Evaluation and Estuarine Sediment Dynamics; Coastal Dynamics Geomorphology and Sediment Process; Estuarine and Coastal Ecology and Environment. Achievements of the laboratory were used to solve problems encountered in coastal development of China, especially many large engineering projects, such as national survey on coastal resources, construction for arbors and ports, navigation channel regulations projection of coastal wetlands and engineering structures. SKLEC has become a national site for high level research on estuarine and coastal environment and a high level training base in China.

For more information, please visit: http://english.sklec.ecnu.edu.cn/

Integrated Marine Biosphere Research (IMBeR)

IMBeR is an international project co-sponsored by the Scientific Committee on Oceanic Research (SCOR) and Future Earth. Its aim has been to develop a comprehensive understanding of, and thus an accurate predictive capacity of, ocean responses to accelerating global change and the consequent effects on the Earth system and human society. Now, after ten years of successful interdisciplinary research, the IMBeR community has develop a new science plan aimed at providing evidence-based knowledge and guidance foe policy decision makers, managers and marine related communities to secure or transition towards sustainability of the marine realm under global change.

For more information, please visit: http://www.imber.info/

Logistical Information

❖Meeting venue

Lecture Hall, 2nd floor, East China Normal University Library

East China Normal University (ECNU) North Zhongshan Road Campus
3663 North Zhongshan Road
Shanghai 200062, China

❖Accommodation

★*Yifu Guest House*　（逸夫楼）

Address: East China Normal University,
3663 N. Zhongshan Rd., Shanghai 200062, China
地址：上海市普陀区中山北路 3663 号华东师范大学逸夫楼

★*Vienna International Hotel*　（*formerly Jin Sha Jiang Hotel*）
（维也纳国际酒店，原“金沙江大酒店”）

Address: East China Normal University,
3663 N. Zhongshan Rd., Shanghai 200062, China
地址：上海市普陀区中山北路 3663 号华东师范大学逸夫楼

❖Time zone

Shanghai is eight hours ahead of G.M.T. (GMT+8).

❖Language

English is the working language of the symposium.

❖File sharing and privacy polices

In order to protect the intellectual property, all documents presented during the symposium will be protected by copyright. If you wish to get a copy of the PPT file from any specific speaker, please kindly contact the speaker him/herself directly. It is strictly forbidden to copy the files from the conference computers. Thank you for your understanding and cooperation with our protection rules.
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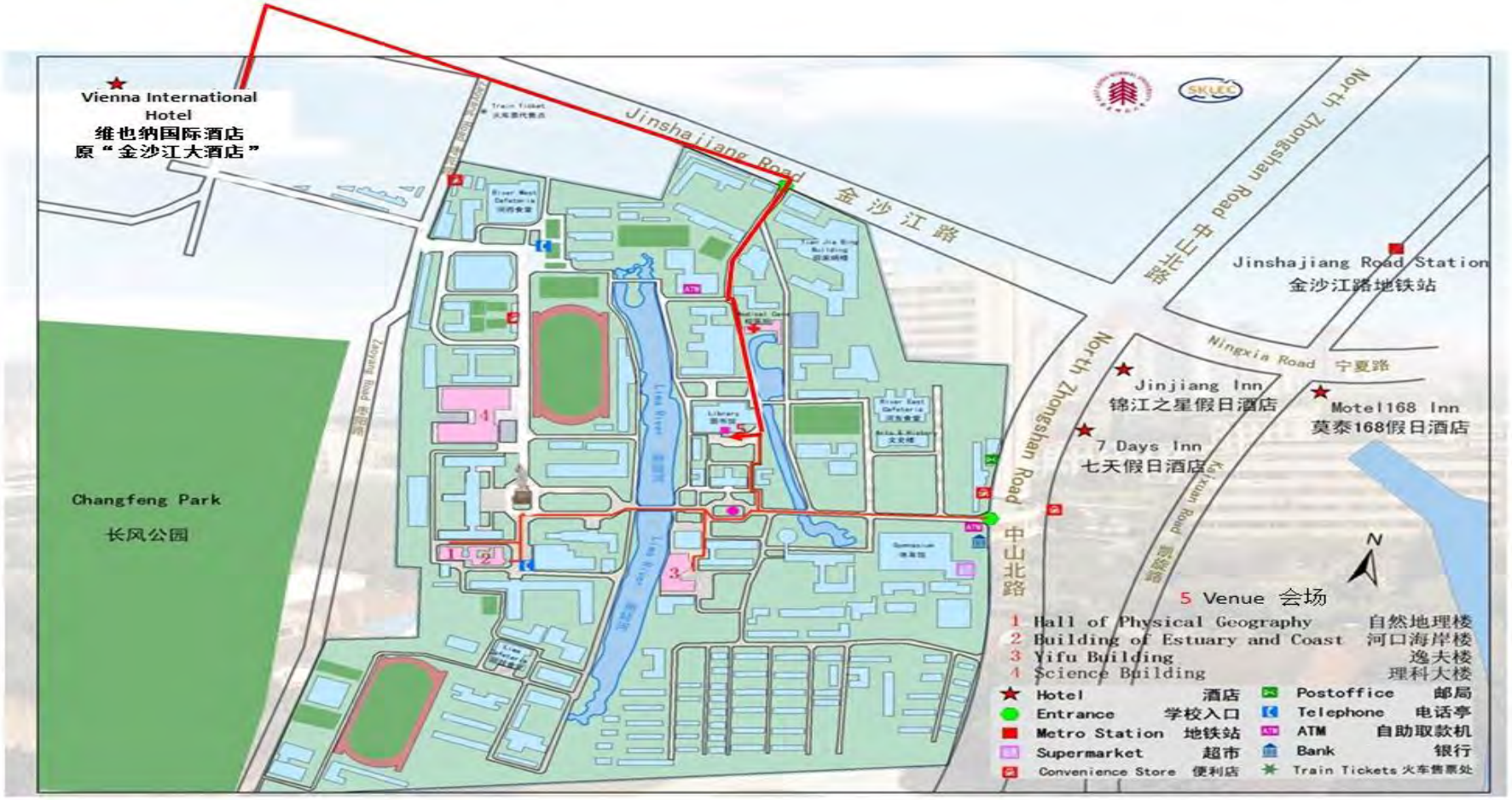
❖Contacts

► Fang Zuo: IMBeR Regional Project Office, Shanghai, China (fzuo@sklec.ecnu.edu.cn)
► Xiaona Wang: IMBeR Regional Project Office, Shanghai, China (imber@ecnu.edu.cn)

❖**Transportation**

★**Getting to the venue**



Oral Sessions

16 September 2018, Sunday

Time	Event
18:00-20:00	**Registration & Welcome Reception** *East China Normal University Library, 2nd floor* Please join us for welcome drinks and finger food to meet your fellow participants

17 September 2018, Monday

Time	Event
08:30-09:00	**Registration**
9:00-09:30	**Opening Session** Welcome Speech (Xiuzhen Li) Remarks by East China Normal University Delegates (Subin Wang) Remarks by CJK IMBeR Symposium Organizing Committee Delegates (Sinjae Yoo, Hiroaki Saito)
09:30-09:40	**Progress of IMBeR Project** John Claydon
09:40-09:50	**CJK IMBeR Symposium: past, present, and future** Ying Wu
09:50-10:20	**Group Photo & Morning tea**
Session 1: Advances in observation and modelling of physical and biogeochemical processes in the West Pacific region **Conveners: Hui Wu, Gi Hoon Hong**	
Keynote speech	
10:20-10:50	BGC-Argo observations and physical-biogeochemical modeling in Northwest Pacific | Fei Chai
10:50-11:20	The history of Kuroshio studies, the progress and emerging issues | Hiroaki Saito
Paper presentation	
11:20-11:35	Seasonal variations in nutrients and biogenic particles in the upper and lower layers of East China Sea Shelf and their export to adjacent seas | Xinyu Guo
11:35-11:50	Variability and mechanisms of seasonal hypoxia off the Changjiang Estuary, China | Feng Zhou
11:50-12:05	Physical control on the biogeochemical processes in the Changjiang River estuary | Zhaoru Zhang
12:05-14:00	**Lunch**

Time	Event
Session 1: Advances in observation and modelling of physical and biogeochemical processes in the West Pacific region **Conveners: Feng Zhou, Hiroaki Saito**	
14:00-14:15	Variability of particle export in the northwestern Pacific | Peng Xiu
14:15-14:30	Transport and transformation of nitrate in the Changjiang Estuary | Shan Jiang
14:30-14:45	Nutrient supply to the euphotic layer in the Kuroshio and Kuroshio Extension | Yingying Hu
14:45-15:00	The impact of cyclonic- and anticyclonic- mesoscale eddies on biogeochemistry of dissolved and particulate organic matter in the northern slope of South China Sea | Miao Zhang
15:00-15:15	Tracing external sources of nutrients in the East China Sea and evaluating their contributions to primary production | Jing Zhang
15:15-15:35	**Afternoon tea**
15:35-15:50	Characterizing photochemical and optical properties of terrigenous dissolved organic matter in Otsuchi Bay, Japan | Chia-Jung Lu
15:50-16:05	Transient hypoxia extent off Changjiang River Estuary due to mobile Changjiang diluted water | Wenxia Zhang
16:05-16:20	Isotopic constraints on biogeochemical cycling of selenium in the East China Sea | Yan Chang
16:20-16:35	Atmospheric deposition of ^{7}Be, ^{210}Pb and ^{210}Po during typhoons and thunderstorm in Shanghai, China and global data synthesis | Juan Du
16:35-16:50	Recent surface cooling in the Yellow and East China Seas in association with the North Pacific climate regime shift in 1997/98 | Chan Joo Jang
17:00-19:00	**Poster Session (Snacks and Drinks)**

18 September 2018, Tuesday

Time	Event
Session 2: The response of marine ecosystems to natural and anthropogenic forcing: past, present and future **Conveners: Ying Wu, Thamasak Yeemin**	
Keynote speech	
08:30-09:00	A critical re-assessment of the primary productivity of the Yellow Sea, East China Sea and Sea of Japan/East Sea Large Marine Ecosystems | Sinjae Yoo
09:00-09:30	Ocean acidification from below in the tropical Pacific | Masao Ishii
Paper presentation	
09:30-09:45	Potential impact of typhoon on the planktonic ecosystem in the Yellow Sea | Jung-Hoon Kang
09:45-10:00	Evaluation and prediction of the influences of ocean acidification to the subarctic coast | Masahiko Fujii
10:00-10:15	Effect of seasonal acidification on $CaCO_3$ cycling in the Yellow Sea | Weidong Zhai
10:15-10:30	Comparative study on the chronology in the sediment of estuary by multi-radionuclides | Jinzhou Du
10:30-10:50	**Morning tea**
10:50-11:05	Decadal changes in East China Sea and Southern Yellow Sea ecosystem | Christina Eunjin Kong
11:05-11:20	Interannual variability in the chlorophyll concentrations on the Mid-Atlantic Bight along northeast United States | Yi Xu
11:20-11:35	High net growth of phytoplankton under the serious nitrogen limitation in subtropical North Pacific Ocean | Siyu Jiang
11:35-11:50	Vertical distribution of planktonic ciliates in the oceanic and slope areas of the western Pacific Ocean | Wuchang Zhang
11:50-12:05	Impact of river discharge on the primary productivity and its contribution to the biological productivity in the Indus delta creeks and shelf area | Samina Kidwai
12:05-12:20	Implementation of ecosystem based coastal resilience management program for minimize the hazards impacts to the coastal communities in Sri Lanka | Anil Premaratne
12:20-14:00	**Lunch**

Time	Event
Session 2: The response of marine ecosystems to natural and anthropogenic forcing: past, present and future **Conveners: Sinjae Yoo, Masao Ishii**	
Keynote speech	
14:00-14:30	Managing ecotourism on coral reefs and underwater pinnacles in the Western Gulf of Thailand | Thamasak Yeemin
Paper presentation	
14:30-14:45	Black coral as a new environmental recorder: the iron profiles in coral skeleton from Sanya Bay over the past century | Dan Wu
14:45-15:00	Lagrangian study of cross-slope transport and its role on phytoplankton bloom in the Northern South China Sea | Ziyuan Hu
15:00-15:15	Spatial and temporal variations of nutrients and chlorophyll a in River Indus, Indus Delta, and adjacent Arabian Sea | Waqar Ahmed
15:15-15:35	**Afternoon tea**
15:35-15:50	Organic matter input from rivers into coastal waters of Sarawak and related GHG emissions: an overview of ongoing work | Moritz Müeller
15:50-16:05	Origin and fate of particulate organic matter in a small tropical river - Zuari River, India with special reference to amino acids | Dearlyn Fernandes
16:05-16:20	Diel observation for amino acids enantiomers in the South China Sea slope | Zhuoyi Zhu
16:20-16:35	Trophic interactions of mesopelagic fishes in the South China Sea from the perspective of stable isotopes and fatty acids | Fuqiang Wang
16:35-17:00	Meet the Editors | Anthropocene Coasts; Acta Oceanologica Sinica
19:00	**IMBeR Dinner**

19 September 2018, Wednesday

Time	Event
Session 3: Responses of Society to global change in marine systems: ways forward **Conveners: Yinji Li, Richard Bellerby**	
Keynote speech	
08:30-09:00	Why Human Dimensions today? The meaning of integration of natural science and social science | Mitsutaku Makino
09:00-09:30	Towards a common framework for marginal social-ecological system research | Richard Bellerby
Paper presentation	
09:30-09:45	The future of fishes and fisheries in the Western Pacific Biosphere under the changing ocean | Vicky Win Yee Lam
09:45-10:00	Potentiality of IMBeR-ADApT framework for coastal governance in Northeast Asia Seas | Yinji Li
10:00-10:15	Joint management of local fishery in Japan and its performance evaluation: a case study of the Sarufutsu Village in Hokkaido | Yao Wei
10:15-10:35	**Morning tea**
10:35-10:50	Stakeholders engagement and cooperation reconstruction: the protection of the Chinese white dolphin in the Pearl River Estuary | Mingbao Chen*
10:50-11:05	The development of coastal governance in Japan | Xiang Gao
11:05-11:20	Factors influencingthe resilience of small-scale fishers in the Gulf of Thailand | Suvaluck Satumanatpan
Discussions & Session 3 Wrap up	
11:20-11:40	Conveners: Mitsutaku Makino, Yinji Li, Richard Bellerby
11:40-11:55	**8th CJK IMBeR Symposium – Closing Address**
12:00-14:00	**Lunch**
14:00-17:30	**The IMBeR Human Dimensions Training Course:** ***Responses of society to global changes in marine system*** Yinji Li, Mitsutaku Makino, Ling Cao, Gi Hoon Hong

*Need to confirm their attendance.

