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

AGENDA ITEM 1

Opening remarks

The online annual meeting was opened by Vyacheslav Lobanov, Co-Chairman of AP-CREAMS, on September 10, 2020 at 9:00 am (Chinese time; which is 10:00 am in Japan and Korea; 11:00 am in Vladivostok, Russia; and 3:00 pm the prior day in Honolulu, USA). Participants gave self-introductions (*AP-CREAMS Endnote 1*) and adopted the meeting agenda (*AP-CREAMS Endnote 2*). SungHyun Nam was nominated as rapporteur of the meeting, to which he agreed.

Participants of the 2020 PICES AP-CREAMS online meeting (Day 1) in September 10, 2020. Left to right and top to bottom: Vyacheslav Lobanov (Russia), SungHyun Nam (Korea), Joji Ishizaka (Japan), Guebuem Kim (Korea), Hee-Dong Jeong (Korea), Dongfeng Xu (China), Takafumi Yoshida (observer, NOWPAP), Yosuke Igeta (Japan), Jae-Hak Lee (Korea), Jing Zhang (Japan), Yury Zuenko (Russia), Ryan Rykaczewski (USA), Fei Yu (China), Su Mei Liu (China) Sonia Batten (PICES Executive Secretary).

Participants of the 2020 PICES AP-CREAMS online meeting (Day 2) in September 11, 2020. Left to right and top to bottom: Vyacheslav Lobanov (Russia), SungHyun Nam (Korea), Hee-Dong Jeong (Korea), Yosuke Igeta (Japan), Dongfeng Xu (China), Guebuem Kim (Korea), Fang Zuo (observer, IMBeR), Jae-Hak Lee (Korea), Ryan Rykaczewski (USA), Fei Yu (China), Yury Zuenko (Russia), Joji Ishizaka (Japan), Takafumi Yoshida (observer, NOWPAP), Jing Zhang (Japan), Su Mei Liu (China).

AGENDA ITEM 2

Completion of previous business

2.1. Status of the report on EAST-II publication

Joji Ishizaka provided an update on the current status of how the EAST-II Report progressed after the inter-sessional video meeting. The report, titled "Oceanography of the Yellow Sea and East China Sea" was re-submitted to parent committees (POC and MONITOR) after necessary revision. After positive reviews, the report was submitted to the Secretariat for final editing.

2.2. Status of the CREAMS related chapters of the PICES North Pacific Ecosystem Status Report-3

Vyacheslav Lobanov updated members on the current status of the regional chapter for Area 19 (EAST-I region) of the North Pacific Ecosystem Status Report-3 (NPESR3). Lead authors for subchapters/sections were identified and discussed to complete the drafting of this regional chapter. SungHyun Nam informed that Se-Jong Ju (GC and BIO committee) volunteered to help with either finding missing experts or providing necessary but missed information for the report, and promised to provide his contact information to Vyacheslav Lobanov.

AGENDA ITEM 3

Joint cruises and field observations

3.1. China, Japan, Korea joint cruises

SungHyun Nam provided an update on the current status of field observations in the EAST-II region originally planned as a China-Japan-Korea joint cruise but planned as a Korean national cruise for the

period from August 10 to 20, 2020 using the R/V *Onnuri*. The cruise was conducted as planned to collect *in-situ* data for physical and chemical properties of sea water and marine meteorology. Preliminary results were presented along with future plans for on-going analysis and potential international collaboration. As a way toward better collaboration, he suggested national cruises within each country's EEZ with coordination among the countries surrounding the region.

3.2. Suggestions on development of international collaboration

Feasibility of a national cruise with coordination in advance suggested by SungHyun Nam was discussed as one possible way for future collaboration among the member countries. Common observational lines for the decade may be set up with enough (1 or 2 years) lead time under the umbrella of CREAMS and other similar international programs. The data can be collected by each country using its own ships within the EEZ along the common observational lines, preferentially modified through the CREAMS coordination for the best collaboration. Common observational lines in the EAST-I region would be a good example of such collaboration for setting up new common observational lines for the EAST-II region. Dongfeng Xu shared his experience of combining two separate cruises into one coordinated cruise for effectively supporting the tropical Pacific Observing System (TPOS). Yu Fei supported the possibility of separate national cruises conducted within each country's EEZ along the same observational line and at the same time. In addition to coordinated national cruises, Jing Zhang and Su Mei Liu emphasized the importance of exchanges of data, samples, and students among the member countries and joint analysis of the samples to enhance the international collaboration. Personal level collaborations among the individual CREAMS scientists are also recommended.

AGENDA ITEM 4

Brief update on national activities and plans related to the AP-CREAMS Program

4.1 China

Fei Yu updated members on a half-month cruise planned for sampling in the southwestern Yellow Sea in spite of overall reduced activities of IOCAS due to the COVID-19 pandemic. Typical green tides found in the region from the analysis of data collected via this cruise and mechanisms underlying the process were discussed.

Dongfeng Xu updated members on the on-going activities for developing moored observing systems in the western tropical Pacific and providing contributions to the TPOS with ten surface moorings/buoys. To deploy 3 surface moorings/buoys in the western tropical Pacific, multiple cruises are currently planned for December 2020.

Su Mei Liu updated members on results of analysis of cruise data collected in the Yellow Sea. She presented composition of nutrients (N and P), distribution of chlorophyll-a and three kinds of phytoplankton at the surface, middle, and bottom layers. Guebuem Kim suggested an exchange of raw data and published papers for initiating new collaboration. Seasonal variations of nutrients and normalization with use of salinity or other parameters, and possible effects of tides, were suggested as future works.

4.2 Japan

Yosuke Igeta updated members on the status of the gridded products of a water temperature and salinity database for the eastern part of the EAST-I region. The data collected from multiple cruises in the region were gridded and have started to be publicly available, as planned and reported during the latest AP-CREAMS (inter-sessional) meeting, in August via The Global Temperature and Salinity Profile Programme (GTSPP).

