Newsletter from

NOWPAP CEARAC

Northwest Pacific Action Plan
Special Monitoring & Coastal Environmental Assessment
Regional Activity Centre

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Greeting from Director of CEARAC

Mr. Makoto HAYASHI

To promote conservation of the marine and coastal environment through a "shared sea" approach among littoral countries, various region-specific activities have been carried out under the Regional Seas Programme led by the United Nations Environment Programme (UNEP). Northwest Pacific Action Plan (NOWPAP) is one of the UNEP Regional Seas Programmes, which launched in 1994 by the People's Republic of China, Japan, the Republic of Korea and the Russian Federation, for the protection, management and development of the marine and coastal environment of the Northwest Pacific Region. There are four Regional Activity Centres (RACs) in each member state and they carry out relevant activities.

In Japan, Special Monitoring and Coastal Environment Assessment Regional Activity Centre (CEARAC) was established in Toyama City in 2002 when UNEP appointed the Northwest Pacific Region Environment Cooperation Center (NEPC) as a RAC of Japan. As CEARAC specializes in monitoring and assessment of the marine and coastal environment, it implements most of its activities by applying remote sensing technology.

The entire biennial activities and budgets of NOWPAP including ones by respective RACs, so-called Programme of Work (PoW), are to be discussed and adopted by the four member states at intergovernmental meetings (IGMs); however, because of the global conflict and destabilization started in February 2022, the current 2022-2023 PoW has not been adopted yet. Therefore, it is regretful to say that CEARAC has not launched any planned activity for 2022-2023 yet, but has been working on some prolonged work for the 2020-2021 biennium to be fully completed.

In 2022, CEARAC developed an electronic report on Assessment of the Distribution of Tidal Flats and Salt Marshes in the NOWPAP region, the video manual of environmental DNA (eDNA) analysis in English and Japanese, and a webinar site of ocean remote sensing data analysis including materials used in the past training courses. Remote sensing technology has been fast-evolving in recent years. Thus, CEARAC tries to catch up with its advancement to make full use of it to ensure biological diversity as well as to address climate change and marine litter while pursuing the conservation of the NOWPAP region.

This 19th issue of the newsletter introduces the progress of CEARAC activities in 2022.It would be grateful for CEARAC staff if this newsletter could help any reader get familiar with CEARAC activities and get interested in the marine and coastal environment of Toyama Bay and wider NOWPAP region.

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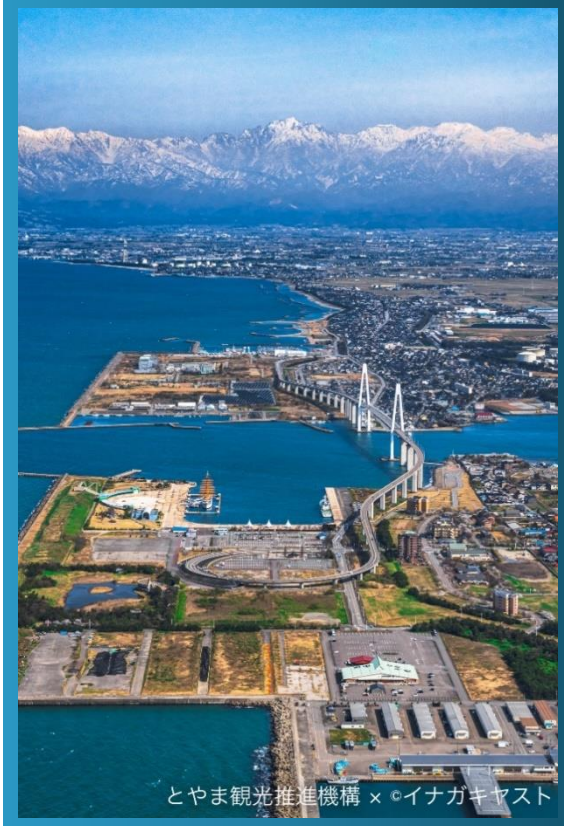
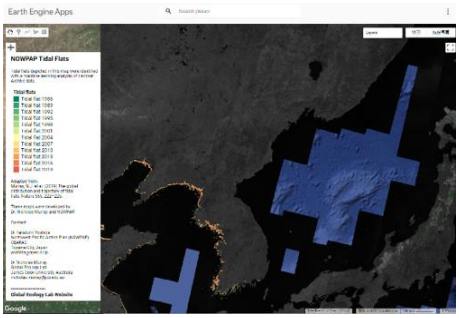


