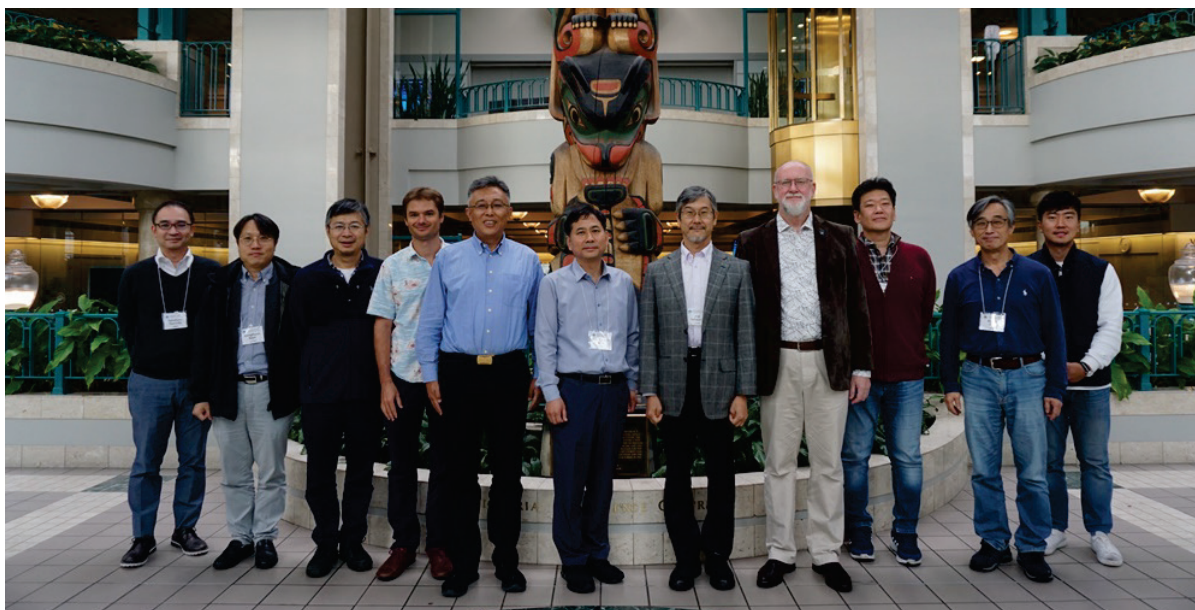


Report of the Advisory Panel for a Circulation Research in East Asian Marginal Seas/PICES Program

The meeting the Advisory Panel for a *Circulation Research in East Asian Marginal Seas* (AP-CREAMS) was opened by Dr. Joji Ishizaka, Co-Chair, at 2:00 pm, October 19, 2018 in Victoria, Canada. Participants gave self-introductions (*AP-CREAMS Endnote 1*) and adopted the meeting agenda was adopted by the AP members (*AP-CREAMS Endnote 2*). Dr. SungHyun Nam agreed after being nominated to act as rapporteur.



Participants of the AP-CREAMS meeting at PICES-2019, Victoria, Canada. Left to right: Takafumi Yoshida (Japan), SungHyun Nam (Korea), Dongfeng Xu (China), Ryan Rykaczewski (USA), Fei Yu (China), Guebuem Kim (Korea), Joji Ishizaka (Japan), Vyacheslav Lobanov (Russia), In-Seong Han (Korea), Sinjae Yoo (Korea), and Hojun Lee (Korea).

AGENDA ITEM 2

Report of Workshop (W4) on October 18, 2019

SungHyun Nam reported on the outcome of the workshop (W4) (*AP-CREAMS Endnote 3*) on “*Circulation, biogeochemistry, ecosystem, and fisheries of the western North Pacific marginal seas: Past and future of CREAMS*”. The workshop involved participation from several members of the PICES community and provided a forum for summarizing the progress made during the decades of CREAMS since its birth in the early 1990s, and during the 15 years of AP-CREAMS, since 2005, and for envisioning the future of CREAMS over the coming decades. About 30 people attended and one invited, 15 oral and 1 poster presentations were made. PICES members from four countries, except Canada and US, contributed presentations. From the presentations and suggestions during the workshop, we found a wide need for international coordination and collaboration to study the variability and changes in hydrodynamics, biogeochemistry, ecosystems, and fisheries, and the influence of human activities at multiple scales in the East Asian Marginal Seas, including Okhotsk Sea and South China Sea). It was also suggested that AP-CREAMS focus more on the interactions among the marginal seas. PICES scientists are vigorously studying the progress made in this region, and highly support the continuation of CREAMS (CREAMS 3.0) with broader impacts.

AGENDA ITEM 3

Report and discussion on AP-CREAMS publications

Status report on EAST-II publication

Drs. Joji Ishizaka and Fei Yu reported that progress was made on the EAST-II report for the PICES Scientific Report series following the Gangneung inter-sessional meeting. AP-CREAMS received reviews from its parent committees (POC and MONITOR) in early 2019. They were sent to the editors and section editors who asked their lead authors to make revisions. The revision process still needed to be completed for a few subsections. Dr. Ryan Rykaczewski volunteered to edit the report, mostly for language. Members discussed what the next step for publication, as completion of the revisions is expected by December 1, 2019.