Jing Zhang presented on two cruises conducted recently. The cruise using the T/S *Nagasaki* was originally scheduled from July 18 to 24, 2020 but shortened to three days due to COVID-19. Scientists and students from Kyushu University and University of Toyama were onboard, and no one from Ocean University of China joined the cruise but took samples for analysis. Another cruise (KH20) using the R/V *Hakuho-maru* was conducted from August 24 to September 3, 2020 where 20 scientists/students from Tokyo University, Toyama University, Hyogo prefecture University, Ryukyu University, *etc*. were onboard. Ocean University of China joined to analyze the samples collected during the cruise. Preliminary results obtained from the analysis of chemical parameters, piston cores and multicores, and others were presented and temporal changes of cross-sectional structures of water temperature, salinity, dissolved oxygen, and transmission were discussed in association with enhanced mixing due to internal tides at critical latitude.

4.3 Korea

SungHyun Nam and Jae-Hak Lee updated members on a US-Korea joint cruise that was originally planned for late 2020 as reported during the latest meeting, but postponed to July–August 2021 due to the serious COVID-19 situation in the US. Although the joint cruise was postponed, 9 surface drifters that US colleagues provided were deployed in the southwestern area of the EAST-I region via other cruises in August and September 2020. More surface drifters will be deployed in 2021 either during or beyond the joint cruise.

Guebuem Kim provided an update on the status and plans for the Korean national program (EAST) and the cruises in the EAST-I and EAST-II regions. The EAST program will be terminated by 2022 and re-designed for successive years. Preliminary results of analysis of the data and samples collected during the cruise in the EAST-II region were presented and discussed. The results include distributions of humic-like CDOM and FDOM in the Yellow Sea and northern East China Sea. In particular, cross-sectional structures of water temperature, salinity, and nutrients were discussed.

Hee-Dong Jeong updated members on the status and plans for ferry-based observations between Russia and Korea. As the company operating the ferry boat (*Eastern Dream*) was sold to another company, there was an inevitable change. The observation route was changed to the connection between Vladivostok and Pohang, which may be better as the route is longer than previous connection between Vladivostok and Donghae.

4.4 Russia

Yury Zuenko updated members on the planned cruises mostly postponed or cancelled due to COVID-19 while basic monitoring of the Russian coastal waters and water properties along the standard sections could be continued. Results of data analysis were discussed. In particular, warm and salty water unusually extended northward into the tip of Sakhalin Island which may be relevant to unusual fisheries in the Tartar Strait reported along with contrasting environmental conditions between northern and southern parts of the EAST-I region. Potential effects of climate variability on changes of squid and sardine catches (*e.g*., commercial squid catches became available off the Russian coast which was not previously seen) as an example of socio-economic impacts of marine environments were discussed in association with changes of the Tsushima Current transporting warmer than normal water into the western part of Sakhalin.

Vyacheslav Lobanov provided an update on POI cruises using the R/V *Akademik Oparin*. Although the ship schedule was affected by COVID-19 and the ship was also used for other areas such as the Shantar Islands area (for 16 days in September, 2020), and Chaunskaya Bay (from September to November, 2020), it could be used to collect *in-situ* data and utilize oceanographic instruments in the EAST-I region from September 9 to 10, October 26 to 31, and December 5 to 24, 2000. Two shelf (100 m) moorings were deployed in the area off the Vladivostok where three major currents (North Korea Warm Current, Western Branch of Tsushima Current, and Primorye Current) merge in the fall season. Distribution of physical and chemical properties of sea water observed along the climate observational sections were presented and discussed.

AGENDA ITEM 5

Capacity building activities

5.1. Summer School on Ocean Turbulence in China postponed to 2021

Fei Yu updated members on the status and plan for the Summer School on *Ocean Turbulence*. The Summer School was originally planned for 2020 but postponed to summer 2021 due to the COVID-19 pandemic. He will ask for travel support for next year's Summer School to the PICES.

5.2. Training course on satellite information with NOWPAP and NOWPAP training course on eDNA techniques

Takafumi Yoshida provided an update on the status and plans for two NOWPAP-related training courses. The training courses were originally planned for 2020 but will be postponed to 2021. A series of webinars for satellite information and a face-to-face training course on eDNA are currently considered for the next year. A new proposal to support the satellite training course with a budget request for travel for 1 lecturer and 1 trainee will be submitted to parent committees (POC and MONITOR) and another proposal to support eDNA technique will be separately submitted to another relevant committee (MEQ). Su Mei Liu emphasized the importance of synthesizing numerical model results and satellite remote sensing data to provide key information for ecosystem-socioeconomic impacts. Joji Ishizaka supported relevant contexts of long-term changes of chlorophyll concentration and eutrophication, and evaluation of the long-term environmental changes and human activities for the training course, and will draft and submit short descriptions on the training courses with Takafumi Yoshida.

5.3. Other proposals

Potential future training courses hosted by others, *e.g.*, Seoul National University, Toyama University or Xiamen University, were discussed. Fang Zuo shared information on the status and trend of IMBeR training courses. In particular, IMECaN (Interdisciplinary Marine Early Career Network) and Marine Spatial Planning Workshop (680 participants from 81 countries joined) were introduced together with efforts to solving complex ocean challenges through interdisciplinary research that will be published soon. IMBeR's ClimEco7 Summer School will be hosted in Vancouver, Canada, from of August 9 to 13, 2021. The limitation of video conferencing for a training course in comparison to a face-to-face one, and ways on how to integrate all disciplines toward the integrated marine science were discussed.

AGENDA ITEM 6

Presentation from FUTURE program

Vyacheslav Lobanov introduced the integrated PICES Science Program and transition from Phase II (2016–2020) to Phase III (2021–2025) of the FUTURE (Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Marine Ecosystems). During Phase III, momentum developed during Phase II should be maintained, North Pacific Social-Ecological-Environmental System (SEES) approach will be exploited, and leadership to the United Nations Decade of Ocean Science for Sustainable Development (UNDOS) will be provided. A joint PICES–ICES statement of coordinated activities during the UNDOS was drafted and a proposal to establish a joint PICES-PICES Study Group on UNDOS has been submitted to Governing Council.