Poster Sessions

Session 1: Advances in observation and modelling of physical and biogeochemical processes in the West Pacific region

Authors	Poster Title
Jianzhong CHEN, Richard BELLERBY, Jianzhong GE	Seasonal Changes of Pelagic Ecosystems in the East China Sea
Fahui GONG, Guihao LI, Kedong YIN, Jun GONG	Diversity and distribution of pico- and nano-eukaryotes in the coastal upwelling waters off Hainan (South China Sea)
Jinqiang GUO, SK LIANG, YF WANG, XJ PAN	Distribution and bioavailability of dissolved organic matter in Changjiang Estuary during dry and wet seasons
Chenglong LI	Decomposing monthly declines of subsurface-water aragonite saturation state from spring to autumn in the North Yellow Sea
Xiaoshuang LI, Richard G.J.BELLERBY, An-qiang YANG, Ya-wen WEI	Extending our understanding of the marine carbonate system in the Changjiang Estuary and adjacent East China Sea shelf using Artificial Neural Networks
Zhijian LIN, Xiaochun WANG, Peng XIU, Fei CHAI	Phosphate boundary transport of the East China Sea and its influence on biology
Sumei LIU, Nian WU, Hongmei ZHANG, Guiling ZHANG	Nutrient variations in the lower reach of Huanghe and their impacts on the Bohai ecosystem
Xiaolu WANG, Y WU, H WU, LJ QI, JL DAI	Organic Carbon Distribution and Budget in the Changjiang Diluted Plume based on Chemical analysis and Numerical Model
Yawen WEI, Richard BELLERBY	High precision measurements for carbonate system
Qiong WU, Xiaochun WANG, Xianqiang HE, Wenhao LIANG	Validation and Application of SMAP SSS Observation in Chinese Coastal Seas
Ruiming WU, Hui WU	Distributions and transports of the diluted water from major rivers in East Asian Marginal Seas
Tianning WU, H WU	Tidal mixing sustains a bottom-trapped river plume and buoyant coastal current on an energetic continental shelf

Authors	Poster Title
Haiyan ZHANG, Simeng QIAN, Liang ZHAO, Hao WEI	Simulation on formation of summer low oxygen zone in the Bohai Sea
Zhichun ZHANG, Fei CHAI, Yi CHAO	Variability of the Pacific North Equatorial Current Based on a 1/8° Pacific Model Simulation
Yanchu ZHAO	Distribution patterns of virioplankton in Caroline Seamount of the tropical Western Pacific Ocean

Session 2: The response of marine ecosystems to natural and anthropogenic forcing: past, present and future

Authors	Poster Title
Huayang CAI, F LIU, L REN, S OU, Q YANG	Decadal variability of tidal dynamics in the Pearl River Delta: spatial patterns, causes, and implications for estuarine water management
Xiaogang CHEN, Neven CUKROV, Jinzhou DU	Submarine Groundwater Discharge in a Typical Anchialine Eco-System, Zaton Bay, Croatia
Narainrit CHINFAK, Nuporn TOMET, Penjai SOMPONGCHAIYAKU, Ying WU	Diurnal Changing of Nutrients in Seawater Inside and Outside Coral Reefs Zone of Mo Ko Same San, Chonburi Province
Jinlong DAI, Qi YE, Ying WU, Xiaolu WANG, Jie JIN, Huiping XU, Meng ZHOU	Niche partitioning of key bacterial and archaeal groups along the Changjiang River Estuary to the East China Sea
Futao FANG, Zhuoyi ZHU, Jinzhou DU，Bing DENG, Yueying LIU	Trends of pigments buried in sediments from the Changjiang Estuary as a function of depth
Shujin GUO, Xiaoxia SUN, Mingliang ZHU, Junhua LIANG, Zengxia ZHAO	Spatial and temporal variation of transparent exopolymer particles in a semi-enclosed bay: the Jiaozhou Bay, North China
M Shahanul ISLAM, Jun SUN	Variability of Phytoplankton sinking rates with related to Physico-Chemical parameters after Northwest Pacific Typhoon Activity in the transects near Philippine current in Western Pacific Ocean
Shuo JIANG, Jing ZHANG, Ruifeng ZHANG, Yun XUE, Wei ZHENG	Dissolved Lead in the East China Sea with Implications for Impacts of Marginal Seas on the Open Ocean Through Cross-Shelf Exchange

Authors	Poster Title
Jie LIU,Richard G.J. BELLERBY, Jianzhong GE	Ecosystem-based management under a changing environment via outputs from coupled marine physical and biogeochemical models and participance of stakeholders
Jing LIU, Richard BELLERBY,YW WEI,XS LI,AQ YANG	Characteristics of the East China Sea shelf carbonate system in the early summer
Xiaona WANG, Ying WU, U.K.PRADHAN, Zhuoyi ZHU, Hongyan BAO, Guosen ZHANG, Jing ZHANG	The impact of typhoon induced hydrological variation on nutrient and organic carbon dynamics in the Nandu River on Hainan Island, South China Sea
Yali WANG, Tangrong HE, Fenfen ZHANG	1H NMR spectroscopy of dissolved organic matter in the coastal waters of the Changjiang Estuary
Anqiang YANG, Richard BELLERBY	Are changes in N:P ratios in coastal waters the key to change Harmful algal blooms species?
Fenfen ZHANG, Dan WU, Jing ZHANG	A micro-Raman and synchrotron radiation XANES study of coordination mode for iron in black coral
Kun ZHU, Ying WU, Jing ZHANG, Moritz MüLLER, Shan JIANG,Aazani MUJAHID	Impacts of land use change on the sedimentary organic matter in peat−draining rivers, Sarawak, Malaysia
Avianna ZHUKOVSKAYA, A.A.CHESNOKO, A.A.KOSJYANENKO, V.P.CHELOMIN	Impact of CuO Nanoparticles on Protein Oxidation in *Mytilus Trossulus*

Session 3: Responses of Society to global change in marine systems: ways forward

Authors	Poster Title
Xiaobo LOU, Yao WEI, Wancong DUAN, Harada SACHIKO	Joint Management of Local Fishery in Japan and Its Performance Evaluation : A Case Study of the Sarufutsu Village in Hokkaido
Sheng-Yuan TENG, Ming-An LEE, Nan-Jay SU	Assessing the vulnerability of fishery villages influenced by climate change and anthropogenic activity in the coastal zone of north Taiwan
Hong WANG, Zhan HU	A new way of guiding wave dissipation by vegetation in SWAN
Xiaofan ZHANG	Correlation analysis between marine ecosystem health and marine industry agglomeration

IMBeR HDWG Training Course: Responses of society to global change in marine systems

Time: 2:00-5:30 pm, 19 September 2018

Location: East China Normal University, Shanghai, China

Global change is occurring now, often with consequences far beyond those anticipated. Marine ecosystems in particular face multiple challenges from global change, induced by natural and anthropogenic stressors, which affect their ability to function and deliver goods and services to humankind (Bundy et al. 2016*). Needless to say, it's urgently necessary to create effective and efficient social responses to the global change in marine systems. To this end, the IMBeR HDWG training course aims to provide early career scientists and students with information on the latest progress in IMBeR related research on the development of a new concept of social responses to the global change in marine systems by presenting an integrated assessment framework-IMBeR-ADApT (Assessment based on Description, Responses and Appraisal for a Typology) and its related studies. In the training course, four lectures will be given by experts from China, Japan and Korea and a facilitated discussion will follow. Participants are highly encouraged to take a look into IMBeR-ADApT template in advance and try to bring a case study to the training course for discussion.

Webpage for IMBeR-ADApT template:
http://www.imber.info/en/projects/imber/science/working-groups-1/human-dimensions-working-group-hdwg/i-mber-adapt

*Bundy A., Chuenpagdee R., Cooley S.R., Defeo O., Glaeser B., Guillotreau P., Isaacs M., Makino M. and R.I. Perry (2016), A decision support tool for response to global change in marine systems: The IMBER-ADApT Framework, Fish and Fisheries 17(4): 1183-1193.

Lecturers

Dr. Yinji Li
Member of IMBeR HDWG

Tokai University
Shizuoka, Japan

Social and economic coastal management issues

Dr. Mitsutaku Makino
Associate Member of IMBeR HDWG

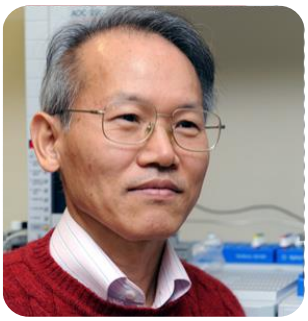
National Research Institute of Fisheries Science, Yokohama, Japan

Policy, economics

Dr. Ling Cao

Shanghai Jiao Tong University, China

Marine Conservation and Sustainable Fisheries



Dr. Gi Hoon Hong
Past Director of KIOST, Korea
ECNU's Overseas High Level Expert

Low temperature geochemistry
Environmental radioactivity
Science based international marine environment protection policy formulation

Program

2:00 - 2:10【Opening】
1. [2:00-2:05] Welcome speech Dr. Ying Wu, Member of IMBeR SSC, East China Normal University, China
2. [2:05-2:10] Opening remarks Dr. Yinji Li, Member of IMBeR HDWG, Tokai University, Japan
2:10 - 3:00【Part 1: Potentiality of IMBeR-ADApT】
1. [2:10-2:30] Introduction of IMBeR HDWG and IMBeR-ADApT Dr. Yinji Li, Member of IMBeR HDWG, Tokai University, Japan
2. [2:30-3:00] The IMBeR-ADApT: A decision support tool for response to global change in marine systems Dr. Mitsutaku Makino, Associate member of IMBeR HDWG, Japan Fisheries Research and Education Agency, Japan
3:00 - 4:30【Part2: Responses of society to global changes in marine system】
1. [3:00-3:30] Role of Aquaculture in food security and climate mitigation Dr. Ling Cao, Shanghai Jiao Tong University, China
Break 3:30-3:50
2. [3:50-4:20] Responses of society to global change in marine systems way forward: A case study to mitigate heat wave over the sea Dr. Gi Hoon Hong, Korean Institute of Ocean Science and Technology, S. Ko rea
Break 4:20-4:30 (Table setting)
4:30-5:25【Part3: Open Discussion】
The participants will be divided into small discussion groups. Each group will discuss the topics bellow. 40min of group discussion will be followed by 15min of presentation by each group. Topics: ◆Types of global changes in East Asian marine systems ◆Background factors of the changes ◆Impacts of the changes ◆Responses to the changes ◆Challenges remain
5:25-5:30【Closing Address】
Dr. Makino Mitsutaku, Associate Member of IMBeR HDWG, Japan Fisheries Research and Education Agency, Japan

Oral Abstracts

Session 1: Advances in observation and modelling of physical and biogeochemical processes in the West Pacific region

BGC-Argo observations and physical-biogeochemical modeling in Northwest Pacific

Fei CHAI

Second Institute of Oceanography, Hangzou,China

The Biogeochemical-Argo (BGC-Argo) Program aims at operating a network of profiling floats equipped with sensors of key biogeochemical variables for supporting research activities that address impacts of changing climate on ocean biogeochemical cycles and ecosystems. In the Northwestern Pacific, there are only a few BGC-Argo floats deployed during the last several years. In this talk, we will show examples of using BGC-Argo floats and coupled physical-biogeochemical models to investigate how ocean circulation effect on biogeochemical processes and distributions in the water column.

To investigate how marine ecosystem responses to both natural climate variability and anthropogenic forcing, we also developed a series of high-resolution coupled physical-biogeochemical models to investigate interaction and exchange processes between Northwest Pacific and China Seas (East China Sea and South China Sea). We will present some our model results related to nutrient sources and transports and how these processes may affect phytoplankton productivity and carbon cycle in Northwest Pacific and China Seas. Combining physical-biogeochemical models and multiple observations including remote sensing and BGC-Argo data, we have started to produce short-term forecasts of nutrients, oxygen and carbon cycle for the Northwest Pacific and China Seas.

The history of Kuroshio studies, the progress and emerging issues

Hiroaki SAITO

The University of Tokyo, Tokyo, Japan

The Kuroshio transports warm subtropical water and organisms to the north and influences climate and ecosystems of the region along the Kuroshio axis (Kuroshio region). The economy and culture of human society in the Kuroshio region are also influenced by the Kuroshio through the continuous supply of the marine ecosystem services. In Japan, various sea foods from sea weed, molluscs, fish and marine mammals have been used. This is based on high fisheries productivity in the Kuroshio region in spite of the oligotrophic condition. I named this inconsistency of high fisheries production in oligotrophic environment as the Kuroshio Paradox. To solve the paradox, an interdisciplinary approach encompassing physical oceanography to fisheries sciences is essential. In the presentation I review the history of the recognition of the Kuroshio and scientific research, and also recent developments in research focused on solving the Kuroshio Paradox. Better understanding of the Kuroshio is essential not only to solve the paradox but also to develop sustainable use of marine ecosystem services that our society is dependent on.

Seasonal variations in nutrients and biogenic particles in the upper and lower layers of East China Sea Shelf and their export to adjacent seas

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Based on a three dimensional low-trophic ecosystem model, we revaluated budgets of nutrients and biogenic particles (phytoplankton and detritus) in the East China Sea (ECS), a continental shelf sea with high productivity that is affected by a large river (Changjiang River) and a western boundary current (Kuroshio). Following careful comparison of model results with available observation data, we calculated the monthly inventories of the nutrients and biogenic particles in the ECS and the fluxes of the nutrients and biogenic particles through the lateral and vertical interfaces of the ECS. As an improvement over previous nutrient budget calculations that treated the ECS as one box, we divided the water column into two layers: upper and lower layers corresponding to different light condition. Our calculation shows the necessary of evaluating not only the horizontal fluxes of nutrients and biogenic particles into and out of the ECS through lateral boundaries with adjacent seas but also the exchange fluxes of nutrients and biogenic particles between the upper and lower layers because the latter is larger than the former. Our calculation also reveals that the export of biogenic particles is more from the ECS to the Japan/East Sea through the Tsushima Strait than from the ECS to the Kuroshio region through the shelf slope and the export pathway of biogenic particles from the ECS to the Kuroshio region is through the middle layer (from ~60 m to ~160 m) of the shelf slope of the ECS and not through the bottom layer, as previously reported.

Variability and mechanisms of seasonal hypoxia off the Changjiang Estuary, China

Zhou FENG[1], Fei CHAI, Daji HUANG, Huijie XUE, Jianfang CHEN, Peng XIU, Jiliang XUAN, Jia LI, Dingyong ZENG, Xiaobo NI, Kui WANG

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Hypoxia off the Changjiang Estuary, one of the largest in the world, has been observed frequently in the recent decade with large variability. With limited times of field surveys, it is difficult to understand what causes hypoxia to change. A coupled model has been used and comprehensively evaluated, which is applicable and reliable for hypoxia studies in the East China Sea. Event-scale reduction of hypoxia occurred during the weakening of stratification in mid-July and mid-September, which was associated with strong stirring due to tropical storms or strong northerly winds. Change in wind direction shifted the location of hypoxia by altering the spread of Changjiang Diluted Water. Increase in river discharge led to an expansion of hypoxic water under the summer monsoon. Sensitivity experiments suggested that the hypoxia extent was affected by the change in nutrient concentration of the Changjiang as well as that in the Kuroshio. Sensitivity experiments also suggested the importance of sediment oxygen consumption to the size of the hypoxic zone.

Physical control on the biogeochemical processes in the Changjiang River estuary

Zhaoru ZHANG[1], Meng ZHOU, Yisen ZHONG

[1]*Shanghai Jiao Tong University, Shanghai,China*

High-resolution cross-sectional profiles of hydrographic and biogeochemical variables in the lower Changjiang River estuary were obtained for the first time with a towed, undulating vehicle equipped with integrated physical, chemical and biological sensors. The observations revealed several important mesoscale physical features associated with the plume dynamics that impose significant influences on the biogeochemical processes in the estuary in multiple ways. Near the river mouth, biological production was initiated by an improved light field together with a rapid development of stratification downstream from the turbidity maxima zone; a sharp increase in chlorophyll concentration appeared at the major front of the plume where strong downwelling and mixing existed. Offshore of the major front, internal waves characterized by undulations of low-salinity and high-chlorophyll-concentration signals were observed. In the offshore areas where nutrient concentration in the plume water was low, mixing between the plume and offshore water masses, such as the Taiwan Warm Current Water and the Jiangsu coastal water can provide additional nutrients for the plume and promotes local biological production. On the west bank of the submarine valley in the Changjiang River estuary, upwelling processes can upwell nutrients which may initiate the phytoplankton blooms, and then the northward intrusion of the upwelled water enhances the ecosystem production in the northern estuary. Trajectories of Lagrangian drifters revealed a residence time of the Changjiang River plume water between 5 and 10 days for waters in the estuary area moving northeastward, and between 10 and 18 days for waters initially moving southward. The residence time was sufficient for the phytoplankton blooms to occur in the lower Changjiang River estuary.