AGENDA ITEM 4

Development of PICES North Pacific Ecosystem Status Report-3

Drs. Sinjae Yoo, Fei Yu, and Vyacheslav Lobanov related discussions WG 35 had during its business meeting in October 17, 2019, and current status of regional chapters for Areas 21 and 19. A draft regional chapter for Area 21 was received by the NPESR editorial board in early October 2019 and is expected to be submitted as scheduled. Vyacheslav Lobanov updated status of drafting regional chapter for Area 19 where many ETSOs were submitted but unevenly distributed. The missing supplementary chapter in NPESR-2 has delayed the drafting up to date, but WG 35 members will continue to work on this area (Area 19), positively, for NPESR-3 in anticipation for publishing the missing chapter in NPESR-2 and discussed for the next step of publication as a following timeline:

- November 1, 2019: Lead author will provide necessary information for the Area 19 and submitted ETSO to contributing co-authors;
- November 15, 2019: Contributing co-authors will draft and submit subsections to the lead author;
- December 2019: Lead author will submit merged draft that will be reviewed in December 2019;
- February 2020: All authors will complete the revision in response to reviews.

AGENDA ITEM 5

Extension of AP-CREAMS

AP-CREAMS members provided reasons for the extension of AP-CREAMS based on discussions during the workshop W4 on October 18, 2019. AP-CREAMS was established in 2005 to initiate and oversee a program to study the hydrography, circulation, and biology and their variability in East Asian Marginal Seas in the PICES area, and to study the effect of climate and long-term changes in the abiotic and biotic environments of this region, to facilitate the establishment of permanent observation and data exchange networks in this region, and to convene workshops/sessions to evaluate and compare results from the program. At PICES-2014, the AP term was extended for 5 years, to 2019.

The AP agreed that it was important to continue in the coming decade, particularly for the period of UN Decade of Ocean Science (2021–2030). The rationale includes a need for coordinating international cooperative experiments, integration between international programs in the region, building capacity with training courses, and providing outreach products and public awareness in the region.

Meeting participants agreed it was important to extend AP-CREAMS:

- 1) To coordinate programs to study the marine ecosystem and its variability in East Asian Marginal Seas in the PICES area under global changes, both natural and anthropogenic, and to study the effect of long-term and extreme changes in the abiotic and biotic environments of this region;

- 2) To facilitate the establishment of a permanent observation and data exchange network in this region;
- 3) To convene workshops/sessions to evaluate and compare results from the program;
- 4) To enhance capacity building, knowledge dissemination, and cooperation with other international marine organizations/programs in the region.

Meeting participants also discussed the comparison and interaction among the marginal seas in this region, including the human dimension (pollution, aquaculture), more international collaboration and coordination (cruises, data exchange, *etc.*), information exchange, capacity building, cooperation with other organizations/programs like NOWPAP, influence of global warming (climate issue, heat waves, water cycle), modeling and forecasting, and deep sea mining. Based on the changing role of the AP-CREAMS, terms of reference were updated (*AP-CREAMS Endnote 4*).

AGENDA ITEM 6

Status report and discussion on international cooperation

6.1. Korea-Russia joint cruises

Dr. Guebeum Kim provided an update on the Korea-EAST program (2016–2023), with recent and planned cruises in the EAST-I area. Korea–Russia joint cruises were conducted in December 2018 and will be conducted in October–November 2019. The latter cruise is particularly important for comparison with results from 20 years ago (CREAMS-1999/2000).

6.2. China, Japan, Korea joint cruises

Dr. Guebeum Kim reported on planned cruises in the EAST-II area. Due to difficulties in EEZ permission, China–Korea–Japan joint cruises were modified to a Korea-only cruise, and it will be conducted in August 2020.

6.3. CREAMS-III basin scale survey

Dr. Vyacheslav Lobanov explained CREAMS 3.0 international cooperative experiments to revisit the same basin scale survey of 1999–2000 (after 20 years), in 2020. Climate monitoring sections (CREAMS and NEAR-GOOS) and sections supported by national agencies (NIFS, TINRO, and JMA) will be revisited. A series of experiments for processes/monitoring, such as convection, ventilation, deep and abyssal circulation (including the abyssal front off Peter the Great Bay and the July 2016 to June 2017 deep current mooring west of Tsugaru Strait), mesoscale and small-scale water dynamics, and ferry-based monitoring lines will be conducted.

6.4. US NRL project (MJES) and US ONR plans

Dr. SungHyun Nam announced planned joint cruises in September 2020 and March 2021 between the US (Naval Research Laboratory – NRL) and Korea (SNU, KIOST, and GeoSys). The joint cruises will be conducted to deploy (September 2020) and recover (March 2021) a number of moorings/instruments in the southwestern part of EAST-I area for better understanding small-scale processes and turbulent mixing in the vicinity of front.

AGENDA ITEM 7

Capacity building activities

7.1. PICES/AP-CREAMS Summer School on Ocean Turbulence

Dr. Fei Yu announced that the Summer School on “*Ocean turbulence*”, to be held in Qingdao, China, and originally scheduled for 2019, is postponed to August 2020, and an application for the summer school in 2020 was resubmitted to the Secretariat. Lecturer(s) are presently being sought.