AGENDA ITEM 7

Cooperation with other active programs/organizations in the region

7.1. IMBER Continental Margins WG

Fang Zuo suggested ways of better collaboration between IMBeR and PICES. She explained that the PICES AP-CREAMS network would be very helpful for IMBeR working group activities and that the interdisciplinary approach of the WG, including social science, may help in supporting the activities in East Asian marginal seas for CREAMS and IMBeR.

7.2. WESTPAC WG06

Jing Zhang explained two stages of the WG; Phase-I (2017–2019) and Phase-II starting from 2020 or 2021. Three workshops were held during the Phase-I, and next one will be held as a virtual (video) meeting in October and also closely associated with the PEACE (Program of the East Asian Cooperative Experiments) meeting. She emphasized the importance of long-term monitoring of the East China Sea and other areas that both programs (PICES CREAMS and WESTPAC WG06) support, as the two programs have common scientists involved in and geographic areas of interest.

7.3. UN Decade of Ocean Science

Ryan Rykaczewski confirmed that there was no update since the latest meeting (inter-sessional meeting).

7.4. CSK-2

SungHyun Nam updated what was informed from series of the Co-operative Study of the Kuroshio and Adjacent Regions (CSK-2) webinars. He explained that geographic area of CSK-2 interest is not just frontal zone of the Kuroshio Current but quite a large area, including the areas where the Kuroshio originates, interacts with surrounding waters, branches, and extends far from the continent including the CREAMS area. Since the CSK-2 will be planned to align with the UNDOS to emphasize the outcomes/deliverables for stakeholders, not only the scientific understanding but also the socio-economic impacts, CREAMS may leverage the momentum to provide our best outcomes/deliverables for the society. Since several countries already developed or are currently developing national programs (either observational or numerical modeling programs) to contribute the CSK-2, future CSK-2 activities will be helpful for our vision/roadmap for next five years. SungHyun Nam promised to circulate the Science Plan of CSK-2 once it is drafted.

Jae-Hak Lee supplemented what was discussed during the CSK-2 webinars. The EEZ issue and collaboration beyond the countries' national borders/boundaries were discussed in spite of no clear solution for now. The gap between CSK-2 and UNDOS, and ways of how to fill the gap were also discussed during the webinars. A Science Plan will be drafted and the CSK-2 proposal will be submitted to WESTPAC by the end of 2020.

AGENDA ITEM 8

AP-CREAMS Roadmap for 2021–2024

Vyacheslav Lobanov reminded us of continued discussions on new plans for AP-CREAMS activities and roadmap for 2021–2024. Four issues to set the roadmap up were discussed; 1) CREAMS database, 2) coordinated cruise, 3) contribution to UNDOS, and 4) proposals for a training course.

1) CREAMS database: Joji Ishizaka raised issues of data sharing, doi for data publication, and a database for the CREAMS region, to be discussed. Jing Zhang expressed strong support for an increase in data accessibility, *e.g.*, toward the transparent ocean for UNDOS, and development of its own CREAMS

data sharing system . AP-CREAMS members agreed to check on the feasibility of a CREAMS database and submit a proposal to TCODE.

2) Coordinated cruise: Ryan Rykaczewski questioned whether we can motivate new observations outside one country's EEZ based on scientific findings. Vyacheslav Lobanov reminded everyone of the issue for coordinated cruises and the importance of an integrative approach in discussing with the modeling community to identify observations of high priority. Yosuke Igeta pointed out potential difficulties in coordinating national fisheries vessels for international collaboration but promised that he will try to move toward the coordination. SungHyun Nam emphasized the importance of continued climate monitoring along the coordinated/common observational lines and enhanced monitoring capability/infrastructure and data/information under the condition of increasing climate impacts during the decade or next five years. Hee-Dong Jeong hoped to continue ferry-based monitoring under the CREAMS. Jing Zhang and Fei Yu addressed the increasing needs for oceanographic sensors/platforms with new ocean observing technologies. Guebuem Kim and Su Mei Liu pointed out difficulties/hurdles in developing chemical sensors and collecting high resolution chemical data.

3) Contribution to UNDOS: Jae-Hak Lee pointed out what the UNDOS emphasize. Considering the emphasized connection between research community and society, outreaching activities need to be encouraged. Takafumi Yoshida recommended future activities for better collaboration between NOWPAP and CREAMS. AP-CREAMS may recommend/suggest future environmental monitoring of NOWPAP. Fang Zuo recommended future activities for science and collaboration between IMBER WG and AP-CREAMS. Scientists from all disciplinary and easy data accessible to general public may be important.

4) Proposals for training course: Vyacheslav Lobanov reminded us of the development of new training courses. We may need to think about proposals for a training course in the future.

AGENDA ITEM 9

Miscellaneous items

No item was identified.

AGENDA ITEM 10

Next AP-CREAMS meeting

Next offline (face-to-face) business meeting in Vladivostok or online video business meeting will be held in late February to April, 2021. See *AP-CREAMS Endnote 3* for the AP-CREAMS inter-sessional meeting held virtually in July 2020.

AGENDA ITEM 11

Summary and closing

Vyacheslav Lobanov reviewed the progress during the two-day online meetings (September 10–11, 2020) and the meeting was closed at around 2:30 pm (Vladivostok, UTC+10) on September 11, 2020.