Variability of particle export in the northwestern Pacific

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[2]*Second Institute of Oceanography, Hangzou,China*

The variability and controlling mechanism of particle sinking flux in the northwestern Pacific were investigated by using data from a moored sediment trap and a coupled physical-biogeochemical model. The sediment trap was located at the S1 location (30° N, 145°E) and the particle flux data collected during 2010-2013 at three depths (200 m, 500 m, and 4810 m) were analyzed. Strong seasonal variability in particulate organic carbon (POC) flux was found at all three depths, in a relatively consistent pattern with vertical fluxes of particulate iron, opal, and lithogenic matters. In order to elucidate dominant mechanisms, we incorporated the iron cycling process into an existing biogeochemical model, CoSiNE, and coupled it with a one-dimensional physical model configured at the S1 location. This new CoSiNE-Fe model can explicitly simulate iron and ligand dynamics, as well as the dust deposition process. The model results and sensitivity studies indicate that dust deposition into the northwestern Pacific may play an important role in driving the vertical POC export at depth.

Transport and transformation of nitrate in the Changjiang Estuary

Shan JIANG

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Changjiang is the longest river in China, delivering more than 9.24×1011 m^3 yr^{-1} fresh water into the East China Sea. Coupled with river water discharge, substantial amount of land-borne NO_3^- transports to the adjacent coastal ocean, likely triggering harmful algae blooms and benthic hypoxia. In the present study, dual stable isotope fractions ($\delta^{15}N\text{-}NO_3^-$ and $\delta^{18}O\text{-}NO_3^-$) were analyzed to evaluate transformation of NO_3^- along two transects in the Changjiang Estuary at the summer of 2017. The sampling extended from river channels to the high salinity outer plume. The results revealed that NO_3^- in Changjiang River water was mainly derived from chemical fertilizer leakage and organic nitrogen degradation. The mixing between river water and seawater decreased NO_3^- concentration because of dilution. However, compared with the value obtained from the conservative mixing, a net production in NO_3^- content was observed in the turbidity maximum zone, which may be related with mineralization and nitrification occurred on the suspended particle. In the outer plume, a net reduction was found in the surface water, resulting from diatom assimilation and leading to enriched $\delta^{15}N\text{-}NO_3^-$ and $\delta^{18}O\text{-}NO_3^-$. Coupled with increases in water depth, nitrification, stimulated by degradation of diatom debris, and denitrification, performed by sediment denitrifiers, coexisted and added uncertainties to the estimation of NO_3^- budget.

Nutrient supply to the euphotic layer in the Kuroshio and Kuroshio Extension

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As a western boundary current in the North Pacific, Kuroshio brings a large amount of nutrient from its upstream to downstream with a maximum nutrient flux core at 400 - 500 m approximately. However, only the nutrients transported into euphotic zone can be used by primary production. With a "Kuroshio nutrient stream" underlying the Kuroshio, nutrient supply to euphotic layers in the Kuroshio region needs more study.

In this study, we use results of an eddy-resolving coupled physical-biological ocean model to investigate (1) lateral and vertical transport of nutrient into the euphotic layer (0-100 m) in the Kuroshio and Kuroshio Extension, (2) the contribution of different sources of nutrient (coastal, deep layer and open ocean) to the variation of downstream nutrient transport along the current. Our analysis shows that around the Luzon Strait, the horizontal transport of nutrient along the Kuroshio direction in the euphotic layer increases from 2.8 kmol/s to 7.9 kmol/s, while vertical transport provides 3.8 kmol/s of net nutrient transport to the euphotic layer. As the Kuroshio flows to south of Japan, its nutrient transport increases from 8.9 kmol/s at the area south of Kyushu to 21.5 kmol/s near the Izu-Ogasawara Ridge. The main input for the Kuroshio south of Japan is the horizontal transport from onshore side which provides 14.3 kmol/s of net nutrient transport. In the Kuroshio Extension region, the transport in the direction across the Kuroshio brings 4.0 kmol/s of nutrient transport from subpolar gyre into the Kuroshio Extension region and 5.7 kmol/s of nutrient transport from the Kuroshio Extension region to subtropical gyre. Vertical transport in the Kuroshio Extension region shows an interesting staggered upward and downward distributions and have a total transport of 5.2 kmol/s nutrient into the euphotic layer.

The impact of cyclonic- and anticyclonic-mesoscale eddies on the biogeochemistry of dissolved and particulate organic matter in the northern slope of the South China Sea

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South China Sea (SCS) is the largest marginal sea with abundant multi-eddy processes. Mesoscale eddies influence the distribution as well as global export flux of organic matter from euphotic layer to deep ocean. However, the impact of eddies on organic matter biogeochemical processes in slope ecosystem was rarely addressed. Cyclonic-anticyclonic eddy-pair was existed in northern slope of South China Sea. Fluorescent dissolved organic matter (FDOM) as well as dissolved and particulate organic carbon (DOC and POC) were determined, and contrasting influence caused by mesoscale eddies on organic matter was observed. In the cyclonic eddy, DOC was net consumed while POC was net produced in euphotic layer, which was inverse in the anticyclonic eddy. The contribution of POC to total organic carbon (TOC) flux in euphotic layer was highest in summer (7.03%), followed by in autumn (5.12%) and spring (3.79%). The flux of TOC in the anticyclonic eddy was 72.5±2.86 g m^{-2}, which was higher than that in the cyclonic eddy (49.5±10.3 g m^{-2}). But the POC flux contribution to TOC in the cyclonic eddy was higher than that in the anticyclonic eddy. The cyclonic mesoscale eddy could contribute to the production of fresh organic carbon, while anticyclonic process could increase carbon export from euphotic layer to deep ocean. Different mesoscale processes could influence the production and consumption of organic matter, thus mediate the global biogeochemical cycle of carbon.

Tracing external sources of nutrients in the East China Sea and evaluating their contributions to primary production

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Nutrients in the East China Sea (ECS) have several external sources such as the Kuroshio, Taiwan Strait, rivers, and the atmosphere. In order to evaluate the contribution of each source of nutrients to the nutrient inventory and primary production over the ECS shelf, a tracking technique was applied to nitrogen-related state variables in a low-trophic ecosystem model. Each source of dissolved inorganic nitrogen (DIN) has strong seasonal variations in the spatial distribution that depends closely on circulation, mixing, and stratification. The primary production supported by each source of nutrient is under the control of a combination of nutrients, temperature, and light. Over the entire ECS shelf, the DIN from the Kuroshio contributes more than half of the DIN input flux, DIN inventory, and primary production while the other three sources cover the residual with a similar ratio. A more detailed examination shows that the contributions of the four external DINs have strong spatial dependence: the riverine and atmospheric DINs dominate the inner shelf (0-50 m); the DIN from Taiwan Strait dominates the south part of middle shelf (50-100 m), and the DIN from the Kuroshio dominates the outer shelf (100-200 m) and the north part of the middle shelf. The production efficiencies of the DIN from the Kuroshio and rivers are low while those from the atmosphere and Taiwan Strait are high. The nutrient limitation, light and water temperature determine the production efficiency of each specific DIN.

Characterizing photochemical and optical properties of terrigenous dissolved organic matter in Otsuchi Bay, Japan

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Humic substances (HS) are abundant in terrigenous dissolved organic matter (tDOM), however, the optical characteristics of HS in dissolved organic matter (DOM) are still unclear. In this study, chromophoric DOM (CDOM) and fluorescent DOM (FDOM) were carried out in a river-influenced coastal area (Otsuchi Bay, Japan) in order to investigate the characteristics and dynamics of tDOM in a natural environment. HS was extracted using solid phase extraction (C-18) to feature the optical properties of HS. In addition, hydrophilic and hydrophobic fractions of DOM were further partitioned using C-18 cartridges to identify the linkage between chemical properties and optical characteristics.

Our CDOM and FDOM results provided a range of information about DOM in this bay including allochthonous and autochthonous origins, and also the dynamics of tDOM during its transit from the river to the ocean. An excitation-emission matrix and parallel factor (EEM-PARAFAC) analysis revealed three humic-like and two protein-like components in this study. Humic-like fluorescent components were strongly correlated with river-derived organic matter, and protein-like fluorescent components were related to in-situ microbial processes. The results of CDOM spectral slopes and the ratio of humic-like components indicated photobleaching of tDOM, and a specified fluorescent parameter inferred microbial processes in waters. Additionally, our results further pointed out the optical characteristics of HS were close to that of hydrophilic components. HS was very prevalent In bulk DOM and highly correlated with photo-transformation. This study directly found the linkages between chemical and optical properties in DOM and also highlighted optical measurement as a useful method to identify DOM quality in a natural environment.

Transient hypoxia extent off the Changjiang River Estuary due to mobile Changjiang diluted water

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Observed oxygen concentrations collected during research cruises are conventionally used to estimate spatial extent of bottom low-oxygen/hypoxia. Yet, observed oxygen condition is often not quantitatively representative of instantaneous oxygen condition in coastal oceans, especially when bottom hypoxia is transient. Over Changjiang River estuary and the adjacent sea, research cruises can easily be longer than the time scale of variability of bottom hypoxia extent. Changjiang diluted water is extremely mobile due to changes in wind magnitude and direction, and the re-distribution of this fresh cap strongly regulates vertical stratification on which bottom hypoxia formation and sustain depend. A high-resolution ecosystem model successfully reproduced observed temperature, salinity, and bottom oxygen concentration. This model suggests fast response of bottom oxygen to vertical stratification evolution and transient spatial extent of summer bottom hypoxia off the Changjiang River estuary. Comparisons between observed and modeled oxygen concentrations imply that the observed hypoxic area is often biased, and the estimated magnitude of which depends on the chronological order of observations.

Isotopic constraints on biogeochemical cycling of selenium in the East China Sea

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Selenium is an essential micronutrient for many organisms whose cycling in the ocean is primarily controlled by uptake by phytoplankton and subsequent recycling to the water column. With multiple oxidation states and six stable isotopes, Se isotopes have the potential to trace the yield biogeochemical cycles of Se. To investigate the behaviors of inorganic selenium in East China Sea, samples were taken in August, 2013 by a research vessel "Dongfanghong 2". A hydride generator combined with a desolvation device with methane addition was coupled to multiple collector inductively coupled mass spectrometry to measure dissolved inorganic selenium isotopes precisely. The 82/76DISe in the East China Sea of this study ranged from -1.14‰ to 1.66‰ with an average of 0.82‰. At a station which affected by the western boundary current, the $\delta^{82/76}$DISe values were relatively constant with average values of 1.59±0.06‰ from the surface to a depth of 130m, and then decreased linearly to a depth of 800m; below 800m, $\delta^{82/76}$DISe values remained at a relatively stable value of 0.40±0.05‰, suggesting homogenization by strong vertical mixing. Heavier $\delta^{82/76}$DISe values in the euphotic zone clearly suggest that phytoplankton preferentially accumulate the lighter Se isotopes. The negative $\delta^{82/76}$DISe was found in the near bottom water (-1.14‰) in Changjiang Estuary which suffered from hypoxia (DO=1.54 mg/L), while the overlay surface water which influenced by Changjiang Diluted Water was positive (1.03‰). The Se fractionation between the surface water and the hypoxia near bottom water was 2.17‰, which was in the ranges (1.7‰ to 7.2‰) of fractionations observed in microbial Se(VI) reduction to Se(IV) in the laboratory study. The physicochemical properties and abiotic and biotic processes are potential factors that influenced Se isotopic composition in the seawater.

Atmospheric deposition of ^{7}Be, ^{210}Pb and ^{210}Po during typhoons and thunderstorms in Shanghai, China and global data synthesis

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Atmospherically-delivered ^{7}Be, ^{210}Po and ^{210}Pb in bulk precipitation and air samples collected around the globe have provided valuable information of their removal as well as quantification of sources and transport of air masses; however, such studies during thunderstorm and typhoon events are limited. We report the first continuous time-series rainwater sampling and analysis of ^{7}Be, ^{210}Pb and ^{210}Po from two typhoons and one thunderstorm during 2015 summer in Shanghai. The depositional fluxes within individual rain events of typhoons and thunderstorms varied by a factor of 10 for ^{7}Be, 5.7 for ^{210}Pb, 7.4 for ^{210}Po, and 7.0 for ^{7}Be/^{210}Pb activity ratios (AR). Such large observed variations in the depositional fluxes of ^{7}Be, ^{210}Pb, ^{210}Po and ^{7}Be/^{210}Pb activity ratios were attributed to air masses injected from surrounding high pressure system adjoining the typhoon to low pressure system within the typhoon. Based on ^{7}Be/^{210}Pb activity ratios, we estimated the variations in the fraction of maritime and continental air masses into the typhoon. Observed constancy in the ^{210}Po/^{210}Pb AR indicates that the residence times of air masses contributing to the typhoon during heavy rain are similar. From a synthesis of global fallout of ^{7}Be and ^{210}Pb during pulse events (precipitation ≥ 50 mm from single rainout event), we quantify the importance of pulse events in the atmospheric fallout of these radionuclides.

Recent surface cooling in the Yellow and East China Seas in association with the North Pacific climate regime shift in 1997/98

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The Yellow and East China Seas (YECS) have warmed during the last decades. In addition to this warming trend, the sea surface temperature (SST) reveals a basin-scale surface cooling trend after the late 1990s. In this study, we investigated the characteristics of this recent cooling trend and its dynamic relationship with large-scale climate variability through cyclostationary ortho-gonal function analysis for the 1982–2014 period. Both regressed surface winds on the primary mode of the YECS SST and trends in air-sea heat fluxes show that the intensification of the northerly winds in winter contribute largely to the recent cooling trend by increasing heat loss to the atmosphere. As a localized oceanic response to these winds, the upwind flow seems to bring warm waters and partially counteracts the basin-scale cooling, thus contributing to a weakening of the cooling trend along the central trough of the Yellow Sea. In the context of the large-scale climate variabilities, a strong relationship between the YECS SST variability and Pacific Decadal Oscillation (PDO) has considerably weakened during the recent cooling period after the late 1990s as the PDO signals appeared to be confined within the eastern basin of the North Pacific in association with the regime shift. In addition to this decoupling of the YECS SST from the PDO, the intensified Siberian High pressure system likely enhanced northerly winds, leading to the recent cooling trend. Our findings highlight relative roles of the PDO and the Siberian High in shaping the YECS SST variance through the changes in the large-scale atmospheric circulation and attendant oceanic advection.

Session 2: The response of marine ecosystems to natural and anthropogenic forcing: past, present and future

A critical re-assessment of the primary productivity of the Yellow Sea, East China Sea and Sea of Japan/East Sea Large Marine Ecosystems

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Despite the importance of the primary production in coastal Large Marine Ecosystems, the complex bio-optical properties in some coastal waters make the estimation of primary productivity using satellite data quite challenging. Here we critically reviewed the accuracy of parametrization of three core variables, i.e., chlorophyll-*a*, chlorophyll-specific photosynthetic rate, and euphotic depth, in the Yellow Sea, East China Sea, and Sea of Japan/East Sea Large Marine Ecosystems. We also compared the annual primary productivity estimates of the three Large Marine Ecosystems by a depth-integrated model with those from two other global assessments which used different primary productivity models: an absorption-based model, and a time and depth-resolved model. Our assessment suggests that 1) accurate parametrization of the core variables is more important than choosing a particular primary productivity model, and 2) the previous global Large Marine Ecosystem assessments might have overestimated the annual primary productivity in the Yellow Sea by a factor of 2 or so.

Ocean acidification from below in the tropical Pacific

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Identifying the rate of ocean acidification and its controlling mechanisms is an important priority for understanding how CO_2 emission by human industrial activities is changing the ocean globally. For the Warm Pool in the western tropical Pacific which hosts the singularly diverse and productive coral habitats, we have analyzed extensive observational data products and demonstrated that acidification is indeed occurring significantly over the last three decades. However, its mean rate of progression was ~20% slower than what would be expected if the rate were to simply controlled by the rate of atmospheric CO_2 increase through local air-sea CO_2 equilibration. Lagrangian diagnostics of a forward ocean model indicates that Warm Pool acidification occurs primarily by the re-emergence of anthropogenic CO_2 from below through the shallow thermocline overturning circulations linking extratropical subduction regions in both hemispheres where anthropogenic CO_2 enters the ocean interior with the Equatorial Undercurrent. An interior residence time of an order of decade prior to re-emergence, acting in accord with the accelerating CO_2 growth in the atmosphere6, may account for delayed ocean acidification in the Warm Pool.