AP-CREAMS – 2019

7.2. NOWPAP

Drs. Takafumi Yoshida and Joji Ishizaka presented a proposal to AP-CREAMS for a remote sensing data analysis training/tutorial course in 2020 which will be submitted to parent committees, POC and MONITOR during PICES-2019.

AGENDA ITEM 8

FUTURE program

Dr. Lobanov, FUTURE liaison to AP-CREAMS, reminded AP-CREAMS members that FUTURE is a core program of PICES and a mechanism for integrating diverse PICES activities. He also emphasized how AP-CREAMS would align with FUTURE now that it was taking a new direction, covering wider geographic areas (trying to include all East Asian Marginal Seas)/disciplines (trying to include the human dimension), and cooperating with other programs such as NEAR-GOOS, WESTPAC WG06, CSK-II, NOWPAP, GEOTRACES, PEACE, and PAMS (former JECSS).

AGENDA ITEM 9

Next meeting

The AP-CREAMS inter-sessional meeting will be held in Vladivostok in late May or early June, 2020. An important agenda item to consider would be how to continue AP-CREAMS activities. Member will have enough time for discussing this important issue more during the intersessional meeting. See *AP-CREAMS Endnote 5* for the AP-CREAMS inter-sessional meeting in May 2019 in Gangneung, Korea.

AGENDA ITEM 10

Miscellaneous items

None.

AGENDA ITEM 11

Closing

The meeting closed at 18:20 October 20, 2019.

AP-CREAMS Endnote 1**AP-CREAMS participation list**Members

Joji Ishizaka (Japan, Co-Chair)
 Vyacheslav Lobanov (Russia, Co-Chair)
 Fei Yu (China, Co-Chair)
 Guebuem Kim (Korea)
 Sung-Hyun Nam (Korea)
 Ryan Rykaczewski (USA)
 Dongfeng Xu (China)
 Osamu Katoh (Japan)

Observers

Tetsuo Fujii (Japan)
 In-Seong Han (Korea)
 Ji Hyun Kim (Korea)
 Hojun Lee (Korea)
 Sinjae Yoo (Korea)
 Takafumi Yoshida (Japan)

Members unable to attend

China: Sumei Liu
 Japan: Jing Zhang
 Korea: Hee-Dong Jeong, Jae-Hak Lee (Co-Chair)
 Russia: Pavel Ya. Tishchenko, Yury Zuenko

AP-CREAMS Endnote 2**AP-CREAMS agenda**

1. Opening remarks, introduction of the participants, adoption of the agenda, rapporteur (AP-co-chairmen)
2. Report of Workshop on October 18, 2019 (SH Nam)
3. Report and discussion on AP-CREAMS publication
 - 3.1 Status report on EAST-II Publication after Gangneung (J. Ishizaka)
4. Development of PICES North Pacific Ecosystem Status Report-3 (V. Lobanov, Y. Fei)
5. Extension of AP-CREAMS
6. Status report and discussion on international cooperation
 - 6.1 Korea-Russia joint cruises (GB Kim)
 - 6.2 China, Japan, Korea joint cruises (GB Kim)
 - 6.3 CREAMS-III Basin Scale Survey (V. Lobanov)
 - 6.4 US NRL project and US ONR plans (SH Nam)
 - 6.5 Suggestions on development of international collaboration
7. Report and discussion on capacity building activities
 - 7.1 Status of TC in China postponed to 2020 (Y. Fei)
 - 7.2 NOWPAP (J. Ishizaka)
8. Presentation about the FUTURE program (V. Lobanov)
9. Next AP-CREMS meeting
10. Message from FUTURE
11. Miscellaneous items
12. Closing

AP-CREAMS Endnote 3

**Report on the POC/BIO/FIS Workshop (W4)
*Circulation, biogeochemistry, ecosystem, and fisheries of
the western North Pacific marginal seas:
Past and future of CREAMS (Circulation Research of East Asian Marginal Seas)***

Convenors

SungHyun Nam (Korea) corresponding, Fei Yu (China), Joji Ishizaka (Japan), Yuri I. Zuenko (Russia)

Invited Speaker

Kuh Kim (Formerly, Professor of Physical Oceanography at Seoul National University, Korea)

Background

The western North Pacific, one of the areas of the global ocean most affected by climate change and anthropogenic activities, consists of several marginal seas. Two time series programs have contributed to significant advances in understanding of these seas/regions, named East Asian Seas Time-series (EAST-I and EAST-II regions) since the CREAMS (Circulation Research of East Asian Marginal Seas) program was initiated beyond the national borders several decades ago (early 1990s). We proposed a workshop that involves participation from PICES committees and focuses on circulation, biogeochemistry, ecosystems, fisheries, and human interactions of the East Asian Marginal Seas.

This workshop provided a forum for summarizing progress made during the decades of CREAMS and during the 15 years of the PICES Advisory Panel (AP-CREAMS; active since 2005) since its birth in early 1990s, and for envisioning the future of CREAMS over the coming decades. This workshop was an opportunity to share the knowledge/findings and experience/lessons learned in hydrodynamics, biogeochemistry, ecosystem, and fisheries variability at multiple scales in the regions. There were contributions from studies including, but not limited to, weakening of ventilation, mesoscale eddies, shelf circulation, Kuroshio intrusion, changes of biological community structures, and more. We also discussed cooperation of the CREAMS with other international organizations/programs such as WESTPAC WG06, NOWPAP, and more.