AP-CREAMS Endnote 1

AP-CREAMS participation list

Members

Joji Ishizaka (Japan, Co-Chair)
Jae-Hak Lee (Korea, Co-Chair)
Vyacheslav Lobanov (Russia, Co-Chair)
Fei Yu (China, Co-Chair)
Yosuke Igeta (Japan)
Hee-Dong Jeong (Korea)
Guebuem Kim (Korea)
Sumei Liu (China)
SungHyun Nam (Korea)
Ryan Rykaczewski (USA)
Dongfeng Xu (China)
Jing Zhang (Japan)
Yury Zuenko (Russia)

Members unable to attend

Russia: Pavel Ya. Tishchenko

Observers

Sonia Batten (PICES Executive Secretary)
Takafumi Yoshida (NOWPAP)
Fang Zuo (IMBeR)

AP-CREAMS Endnote 2

AP-CREAMS meeting agenda

September 10–11, 2020, 11:00-14:00 (Vladivostok, UTC+10) by video-conference

1. Opening remarks, introduction of the participants, adoption of the agenda, rapporteur (AP co-chairmen)
2. Completion of previous business
   2.1. Status of the report on EAST-II Publication (J. Ishizaka)
   2.2. Status of the CREAMS related chapters of the PICES NPESR-3 (V. Lobanov)
3. Joint cruises and field observations
   3.1. China, Japan, Korea joint cruises (SH Nam)
   3.2. Suggestions on development of international collaboration
4. Brief update on national activities and plans related to the AP-CREAMS Program
   4.1. China (Y. Fei, S. Liu, D. Xu)
   4.2. Japan (J. Ishizaka, J. Zhang, Y.Igeta)
   4.3. Korea (JH Lee, SH Nam, GB Kim, HD Jeong)
   4.4. Russia (Y.Zuenko, V. Lobanov)
5. Update on capacity building activities
   5.1. Summer School on Ocean Turbulence in China postponed to 2020 (F. Yu)
   5.2. TCs on satellites information and eDNA with NOWPAP (J. Ishizaka, T. Yoshida)
   5.3. Other proposals
6. Presentation from FUTURE program (V. Lobanov)
7. Cooperation with other active programs/organizations in the region
   7.1. IMBeR Continental Margins WG (SM. Liu, F. Zuo)
   7.2. WESTPAC WG06 (J. Zhang)
   7.3. UNDOS (R. Rykaczewski)
   7.4. CSK-2 (SH Nam, JH Lee)
8. AP-CREAMS Roadmap for 2021–2024 (overall discussion)
9. Miscellaneous items
10. Next AP-CREAMS meeting
11. Summary and closing

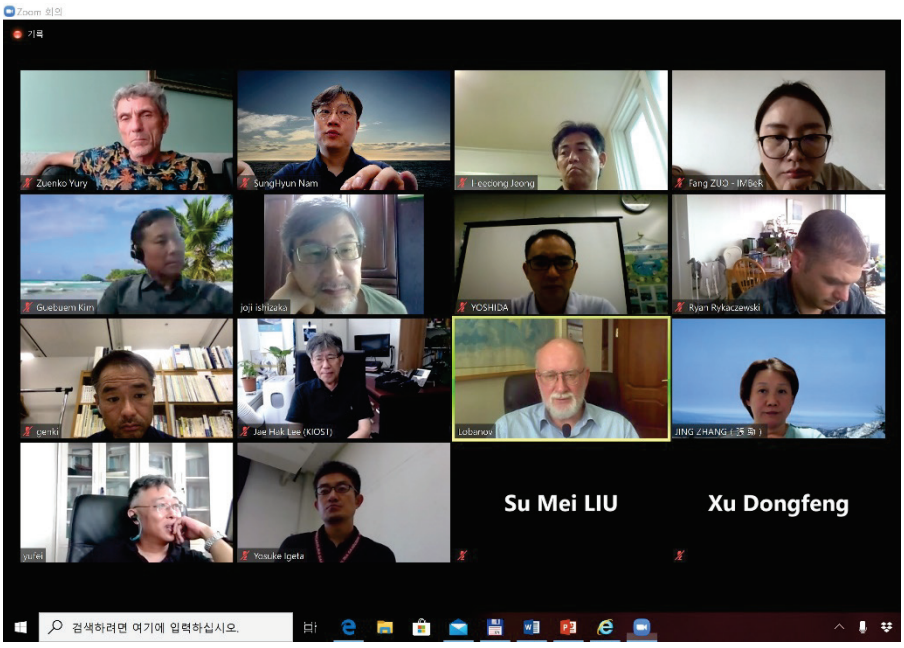
AP-CREAMS Endnote 3

Report of the Advisory Panel for
***Circulation Research in East Asian Marginal Seas* (AP-CREAMS)**
Inter-sessional Meeting

July 13–14 and 20, 2020
(video-conference)

1. Opening remarks

The online inter-sessional meeting was opened by Vyacheslav Lobanov, Co-Chairman of AP-CREAMS, on July 13 at 9:00 am (Chinese time; which is 10:00 am in Japan and Korea; 11:00 am in Vladivostok, Russia; and 3:00 pm the prior day in Honolulu, USA). Participants gave self-introductions (*AP-CREAMS Endnote 1*) and adopted the meeting agenda (*AP-CREAMS Endnote 2*). SungHyun Nam (Day 1, half of Day 2, and Day 3) and Ryan Rykaczewski (half of Day 2 and Day 3) were nominated as rapporteurs of the meeting, and they kindly agreed.



Participants of the 2020 PICES AP-CREAMS online meeting in July 13–14, 2020. Left to right: Yury Zuenko (Russia), SungHyun Nam (Korea), Hee-Dong Jeong (Korea), Fang Zuo (observer, IMBER), Guebuem Kim (Korea), Joji Ishizaka (Japan), Takafumi Yoshida (observer, NOWPAP), Ryan Rykaczewski (USA), Genki Terauchi (observer, NOWPAP), Jae-Hak Lee (Korea), Vyacheslav Lobanov (Russia), Jing Zhang (Japan), Fei Yu (China), Yosuke Igeta (Japan), Su Mei Liu (China), Dongfeng Xu (China).