Potential Impact of Typhoon on the Planktonic Ecosystem in the Yellow Sea

Jung-Hoon KANG, Se-Jong JU

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The response of planktonic ecosystem to Typhoon passage was assessed in the Yellow Sea in summer during four years (2010-2013). In-situ surveys were carried out to investigate the water column properties and spatial distribution of mesozooplankton population at the fixed station in the summer, when the water column was strongly stratified. Only year 2011, one of the strongest typhoons, named 'MUIFA', directly passed through the study site just before the in-situ survey. The spatial distributions of nutrient, chlorophyll-*a* (chl-*a*), and mesozooplankton community were compared between the year(s) with and without the typhoon passage. Typically, the water column was strongly stratified (more than 10 ℃) in the summer of the years without the typhoon, whereas in the year 2011, the vertical stratification became weakened after the typhoon passage. Due to the vertical mixing of the water column, nutrient concentrations (nitrate, phosphate, and silicate) of the subsurface waters were higher in the year 2011 than other years, leading to increment of chl-*a* and standing crops of phytoplankton. Vertical distributional pattern of female adults and copepodites (CIV and CV) of *Calanus sinicus* was clearly different between the years with vs. without the typhoon passage although the difference of *C. sinicus* abundance

was not clear. Large abundance of female adults and copepodite (CV) at surface waters in the year 2011 could be related with the lowered water temperature as a result of mixing of water column. In conclusion, the vertical mixing of water column by the typhoon passage during the summer supplies nutrients from the bottom to surface and subsurface water which could affect the structure and function of the ecosystem temporally in the Yellow Sea in summer. However, further studies are needed to quantify and qualify the contribution of episodic typhoon events to the Yellow Sea ecosystem.

Evaluation and prediction of the influences of ocean acidification to the subarctic coast

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Global warming and ocean acidification are in progress all at once due to anthropogenic CO_2 emissions associated with human activities. As ocean acidification proceeds, it is concerned difficult for calcium carbonate and magnesium carbonate to be produced in the ocean, and calcifying organisms such as corals and shellfish having these skeletons and shells may be adversely affected. Moreover, the diurnal, seasonal and interannual fluctuation are all considered more prominent in coasts than in the open ocean, because of relatively larger amount of sea grass beds and more direct and significant terrestrial impacts.
On the other hand, in the subarctic coastal region, it is difficult to maintain observation due to stormy weather in winter, which yields paucity of observational data. In this study, long-term continuous monitoring of physical and biogeochemical parameters was conducted in Oshoro Bay, Otaru City, Hokkaido.Our results show that the timing of increase and decrease of pH and dissolved oxygen (DO) almost coincided with each other, and the diurnal variation of pH was larger in spring and summer than in fall and winter. The diurnal variation of pH was 0.1 or more on average from May to August. The variation was 0.15 on average and 0.26 at the maximum, respectively, in August, that was less than 0.1 on average, and was 0.03 on average and 0.07 at the maximum, respectively, in November. Thus, the seasonal difference in the diurnal variation was clear, suggesting significant effects of the photosynthesis in the daytime and the respiration in the nighttime by primary producers including algae and seaweeds. The results suggest relatively predominant biological effects with larger biomass and higher solar radiation in summer compared to those in winter.

Effect of seasonal acidification on $CaCO_3$ cycling in the Yellow Sea

Wei-dong ZHAI, Di Qi, Cheng-long LI, Tian-qi XIONG
Institute of Marine Science and Technology, Shandong University, China

The Yellow Sea on the western continental margin of the North Pacific Ocean is of major ecological and economic importance. Based on field surveys of carbonate system during 2011-2016, we found one third of the Yellow Sea suffer from serious subsurface seawater acidification (with aragonite saturation state of <1.5) during summer and autumn. The seasonal subsurface acidification mostly results from the community respiration induced CO_2 accumulation in the cold water mass of the Yellow Sea. Based on a parallel study conducted in the North Yellow Sea, we found community calcification rate is closely related to the aragonite saturation state values, while the

aragonite saturation state value of ~1.5 serves as a threshold value between community $CaCO_3$ precipitation and dissolution. Field data also showed quite high Ca : Salinity ratios, suggesting a net $CaCO_3$ dissolution in the Yellow Sea.

Comparative study on the chronology in the sediment of estuary by multi-radionuclides

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Modern deposition rate, which is an important characterization of sedimentary evolution of landscape environment, could reflect the sedimentary geochemical process. In the present study, the modern sedimentation rates of sediment cores in the Yellow Sea (YS) and Krka River estuary (KRE) were studied by the radioactive isotope chronology (^{210}Pb, ^{137}Cs and $^{239+239}$Pu). The main results were shown that the average modern sedimentation rates of core B25, B07, H07 and H25 in the YS were 0.20 cm y^{-1}, 1.30 cm y^{-1}, 0.34 cm y^{-1} and 0.36 cm y^{-1}, respectively. Due to the solubility and mobility of ^{137}Cs/Pu in the marine environment, the ^{137}Cs/Pu chronology could not be used to estimate the sedimentation rates in the YS. The ^{210}Pb activities decreased exponentially with depth in the sediment cores in the Croatia KRE, indicating the relatively stable sedimentary environment in this region, so the physical or biological disturbance can be ignored when using the ^{210}Pb chronology. Activities of ^{137}Cs and $^{239+240}$Pu were high in the sediment cores in the KRE, the dating results by ^{137}Cs and $^{239+240}$Pu (1963) were basically consistent with those by ^{210}Pb chronology results. However, the sedimentation rates estimated by the "1952" and "1986" peak of ^{137}Cs and $^{239+240}$Pu were much larger and lower than that by the "1963" peak, indicating the movement of these radionuclides in the sedimentary processes.

Decadal changes in East China Sea and Southern Yellow Sea ecosystem

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The Three Gorges Dam on the Changjiang river discharge (CRD) is the largest hydropower project in the world, implemented in June 2003. Many researchers were concerned with the potential impact of the TGD on the marine ecosystem. Gong et al. (2003), for example, argued that this massive dam may cause reduction in marine primary productivity in the East China Sea by changing the supply of nutrients and sediment loading in the area. In this study, we examined the long-term trend of marine primary productivity (PP), chlorophyll-*a* (CHL), photosynthetically active radiation (PAR), sea surface temperature (SST) and euphotic depth (Zeu) in the East China Sea and Southern part of Yellow Sea during last 15-years (1998-2012). We also examined the correlation between the anomalies of Changjiang River discharge (CRD) and chlorophyll during pre-TGD (1998-2002) and post-TGD (2003-2007) to understand the sensitivity of the change and some potential cause of the trend in the primary productivity. Our result showed that the geographic extent of CRD influence was indeed greatly reduced after 2003. However, the large scale variability of the primary productivity did not show any correlation with the operation of the TGD nor show clear temporal trend in the ECS. Therefore, we conclude that the TGD has not reduced the primary productivity of the East China Sea as a whole.

Interannual variability in the chlorophyll concentrations on the Mid-Atlantic Bight along northeast United States

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We examine the interannual trends (from 1998 to 2016) of chlorophyll *a* (chl *a*) concentrations in the Mid-Atlantic Bight (MAB) by SeaWiFS and MODIS data. There has been an 33% increase in the annual spatially averaged chl *a*. The changes in chl *a* over the last decade are associated with increases in phytoplankton biomass in the spring and fall. The changes in spring bloom are associated with declining wind and storm frequency, allowing for earlier water column stabilization. Changes in the fall bloom are associated with increasing wind speed and storm frequency which would increase erosion of the pycnocline promoting injection of nutrients into the oligotrophic surface layers of the MAB. The magnitude of the winter bloom continues to show a long term declining trend which is associated with increasing wind speed and storm frequency. To explore the major physical factors influencing the magnitude of chl *a*, a regional model was used to conduct a series of sensitivity studies. Model simulations identified wind mixing, solar net heat flux, and river discharge as the dominant factors influencing the MAB water column stability, which in turn was the primary driver for phytoplankton growth. Nutrient inputs from rivers were not significant on a regional basis. Results suggest that shifting weather and climate forcing will alter the annual timing/magnitude of the phytoplankton productivity differently and these phenological changes will be important to the ecosystem.

High net growth of phytoplankton under the serious nitrogen limitation in subtropical North Pacific Ocean

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The major pathway for phytoplankton primary production engaging in the marine food web and supporting the higher trophic levels is microzooplankton (2-200μm) grazing. Previous studies reported microzooplankton could consume 67% phytoplankton production on global scale. However, this average value is incapable of reflecting microzooplankton grazing in extensive open oceans since studies are still limited, and the prey-predator interaction is sensitive to environmental conditions and could vary even in stable oligotrophic waters.

For figuring out the variation of microzooplankton grazing and its impact on transferring primary production in the most unstudied subtropical North Pacific gyre, we carried out trans-Pacific cruise (23ºN, 137ºE to 120ºW) in summer 2017. Using the dilution technique, the growth and mortality rates of phytoplankton community and specific groups (diatoms, haptophytes, pelagophytes, Synechococcus and Prochlorococcus, represented by pigment markers, respectively) due to microzooplankton grazing were examined.

Microzooplankton consumed 52% of daily phytoplankton production. The phytoplankton instantaneous growth were decoupled with mortality but positively correlated to net growth rates (growth minus mortality, $p<0.01$). Also, the instantaneous growth rates were higher when nutrient stress (determined by nutrient limitation index of dilution experiments) was relaxed. These results indicated the bottom-up processes controlled the dynamics of phytoplankton. Even under the serious nitrogen limitation (concentrations of NO_2^- and NO_3^- were generally lower than the detection limit of 3 nM), the phytoplankton showed relatively high net growth rate (0.34 ± 0.29 d^{-1}), especially in the central Pacific Ocean (140 to 170ºW). This can be attributed to the dominant prokaryotic

phytoplankton Prochlorococcus, which contributed 48% phytoplankton community biomass and showed significantly higher net growth (0.63±0.36 d^{-1}) than eukaryotic phytoplankton (averaged 0.11 d^{-1}). Prochlorococcus was advantageous from their small size on acquiring nutrients efficiently and made them adapted to the oligotrophic environment (no obvious nutrient limitation at 7 of 11 stations).

Vertical distribution of planktonic ciliates in the oceanic and slope areas of the western Pacific Ocean

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Ciliates are important grazers in the planktonic food web, and spatial distribution information is the key to understanding their function. However, our understanding of their vertical distribution in the euphotic zone of oceanic waters is limited. In this study, we investigated the vertical distribution of ciliates in the western Pacific Ocean and the northern South China Sea. The ciliates showed a bimodal distribution, with abundance peaks in surface waters and the deep chlorophyll maximum (DCM) in the western Pacific, but a single surface peak in the northern South China Sea slope. At stations influenced by shelf water, the surface abundance was much greater than in slope waters. Within the ciliates, the vertical distribution of tintinnid species groups I and V had higher abundances overall and showed surface and DCM peaks, respectively. We speculate that aloricate ciliates might also have surface peak and DCM peak groups. The overall vertical distribution patterns showed that the planktonic food web may function differently within the surface waters and the DCM.

Impact of river discharge on the primary productivity and its contribution to the biological productivity in the Indus delta creeks and shelf area

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The freshwater and sediment discharge from the River Indus to the Arabian Sea has reduced over the years, this has subsequently affected the delta in the form of seawater intrusion sometimes up to 80 km upstream and has resulted in the shrinking of the deltaic area. The delta supports a mangrove ecosystem and the broad shelf area contributes to the coastal fishery sector offshore. Shrimp fishery and demersal species dominating the catch from the shelf. The shrinking of the deltaic area and other anthropogenic factors has resulted in the stress to the mangrove ecosystem in the form of reduction in the mangrove habitat, alteration in the estuary, and therefore the nursery area of important fish and shellfish species are impacted. The present study reviews and compares the historical (1980, 1990s) and more recent observations acquired during the Fishery Resource Appraisal Program of Pakistan (2013-14) and the collaborative research on going between the State Key Laboratory in Estuarine and Coastal Research (SKLEC) and the National Institute of Oceanography (2016-18). Observations were carried out during the monsoon and inter-monsoon periods, from four major creeks of the Indus delta that have a direct connection to the sea, this includes the main River Indus channel. The preliminary findings of changes that have

taken place over the years from the reduction in the river discharge on the biogeochemistry, nutrients and primary productivity, that contribute towards the higher level shelf productivity are presented here.

Implementation of ecosystem based coastal resilience management program for minimize the hazards impacts to the coastal communities in Sri Lanka

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Sri Lanka is an island in the Indian Ocean with subject to different type of coastal hazards. The Coastal Resource managers in Sri Lanka are receiving many demands to consider the resilience of coastal communities that they are mainly rely on coastal and marine ecosystem goods and services, and the resilience of natural systems themselves. These demands are may be in response to growing dangers to coastal communities from outside factors such as declines in natural resources perhaps caused by over-fishing, coastal hazards, climate change, and changes in employment and inequality.

However, some coastal communities in the country have had knowledge in managing for hazards using the coastal ecosystems. At the same time, understanding of the factors that make a natural or social system resilient is also somewhat limited. Further, there is a lack of consensus-based definitions and performance measures for assessing resilience. These reasons, along with other obstacles, will required to be overcome before implementing the effective ecosystem based coastal resilience management plan in Sri Lanka to minimize the coastal hazards.

This paper will discuss the implications of ecosystem based coastal hazards management plans as resilience and its application to protect coastal communities from coastal hazards in Sri Lanka with some examples. The paper concludes that the complexity of ecosystem based coastal resilience and requirements of collective stakeholder participation for each and every step for management of coastal hazards through the ecosystem based coastal resilience.

Managing ecotourism on coral reefs and underwater pinnacles in the Western Gulf of Thailand

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Dive tourism exhibits a great economic importance derived from coral reef ecosystem services in coastal communities worldwide. However, intensive tourism without proper management also causes adverse effects on coral reef ecosystem. Seeking new dive sites is one of the solutions that could help reduce pressures on major dive sites. In this study, we assessed the potential of ecotourism development at some coral reefs and underwater pinnacles in Chumphon Province, the Western Gulf of Thailand. An assessment framework and criteria were developed. A total of 52 factors consisting of physical (12 factors) and biological factors (40 factors) were considered. Weighing scores were given and validated by experts. Field surveys were then conducted at 23 coral reefs and 13 underwater pinnacles during February – July 2018 to gather relevant information for the analysis. According to our analysis, the study sites that showed the study sites with high potential scores were resulted from having diverse marine organisms as well as having uniqueness, and ease of access. Three reef sites (Ko Ngam Noi, Ko Lak Ngam, and Ko Thalu) and an underwater pinnacle (Hin Pae) exhibited a high potential for ecotourism

development. Eight reef sites (Ko Kula, Ko Rang Kachiu, Ko Kalok, Ko Ngam Yai, Ko Thonglang, Ko Lawa, Ko Mattra, and Ko Chorakhe) and three underwater pinnacles (Hin Mai, Hin Klang Ao, and Hin Haeng) were assessed as medium potential. This study presents assessment methodology and identifies coral reefs and underwater pinnacles that can be possibly promoted and developed for ecotourism sites. Ecological baseline data of coral reefs and underwater pinnacles of Chumphon Province were also provided to support coral reef conservation and management under the coral reef degradation trends caused by anthropogenic and climate change impacts.

Black coral as a new environmental recorder: the iron profiles in coral skeleton from Sanya Bay over the past century

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As Fe cycle in seawater plays an important role in maintaining global climate balance, long-term and high-resolution Fe proxy now attracts great interests. Black coral (*Antipatharia*), one of ahermatypic corals with annually-layered growth ring and high enrichment of trace metals, has recently been found to be of great potential in environmental record. In this work, using high resolution (~2.5 μm) Synchrotron Radiation Micro X-ray Fluorescence (SR μ-XRF), combined with ^{210}Pb dating method and Scanning Electron Microscope (SEM), we analyzed black corals (*Cirrhipathes spp.*) collected from the South China Sea (SCS) for accurate determination of iron (Fe) content and its variation profile. XRF spectra of Fe profile during the last 110 years exhibit content peaks during 1939-1945 and 1948-1960 in a near-shore black coral sample from Sanya Bay, indicating that brief and transient regional contaminant inputs to the coral living area may be the primary factor controlling the Fe content in coral skeletons during the last century. The exploiting history of Tiandu Iron Mine, including the first development during Japan colonial period and the resuming at the end of civil war, corresponds well to the peaks of Fe content. Our work demonstrates the feasibility of Fe in black coral to be faithful elemental proxy of environmental record.