Summary of presentations

About 30 persons attended and one invited, 15 oral and 1 poster presentations were made. PICES members from four countries, absent US and Canada, contributed the presentations. The session started with a brief introduction by Prof. SungHyun Nam, outlining the need to summarize progress made during the decades of CREAMS and the 15 years of AP-CREAMS and to envision the future of this program.

During W4, an invited talk by former Prof. Kuh Kim introduced his personal lessons learned from 1973's MODE (Mid-Ocean Dynamics Experiment) where more than 100 scientists participated. The experiment provided conclusive evidence of mid-ocean eddies, bottom-intensified currents, and more, and his personal learnings (highly variable eddies in space and time, only beginning of new and full understanding, critical importance of instruments, calibration, and quality control of data, unselfish cooperation of scientists, open ocean vs marginal seas) as a graduate student at that time motivated him to establish a marginal sea program, CREAMS after returning to Korea. He introduced a detailed history of Pacific Asian Marginal Seas (PAMS) as a follow up of the Japan and East China Seas study (JECSS) in the 1980s, and initiation of CREAMS in 1990s as a collaborative effort between Korea, Japan, and Russia. Then, progress with first full understanding of the water mass structure of the EAST-I region was shown with other findings on warming over the entire water column and structural changes in dissolved oxygen and ventilation pattern of the sea. He also introduced descriptions on this program in a series of PICES Press published in 1997 and 1998 (including US participation *via* ONR JES), IPCC fourth Assessment Report, and special issues of

Journal of Oceanography (1999), *Marine Technology Society Journal* (1999), *Progress in Oceanography* (2004), *Deep-Sea Research* (2005), and *Oceanography* (2006).

A contributed talk by Dr. Vyacheslav Lobanov introduced a brief history of further development of a very informal (but successful) initial CREAMS program started in 1993 along with CREAMS-II (ONR JES DRI) supported by PICES, and the establishment of AP-CREAMS in 2005. He talked about the main results of the time series program (EAST-I) achieved *via* POI-SNU joint cruises since 2001 and the need for further development of this program, CREAMS 3.0, was suggested considering the UN Decade of Ocean Science 2021–2030 and cooperation with other organizations/programs (NEAR-GOOS, WESTPAC WG06, CSK-II, UNEP/NOWPAP, GEOTRACES, PEACE, and PAMS). The WESTPAC WG06 was introduced by Prof. SungHyun Nam on behalf of Prof. Jing Zhang, with an emphasis on its recent extension and need for future cooperation with CREAMS. Dr. Takafumi Yoshida introduced NOWPAP of UNEP where four member countries, China, Japan, Korea, and Russia, have a center in each country. He discussed the history of PICES–NOWPAP collaboration, including the establishment of a joint PICES–NOWPAP Study Group for *Scientific Cooperation in the North Pacific Ocean* in 2014 which developed a PICES–NOWPAP framework for collaboration on such prioritized topics as harmful algal blooms and marine pollution.

On behalf of Dr. Olga Novikova, Prof. SungHyun Nam presented fisheries results from one of the East Asian Marginal Seas, Okhotsk Sea. He showed the influence of external environmental factors on the dynamics of the number of Pacific cod and saffron cod in the eastern part of the Okhotsk Sea. Long-term variations in the microbenthic community in the southern Yellow Sea, and influence of the Kuroshio Current on the East China Sea shelf were presented by Dr. Xinzheng Li. He showed global changes and long-term variations of the species distribution pattern in the Yellow and East China Sea and long-term variations of the macrobenthic community distribution pattern in the Yellow and East China Sea, emphasizing importance of the 32°–33°N region on the distribution of macrobenthos. A contributed talk by early career scientist Ms. Ji Hyun Kim showed long-term variations in nutrient concentrations, particularly the N:P ratio in the upper ocean of the East-I region from the analysis of CREAMS and other historical data collected from 1980 to 2017. Another contributed talk by early career scientist Mr. KyungJae Lee showed statistical characteristics of the mesoscale eddies detected, tracked, and grouped in the East-I region using satellite altimeter data from 1993 to 2017. His eddy detecting method from satellite altimetry was verified with hydrographic observations, and statistical characteristics of mesoscale eddies and group categorization were presented with discussions on speed and direction of eddy movement in the sea in comparison with those in the global ocean. Moreover, a contributed talk by early career scientist Ms. Jiwon Kang showed non-seasonal variability of the Kuroshio shelf intrusion and its associated change in the environment over the East China Sea during 1993–2017. She introduced a Kuroshio shelf intrusion (KSI) index, and showed seasonal and non-seasonal (intra-seasonal, interannual, and decadal) variations of the KSI in close relationship with wind stress curl and wind stress, air-sea turbulent heat flux, sea surface temperature, and eddy kinetic energy.