2. Current status of the AP-CREAMS: Brief history and future plans

Vyacheslav Lobanov introduced a brief overview of the history of the AP-CREAMS along with original terms of reference (TOR), the current members including co-chairs, the geographic areas of focus, and past/recent and future activities. In particular, new extended TOR were explained with an emphasis on efforts of program coordination, ecosystem approaches, inclusion of extreme as well as long-term environmental changes, and enhancements of capacity building, knowledge dissemination, and cooperation

with other international marine organizations/programs in the wider geographic areas within the East Asian Marginal Seas.

3. Completion of previous business

3.1. Status of the report on EAST-II publication

Joji Ishizaka updated current status of how the EAST-II Report progressed after the Victoria meeting. The report, titled "*Oceanography of the Yellow Sea and East China Sea*" will be re-submitted to parent committees (POC and MONITOR) after finishing the revision within one month.

3.2. Status of the CREAMS related chapters of the PICES North Pacific Ecosystem Status Report-3

Vyacheslav Lobanov introduced the PICES North Pacific Ecosystem Status Report (NPESR-3) consisting of 15 regional chapters and a synthesis paper, where only the synthesis paper currently under review will be published in printed version. The 15 regional chapters, including the chapters for Area 19 (EAST-I region) and Area 21 (EAST-II region), will be reviewed and published online only. He provided an update on the current status of the regional chapter of NPESR-3 for Area 19 and led the discussions to leverage the unpublished 2011 Report data. Leading authors for subchapters/sections were identified to complete the drafting of this regional chapter.

4. Joint cruises and field observations

4.1. Korea-Russia joint cruises

SungHyun Nam and Guebuem Kim introduced the latest Korea-Russia joint cruise, conducted in the EAST-I region from October 27 to November 22, 2019 using the R/V *Akademik Oparin*. They presented preliminary results on physical and chemical properties of sea water observed during this and past joint cruises. In particular, mesoscale eddies in the southern area, deep temperature-salinity properties, cross-sectional structures of rare earth elements, and efficient scavenging and boundary processes were presented.

4.2. China, Japan, Korea joint cruises

SungHyun Nam and Guebuem Kim introduced a plan to have a Korean national cruise in the EAST-II region from August 10 to 20, 2020 using the R/V *Onnuri* and suggested future coordination of upcoming cruises and data exchange among the countries surrounding the region.

4.3. CREAMS-3.0 International Cooperative Experiments

Vyacheslav Lobanov suggested moving this item under the Overall discussion on new plans for AP-CREAMS (Agenda item 8).

4.4. US NRL project and US ONR plans (USA-Korea joint cruises)

SungHyun Nam and Jae-Hak Lee introduced a plan to have two Korea-USA joint cruises in the southwestern parts of the EAST-I region or coastal area off the Korean east coast using the R/V *Onnuri*, R/V *Ieodo*, and R/V *Tammsa-2*. The first cruise was tentatively scheduled (postponed) for December 4 to 18, 2020. The program (mixing in the sea, MJES) funded by the US ONR (Office of Naval Research) is supporting these intensive field experiments during the two cruises and the collection of time series data for ~6 months or longer. The objective is to understand the physics of small-scale to sub-mesoscale processes that determine the current and water-mass transformation in the southwestern part of the EAST-I region.

4.5. Suggestions on development of international collaboration

Yu Fei offered to SungHyun Nam and Jae-Hak Lee a provision of his expendable vertical microstructure profilers (VMP-X) for potential use for the US-Korea joint cruise, which can be an example of international collaboration.

5. National reports on activities and plans related to the AP-CREAMS program

5.1. China

Yu Fei introduced nine cruises conducted by the Institute of Oceanology, Chinese Academy of Sciences in 2019 to deploy/recover instruments and to observe water properties with samples in the Yellow Sea, Luzon Strait, and other areas in the western Pacific using the R/V *Kexue* and other vessels under the support of programs like the Health Ocean Program. In particular, mesoscale eddies, intrusion of the Kuroshio, and the turbulent properties of sea water within and beyond the bottom boundary layer were presented.

Su Mei Liu presented impacts of human activities on marine ecosystem in the Yellow Sea, Bohai Sea, and East China Sea using the data collected via multiple cruises in different seasons. In 2019, there were four cruises in each season in the Yellow Sea and three cruises (spring, summer, and fall) in the Bohai Sea. Nutrient dynamics in the Changjiang River and retention effort in the three Gorges Reservoir were also presented.

Dongfeng Xu presented on the recent and planned works of the Second Institute of Oceanography (SIO). A program to develop and deploy a "Double Cross" mooring system with a focus on an area of frequent typhoon passages into the East Asian countries and western tropical Pacific was initiated recently. SIO envisions the link of this observational program to the TAO/TRITON program as a part of TPOS (Tropical Pacific Observing System) and GOOS (Global Ocean Observing System) taking over the decaying TRITON program of Japan and sustaining the monitoring of the western tropical Pacific. SIO will deploy the surface and subsurface moorings in the subtropic and tropic areas in the western Pacific as a step for the next five years; 2–3 moorings for Phase I (2020), 4–6 moorings for Phase II (2021), and the remaining more than 12 moorings for Phase III (2022–2025). Another program (Deep Sea Mining in the northwest Pacific seamount) and a scientific paper on the bacterial community published in support of the program were briefly mentioned.

5.2. Japan

Joji Ishizaka introduced activities and plan for a few cruises in the East China Sea using vessels such as the R/V *Nagasaki-maru*. Since the university-wide funding program on ocean mixing (OMIX program) ended last spring, active field experiments have not been supported widely. The data collected through the past cruises in support of the OMIX program were analyzed and led to many good publications.

Yosuke Igeta introduced recent efforts to produce new gridded products of a water temperature database for the eastern part of the EAST-I region that involved coordinated efforts by individual prefectures. This gridded dataset has previously been kept closed, but it will be made publicly available in the coming months. He also introduced an observational initiative to set up a monitoring line (SI-line) with mooring and bottom mounted instruments, seagliders, and hydrographic observations since 2014. In particular, hydrographic measurements have been conducted four times per year, and the moored instruments have been serviced on an annual basis. The seaglider and ship-based hydrographic observations sample from the surface to 1000 m depth.