1. Reports of main projects for 2020-2021 biennium

1-1. Assessment of the Distribution of Tidal Flats and Salt Marshes in the NOWPAP region

CEARAC has a long history on habitat mapping using remote sensing techniques. CEARAC tried to assess the distribution of tidal flats and salt marshes in the NOWPAP region in the 2020-2021 biennium with support from Dr. Nicholas Murray of James Cook University and the nominated experts of the member states. Dr. Murray developed a mapping tool, Global Intertidal Changes, which can map the global distribution of tidal flats using Landsat satellite images and machine learning. By applying this tool into the NOWPAP region, the draft distribution map of tidal flats in the NOWPAP region was developed in 2021. However, there were several difficulties and limitations for mapping in our region due to the limitation of satellite images, training data and high turbidity water. Then, with the help of the experts and revision of the mapping tool, the accuracy was improved from the original version, and we developed the first map in the NOWPAP region. The map is available through Google Earth Engine, https://murrnick.users.earthengine.app/view/nowpap-app.

Next, in 2022, CEARAC published the summary report of this project, "Report on Assessment of the Distribution of Tidal Flats in the NOWPAP Region" in a digital format which showed detailed information on the mapping method and differences between the mapping tool and real distribution. The report is available on the CEARAC's website (https://cearac.nowpap.org/nowpap/wp-content/uploads/2024/03/tidal_flat.pdf).



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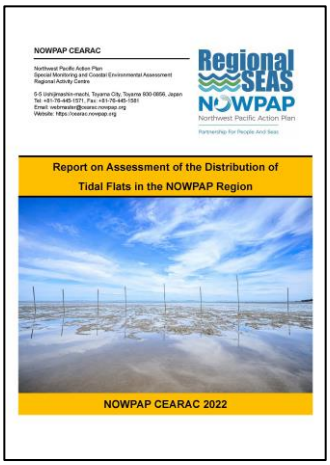
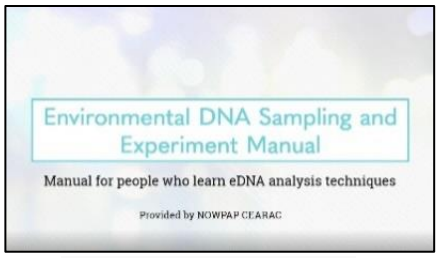


https://cearac.nowpap.org/nowpap/wp-content/uploads/2024/03/tidal_flat.pdf

1-2. Organization of a Training Course on eDNA Analysis

CEARAC planned to organize a training course on eDNA analysis in the 2020-2021 biennium. However, the pandemic of the COVID-19 in the world restricted international travel and face-to-face meetings. CEARAC Secretariat, therefore, canceled the training course and proposed to organize one in the following 2022-2023 biennium. Then, as an alternative action, CEARAC developed a video manual on eDNA analysis with support of Profs. Toshifumi Minamoto (Kobe University) and Akihide Kasai (Hokkaido University). English and Japanese versions are now provided from the CEARAC's YouTube channel (English: https://youtu.be/I4K00_ysCtc, Japanese: https://youtu.be/97v-77G5I6w). In addition to these versions, Chinese, Korean and Russian version are planned to be developed to help promotion of this technique more widely in the NOWPAP region.



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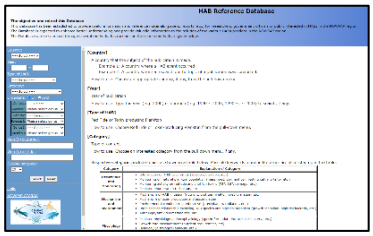
https://youtu.be/97v-77G5I6w

1-3. Updating HAB Database and HAB Reference Database



https://cearac.nowpap.org/hab-web/hab-ref-db/

CEARAC developed the HAB Reference Database in 2004, and the HAB Integrated Website in 2009 to share information on harmful algal blooms (HABs) in the NOWPAP member states. To update information of these databases, CEARAC asked the nominated experts of the member states to collect the latest information in each country. The collected information from 2009 to 2020 was added into the original data and the website was updated.