Afternoon presentations included a contributed talk by early career scientist Mr. Hojun Lee who showed observational results on the cyclonic circulation and retroflexion of the Jeju Warm Current in the southern front of the warm-tongue in the northern East China Sea. He presented the Changjiang–Yangze Front (particularly the southern front), the thermohaline front in the northern East China Sea, well developed in winter, and confirmed from recent hydrographic observations in February 2017 and April 2018 as well as historical hydrographic data, and relevant circulation. A contributed talk by early career scientist Mr. Min-Young Lee showed monthly wet depositional fluxes of organic matter in the precipitation of Jeju Island to determine dissolved organic carbon and particulate organic carbon concentrations in precipitation based on the data sampled from January to December 2018 and calculated backward trajectories (HYSPLIT model). A contributed talk by Dr. Yong Xu showed the spatial pattern of benthic macroinvertebrate communities and their relationship with environmental variables on the East China Sea shelf. In particular, he described

the influence of the bottom current (nearshore branch of intrusion of Kuroshio Current onto the shelf) on the benthic communities based on the sampling with an Agassiz trawl (R/V *Kexue III*). A contributed talk by Prof. Guebuem Kim showed results of estimating the vertical fluxes of nutrients using Ra-228 as a tracer in the EAST-I region. Using the long-lived Ra isotope (MnO_2 fiber attached to the moorings), he estimated vertical eddy diffusivity (K_z) to $9.6 \text{ cm}^2/\text{s}$ (averaged over 20 years) at a depth ranging from 100 to 500 m. A contributed talk by early career scientist Mr. Kazuki Ogi showed the effects of strong turbulent mixing on phytoplankton around the Tokara Strait (shallow, complex topography, many seamounts/islands, strong turbulent intensity) based on *in-situ* observations from 2015 to 2018. He tested his hypothesis that turbulent intensity increases from the upstream to downstream Kuroshio, supplying nutrients to the euphotic layer and increasing phytoplankton and rapidly grazing zooplankton. A contributed talk by early career scientist Ms. JiYun Shin showed intraseasonal abyssal current variability of bottom-trapped topographic Rossby waves in the southwestern EAST-I region from the analysis of mooring observational data and reanalysis model data. She characterized the bottom-trapped topographic Rossby waves with several parameters and dispersion relations, accounting for the deep intraseasonal current variability in the eastern Ulleung Basin and Ulleung Interplain Gap. In addition, a contributed talk by Dr. Dongfeng Xu showed slope current and diel vertical migration of zooplankton and micronecton in the northern continental slope of the South China Sea where one cyclonic circulation in winter and two counter-rotating circulations in summer are dominant. He presented results from mooring observations in 2015–2017 and drifter observations in October 2014 vs June 2015. Diel vertical migration of zooplankton and micronecton derived from acoustic intensity was shown. A poster was presented by early career scientist Mr. Koki Mukai on the effect of environmental factors on bloom formation of the toxic dinoflagellate in Kariya Bay of northern Kyushu, Japan.

From the presentations described above, we found a wide range of needs for international coordination and collaboration to study the variability and changes of hydrodynamics, biogeochemistry, ecosystems, and fisheries, and influence of human activities at multiple scales in the East Asian Marginal Seas, including the Okhotsk Sea and South China Sea. It was also suggested to focus more on the interactions among the marginal seas. PICES scientists are vigorously studying processes in this region, and supporting continuation of CREAMS (CREAMS 3.0) with broader impacts. We look forward to continue this program for next term.

Oral presentations

History of PAMS, CREAMS-I and II (JES) with important findings in 1981-2005 (Invited)

Kuh [Kim](#)

Toward CREAMS 3.0: recent achievements of collaborative studies in the northern Asian marginal seas and future challenges for sustainable development of the region

Vyacheslav [Lobanov](#)

Material exchanges between land and the open ocean - A framework for cooperative studies in the western North Pacific Marginal Seas (WESTPAC WG06)

Jing [Zhang](#)

NOWPAP activities and cooperation with PICES

Takafumi [Yoshida](#)

Long-term variations of macrobenthic communities from the Yellow Sea and East China Sea, under the climate change

Xinzheng [Li](#)

Long-term variations in nutrient concentrations in the upper ocean of the East/Japan Sea

Ji Hyun [Kim](#) and Guebuem Kim

Statistical characteristics of East Sea (Japan Sea) mesoscale eddies detected, tracked, and grouped using satellite altimeter data from 1993 to 2017

KyungJae [Lee](#), SungHyun Nam

Non-seasonal variability of the Kuroshio shelf intrusion and its associated changes in the ocean environment over the East China Sea during 1993-2017

Jiwon Kang and Hanna Na

Observations on the cyclonic circulation semi-persistently formed in the northern East China Sea

Hojun Lee, Kyungjae Lee, SungHyun Nam, and Jae-Hak Lee

The monthly wet depositional fluxes of organic matter in precipitation of Jeju Island

Min-Young Lee, Tae-Hoon Kim and Na-Yeong Song

Spatial pattern of benthic macroinvertebrate communities and the relationship with environmental variables in the East China Sea shelf

Yong Xu and Xinzheng Li

Estimating the vertical fluxes of nutrients using Ra-228 as a tracer in the East/Japan Sea

Yongjin Han and Guebuem Kim

Effects of strong turbulent mixing on phytoplankton around the Tokara strait

Kazuki Ogi, Naoki Yoshie, Anri Kabe, Toru Kobari, Daisuke Hasegawa and Joji Ishizaka

Intraseasonal abyssal current variability of bottom-trapped topographic Rossby waves in southwestern East Sea (Japan Sea)

JiYun Shin, SungHyun Nam

Diel vertical migration of zooplankton and micronekton on the northern slope of the South China Sea observed by a moored ADCP