5.3. Korea

Jae-Hak Lee mentioned the 2016–2023 Korea EAST project sponsored by the Ministry of Oceans and Fisheries focusing on physics and biogeochemistry. Some observations in recent cruises included an increase in the number of time series measurements and platforms in the Yellow Sea and East China Sea using high-frequency radar. The second trend examined is changes in Yellow Sea Cold Water, coastal upwelling, and low salinity water in the East China Sea. Microplastics and heat waves are also of interest. The third trend is studies in marginal/open ocean exchanges, typhoon studies, and some other focused areas (Western Boundary Current, Kuroshio Extension, and the Bering Sea). He noted that the cruises are now being conducted aboard a relatively new vessel that has 5000 tons displacement. (Vyacheslav Lobanov noted that Russia is constructing a vessel that will be 6000 tons!)

5.4. Russia

Yury Zuenko introduced some limited activities with no cruises except a minimal coastal monitoring program with bottom trawling and other tasks. There were short trips to continue the monitoring program off the Primorye coast and repeated hydrographic observations (*e.g.*, CTD casing down to 500 m) along the lines from the Russian coast to southeastward down to the border of the Russian EEZ.

Vyacheslav Lobanov presented observational activities of POI FEB RAS on the R/V *Akademik Oparin* with two cruises, one from October 2 to October 20, 2019 focused on mesoscale water dynamics, and the second from October 24 to November 24 focused broadly on characterizing the marginal sea. The second cruise was implemented jointly with Korean scientists and presented earlier by SungHyun Nam and Guebuem Kim. Part of the data has been analyzed jointly with Korean scientists (SNU) to address large-scale processes and biogeochemistry and the other data were used to address mesoscale water dynamics accompanying the cyclonic gyre over the deep Japan Basin. The latter is particularly of importance in bringing warm water such as High Salinity Subsurface Water toward the Russian coast by the Western Branch of the Tsushima Current and North Korea Warm Current in the fall season, as well as coastal currents along the Primorye coast. Fukushima water was evident in the tritium and cesium distributions, and results of optical observations in the Peter the Great Bay were also mentioned. In addition, activities regarding a Pacific Floating University for student training and a planned cruise in August 2020 and long-term climate monitoring sections in the EAST-I region (CREAMS Line with SNU, Korea and NEAR-GOOS Line with JMA, Japan) were presented and discussed.

6. Capacity building activities

6.1. Summer School on Ocean Turbulence in China postponed to 2020

This Summer School had been proposed by Yu Fei. He has prepared everything for it, but because of the current COVID-19 pandemic, the School could not take place. It was suggested that it be postponed until next year. However, funding from the National Science Foundation of China was withdrawn for the current year, and he was told to apply again for funding in the coming year. He will apply, but whether it is funded or not is uncertain. Vyacheslav Lobanov noted that we will report to PICES that the School may be delayed, and we will have to request support again from PICES. This is quite understandable.

6.2. Training course on satellite information with NOWPAP

Joji Ishizaka mentioned that there are two training courses that NOWPAP is planning, but the fate is uncertain given the pandemic. Genki Terauchi gave a presentation on these courses. Four training courses on remote sensing data analysis have been conducted in the past with PICES support of travel for students and lecturers (2007, 2008, 2011, and 2013). It has now been seven years since the last course, and NOWPAP was planning another course. Seven years ago, a scientist from Scripps led the hands-on work, but now NOWPAP has the capacity to do this on its own. This course had been scheduled for December

2020, but it is likely to be rescheduled and perhaps completely online. The emphasis here is on the continental shelf and coastal areas. A total of 20,000 USD has been allocated for this from the NOWPAP Trust Fund.

6.3. Other proposals

Takafumi Yoshida mentioned the eDNA technique that can be used to monitor biodiversity from small samples of water. In collaboration with the eDNA Society of Japan, a manual on eDNA techniques has been developed. NOWPAP will host a training course in Spring 2021. Young scientists from the NOWPAP member states will be invited (15 students total). This will occur at Kobe University over five days. If member states agree to delay this course, it may be delayed until 2022. The course is something than cannot be conducted remotely. Since AP-CREAMS is moving towards more of an ecosystem approach, then it may be wise for NOWPAP to offer support for this course.

7. Cooperation with other active programs/organizations in the region

7.1. IMBeR Continental Margins WG

Su Mei Liu introduced IMBeR and the FEC (Future Earth Coast) which have a joint Working Group on Continental Margins (CMWG). This is focused on the Chinese Marginal Seas and the impacts of major societal activities on the ecosystem and environment. She introduced the DPSIR (driver-pressure-state-impact-response) model. This is meant to be a comprehensive approach to understanding a process, from drivers to societal responses and impacts. Su Mei Liu highlighted three key issues in the Chinese Marginal Seas case study: knowledge and understanding; development, innovation, and risk; and governance and management. Over the next 3–5 years there will be a focus on four tasks, which are the effect of eutrophication and environmental changes in the past 50 years, impacts of aquaculture and pollution, and policy studies. Derivatives from this project will be books, papers, scientific reports, suggestions and services to administrators, policy makers, and stakeholders.

7.2. WESTPAC WG06

Jing Zhang highlighted the critical need to include language about cross-EEZ collaboration in the UN Decade of Ocean Science (UNDOS) Implementation Plan. Such language did not appear in the zeroth-order Implementation Plan, nor did it appear in the first-order Implementation Plan. Eventually, this is a challenge that needs to be addressed, and the UNDOS seems like an appropriate place to raise the issue.