1-4. Case Studies of Estimating Seagrass Blue Carbon in the Selected Sea Areas in the NOWPAP Region

Following the worldwide attention to the potential of blue carbon (carbon sequestration in ocean) to mitigate climate change, CEARAC launched an activity of estimating seagrass blue carbon in the NOWPAP region in the 2020-2021 biennium. By the end of 2021, most of case studies were completed by the nominated experts of the member states, and on February 11, 2022, CEARAC virtually held an online meeting with three experts from Japan, Korea and Russia to report the progress of their case studies and then to discuss setting of a regional value to estimate seagrass blue carbon in the NOWPAP region and requirements of the booklet for conservation of seagrass in the NOWPAP region which was proposed by CEARAC.

The case study in China had been behind the schedule and a draft was finally submitted to CEARAC in December under cooperation of NOWPAP RCU. Unfortunately, however, there was lack of necessary information in the report, CEARAC has helped refinement of the report since then.

The four case study reports from the member states will be combined and published in a form of a booklet in 2023.

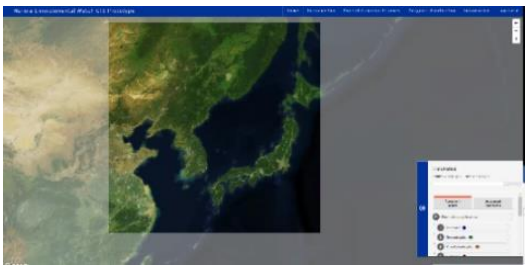
1-5. Improvement of the NOWPAP Eutrophication Assessment Tool (NEAT) for Assessment and Monitoring of Eutrophication Using Satellite-derived Chlorophyll-a

CEARAC has implemented series of activities on coastal eutrophication over a decade. In the 2020-2021 biennium, CEARAC focused on the improvement of its developed eutrophication assessment tool, the NOWPAP Eutrophication Assessment Tool (NEAT) to incorporate satellite data products from recent ocean color sensors.

On February 25, 2022, CEARAC virtually held the Third Expert Meeting on Eutrophication Assessment in the NOWPAP Region with the nominated experts of the member states to review the results of data evaluation and to collect opinions and advice on improvements of the multi-sensor, long-term consistent satellite-derived chlorophyll-a time-series used in eutrophication screening.

Then, CEARAC updated the Global Eutrophication Watch App in December 2022. The updated App includes a language selection panel that allows users to switch between the four NOWPAP member countries languages and a new chlorophyll-a dataset from the SGLI/GCOM-C with 250 m spatial resolution. With the new dataset, eutrophication screening can be conducted in nearshore waters.

The Marine Environmental Watch GIS prototype (https://cearac.nowpap.org/map-webgis/) is also being updated to include eutrophication screening map obtained using the Global Eutrophication Watch and YOC dataset. This will make the NEAT-based assessment map more accessible to all NOWPAP member states.



https://cearac.nowpap.org/map-webgis/

1-6. Developing a Website for NOWPAP Remote Sensing Training Program

To consolidate information and resources of the past training courses on remote sensing data analysis to use in future trainings, CEARAC developed a website in August 2022 (https://nowpap-remote-sensing-training.org/npwd/), which includes information of the past four in-person training courses (2007-2013) and materials used during the two webinars held at the end of 2021 on remote sensing data analysis.
While creating the website, one CEARAC staff member joined the meeting for Early Career Ocean Professionals (ECOPs) in Africa in June and gave an online training as a demonstration and evaluation of the materials developed for the website.

https://nowpap-remote-sensing-training.org/npwd/

1-7. Upgrading CEARAC Website

Because of the global COVID-19 pandemic, some of the planned activities, in particular, organization of meetings were forced to be canceled. As a result, there was some budget left unspent at the end of 2021. Then, following the suggestion by NOWPAP RCU, CEARAC amended Small-scale funding agreement (SSFA) with UNEP.
In line with the amended SSFA adopted in 22 June 2022, CEARAC is planning to improve quality of CEARAC websites to meet the needs of users in and out of the NOWPAP member states, and to satisfy security requirements to maintain integrity, availability, accountability and authenticity of the websites' information and services. We are currently working on reviewing the existing websites related to CEARAC activities for future upgrade.