Chenghao Yang, Dongfeng Xu, Zuozhi Chen et al

Poster presentation

Effect of environmental factors on bloom formation of the toxic dinoflagellate *Alexandrium catenella* in Kariya Bay of northern Kyushu in Japan

Koki Mukai, Yohei Shimasaki, Yukie Ohara, Abrianna Elke Chairil and Yuji Oshima



Participants of the PICES-2019 workshop W4: Past and future of CREAMS. Front, from left: Hojun Lee, Kyungjae Lee, JiYun Shin, Ji Hyun Kim, Jiwon Kang, Xiaopei Lin, Dongfeng Xu; back, from left: Joji Ishizaka, Fei Yu, Takafumi Yoshida, Kuh Kim, SungHyun Nam, Guebuem Kim, Olga Trusenkova, Xinzheng Li, Yong Xu.

AP-CREAMS Endnote 4

Rationale for AP-CREAMS extension through to 2024 and revised terms of reference

1. CREAMS AP tasks and their implementation

The AP-CREAMS (Advisory Panel on *Circulation Research in the East Asian Marginal Seas*) was established in October 2005 with the tasks:

1. To initiate and coordinate the studies on hydrography, circulation, and biology, as well as on variability of oceanographic and biological properties in PICES area of the East Asian Marginal Seas;
2. To estimate climate-scale and long-term changes in abiotic and biotic environments of this region;
3. To facilitate the establishment of permanent observation and data exchange networks in this region;
4. To convene workshops/sessions to evaluate and compare the results of national and international research programs.

AP-CREAMS' term was extended for 5 years at PICES-2014, and now its second term is finishing. The AP members drafted new terms of reference, as below:

AP-CREAMS revised terms of reference

1. To coordinate programs to study the marine ecosystem and its variability in East Asian Marginal Seas in the PICES area under global changes, both natural and anthropogenic; effect of long-term and extreme changes in the abiotic and biotic environments of this region;
2. To facilitate the establishment of permanent observation and data exchange networks in this region;
3. To convene workshops/sessions to evaluate and compare results from the program;
4. To enhance capacity building, knowledge dissemination, cooperation with other international marine organizations/programs in the region.

For the marginal seas sensitive to climate change and anthropogenic impacts, where national activities take place, there is a strong need for international coordination and collaboration to study the variability of hydrodynamics, biogeochemistry, ecosystems, fisheries, and influence of human activities at multiple scales in the area. During the POC/BIO/FIS workshop (W4) on “*Circulation, biogeochemistry, ecosystem, and fisheries of the western North Pacific marginal seas: Past and future of CREAMS (Circulation Research of East Asian Marginal Seas)*” at PICES-2019, in addition to the above mentioned tasks, AP-CREAMS will begin in two new directions, as a contribution to FUTURE: i) extend geographic coverage to include all East Asian Marginal Seas beyond the EAST-I and EAST-II regions, and ii) to pursue an integrative approach to include multiple disciplines beyond the physics and chemistry to cover whole social-ecological-environmental-system framework developed by FUTURE.

During 2015–2019, AP-CREAMS continued coordination of national and international research in the framework of the research projects, EAST-I and EAST-II: 4 Korean–Russian joint cruises were conducted in the EAST-I area, 5 China–Japan–Korea joint cruises were implemented in the EAST-II area. AP-CREAMS has coordinated/organized capacity building summer schools/training courses, including:

- A PICES Summer School on “*Satellite oceanography*” (2009, Seoul, Korea),
- A NOWPAP/PICES/WESTPAC Training Course on “*Remote sensing data analysis*” (2011, Vladivostok, Russia)
- A second NOWPAP/PICES Training Course on “*Remote sensing data analysis*” (2013, Qingdao, China)
- An International Hydrological Program-led Training Course on “*Coastal vulnerability and freshwater discharge*” (2016, Nagoya, Japan).

A new series of training courses on “*Satellite remote sensing*” is planned for 2020, jointly with UNEP/NOWPAP.

Meetings/scientific workshops were held where the programs and results of the EAST-I and II surveys were discussed, including at four inter-sessional meetings of the AP. In addition, results of the joint research in the CREAMS area have been published in leading scientific literature. AP-CREAMS is continuing preparation of publications on the state of the regional ecosystem, namely on the PICES Scientific Report “*Oceanography of the Yellow and East China Seas*”, and regional chapters (Areas 19 and 21) for the North Pacific Ecosystem Status Report-3. All these activities are successfully developing and should be continued.

2. Reasons for extending AP-CREAMS AP activities

2.1 Coordinate the current research projects

- In the framework of the EAST-I project, a Russia–Korea joint cruise aboard a Russian research vessel is planned in October–November 2019 and series of other cruises in collaboration with Russia, Korea, and US are planned;
- In the framework of EAST-II project, a China–Japan–Korea joint cruises are planning by Japanese and Korean research vessel in July–September 2020;
- AP-CREAMS meeting and seminar to coordinate these surveys and discuss their results with next term program CREAMS 3.0 is planned for May–June 2020 in Vladivostok.

Negotiations on closer collaborations with other active programs in the region such as WG-06/WESTPAC, NOWPAP and PEACE are planned for the first half of 2020.

2.2 Training course on “Satellite remote sensing”

As a capacity building effort, this course is planned for the second half of 2020 in Japan jointly with UNEP/NOWPAP.