7.3. UN Decade of Ocean Science

Ryan Rykaczewski provided a brief overview of the UNDOS for Sustainable Development. PICES is anticipated to be a leader of the UNDOS efforts in the North Pacific. He highlighted some UNDOS actions in which PICES excels as well as some areas in which PICES needs to expand or find partner organizations to better address the intended outcomes. Several of the “priority areas” and “challenges” of the UNDOS are relevant to AP-CREAMS. The EAST-I region in the East Asian Marginal Seas is sometimes considered as “mini-oceans” with gyre circulation, mixing, meridional overturning, and exchange with other basins. In many ways, AP-CREAMS (with its international collaboration, data exchange, joint research efforts, and training courses) could be viewed as a mini-UNDOS. AP-CREAMS might serve as a model for larger-scale UNDOS efforts. Ryan Rykaczewski also highlighted the fact that many PICES expert groups are approaching the end of their terms, and so there is the opportunity to realign some of the PICES efforts with those of the UNDOS by shaping the activities of new expert groups.

7.4. CSK-2

Jae-Hak Lee introduced the Cooperative Study of the Kuroshio and Adjacent Regions (CSK)-2 Program that had an initial phase from 1965 to 1979 as a first international cooperation program under WESTPAC. The idea of a second phase program after ~50 years following the initial program has been discussed over the last three years with a feasibility study. Workshops have reviewed the themes of this program, a review paper was submitted in March 2020, and a webinar series will occur in July and August 2020 (*e.g.*, every Friday afternoon) to understand scientific interests of countries and their institutions in CSK-2, and the environmental, social-economic importance of Kuroshio from its origin to extension, and to formulate a preliminary outline for the CSK-2 Science Action Plan. Common themes are material, organism, salt, and heat (MOSH) transports and changes and these ecosystem, weather and climate services (FOCS) to societies, economics, and cultures (SEC), such as climate change and weather, marine ecosystem, biodiversity, and marine debris. The Science Action Plan will be drafted by September and November 2020 and the report be submitted to the IOC/WESTPAC by February 2021. Since the scope of the planning includes the Kuroshio from its origin to its extension including its branches, whole marginal seas in the western Pacific are considered that match to geographic areas of CREAMS and the CREAMS research is very relevant to the CSK-2 activities. Concerns on the originality from the initial program, emphasis on collaboration among researchers across countries and borders (*e.g.*, EEZs), different ways of implementation strategy among the countries (*e.g.*, leveraging on-going programs in China *vs* developing new programs in Japan and Korea), and potential participation of Russian fisheries or weather and climate communities are discussed.

8. Overall discussion on new plans for AP-CREAMS

Vyacheslav Lobanov reminded us of the new Terms of Reference (TOR) to open discussions on how to broaden the scope and how to implement, *e.g.*, how to include the human dimensions. There are suggestions to include or get help from some experts on human dimensions within PICES and to cooperate with other programs such as NOWPAP and IMBeR. SungHyun Nam suggested that we invite social scientist such as Jongseong Ryu, one of the PICES HD committee members, working for the same university that Hee-Dong Jeong recently moved to. Hee-Dong Jeong also expected he would be willing to join the force for future CREAMS activities. Joji Ishizaka noted that NOWPAP has a stronger relationship with the field of human dimensions, and therefore, we should continue to involve NOWPAP with the new TOR. Following Joji Ishizaka's suggestion, Takafumi Yoshida from NOWPAP emphasized the importance of availability of data and information on chemical and biological environments to implement their activities for socio-economic issues such as harmful algal blooms, eutrophication, and biodiversity. In particular, the NOWPAP activities connected with societal impacts and aligned with sustainable developing goals under the UN umbrella would rely on PICES for information on fisheries and biodiversity data. Yury Zuenko raised an issue of difficult collaboration between fisheries agencies among countries, *e.g.*, sharing data concerning fisheries resources in the marginal seas, and envisioned contributions to human dimension through large-scale predictions of fisheries resources that better collaboration is possible. Fang Zuo from IMBeR noted that the Chinese Continental Margins program having its own working group on human dimension is the first attempt to co-design a project with social scientists. It is perhaps easier to include social scientists with the region of focus (*e.g.*, coastal zone management), and the region may be expanded in cooperation with the CREAMS in the future.

Vyacheslav Lobanov noted the AP activities to remind us what tools we have to make contributions to broad disciplines/communities: meetings, national activities, joint cruises, capacity building, training courses, workshops, sessions, and publications. A key question to discuss is what the practical steps are to implement our plans for improving our involvement with social scientific efforts. He reviewed the vision for the UNDOS and highlighted the fact that this is a once-in-a-lifetime opportunity. How to leverage the UNDOS momentum was discussed then. Ryan Rykaczewski questioned whether data sharing would be a

relatively easy task to implement. Availability of data may help with numerical modeling and predicting efforts. He also suggested that utilizing the CREAMS cruises to collect biological data (*e.g.*, eDNA and mesozooplankton concentrations) would be valuable. Guebuem Kim noted the difficulty of sharing chemical data (more efforts and time delays are inevitable to assure the quality and publication of the data) in contrast to physical data. Takafumi Yoshida noted that standardized methodology for eDNA sampling across the countries is not established yet, but possible in the future. Mesozooplankton sampling on joint cruises might be possible although resources are necessary for these samplings. SungHyun Nam suggested that we modify and re-design our cruises and permanent monitoring/observation programs to provide data and information better fitting to the societal issues that are identified from communities of human dimensions, *e.g.*, activities like NOWPAP contributing to the UNDOS and Sustainable Development Goals will help us identify what kind of data and information we should provide to the communities. Yury Zuenko suggested that we implement PICES best practices in CREAMS activities and that we make better use of the AP-CREAMS webpage to share Environmental Time Series Observations with a focus on the marginal seas. Guebuem Kim suggested that we modify the webpage to provide more accessible information useful for societal issues and better motivations for new collaborations and suggestions, *e.g.*, to include information on future as well as past cruises (metadata including locations of sampling and measured parameters, *etc*.). Jae-Hak Lee asked whether we might have improved communication with committees other than the parent committees (POC and MONITOR). Review by another committee might help highlight how our science could be relevant to issues for broader disciplines. We may try all suggested activities but practical implementation would be quite challenging.