Lagrangian study of cross-slope transport and its role on phytoplankton bloom in the Northern South China Sea

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The wide basin of the SCS is considered to be an oligotrophic ocean-dominated marginal sea while it still provides important services in regional and global fisheries. The Northern South China Sea (NSCS) is influenced by the inflow of the Pearl River and is present as a biological hot spot. Therefore, the transportation processes and dynamics control the cross-slope interaction between the coast and the basin and play important role on the distribution and variation of the ecological and biogeochemical conditions in the NSCS. In this work, we use altimetry-based Finite-Size Lyanpunov Exponents (FSLE) analysis to investigate the surface transport properties on the slope of the NSCS, and further quantitatively study the cross-slope transport and its role on phytoplankton bloom occurred in this area.

Spatial and temporal variations of nutrients and chlorophyll a in River Indus, Indus Delta, and adjacent Arabian Sea

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Nutrient dynamics play an important role in tropical mangrove and adjacent coastal ecosystems. There is limited information about nutrient and Chlorophyll *a* dynamics of the River Indus and adjacent region, especially considering the monsoonal effect. Dissolved nutrients concentration and Chlorophyll *a* were selected and studied as indicators for water quality between densely populated and less or no mangrove creeks in four seasons. The highest concentration of nitrate was found in Khobar creek in all seasons. The concentration of nitrite ranged from 0.08 ± 0.05 µM to 1.39 ± 0.33 µM in all the four creeks. In Fall inter monsoon ammonia was high and silicate increased from NE to SW monsoon and decreased during Fall inter monsoon. Chlorophyll *a* concentration showed an increased trend from the upstream towards downstream in river, while the maximum concentration of chlorophyll *a* was found in Khobar creek in NE monsoon (7.99 ±1.08 mg/m$^{3)}$. Freshwater discharge during SW monsoon from River Indus altered the salinity and water quality of the Indus Delta by changing the structure and function of creeks and River Indus. During the SW monsoon the concentration of nitrate was higher and effects were observed in offshore region in the form of enhanced chlorophyll *a* because of an export of nutrients from creeks to coastal area which may stimulate phytoplankton productivity. This study suggests that river runoff and geomorphological settings of creeks and River Indus are directly or indirectly affecting the nutrient and chlorophyll *a* distribution.

Organic matter input from rivers into coastal waters of Sarawak and related GHG emissions: an overview of ongoing work

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South-East Asian peatlands are a globally significant terrestrial carbon sink. Rivers draining these peatlands are very rich in dissolved organic carbon (DOC), and are believed to account for up to 10% of the global land-to-ocean carbon flux, and thus represent an important input to the marine carbon cycle. Although the release of DOC from peatlands is a natural process, it remains unknown whether the extensive conversion of South-East Asian peatlands to agricultural plantations over the past two decades has accelerated fluvial carbon losses to coastal seas. We will present data from recent and ongoing work on several rivers in Sarawak, Borneo, Malaysia. Our results reveal substantial inputs of DOC from Sarawak rivers, which is very rich in coloured dissolved organic matter (CDOM),

with a strongly terrigenous spectral signature. DOC concentrations in coastal waters were higher during the rainier north-east monsoon than during the drier south-west monsoon. Our results suggest that tropical peatland-derived DOC is efficiently transferred to coastal waters in South-East Asia, but is then readily remineralised to CO_2 in seawater, with potentially significant consequences for the seawater carbonate system.

Origin and fate of particulate organic matter in a small tropical river - Zuari River, India with special reference to amino acids

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Terrestrially derived organic matter (OM) exported by rivers is a key component of the global biogeochemical cycles. Transitional ecosystems – coastal waters and estuaries are distinctively affected by both natural and anthropogenic factors. In this study, we explored the origin and fate of riverine OM within the Zuari River catchment along the west coast of India, by employing the enantiomers of amino acids (L- and D-AAs) as biomarker along with the other bulk parameters such as organic carbon, total nitrogen, suspended particulate matter, chlorophyll *a*. No significant seasonal variation was observed with the parameters analyzed. Nonetheless, salinity, organic carbon, total nitrogen, $\delta^{13}C$, $\delta^{15}N$, glutamic acid, serine, alanine, tyrosine, leucine and D-aspartic acid exhibited significant spatial variability ($p<0.05$). The OC content showed some seasonal variability with low values during the post-monsoon season owing to inputs from deeper soils due to erosion. Estuarine samples were less depleted than the riverine samples suggesting contributions from terrestrial C3 plants to riverine region and the dominance of regional effects. Labile OM was observed within the estuarine region during monsoon and post-monsoon season, whereas during the pre-monsoon season estuarine stations showed presence of older OM. Principally five factors were extracted which explained 85.51% of the total variance. First factor accounted for 35.29% of the variance and is associated with particle associated bacterial matter and contributes majorly to the amino acid pool. Factor two (17.74%) – tidal factor associated with salinity and it influences chlorophyll *a*. Third factor (13.25%) can be termed as degradation factor. Based on this study we can infer that there are no significant seasonal differences and this river was not sensitive to the flow dynamics controlled by the southwest monsoon. Thus in small tropical rivers, OM export from catchments are not always altered by seasonal changes.

Diel observation for amino acids enantiomers in the South China Sea slope

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Organic matter degradation status is a key parameter in the organic matter study. Amino acids are found to be useful indicator of organic matter degradation and a DI (degradation index) is often used in such studies. Though DI values usually are found to be within -1 to +1.5 for majority of natural samples, the precision of DI is seldom discussed in previous work. In both June and October, we respectively carried out diel observations (at TS station) in the South China Sea slope region for the upper 150 m, where biological activities are among the strongest in the entire water column. And further at a station named L07 we further took water samples for both organic matter composition and dissolved oxygen isotopes to reveal the relationship between organic matter composition and

community respiration.

For the diel station (TS station), higher bacteria abundance and lower biodiversity corresponded to less fresh organic matter composition, and reversely lower bacteria abundance and higher biodiversity corresponded to higher fresh organic matter composition. The organic matter composition showed different degradation status between daytime to night time, probably due to microbiological activities. For October 2014, organic matter showed decreasing freshness during daytime (from morning to evening), whereas in the night time the freshness slightly increased. For July 2015, the diel variation patter was more complicated. At L07 station, organic matter composition showed good relationships with respiration proxy (indicated by dissolved oxygen isotope $\delta^{18}O$), namely stronger respiration effect correlates more degraded dissolved organic matter status. The short time scale (from hours to years) organic matter composition variation shed new light into the organic carbon cycle study.

Trophic interactions of mesopelagic fishes in the South China Sea from the perspective of stable isotopes and fatty acids

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As the most abundant fishes of the ocean ecosystem, mesopelagic fishes play an important role in biogeochemical cycles. There are major gaps in knowledge of their trophic dynamics and diel vertical migration (DVM). Here we present evidence of trophic interactions among various species of mesopelagic fishes collected from the South China Sea indicated by isotopes ($\delta^{13}C$, $\delta^{15}N$) and biomarkers (fatty acids (FAs) and compound- specific stable isotope analysis (CSIA)). Higher lipid contents of migrant planktivorous fishes were observed with average values of 35%, while others ranged from 22 to 29.5%. These high lipids contents limit the application of $\delta^{13}C_{bulk}$ (bulk–tissue $\delta^{13}C$) as diet indicators of the mesopelagic fishes; instead $\delta^{13}C_{extraction}$ (lipid extracted $\delta^{13}C$) values were applied successfully to reflect dietary sources. The $\delta^{15}N$ values of non-migrant planktivorous and piscivorous fishes varied in a narrow range (9.8 to 10.8‰). These small difference may be caused by low temperature, which results in low metabolic rates of nitrogen. The piscivorous fishes had higher FA ratios of DHA (22:6n-3)/EPA (20:5n-3) than planktivorous fishes, which mirrored their potential feeding behaviour. The $\delta^{13}C$ values of the 20:4n-6 and 20:5n-3 FAs were significantly higher in the non-migrant piscivorous fishes than the semi-migrant piscivorous fishes, which suggested these fishes had different dietary sources. The CSIA can mirror more details of trophic interactions neglected by other methods. Our study elucidate the traditional methods of isotopes should be carefully applied to mesopelagic fishes. This knowledge is important to comprehensively evaluate the role of mesopelagic fishes in global carbon budgets.

Session 3: Responses of society to global change in marine systems: ways forward

Why Human Dimensions today? The meaning of integration of natural science and social science

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The 2030 Agenda for Sustainable Development (so called SDGs) declared to achieve the sustainable development in its three dimensions — economic, social and environmental- in a balanced and integrated manner. Why three dimensions to be integrated? Because good scientific arguments for environmental conservation are sometimes not accepted or implemented because of the perceived socio-economic or cultural costs. So, we need the realistic arguments to achieve SDGs in the actual society, not the unrealistic fantasy in a imaginary world. The integrated Social-Ecological Systems (SES) approach to understand how ecosystem changes affect human social systems, and vice versa, is necessary. In other words, recognition that ecological systems and human systems are simply dimensions of a greater whole (Perry 2010). In this presentation, I present the basic concept of the SES approach and how the integration of human dimensions in marine science can contribute to the progress in sustainability science.

Towards a common framework for marginal social-ecological system research

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Continental marginal systems, where societal dependence for food, livelihoods and recreation is growing, are undergoing rapid change following human activity and climate change. Integrating environmental, ecological and economic knowledge of continental margin systems, and how these systems may change under different perturbation scenarios, is imperative to understand the interplays between human use of the oceans and present management strategies of marginal systems; optimising the services they provide. Lessons learned from multidisciplinary syntheses and inter-regional comparative studies of coastal socio-ecological systems will help rationalize and optimize marginal seas management approaches. This presentation will introduce a new opportunity for community participation towards our understanding of marginal social-ecological systems. IMBER and Future Earth Coasts are supporting a working group which has the goal of developing a framework for guiding sustainable development of resources and advising governance regimes to facilitate sustainable governance, facilitating equitable sharing of margin resources, and evaluating alternative research approaches and partnerships that address major margin challenges. Initial case studies are in development for the Chinese and Arctic marginal seas but it is the aspiration of the working group to quickly develop this towards the inclusion of other regions.

The future of fishes and fisheries in the Western Pacific Biosphere under the changing ocean

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This paper highlights the risk of climate change on coupled marine human and natural systems in the Western Pacific Biosphere and explore possible solutions to reduce such risk. Specifically, using recent findings from the simulation modelling and risk assessment algorithms developed by the Changing Ocean Research Unit (CORU) at the University of British Columbia, this paper explores some of the key responses of marine fish stocks and fisheries to climate change and their implications for human society. It highlights the importance of mitigating carbon emission and achieving the Paris Agreement in reducing climate risk on marine fish stocks and fisheries. In addition, it discusses potential opportunities and challenges for helping fish and fisheries to reduce climate threats through local adaptation. Research focusing on using scenarios and models to inform policy on marine ecosystems and fisheries in the region is suggested as a way to support the development of these potential ocean-based climate solutions.

Potentiality of IMBeR-ADApT framework for coastal governance in the Northeast Asian Seas

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Global change is occurring now, often with consequences far beyond those anticipated. Marine ecosystems around the world face multiple challenges from global change, induced by natural and anthropogenic stressors, which affect their ability to function and deliver goods and services to humankind. Thus, there is an urgent need to create effective and efficient social and governance responses to the global change in marine systems. In the seas of Northeast Asia, there are a multitude of coastal issues: resource-related issues such as mass mortalities, large outbreaks of marine species and resource depletion, water quality-related issues such as red tide, blue tide, anoxic water and marine litter; in addition, competition for, and use conflicts over, limited resources and space are becoming increasingly tangible. Social and governance responses to these issues have been gaining momentum in China, Japan and South Korea since the late 1990s. However, management systems vary widely in different jurisdictions and contexts, which have different basic principles, institutional structures and legal characteristics. What are the characteristics of the global change in marine systems in these regions today? What are the background factors and the impacts of the changes? What responses have been made and what challenges still remain? Are there common factors associated with responses that have been successful? This study addresses these questions using an integrated assessment framework- I(MBeR)-ADApT (Assessment based on Description, Responses and Appraisal for a Typology). I-ADApT includes a common template to collect and integrate information across systems enabling a standardized comparison and identification of similarities and differences across systems, issues and responses. The results of this study will form the basis of a discussions of the potent of the I-ADApT framework for coastal governance in the Northeast Asian Seas.

Joint Management of Local Fishery in Japan and Its Performance Evaluation: A Case Study of the Sarufutsu Village in Hokkaido

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Japan was a best fishery country in the world, but the Japanese fishery has declined since the beginning of the 1990s. The reasons of this include the establishment of the EEZ system, the strengthening of international fishery resource management, the intensification of the international competition of the marine products market due to the globalization of the economy, the sharp rise of the management costs, and the deterioration of the marine environment. As a result of deteriorating environmental conditions surrounding such kind of fishery, it has been pointed out that Japanese fishery has a declining competitiveness and the fishing village economy also deteriorates. However, there are also cases where high economic performance is obtained through join management of local fishery. Therefore, the purpose of this research is to elucidate the reason why the concerned fishery could achieve high economic performance. In our analysis, we take Sarufutsu village in Hokkaido as a case. At first, we evaluate the management performance of the target case quantitatively. Then, we analyze the mechanism of the local fishery joint management system that supports it, and clarify its characteristics. Based on the above, finally we consider the way of future management of the local fishery in Japan.

Stakeholders engagement and cooperation reconstruction: the protection of the Chinese white dolphin in the Pearl River Estuary

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In the coastal zone management, the relationship between stakeholders is an important parameter that affects the efficiency of coastal zone management. From the social science level, the formation of efficient cooperative relations among stakeholders can play a positive role in coastal zone management. Based on stakeholder theory, we use the structured interviews and in-depth research methods of management (semi-structured interviews, informal interviews, observations and document review). As a result, we identified the characteristics and types of stakeholders in Pearl River Estuary Chinese White Dolphin Nature Protection Area, and the important stakeholders including government, fishermen, members of the society, regulators, resource developers and scientific research personnel, and the government, fishermen and members of the community are the most important stakeholder. These stakeholders form a relatively loose relationship between the performance for the dolphins to work together with the action of protection, but they exist individual action and personal behavior shows driven by interests, and the lack of the spirit of the contract between them enough. Based on this conclusion, we put forward that it is necessary to establish contracts between stakeholders, which can constrain all parties' actions and punish actions, and specify responsibilities, rights and obligations of all parties. So they can jointly protect the Chinese white dolphins and promote the construction of nature reserves.

The Development of Coastal Governance in Japan

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Human uses of the ocean in Japan has become diversified, complicated, and advanced with the times. Along with that, ocean problems have also become diversified and complicated. Japan has conducted management in both formal and informal ways in various levels to solve the problems in over developing and using the ocean. In this presentation, from the viewpoint of governance, we focus on analysis on the coastal areas that are an important part of Japan's maritime governance and clarify the perspective of coastal governance in Japan at the regional level. Specifically, we first analyze various aspects of the problems which are reflected in the coastal area usage management in Japan. Next, grasp the actual situation of coastal zone governance efforts in Japan (e.g., fishing ground / seaweed bed regeneration, fisheries self-management, coral reefs revitalization, Satoumi etc.). Based on the above, finally, we will present perspectives on coastal governance in Japan.