3. Other motives for continuing AP-CREAMS activities

3.1 Coordination of national and international researches and observational and data-exchange networks

Research activities among PICES member countries in the region of the East Asian marginal seas have a permanent character and need ongoing coordination, as the interests of different countries tightly overlap. Some ideas on further development of international surveys and observation networks have already been discussed by AP-CREAMS though the details, such as joint standard sections, extension to the Okhotsk Sea and South China Sea, *etc.*, are not yet developed.

3.2 Scientific capacity building

This FUTURE-related activity is deeply shared by the entire AP and will be continued in different forms, but most importantly as invite experts from other disciplines such as human dimension beyond the core disciplines (physics and chemistry), observational systems, hydrodynamic and ecosystem modeling, *etc.*

4. Request to PICES

As the activities of AP-CREAMS are continuing successfully, with some definite plans for 2019–2020 and intentions for beyond, AP-CREAMS requests an extension for another term until the end of 2024.

AP-CREAMS Endnote 5

**Report on the inter-sessional meeting of the Advisory Panel for
a Circulation Research in East Asian Marginal Seas (AP-CREAMS)**

**May 21–22, 2019
Gangneung, Korea**

Participants (Members): Joji Ishizaka, Hee-Dong Jeong, Guebuem Kim, Jae-Hak Lee, Vyacheslav Lobanov
(Observers): In-Seong Han, Hee Chan Choi, Kyung-Jae Lee, Ji Yun Shin



AP-CREAMS inter-sessional meeting participants. Front, from left: Kyung-Jae Lee, Guebuem Kim, Chaesung Lee, Vyacheslav Lobanov, Joji Ishizaka, Jae-Hak Lee; back, from left: Ji Yun Shin, Hee-Dong Jeong, In-Seong Han, Hee Chan Choi .

1. Opening remarks

The meeting was opened by Vyacheslav Lobanov, co-chairman of AP-CREAMS, at 9:30 am, May 21, 2019 at the East Sea Fisheries Research Institute of National Institute of Fisheries Science (ESFRI/NIFS) in Gangneung, Korea. Participants gave self-introduction and adopted the meeting agenda. Jae Hak Lee was nominated as a rapporteur of the meeting and he agreed. There was a short break for welcome greetings by Chaesung Lee, the Director General of the ESFRI/NIFS.

2. National reports on activities and plans related to the AP-CREAMS Program

2.1. Japan

Joji Ishizaka introduced the Japanese activities. The T/V *Nagasaki-maru* cruise was conducted in the EAST-I region in the period of October 2–23, 2018. Observation items included LADCP/CTD casting, microstructure survey and deployment of current meter mooring. Current data recorded in the recovered current meter revealed weakening of deep flow by about 30% at 2000 m depth. For the EAST-II region, the results of the *Nagasaki-maru* cruises in July 2017 and July 2018 in the East China Sea were presented. The

propagated 1st and subsurface trapped 2nd modes of nonlinear internal waves were observed in 2017 and 2018, respectively. The results of cruises conducted as parts of the OMIX project in the Kuroshio region, the I-Lane ridge near Taiwan and the Tokara Strait were also explained, focusing on the microstructure survey, turbulence mixing and associated ecosystem change. Also explained was the use of SGLI and GOCI satellite ocean color images which are effective to see topographic effects and sub-mesoscale processes.

2.2. Korea

Jae Hak Lee talked about activities in KIOST in the EAST-II region: the EAST project, time series measurements including the HF radar system and a current meter mooring in the Jeju Strait, and a study for microplastics in the ocean. Guebeum Kim explained the Korea EAST project (2016–2023) and research cruises. Results of investigations for chemical tracers, N, P, DIN, DON, CDOM, Ra-228 *etc.* have been recently published.

2.3. Russia

Vyacheslav Lobanov reported on Russian research cruises in the EAST-I area in 2018. For climate monitoring, the 25-day long CREAMS cruise, La84, with two legs, the 1st jointly with Korea and the 2nd with Russia only, was conducted in November 2018 and a 4-day long cruise La80 in April. The themes of survey cruises included: 1. Climate monitoring with CREAMS and NEAR-GOOS lines, 2. Cascading at Peter the Great Bay (PGB), 3. Structure of an anti-cyclonic eddy off PGB, 4. Radio isotopes analysis of circulation, 5. PAH monitoring, 6. Hydrometeorological regime of PGB with a wavescan buoy, and 7. A Floating University. Summarized results of these cruises are to be addressed to: (a) study of the sea response to climate changes and mechanisms of the sea self regulation; (b) assessment of the sea ecological status and (c) capacity building.

3. Report and discussion on AP-CREAMS publications

3.1. Status report on EAST-II publication

Joji Ishizaka gave an account of EAST-II Report progress made after the Yokohama meeting. AP-CREAMS received three reviews for drafts from MONITOR and POC. In the period of March–April 2019, the reviews were circulated to the editors and section editors who asked their lead authors to make revisions. Summarizing action items on responses to reviews: For biological oceanography, only one subsection finished its revision. For physical oceanography, Jae Hak Lee reported that three subsections were completed in the revision process but three others were not. Vyacheslav Lobanov suggested that chapter editors should edit the drafts and notify the lead authors if there is no response from the lead author. For chemical oceanography, Guebeum Kim agreed to help with progress after contact with the chapter editor, Jing Zhang. Members discussed for the next step of publication the following timeline:

- 20 July, Finish editorial work on each section (Joji Ishizaka, Jae Hak Lee, Guebeum Kim–discuss with Jing Zhang),
- 1 August, Finish writing Conclusion and submit to MONITOR and POC.