Vyacheslav Lobanov shifted discussions to future activities on CREAMS 3.0 for the EAST-I area as a new program in succession to initial CREAMS starting from 1993 (CREAMS 1.0) and 20 years after its second phase starting from 1999–2000 (CREAMS 2.0). Although repeat hydrographic surveys may not be fully implemented due to limited resources, some key observational lines (CREAMS line between Russia and Korea, and NEAR-GOOS line between Russia and Japan) would be maintained through coordinated international cooperative experiments. National cruises supported by TINRO (Russia), NIFS (Korea), and JMA (Japan) would be helpful. There are some challenges to work in international waters between the EEZ boundaries but this may be possible with joint international efforts. Examples of these efforts include convection study experiments, ventilation processes, monitoring and examination of deep circulation, mesoscale water dynamics, internal waves and turbulent mixing, and ferry-based monitoring lines in the EAST-I region. SungHyun Nam noted plans for the future aligned to what he suggested under CREAMS 3.0 to support the key observational lines for climate monitoring with either joint cruises across the EEZs or coordinated and independent national cruises. He supported the international collaboration on the deep circulation in the Japan Basin along with long-term moored current measurements in the northern part (Russia), southeastern part (Japan), and southwestern part (Korea). Heedong Jeong supported a plan for continuing the ferry-based monitoring lines between Russia and Korea, and to establish a new monitoring line between Japan and Korea in the future. SungHyun Nam suggested developing/designing a key observational line in the EAST-II region as well for long-term climate monitoring with coordinated and independent national cruises among the neighboring countries (China, Japan, and Korea). One example is the PEACE (Program of the East Asian Cooperative Experiments) areas to collect common samples as often as possible. Takeshi Matsuno from WESTPAC WG06 introduced the PEACE-1 area within the Korean EEZ and PEACE-2 area within the Japanese EEZ for common observations in the EAST-II region.

Regarding future training courses, in addition to planned summer schools on ocean turbulence (Yu Fei) and NOWPAP satellite information and eDNA (Takafumi Yoshida), new courses on two themes of big data in ocean science and artificial intelligence were suggested by SungHyun Nam. Regarding future products, Jae-Hak Lee preferred to publish a special issue of papers rather than a report, and a publication highlighting 30 years of CREAMS (preceding PICES) sometime in 2023–2024 was suggested by Vyacheslav Lobanov. Plans for future works/activities under the new TOR were left as a homework for next AP-CREAMS meeting.

9. Next AP-CREAMS meeting

The AP-CREAMS online business meeting will be held in September 10–11, 2020.

10. Summary and closing

Vyacheslav Lobanov reviewed the progress during the three-day online meetings (July 13–14 and 20, 2020) and the meeting was closed at around 17:00 (Vladivostok, UTC+10) on July 20, 2020.

AP-CREAMS Endnote 1

AP-CREAMS participation list

Members

Joji Ishizaka (Japan, Co-Chair)
Jae-Hak Lee (Korea, Co-Chair)
Vyacheslav Lobanov (Russia, Co-Chair)
Fei Yu (China, Co-Chair)
Yosuke Igeta (Japan)
Heedong Jeong (Korea)
Guebuem Kim (Korea)
Su Mei Liu (China)
SungHyun Nam (Korea)
Ryan Rykaczewski (USA)
Dongfeng Xu (China)
Jing Zhang (Japan)
Yury Zuenko (Russia)

Members unable to attend

Russia: Pavel Ya. Tishchenko

Observers

Takeshi Matsuno (WESTPAC WG06)
Genki Terauchi (NOWPAP)
Takafumi Yoshida (NOWPAP)
Fang Zuo (IMBeR)

AP-CREAMS Endnote 2

Agenda for the AP-CREAMS Inter-sessional Meeting

July 13-14, 11:00-14:00 (Vladivostok, UTC+10) and July 20, 2020, 14:00-17:00 (Vladivostok, UTC+10) by video-conference

1. Opening remarks, introduction of the participants, adoption of the agenda, rapporteur (AP co-chairmen)
2. Current status of the AP-CREAMS: Brief history and future plans (V. Lobanov)
3. Completion of previous business
   - 3.1. Status of the report on EAST-II Publication (J. Ishizaka)
   - 3.2. Status of the CREAMS related chapters of the PICES NPESR-3 (V. Lobanov)
4. Joint cruises and field observations
   - 4.1. Korea-Russia joint cruises (GB Kim, V. Lobanov)
   - 4.2. China, Japan, Korea joint cruises (GB Kim, J. Ishizaka)
   - 4.3. US NRL project and US ONR plans (SH Nam, JH Lee)
   - 4.4. Suggestions on development of international collaboration
5. National reports on activities and plans related to the AP-CREAMS Program
   - 5.1. China (Y. Fei, S. Liu, D. Xu)
   - 5.2. Japan (J. Ishizaka, J. Zhang, Y. Igeta)
   - 5.3. Korea (JH Lee, GB Kim, HD Jeong)
   - 5.4. Russia (Y. Zuenko, V. Lobanov)

6. Capacity building activities
    6.1 Summer school on Ocean Turbulence in China postponed to 2020 (F. Yu)
    6.2 TC on satellites information with NOWPAP (J. Ishizaka, G. Terauchi, T. Yoshida)
    6.3 Other proposals
7. Cooperation with other active programs/organizations in the region
    7.1 IMBeR Continental Margins WG (S.M. Liu, F. Zuo)
    7.2 WESTPAC WG06 (J. Zhang)
    7.3 UNDOS (R. Rykaczewski)
    7.4 CSK-2 (JH Lee)
8. Overall discussion on new plans for AP-CREAMS (discussion on new TOR; broadening the scope; roadmap, CREAMS 3.0 plans, *etc*.)
9. Next AP-CREAMS meeting
10. Summary and closing