Factors influencing the resilience of small-scale fishers in the Gulf of Thailand

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This study examines factors affecting perceptions of resilience among small-scale fishers in the Gulf of Thailand. 632 small-scale fishermen from 21 landing places along the coast of Rayong Province were interviewed. Findings indicate that fishers' responses to the fishery's decline are associated with four components of resilience derived from a principal component analysis of 12 resilience items: ability 1) to get work elsewhere; 2) to compete and survive and adapt better; 3) to increase confidence by planning for financial security and learning new skills; and 4) to cope when there is a change.

The study indicated that the perceived resilience of fishers depends on a combination of several factors (external and internal). Fishing communities in developed urban areas have high level of competitiveness, survivability and adaptability. While fishing communities in industrialized areas have low capacity to cope with change. It is notable that, even though fishery resources have been declining, most fishers continue to fish and do not want to pursue another occupation—a response seen in most fisheries where adequate research was conducted. In addition, fishers' ages, household income from fishing, education, years of fishing, boat ownership and fishing group membership have varying effects on their perceptions of resilience. Surprisingly, awareness of climate change had no impact on the resilience variables. The paper provides recommendations as to how the findings can aid in design of fishery improvement and governance programs appropriate to the attitudes, beliefs and values of fishers; hence, increasing the likelihood of their relative success.

Poster Abstracts

Session 1: Advances in observation and modelling of physical and biogeochemical processes in the West Pacific region

Seasonal changes of pelagic ecosystems in the East China Sea

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The East China Sea is a highly productive continental shelf sea yet, the important ecosystem services it provides are under pressure from environmental and climate change. A better understanding of the interplay between ecosystems and ecosystem stressors will enable more efficient management of ecosystem services. Our approach is to develop new modelling tools that will deliver an improved understanding of the interaction of the components of the pelagic ecosystem. We developed simulations of though a 1D physical-biogeochemical coupled model: GOTM-FABM-ERSEM that considered phytoplankton, zooplankton, bacteria, particulate matter and nutrients as state variables. Model results indicate that phytoplankton characteristics are driven by temperature, light, feeding pressure and nutrient availability, with two clear productive periods in spring and autumn. The maximum chlorophyll-*a* layer in summer with a peak of 5.3 mg $C \cdot m^{-3}$, and high temperature in seawater and stable stratifications (nutrients are distributed below the thermocline) of water column. In addition, it shows periodic growth under the influence of tides and light.

Diversity and distribution of pico- and nano-eukaryotes in the coastal upwelling waters off Hainan (South China Sea)

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Coastal upwelling waters are highly productive regions, where small-sized eukaryotes contribute substantially to the standing stock of phytoplankton. Yet little is known about the diversity, abundance, and spatial distribution of these small eukaryotes in upwelling regions. In this study we investigated the pico- and nano-sized fractions of eukaryotes in a transect of the upwelling zone off Hainan (South China Sea) in summer of 2017, using multiple approaches (high throughput sequencing, flow cytometry, and quantitative polymerase chain reactions). Sized fractioned chlorophyll *a* showed that the pico- and nanophytoplankton did dominate the total phytoplankton standing stock. Flow cytometry data showed that photosynthetic nanoeukaryotes dominated the inshore, while the photosynthetic picoeukaryotes prevailed in the oligotrophic areas. MiSeq sequencing of 18S rDNA indicated that, the read proportions of Chlorophyta, Diatomea, Dinoflagellata, and some non-photosynthetic microbial eukaryotes such as Ciliophora and MAST groups, were significantly enhanced in the communities of upwelled water masses. Redundancy analysis revealed that water pH, salinity and NO_3^- concentration were the most important environmental parameters in structuring the pico-nano eukaryotic community. There were significant differences in community structure between two representative depths: the MAST groups and Dinoflagellata were abundant in the deep chlorophyll maximum (DCM) layers, whereas 18S rDNA copy numbers of Basidiomycota were notably

higher in the surface layers. This is the first study of the abundance, molecular diversity and vertical distribution pico-nano components in upwelling zones.

Distribution and bioavailability of dissolved organic matter in the Changjiang Estuary during dry and wet seasons

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Large-river estuaries (LRE) are important interfaces for biogenic element fluxes that have a global impact on marine biogeochemistry and have been studied widely. However, due to the highly dynamic, the bioavailability and fate of dissolved organic matter (DOM) in LRE remains enigmatic. To investigate the dynamic characteristics of DOM, three cruises (February, May and July, 2017) were conducted at the Changjiang Estuary and its adjacent sea (CEAS) during dry and wet seasons, Dissolved organic carbon (DOC) concentrations, chromophoric dissolved organic matter (CDOM) absorption and total dissolved amino acids (TDAA) were measured. Degradation status of DOM was indicated by DOC-normalized yields of TDAA [TDAA (%DOC)]. The monsoon has a profound influence on the composition and bioavailability of DOM in Changjiang plume, resulting in seasonal wind-driven high terrigenous DOM with low bioavailability. From river to open sea, the concentration of DOM decreases progressively. Nevertheless, the TDAA (%DOC) firstly increasing and then decreasing, indicate that the contribution of fresh marine plankton production. Additionally, a model for retrieving surface DOC concentrations from CDOM absorption coefficients was established based on absorption coefficient (a_{275} and a_{295}) and multi-linear regression. The model is suitable to use for high resolution and long-term field monitoring of DOC concentration in the CEAS.

Decomposing monthly declines of subsurface-water aragonite saturation state from spring to autumn in the North Yellow Sea

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The North Yellow Sea is a western North Pacific continental margin of major ecological and economic importance, where monthly/bimonthly declines of subsurface-water pH and aragonite saturation state occur from spring to autumn. To quantify controlling processes of these variations, we employed a Redfield-based methodology to decompose the monthly/bimonthly declines of subsurface-water aragonite saturation state observed in 2011 and 2013. Results showed that contributions of the NYS cold water mass community respiration, calcification and temperature changes to the monthly declines of aragonite saturation state from spring to summer were 84 ± 9%, 30 ± 16%, and -13 ± 10%, while contributions of the community respiration, $CaCO_3$ dissolution and temperature change to the bimonthly decline of aragonite saturation state from late summer to autumn were 103%, -5% and 1%. Our results also suggested that the NYS cold water mass net calcification rate declined to nearly zero when the seawater aragonite saturation state reached a critical level of 1.5-1.6. This is much different from a recently published coral reef case observed by Bradley et al. (2018, Science), which suggest that the seawater aragonite saturation state threshold of net calcification rate reaching zero should be 2.9-3.0 in coral reef systems. Thus the

relations between biogenic $CaCO_3$ dissolution rate and seawater aragonite saturation state may vary in different systems. Much remains to be investigated in order to quantitatively evaluate the effect of ocean acidification on marine $CaCO_3$ cycles. Based on a future scenario projection to predict the possible impacts of future CO_2 changes on seasonal variations in the NYS cold water mass aragonite saturation state, we suggested that the very low aragonite saturation state values of <1.5 may exist all year round in the NYS cold water mass in the 2050s, bringing much stress on local benthic fauna community.

Extending our understanding of the marine carbonate system in the Changjiang Estuary and adjacent East China Sea shelf using Artificial Neural Networks

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We developed relationships between the marine carbonate system in the Changjiang (Yangtze River) Estuary and adjacent East China Sea shelf and nutrient biogeochemistry and hydrography using canonical correspondence analysis (CCA), and estimated water column total alkalinity and pH through artificial neural networks (ANN).
The CCA showed that pH was negatively related to salinity (S), phosphate (P) and positively correlated with temperature (T) and dissolved oxygen (DO); total alkalinity (AT), dissolved inorganic carbon (DIC), the partial pressure of carbon dioxide (pCO_2) were negatively related to temperature and positively correlated with salinity and phosphate. This result indicated that both physical and biological processes had significant influence on the carbonate system. Accordingly, an artificial neural network was informed using matrices from measured parameters (T, S, DO, dissolved inorganic nitrogen (N), silicate (Si), and P) during a shelf study in May 2017. The ANN was applied to estimate water column pH and total alkalinity during data from a study in July 2016. Overall the model-observations agreed better than Fassbender et al. [2017]. However, the highly heterogeneity of the coastal system resulted in a large RMSE for both pH and total alkalinity. We obtained RMSE of 14.6 μmol kg^{-1} for total alkalinity (TSOPN), and RMSE of 0.047 units for pH (TSOP) and 0.05 units for pH (TOP). Taking into account the small number of data available and the complex and variable nature of research area, pH and total alkalinity estimates we obtained are robust. Whilst our model is not presently informed to analyze ocean acidification, it will be used to inform on the inter-annual and seasonal variability of the carbonate system using historical ocean data where no carbonate measurements are available.

Phosphate boundary transport of the East China Sea and its influence on biology

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Using a 3D oceanic physical-biological model, the interannual variation of Kuroshio intrusion induced phosphate transport (KIPT) and its influence on the biological process in the East China Sea (ECS) has been investigated during 1997-2016. The KIPT into the ECS mainly occurs to the northeast of Taiwan and southwest of Kyushu, but the former shows stronger interannual variability than the latter. The variation of the KIPT is more significant in the near bottom water and it is dominated by the variation of the volume transport. On the interannual time scale,

the KIPT changes in response to the shift of the Kuroshio main axis and the bottom upwelling at the ECS eastern boundary. When the Kuroshio main axis is closer to (farther away from) the ECS shelf, the strength of the bottom upwelling increases (decreases). This process induces more significant (less significant) topographic beta spiral, which causes an anti-cyclonic (cyclonic) eddy-like bottom velocity feature in the northeast of Taiwan. Eventually there is more phosphate being transported to the ECS inner shelf, which increases chlorophyll concentration around the Zhoushan Islands and Yangtze estuary but reduces chlorophyll concentration in the ECS outer shelf. Conversely, the chlorophyll increases in the ECS outer shelf but decreases around the Zhoushan Islands and Yangtze estuary when there is less phosphate transport. This study highlights the importance of Kuroshio intrusion in connecting the inner and outer shelf of the ECS on the interannual time scale.

Nutrient variations in the lower reach of Huanghe and their impacts on the Bohai ecosystem

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The Chinese coastal environment is experiencing eutrophication, pollution, and changing freshwater input, massive and intensive aquaculture, over-fishing, excess land reclamation, course shifts, land use change, exploitation of renewable and non-renewable sources, and climate change. The Huanghe (Yellow River) estuary and Bohai ecosystem is given as an example to address nutrient variations and their response to anthropogenic activities and global change. The Huanghe discharge represents more than 75% of the total freshwater discharge into the Bohai. The Huanghe sediment load had been the second largest of the world over the last several thousand years, but has decreased recently. Synchronous decrease in Huanghe water discharge and sediment load has had profound physical, ecological, and geomorphological effects on the lower reach of the river and the adjacent Bohai. Obviously, the Huanghe water–sediment regulation events have led to high monthly water discharge and sediment load advancing to as early as June, i.e. occurring at least 2 months prior to the normal high flow season. The seasonal patterns of nutrient transports from the Huanghe to the BS have shifted accordingly. Besides man made flood, i.e. water-sediment regulation events, natural rainstorm events can also affect nutrient transport from the Huanghe to the sea. The water discharge during water-sediment regulation and rainstorm events accounted for 29% and 19% of the annual water discharge, respectively, accordingly, the nutrient fluxes accounted for 38% and 24% of the annual nutrient fluxes, respectively. Thus, nutrient imbalance was aggravated in the Huanghe estuary and Bohai, especially phosphorus limitation for phytoplankton growth.

Organic carbon distribution and budget in the Changjiang Diluted Plume based on chemical analysis and numerical model

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River plume carries lots of materials to adjacent sea, interacting with local ecological environment and has great influence on carbon cycling. However it is difficult to quantify organic carbon (OC) budget in such dynamic region while there are many studies about descriptive of their distribution and behavior only. In this study, based on a three-dimensional numerical model combined with in situ chemical analysis, we characterized the distribution and budgets of OC along the Changjiang Diluted Plume especially the residence time (RT) of water mass and phytoplankton contribution to OC were quantitative estimated. Integrated all physical and chemical parameters,

very different two typical groups (estuarine region and coastal region) were identified by the principal component analysis (PCA). In estuarine region, the average RT was 4.9 days while it was 39 days in coastal region, and the longer RT allows phytoplankton blooming during the spread of the Changjiang Diluted Plume in the offshore. We found, in coastal surface layer, about 17.4% (±10.2%) of DOC and 74.8% (±17.4%) of POC was derived from phytoplankton in situ production while it was only 2.9% (±6.6%) of DOC and 12.1% (±9.8%) of POC in estuarine region and about 30.2% contribution of OC was from the Changjiang. This study first quantitatively estimated the influence of Changjiang plume on carbon cycling of the East China Sea and will shed light on the biogeochemistry of terrestrial delivery of OC in the dynamic coast.

High precision measurements for carbonate system

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High precision measurements for carbonate system are an important part of understanding carbon cycling, air-sea CO_2 exchange and ocean acidification in coastal marine ecosystems. Here we show the how we have developed a new state-of-the-art capacity at the SKLEC-NIVA Ocean Acidification Lab, for seawater sampling and measurements of the full marine carbonate system using shipboard, moored, underway and other in situ observational approaches. As well as common instrumentation such as the Versatile Instrument for the Determination of Total dissolved inorganic carbon and Alkalinity (VINDTA 3C), we employ an automated flow-through pH measurement system for embedded spectrophotometry designed by Norwegian Institute for Water Research (NIVA) measure seawater pH in sampling and underway mode. In addition, underway instruments such as Autonomous Flow-Thru (AFT) and moored systems such as Submersible Autonomous Moored Instrument (SAMI) also are used in the lab. Examples of new scientific results will be presented to show the utility and application of these technologies from open ocean, coastal and mesocosm studies.

Validation and application of SMAP SSS observation in Chinese coastal seas

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Using sea surface salinity (SSS) observation from the Soil Moisture Active Passive (SMAP) mission from September 2015 to August 2016, the spatial distribution and seasonal variation of SSS in the Chinese coastal seas were investigated in this study. First, in situ salinity observation over Chinese East Sea was used to validate SMAP observation. Then, the SSS signature of the Yangtze River freshwater was analyzed using SMAP data and the river discharge data from Datong hydrological station. The results show that the SSS around the Yangtze River estuary, the Bohai Sea and the Yellow Sea is significantly lower than that of the open ocean. The SSS of Chinese coastal seas shows significant seasonal variation and the seasonal variation in the adjacent waters of the Yangtze River estuary is most obvious, followed by that of the adjacent of the Pearl River estuary. The minimum value of SSS appears in summer while maximum in winter. The root mean square difference of daily SSS between SMAP observation and in situ observation is around 3psu in both summer and winter, which is much lower than the annual range of SSS variation. The path of freshwater from SMAP and in situ observation is consistent during

summer time, which indicates potential application of SMAP observation in coastal seas in monitoring the diffusion and advection of freshwater discharge.

Distributions and transports of the diluted water from major rivers in East Asian Marginal Seas

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East Asian Marginal Seas (EAMS) is a continuum receiving multiple large rivers, such as the Changjiang River, Yellow River, Pearl River, and Mekong River. Fate of these river discharges are strongly influenced by the energetic shelf circulation systems in the EAMS. At the same time, the massive buoyancy input by these rivers may also significantly modify the coastal circulations and vertical stratifications. In the past, most river plume studies in the EAMS region only consider one major river (e.g. the Changjiang, Pearl, or Mekong rivers) with limited domain numerical model or survey area, which, however, may underestimate the area of river influence and neglect the interaction between multiple river plumes. Here in this study we develop a numerical model covering the entire EAMS area based on the Regional Ocean Modeling System (ROMS). 12 major rivers discharged into the EAMS were considered so that we can make a comprehensive analysis on the fate of riverine materials and the composition of terrestrial materials in specific water area. By adding dyes to the input river water, the distribution of diluted water was showed. On the other hand, it also can be used to interpret the transport of terrestrial materials, and calculated water age can represent residence time. After analyzing the monthly average data of the output, we find freshwater belt formed along the coast by adding multiple rivers and there are exist significant differences compared to the results of a single river. In another aspect, terrestrial materials are diluted by multiple rivers so their transport distance is decrease, but the extent of buoyant coast current slightly increase.