Members pointed out that the type of PICES publication needed to be checked.

3.2. Development of PICES North Pacific Ecosystem Status Report-3

Vyacheslav Lobanov showed the proposed outline of PICES NPESR-3, including WG 35's report and ETOSs, and reported the progress in Region 19 and the brief status of other chapters (other regions). It was remarked that there is still no decision for publication of the previous NPESR which should be done by consensus between Japanese and Korean delegations.

4. Status report and discussion on international cooperation

4.1. Korea-EAST cruises

Guebuem Kim summarized the Korea-EAST cruises conducted in 2018 and other research issues. The Korea–Russia joint cruise in December occupied 19 CTD stations. The data collected at the EC1 mooring since 1966 was reported and opened in SEANOE. He also reported on the meridional volume transport across the UIG, the structure of Ulleung warm eddies, the meridional circulation mode change, the use of Ra data as a water mixing tracer, the long-term change in nutrient concentration, acidification with PH, alkalinity and DIC measurements, and the nutrient-DIC budget. The cruise plan for 2019 was also introduced.

4.2. Ferryboat monitoring

Hee-Dong Jeong reported the progress for the Korea–Russia ferry boat monitoring system with five domestic lines and one international line. The first monitoring system was installed on the ferryboat vessel *Eastern Dream* connecting between Donghae and Vladivostok. Some results were shown and a future plan (three more international lines) was introduced. Members exchanged ideas for sensor calibration, extension of lines, data quality and data policy.

4.3. Other

Jae Hak Lee talked about the participation of the Korea side in the Japanese *Nagasaki-maru* cruise in the eastern East China Sea in July 2019, and the Korea–US NRL joint cruise for ocean mixing study planned in 2020.

5. Introduction to NIFS

In-Seong Han gave a talk on recent oceanographic research done at the National Institute of Fisheries Science (NIFS), such as marine heatwaves (MHWs) which is now a hot issue in climate society. In recent years, MHWs appeared in East Asian marginal seas in summer and they had a serious effect on the national fisheries economy. He showed the variation of sea surface temperature anomaly in Korean waters in February and August during last 50 years (1968–2018).

6. Report and discussion on capacity building activities

Vyacheslav Lobanov presented a brief history of CREAMS and described the CREAMS-III Basin Scale Survey (2019–2020). Members discussed detailed basin-scale field experiments in 2019–2021 as follows:

- Climate monitoring (CREAMS, NEAR-GOOS)
- Convection study experiment (Russia, Korea)
- Korea–US mixing experiment: Southwestern Ulleung Basin
- Russia–US mixing study: Yamato Rise
- Deep-sea circulation monitoring (Japan, Russia, Korea)
- Meso-scale eddy study (Korea, Russia)
- Ferry-based monitoring lines (Korea, Russia, Japan)
- Expand area to cover both seas (EAST-I and II)
- Integration of national programs (EAST and others)
- Invite national agencies (Fishery, Meteorology, Environment, and others)
- Discuss the parameters for synchronous survey
- Invite on the international organization (WESTPAC, NOWPAP, and others)

7. Proposals for other future AP activities

7.1. Summer school

Vyacheslav Lobanov reported the status of the Summer School on “*Ocean turbulence*” for 2019 proposed by Fei Yu. The PICES Governing Council (GC) approved the proposal at PICES-2018. However, because of delayed action in China and limited time to prepare, the Summer School for 2019 was cancelled. The PICES Secretariat suggested to postpone it to the next year. There is an uncertainty whether the Summer School in 2020 can proceed as an activity of AP-CREAMS if the AP is not continued further.

7.2 Other activities

Members discussed a possible training course as a capacity building activity. Vyacheslav Lobanov remarked on a course conducted in Russia. Members exchanged issues on problems in vessel, ship time and the implementation of marine scientific research in a foreign EEZ.

8. Proposals for other future AP activities

Su Mei suggested (via e-mail to the Co-chairs) that the scope of CREAMS covers ‘Ecosystem-social interactions in the East Asia marginal seas’. Members stated that the effects of climate change, *e.g.*, stratification and heat wave, on ecosystem change and on social response are important issues both in WESTPAC WG06 and in CSK-2 TF. Members discussed Su Mei’s suggestion to modify term of reference 1 to ‘To initiate and oversee a program to study the changed in water physics, chemistry and ecosystem of the East Asian Marginal Seas in the PICES area in response to climate change and anthropogenic impact and their impact on economic’.

9. Next meeting

The AP-CREAMS business meeting will be held in Victoria, Canada on October 19, 2019. A one day workshop will be held on October 18, 2019.

10. Miscellaneous items

A reminder needs to be sent to the Secretariat to correct the AP-CREAMS web page by replacing KR Kim with Sung-Hyun Nam. Members discussed the possibility of finding a replacement for Osamu Katoh (Japan) after the AP-CREAMS meeting in October.

11. Closing

The meeting was closed at 12:00 on May 22, 2019