Tidal mixing sustains a bottom-trapped river plume and buoyant coastal current on an energetic continental shelf

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Conventional wisdom on river plume dynamics suggests that a down-shelf buoyant coastal current will be ultimately trapped at a specific depth, i.e., the trapping depth, as constrained by riverine outflow and offshore bottom Ekman transport. Theoretically, a prerequisite down-shelf current is necessary to form a stable bottom-trapped river plume. In this study an alternative is described by carrying out a modeling study on the Zhe-Min Coastal Current (ZMCC). Buoyant water from the Changjiang River is a major factor driving the ZMCC, as is common in bottom-trapped river plumes; however, the trapping depth is more determined by tidal mixing. When the plume water comes to the sloping topography, strong tidal mixing induces a mixing front, shoreward of which the bottom Ekman layer occupies the entire water column. Such a tidal-induced front maintains a down-shelf frontal current, which is intensified both at surface due to the thermal wind balance and on the top of bottom boundary layer due to the tidal rectification. Direct wind-induced transport only accounts for a small fraction of the ZMCC; however, it redistributes the plume water thus affects the coastal current. The tide-induced frontal trapping depth varies much less between seasons than that predicted by previous plume theories. Instead, it

fluctuates strongly in the spring-neap cycle. Even in summer when upwelling-favorable winds prevail, the mixing front still sustains a down-shelf coastal current. Intense tidal mixing exists in many coastal waters, which might be an alternative mechanism in forming the bottom-trapped river plume and the associated buoyant coastal current.

Simulation on formation of summer low oxygen zone in the Bohai Sea

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In recent forty years, bottom low dissolved oxygen (DO) conditions (< 3 mg/L) in summer have indicated an intensifying trend in the Bohai Sea (BS), which imposes great stress on marine ecosystems and implies the need for effective management to improve eco-environments. To explore oxygen dynamics and low-oxygen formation mechanisms, a coupled physical-biological model (ROMS-CoSiNE) is established in the BS. Sediment oxygen consumption (SOC) used in the model is related to temperature which is based on observations of cruises in 2017. The model reproduces seasonal evolution of low-oxygen conditions in the BS, and capture the observed two low DO centers. DO becomes unsaturated in June, and reaches a minimum in August. In addition, model results also suggest that SOC plays an important role in formation of low-oxygen conditions, which is also can be inferred by statistical analysis of long term observations from 1978 to 1999.

Variability of the Pacific North Equatorial Current based on a 1/8° Pacific model simulation

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Based on a multi-decadal Pacific basin model simulation, inter-annual variations of the North Equatorial Current (NEC) are investigated. The model reproduces well the characteristics of the NEC and its inter-annual variability. Calculated as an integral of the westward velocity from 6º N to 21º N and from the surface to the 1200 m depth, the magnitude and standard deviation of the NEC transport increase from 46.5 and 3.9 Sv at 175° E to 66.7 and 6.5 Sv at 130° E, respectively, and both peak around 132 º E prior to entering the separation region. The NEC transport tends to be higher during positive Oceanic Niño Index (ONI) years but lower during negative ONI years with the maximum difference of more than 20 Sv. The inter-annual variability of the NEC transport is closely related to changes of the sea surface height in the tropical Pacific Ocean, and the increase of the NEC is mostly balanced by the increase in the North Equatorial Counter Current (NECC) on the tropical gyre side. The present study further suggests a long-term decline of the NEC transport from 1993 to 2012, which is consistent with the patterns in the trend of wind stress curl.

Transport anomalies reconstructed from the normal modes of zonal velocity suggest that the 1st baroclinic mode captures about 95% of the variance in the NEC transport, while the 2nd mode adds only additional 3-4%. A 1.5-layer reduced gravity model further reveals that the 1st (2nd) baroclinic mode is driven primarily by the wind (thermal) forcing, respectively, and that the wind forcing plays a predominant role in determining the inter-annual variability in the NEC transport while the effect of the thermal forcing is rather limited.

Distribution patterns of virioplankton in the Caroline Seamount of the tropical Western Pacific Ocean

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The abundance of virioplankton peaked at 50-150 m, with an average of 4.52×10^6 mL^{-1} and virioplankton were less and equally distributed in the depth deeper than 200m. Four subclusters of virioplankton were detected in the depth lower than 75m (V1, V2-a, V2-b, V3, from low to high in fluorescence) and three subclusters were detected in the depth deeper than 75m. The vertical distribution of these subclusters was almost similar to the distribution of all virioplankton. V1 took the largest part of all virioplankton and v3 took the smallest one. The proportion of V1 became lower with the increasing of depth while the proportion of other subclusters became higher within 0-75m. In the depth deeper than 75m, the percentage of V1 became higher as depth increased while the percentage of V2 and V3 decreased. The VPR increased with the depth with an average of 23.

Session 2: The response of marine ecosystems to natural and anthropogenic forcing: past, present and future

Decadal variability of tidal dynamics in the Pearl River Delta: spatial patterns, causes, and implications for estuarine water management

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In this study, we examine the decadal variability of tidal dynamics in terms of the tidal range in the Pearl River Delta (PRD) from the 1950s to 2016. The Mann–Kendall (MK) trend test and Empirical Orthogonal Function (EOF) method are employed to identify the long-term trends and spatial patterns of the annual tidal range series observed at 26 stations over the whole PRD, respectively. The results show that most stations display an increasing tidal range trend, except for some stations near estuarine outlets, which corresponds to the 1st EOF mode characterized by a rapid increase of the tidal range since the 1990s. This means that the cumulative impacts of human interventions reached their peak in the 1990s, exceeding the threshold of tidal dynamics in the PRD. To quantify human-induced alternations of the tidal range, the tidal regime shift was subsequently explored by comparing the tidal ranges of the pre- and post-1992 periods reconstructed from the EOF decomposition. The mechanism causing the tidal regime shift in the PRD can be attributed to the substantially reduced residual water level slope (hence, the effective bottom friction) that greatly enhances the tidal dynamics. Our study describes the shift of spatial–temporal tidal dynamics patterns in detail, which is particularly useful to guide effective and sustainable water management in the PRD.

Submarine groundwater discharge in a typical anchialine eco-system, Zaton Bay, Croatia

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Anchialine eco-systems are common phenomenon in the karstic coast. Nutrient fluxes through submarine

groundwater discharge (SGD) are potentially important yet poorly understood components of coastal nutrient cycling in anchialine eco-systems. Based on a ^{222}Rn mass balance model, SGD and associated dissolved inorganic nitrogen (DIN) and phosphorus (DIP) fluxes were quantified in surface waters of the Zaton Bay, Croatia. Both SGD (m d^{-1}) and associated nutrient fluxes (mmol m^{-2} d^{-1}) in surface waters of Zaton Bay in the wet season (SGD: 0.41−0.56; DIN: 74; DIP: 0.39) were significantly higher than those in the dry season (SGD: 0.25; DIN: 37; DIP: 0.13). Coincidentally, the red tides were observed in the wet season but not occurred in the dry season. Furthermore, our results imply that almost all absorption of nutrients by primary productivity in surface waters were derived from SGD based on nutrient budgets. Therefore, we suggest that seasonal variation of SGD should strongly affect the nutrient fluxes into the Zaton Bay, and then may induce the seasonal outbreak of red tide in the Zaton Bay. Moreover, we deduced that the precipitation is the main controlling factor during the outbreak of red tide for the microtidal environment such as Zaton Bay.

Diurnal Changing of Nutrients in Seawater Inside and Outside Coral Reefs Zone of Mo Ko Same San, Chonburi Province

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Diurnal changing of nutrients in seawater inside and outside coral reefs in Mo Ko Same-San, Chonburi Province was investigated. Seawater were collected from 2 to 3 levels depending on water depth, including surface, mid-depth and bottom, every 2 hours for 24 hours from 3 PM of 26th November to 3 PM of 27th November 2011 at Kao-Ma-Jor (inside the reef) and Ko Same-san (outside the reef). The physicochemical parameters were measured along with water sampling for chemical analyses. The results found average ± SD inside and outside the coral reefs were as following: pH 7.87 ± 0.38 and 8.25 ± 0.06, salinity 31.4 ± 0.2 and 30.3 ± 2.5, dissolved oxygen 6.04 ± 0.53 mg/L and 6.44 ± 0.31 mg/L, total suspended solids 27.3 ± 6.5 mg/L and 25.9 ± 5.4 mg/L, phosphate 0.42 ± 0.26 µM and 0.23 ± 0.14 µM, ammonia 4.90 ± 6.67 µM and 1.74 ± 0.32 µM, nitrite 0.18 ± 0.12 µM and 0.10 ± 0.06 µM, nitrate 2.02 ± 1.46 µM and 0.68 ± 0.41 µM, dissolved silica 6.62 ± 1.36 µM and 7.62 ± 1.65 µM, organic phosphorus 3.54 ± 2.06 µM and 4.30 ± 0.82 µM, and organic nitrogen 298 ± 37 µM and 295 ± 25 µM. In comparison, it was found that most of the physicochemical parameters and nutrients in seawater of Kao-Ma-Jor (inside the reef) showed higher variation through depth and time than those of Ko Same-san (outside the reef). The results also revealed that dissolved organic phosphorus (DOP) exhibit a highly diurnal variation and also with depth. The DOP increased at night and decreases in the early morning. This increasing DOP probably was released from the corals. Diurnal variation of pH and dissolved oxygen may be interpreted that photosynthesis of *Zooxanthalle* in the coral polyps gave energy for corals to uptake carbonate ions from seawater to build up calcium carbonate reef. The loss of carbonate ions induced a decreasing buffering capacity of seawater. Therefore, seawater inside the coral reefs had a highly variation of pH in comparison to outside the coral reef. However, alkalinity is recommended to study to confirm this phenomenon.

Niche partitioning of key bacterial and archaeal groups along the Changjiang River Estuary to the East China Sea

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The Changjiang River estuary and its adjacent area represent a unique ecosystem to explore the relationship between the specific microbial taxa and environmental conditions. In this study, niche partitioning of the key bacterial and archaeal groups from two size fractions (0.2–3 μm and >3 μm) was investigated in three regions including estuary area, maximum turbidity zone, and sea area along the Changjiang estuary to the East China Sea. Within the bacterial domain, we found the niche specificity of *SAR11* in the various regions. Phylogenetic analysis showed that *hgcI* clade was dominant in the estuary area and *flavabacterial* groups were abundant in the sea area. In addition, we found that certain *Cyanobacteria* are abundant in the collection of bacteria above 3μm, which closely related to an obtained clone from Karenia brevis bloom water on the west Florida shelf, suggesting a connection with blooms. Notably, the co-occurrence of sequences belonging to different groups of *SAR11*, *hgcI* clade and *flavabacterial* class in the maximum turbidity zone, indicating there are complicated metabolic pathways in this area. And within the archaeal domain, the *Nitrosoarchaeum* group and several novel groups belonging to marine group I were frequently detected in the estuary area, showing these potential ammonia-oxidizing archaea may be more adaptable in low salinity condition. Sequences affiliated with heterotrophic Maine Group II were predominant in the sea area, indicating they may prefer utilize marine organic matters. Also, a distinct distribution of *bacthyarcheatal* groups was observed in both size fractions in the bottom water, suggesting the metabolic specialists exist in our studied sites. Our results advanced the understanding of preferences of specific bacterial and archaeal taxa for distinct niches within the estuarine environment.

Trends of pigments buried in sediments from the Changjiang Estuary as a function of depth

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The study of pigments buried in sediments is of great significance for mastering the biogeochemical cycle of carbon in the ocean. By combining with other marine geochemical parameters such as total organic carbon and total nitrogen, the pigments buried in sediments can be used to study the composition and abundance of marine phytoplankton, and further calculate the level of marine primary production, eutrophication and its history trend. In this experiment, the pigmentation of the sediments in the A5-4 station of the Yangtze River Estuary in July 2016 voyage was determined by high performance liquid chromatography of phytoplankton photosynthetic pigments. The results showed that the concentrations of Chlorophyll *a*, Fucoxanthin and Lutein decreased with increasing sediment depth. Among them, the concentration of Fucoxanthin dropped to 0 at 40-41 cm. The value of Chlorophyll *b*/ Chlorophyll *a* showed an upward trend from 1903 to 1970 and reached its maximum in 1970, and then showed a downward trend from 1970 to 2011.Peridinin/Fucoxanthin had a maximum in 1968 and an overall downward trend from 1968 to 2011.

Spatial and temporal variation of transparent exopolymer particles in a semi-enclosed bay: the Jiaozhou Bay, North China

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Transparent exopolymer particles (TEP) contribute to carbon export and can represent a significant part of the carbon pool, most notably in eutrophic systems. This study investigates, for the first time, TEP spatial distribution, seasonal variability and contribution to the carbon pool in a highly productive semi-enclosed bay—the Jiaozhou Bay, North China. TEP concentrations ranged from 75.24 to 552.60 μg xanthum gum equivalent (Xeq.) L^{-1} in the Jiaozhou Bay, which was within the range of values reported in other coastal seas around the world. Spatially, high levels of TEP were always observed in the northeastern and northwestern part of the bay during all four seasons, which was consistent with the distribution pattern of nutrients and Chl *a* concentrations. N/P values were found to have a significant positive correlation with TEP concentrations in spring and summer, indicating that a P limitation would probably accelerate production and/or formation of TEP in these two seasons. TEP concentrations were highest in summer (mean = 275.05 ± 141.74 μg Xeq. L^{-1}), followed by winter (mean = 209.41 ± 54.81 μg Xeq. L^{-1}) and fall (mean = 179.54 ± 49.37 μg Xeq. L^{-1}), and lowest in spring (mean = 141.55 ± 43.31 μg Xeq. L^{-1}). Resuspension of exopolysaccharide-rich particles from sediments contributed to the relatively high TEP levels in winter. TEP carbon (TEP-C) ranged from 56.43 to 414.45 μg C L^{-1} in this study, constituting for 26.05 ± 7.68 % of the particulate organic carbon (POC) in the Jiaozhou Bay. This study highlights the fact that TEP-C could represent a significant fraction of the POC pool in the Jiaozhou Bay, and will help to make predictions about biogeochemical and economical effects of TEP in this area.

Variability of phytoplankton sinking rates with related to physico-chemical parameters after Northwest Pacific Typhoon Activity in the transects near the Philippine currents in the Western Pacific Ocean

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Phytoplankton sinking rate sampling were done during Pacific Typhoon Season at western pacific transection near Philippine currents. SETCOL methods were used on board to distinguish settling sample for further analysis with necessary Chlorophyll-*a* and dissolved nutrients samples. Concentration of diatom were higher than dinoflagellates and cyanobacteria. Average concentration of *Rhizosolenia alata* and *Nitzschia sp*. were higher than other phytoplankton but the dominant species were *Bacteriastrum hyalinum* and *Skeletonema sp*. Sinking rates of Phytoplankton were ranges between 0.13 to 6.49 m day^{-1} (average=2.85 m day^{-1}). Average sinking rate were higher at Mixed lyre depths but the highest sinking was observed at Subsurface Chlorophyll Maximum (SCM). Diatom and cyanobacteria abundance were dominant at higher phytoplankton sinking area with lower dissolve nutrients. Ammonium concentration were higher in MLD and remain nutrients were accumulated below SCM. Dinoflagellates and Chl-*a* shows close relation with phytoplankton sinking rates in CCA. Most of the nutrients and depths didn't shows clear correlation with sinking rates. Comparison of average phytoplankton sinking rates showed that it decreased along with depths. Phytoplankton concentration and Chl-*a* may be influence sinking rate than dissolved nutrients.

Dissolved Lead in the East China Sea with Implications for Impacts of Marginal Seas on the Open Ocean Through Cross-Shelf Exchange

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The distribution of lead (Pb) in the ocean is influenced by human activities. During a cruise in the East China Sea (ECS) in August 2013, we investigated six representative stations and gave the first systematic description of dissolved lead (DPb) distributions after the phasing out of leaded gasoline in China. The DPb concentration in the ECS ranged from 23.8 pmol/kg to 96.7 pmol/kg, with the highest concentrations observed at the surface of the middle shelf, while the lowest concentrations were determined to be in deep samples collected at the shelf break. Vertical profiles of DPb vary with geographic locations, seawater turbidity, hypoxic conditions, atmospheric deposition and hydrographic regimes. As one of the most important western boundary currents, Kuroshio receives an additional 10-20 pmol/kg of DPb from the ECS shelf through a cross-shelf exchange process, and approximately (1.1-1.7) $\times 10^9$ g/yr of DPb was exported through the shelf break area, which will directly join the North Pacific circulation based on a preliminary box model. In addition, the ECS shelf exported another 1.4×10^9 g/yr of DPb from the Tsushima/Korea Strait, which has the potential to influence the northwestern Pacific Ocean as well as the Sea of Japan/East Sea. A residence time of 2-3 months for DPb in the ECS was inferred.

Ecosystem-based management under a changing environment via outputs from coupled marine physical and biogeochemical models and participance of stakeholders

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As human pressures on the natural environmental increase through the Anthropocene and simultaneously, our demand for marine ecosystem services grow, it is paramount that adequate tools needs to be developed for good marine ecosystem governance and management. The development of such governance and management requires an understanding of the constituent physic-chemical, biological and socio-economic systems, as well as their connectivity. The efficient and relevant development of coastal management protocols could only be realized when there forms a comprehensive understanding of how the ecosystem changes with the changing environment. To realize the goal, both coupled marine physical with ecosystem models and involvement of stakeholders are needed. Coupled marine physical and biogeochemical ecosystem models are of fundamental importance in fortifying assessment, management and policy support. Outputs from physical FVCOM (Finite-Volume, primitive equation Community Ocean Model)/ ROMS (Regional Ocean Modeling System) coupled with biological ERSEM (European Regional Seas Ecosystem Model) for both Norwegian and Chinese marginal seas are to be analyzed to develop scenarios for the scale, rate and phenology of critical drivers of organism and ecosystem function. The natural scientific information about sustainable development of marine ecosystem services concerning how they change in a changing environment would only be ideal but not be meaningful if the social and economic expectations of the stakeholders, who live on take benefits from ecosystem services, are not considered. So we will need to provide targeted knowledge of ecosystem functioning and services changes to different stakeholders, meanwhile, to adjust models analysis according to their needs, thus to help them adapt to global change.

Characteristics of the East China Sea shelf carbonate system in the early summer

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Coastal and shelf carbonate chemistry of the East China Sea is strongly influenced by physical and biological processes often over short time periods. In order to better understand the tight coupling between coastal physics, pelagic plankton production and carbon biogeochemistry, we followed a drogued patch in two regions to the south and north of the Changjiang River estuary over a three week period in May 2017. We report here modifications in marine carbonate chemistry in relation to rapid changes in phytoplankton and nutrient fields. pH varied from 7.932 ~ 8.268 in the southern region of the Changjiang River estuary and from 7.911 ~ 8.471 in the northern region. High pH values were detected in the surface with relative high phytoplankton biomass. The surface pH value would increase by an average about 0.4 pH units in high productivity regions. The partial pressure of CO_2 (pCO_2) had a similar distribution as the total dissolved inorganic carbon (CT), which was opposite to the varying trend of pH. In the high productivity regions, pCO_2 and CT values decreased. AT ranged from 2181μmol/kg ~ 2262μmol/kg in the southern study region and from 2132μmol/kg ~ 2264μmol/kg in the northern study region and elevated AT values were detected in the bottom and lower values were distributed in the surface. In the surface layer, AT values varied narrowly when the phytoplankton biomass changed greatly, because it is changed by nitrate and phosphate utilization. Relationships between carbonate parameters and environmental factors were studied through the Pearson Correlation Analysis and multiple linear regressions (MLRs). Strong relationships were found between AT and salinity ($P < 0.01$), and between pH, nutrients and Chl-*a*, illustrating the influences of physical and biological processes.

The impact of typhoon induced hydrological variation on nutrient and organic carbon dynamics in the Nandu River on Hainan Island, South China Sea

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Small mountainous rivers are significant affected by climate extremes (typhoon) and play important roles in delivering material to the adjacent seas. However there is limited study characterize organic carbon and nutrient in Nandu River. Here, we analyzed particulate organic carbon (POC), carbon isotope ($\delta^{13}C$), dissolved organic carbon (DOC) and nutrient in Nandu River basin and estuary in August 2011 and October 2012. The results show that the $\delta^{13}C$ in the river basin is -25.20 ± 1.10‰ in August 2011 and -27.66 ± 1.74‰ in October 2012, while in the adjacent sea, $\delta^{13}C$ are -18.97‰ and -21.62‰ respectively, indicating the contribution of marine phytoplankton. Total suspended matter and POC content are increased along the river while the POC% were decreased slightly, suggesting soil erosion is the dominant source of particulate matter. DOC and dissolved inorganic nitrogen (DIN) concentrations are increased significantly in the middle stream, which show the impact of industrial wastewater discharge. Nandu River is depleted with phosphate while enriched with DIN and silicate, the usage of nitrogen fertilizer leading to the high ammonia proportion (3.5% to 36.2%) in Nandu River. The average DOC/POC ratio is 1.7 ± 0.8 and 2.7 ± 1.3 in 2011 and 2012 respectively, indicating increased discharge delivered more particulate carbon to the sea. The typhoon induced hydrological variation result to the differences of organic carbon and nutrient. DOC, POC, nitrite and ammonia show the highest concentrations in the highest water discharge. Nandu

River transport 177.3 t C day^{-1}, 2.83×10^6 mol DIN day^{-1} and 11.5 t C day^{-1}, 0.29×10^6 mol DIN day^{-1} to the sea, in the high and low water discharge period respectively. Our results demonstrate the dominant role of extreme event on small rivers.

^{1}H NMR spectroscopy of dissolved organic matter in the coastal waters of the Changjiang Estuary

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Submarine groundwater discharge (SGD) is recognized as an important pathway between sea and land. Therefore, SGD-dissolved organic matter (SGD-DOM) may contribute to the biogeochemical cycle and carbon budgets of coastal waters. Considering the behavior differences between DOM components in biogeochemical cycles and the role of carboxyl-rich alicyclic molecules (CRAM) as a long-term carbon storage, we determined the chemical composition in coastal surface DOM and SGD-DOM using one-dimensional ^{1}H NMR spectroscopy. The coastal surface DOM was collected within a tide cycle. The results showed that submarine fresh groundwater discharge (SFGD) contributes more to surface seawater DOM than recirculated saline groundwater discharge (RSGD). Through the integration of different zones in the NMR spectra, the relative contents of different components in the DOM were calculated. Aliphatic constituted a major part of the majority components (47.87-63.61%) of the total DOM and CRAM comprised 19.34-28.67% of the DOM in all samples. Compared to the oceanic DOM, the content of carbohydrates in the groundwater and the surface seawater is lower, which may be related to the intense metabolism of microorganism in the complex environment. Furthermore, the CRAM part behavior showed more complex, which may be due to its large molecular weight. Our results could help enhance the understanding for the contribution of SGD-DOM to coastal surface DOM composition, and their biochemical behaviors as well.

Are changes in N:P ratios in coastal waters the key to change harmful algal blooms species?

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There is a growing amount of evidence for an increase in nutrient concentrations in coastal waters from anthropogenic sources. Meanwhile, the frequency, diversity and intensity of harmful algal blooms (HABs) are increasing. Although there are many factors that control the growth and persistence of HABs, recent studies suggested the nutrient ratios (such as N:P and Si:P) are important regulators. However, it is still not possible to conclude the extent to which the N:P ratios in coastal waters can be attributed to the change in HABs species. In May 2017, we surveyed the East China Sea and identified that the dinoflagellate (*Proprocentrum donghaiense*) was blooming (3-21 $*10^5$cells L^{-1}) in higher N:P ratios waters, while diatom (*Skeletonema costatum*) was dominant (1-6 $*10^6$ cells L^{-1}) in lower N:P ratios waters. This result supports, to some extent, that change HABs species coincide with high N:P ratios. We discuss this finding and how other environment factors, such as light, temperatures or CO_2 may also play an important role. This field study is guiding new perturbation studies on the competition between diatoms and dinoflagellates under changing multiple ecosystem drivers.

A micro-Raman and synchrotron radiation XANES study of coordination mode for iron in black coral

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Iron is a biolimiting nutrient in most of the surface ocean, especially in the high nutrient and low Chl *a* (HNLC) regions. To date, lack of environmental Fe proxy with high resolution limits the understanding of iron cycle in ocean. Combination mode of Fe in potential archives is foundation in establishment of Fe proxy profiles. In the present work, in situ micro-Raman and synchrotron radiation XANES were applied to investigate the coordination mode between Fe and organic skeleton of black coral (*Antipatharia*). The Raman peaks of Fe-O complexes (531 cm^{-1}, 589 cm^{-1}, 638 cm^{-1}) in black coral skeleton were proved by treatment with ethylene diamine tetraacetic acid (EDTA) and $FeCl_3$ solutions. Moreover, X-ray absorption near edge spectroscopy (XANES) of Fe k-edge was applied, showing that tris-DOPA-Fe complex is the main existing form of Fe in black coral, followed by bis-DOPA-Fe complex. This coordination structure provides black coral with high accumulation of Fe in ambient environment. Hence the Fe incorporated in black coral skeleton would be proportional to the ambient seawater Fe concentration as well as variations in ocean primary productivity. Our work initially demonstrates the coordination mode of Fe in black coral and further presents the feasibility of black coral as environmental Fe proxy.

Impacts of land use change on the sedimentary organic matter in peat−draining rivers, Sarawak, Malaysia

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In recent decades, the original vegetation cover of peatland in southeast Asia has suffered a rapid degradation, while the impacts of this alteration on the delivery of terrigenous organic carbon in the peat-draining river are largely unknown. In this study, we used lignin phenols to trace the humic and degradation process of the sedimentary organic matter in southeast Asia. We collected surface sediments and plants from three peat-draining rivers (Maludam River, Sebuyau River and Simunjan River) and Rajang River in Sarawak in two seasons. The biogeochemical processes in Rajang River is mainly controlled by hydrological conditions, and the higher OC% and lignin content occurs in the estuary-delta region where anthropogenically disturbed peatland dominated in this area. Compared with the data collected from the Rajang Rang, higher OC% and lignin content in the other three small rivers (Maludam River, Sebuyau River and Simunjan River) sediments may be related to the comparatively lower runoff and less degradation due to low pH and oxygen depletion. S/V and C/V ratios shows that lignin phenols in the sediments of the Rajang River and the other two rivers (Maludam River and Sebuyau River) mainly originated from woody angiosperm plants, only Simunjan River had sources from a mixture of woody and non-woody angiosperm plants, mainly because the original vegetation of Simunjan River is occupied by herbaceous plants. The slight differences between flood and dry seasons proved by (Ad/Al) v and DHBA values indicates the strong seasonal change will aggravate the impacts of land use change on humic and degraded process of the sedimentary organic matter.

Impact of Cuo nanoparticles on protein oxidation in *Mytilus trossulus*

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The invention and use of nanoparticles for new technologies and industries gives rise to them in the environment. Today is the actual problem of revealing the consequences that can cause nanoparticles in having got into the organism of marine hydrobionts. Thus, in order to assess the toxicological effect of nanoparticle to marine hydrobionts we conducted study the impact of some concentrations of CuO nanoparticle on protein oxidation in digestive gland and gills of mussel *Mytilus trossulus*. *M. trossulus* was exposed to nano-CuO 10, 40 and 100 mcg/L during 5 days. After experiment conditions mussels were transfer in natural habitat for restored after exposed. Carbonyl protein content were measures in tissues in control, exposed and restored 1, 3 and 5 days' mollusks by an established method (Levine et al., 1990). Results of this study showed the increase of protein oxidation under nano-CuO exposure according to concentration. And there are decrease of protein oxidation after period of depuration according to 1, 3 and 5 days controlled. The level of protein carbonyl can serve to confirm toxic effect of nanosize particle metals on marine hydrobionts on the example of mussel *Mytilus trossulus*.

Session 3: Responses of society to global change in marine systems: ways forward

Joint management of a local fishery in Japan and its performance evaluation: a case study of the Sarufutsu Village in Hokkaido

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Japan was a best fishery country in the world, but the Japanese fishery has declined since the beginning of the 1990s. The reasons of this include the establishment of the EEZ system, the strengthening of international fishery resource management, the intensification of the international competition of the marine products market due to the globalization of the economy, the sharp rise of the management costs, and the deterioration of the marine environment. As a result of deteriorating environmental conditions surrounding such kind of fishery, it has been pointed out that Japanese fishery has a declining competitiveness and the fishing village economy also deteriorates. However, there are also cases where high economic performance is obtained through join management of local fishery. Therefore, the purpose of this research is to elucidate the reason why the concerned fishery could achieve high economic performance. In our analysis, we take Sarufutsu village in Hokkaido as a case. At first, we evaluate the management performance of the target case quantitatively. Then, we analyze the mechanism of the local fishery joint management system that supports it, and clarify its characteristics. Based on the above, finally we consider the way of future management of the local fishery in Japan.

Assessing the vulnerability of fishery villages influenced by climate change and anthropogenic activity in the coastal zone of north Taiwan

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Coastal zones located in populated and rapidly developing areas face high risks of natural and anthropogenic disasters. In this study, a framework was developed to determine the indicators of vulnerability to natural and anthropogenic disasters in Badouzi, Chuwei, Tamsui and Yongan, four northern Taiwanese fishing villages in the coastal zone of north Taiwan. The analytical hierarchy process was used to determine the vulnerability indices of the locations, with experts evaluating the weights assigned to a range of criteria, namely hydrological data (such as sea surface temperature and sea level), stakeholder perceptions, and fishery data. These four villages have a considerably homogenous exposure (0.202) to hydrological conditions. However, Tamsui had a lower vulnerability value (0.317) than the other, indicating that Tamsui faced fewer effects from natural and anthropogenic change than did. In addition, the vulnerability was most heavily influenced by the adaptive capacity of these villages. This study suggests that both climate change and human factors (e.g., overfishing and pollution) cause decreases in marine resources, thus affecting the livelihoods of stakeholders.

A new way of guiding wave dissipation by vegetation in SWAN

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With the rise of global temperature and the increase of the frequency of extreme weather such as floods and typhoons, the coastal ecological protection becomes more and more important. Coastal hydrodynamic environmental is complex with the coexistence of wave, current and tide. Wave propagates shoreward during flood tide (a following current) and ebb tide (an opposing current). Hu et al. (2014) proposed a simple analytical model to compute wave energy dissipation by vegetation on the condition of wave and current. The SWAN (Simulating Waves Nearshore) model is a third-generation wave model to solve the spectral action balance equation without any a priori restrictions for evolution of wave growth. This paper optimizes the wave dissipation model considering wave-current interaction and applies it to Mangrove Reserve in Yangjiang of China. The results show that the optimized numerical model can provide a better basis for marine ecological protection.

Correlation analysis between marine ecosystem health and marine industry agglomeration

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As a direct manifestation of marine economic activities, the activities of the marine industry are directly related to the marine ecosystem. Therefore, studying the relationship between the two systems is conducive to promoting the coordinated development of the two. Based on this, this paper introduces the connotation of related concepts, explains the interaction mechanism between marine ecosystem health and marine industry agglomeration; The coupling analysis model was introduced to empirically analyze the correlation between the two systems by taking the marine ecosystem health of Jiaozhou Bay and the agglomeration of marine industry in Qingdao as an example.

The comprehensive evaluation value analysis and coupling analysis of the evaluation results were carried out; and suggestions for the coordinated development of the two systems. The research shows that there is a close coupling relationship between the two systems; the two factors that have the greatest impact on the coupling relationship between marine ecological quality and marine industrial agglomeration are the water environment quality and the scale of marine industry development; the marine industry agglomeration structure significantly affects the coordination of the two systems.

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