We're on the Web

See us at:

https://cearac.nowpap.org/

2. Cooperation with NOWPAP partners and organizations

2-1. PICES 2022 Annual Meeting

2022 PICES Annual Meeting was held on Sep. 23 – Oct. 2, in Busan, Korea. CEARAC Secretariat participated in the business meetings of MEQ (Marine Environmental Quality Committee) and S-HAB (Section on Ecology of Harmful Algal Blooms in the North Pacific) virtually, which were held before and/or during the annual meeting. Overviews of these meetings are as follows;

MEQ Business Meeting

MEQ Business Meeting (Sep. 25 and Sep.28)

NOWPAP RCU and CEARAC were invited to the MEQ Business Meeting as observer, and Dr. Ning Liu of NOWPAP RCU made a presentation on current NOWPAP activities during the meeting. MEQ is a host committee of S-HAB and AP-NIS (Advisory Panel on Marine Non-indigenous Species), activities of which are closely related to the CEARAC activities. During the meeting, the members of MEQ expressed their expectation of stronger collaboration with NOWPAP in the future. CEARAC has planned to organize a training course on eDNA analysis and asked AP-NIS to be a co-sponsor. Therefore, it will be advantageous for both if we can implement a joint survey using eDNA technology in the future. CEARAC continues discussion with PICES for the future collaboration.

The Section on *Ecology of Harmful Algal Blooms in the North Pacific* (S-HAB) met under the co-chairmanship of Dr. Mark Wells (USA) and Dr. Pengbin Wang (China) on September 14 at 17:00 (Pacific Daylight Time), September 15 8:00 (Beijing), 9:00 (Tokyo/Seoul), and 10:00 (Vladivostok), 2020, via Zoom. Dr. Wang and Dr. Wells welcomed all participants (Figure 1). The meeting was attended by members from five PICES member countries (*S-HAB Endnote 1*). The provisional agenda for the meeting (*S-HAB Endnote 2*) was reviewed and was approved by the Section.

Figure 1. HAB Section members attending the 2022 Annual Meeting.
First row, from left: Moonho Son, Pengbin Wang, Douding Lu, Mark L. Wells, Seung Ho Baek,
Second row, from left: Yoichi Miyake, Mitsunori Iwataki, Yoshida Takafumi, Vera Trainer, Setsuko Sakamoto, Misty Peacock.

S-HAB Business Meeting

S-HAB Business Meeting (Sep. 15)

Same as the past Annual Meetings, the latest information on HAB in the NOWPAP member countries were reported. Situation of HAB in the NOWPAP member states are;

China: 58 HAB events were recorded in Chinese coastal waters in 2021, and the total area was 23,277 square kilometers. *Noctiluca scintillans* are main causative species, and blooms of *Prorocentrum donghaiense*, *Prorocentrum minimum*, *Prorocentrum micans*, *Akashiwo sanguinea*, *Alexandrium catenella*, *Heterosigma akashiwo*, *Phaeocystis globose*, *Gonyaulax polygramma*, *Chaetoceros curvisetus* were observed. In addition to the above HAB events, green tide (*Ulva prolifera* massive bloom) was occurred in the Yellow Sea, and its covered area was 1,746 km2, which was 2.3 times as large as that of 2013, the largest year before 2021.

Japan: 70 and 100 HAB events occurred in the Seto Inland Sea and Kyushu area respectively. *Chattonella* spp. bloom caused huge fishery damage (26 million JPY) in Hiroshima prefecture, western Seto Inland Sea, and in Yatsushiro Sea, western Kyushu area. There were 48 cases of shellfish ban due to paralytic shellfish poisoning (PSP) in 2021, and main causative species were *Alexandrium catenella*, A. *pacificum* and *Gymnodinium catenatum*. The number of shellfish ban due to diarrhetic shellfish poisoning (DSP) was 6 and the causative species were *Dinophysis fortii* and *D. acuminata*. Massive outbreak of *Karenia selliformis* in eastern Hakkaido was also reported.

Korea: 11 HAB events were observed in 2021. The causative species were *Akashiwo sanguinea*, *Noctiluca scintillans*, *Skeletonema* sp. and *Mesodinium rubrum*. *Cochlodinium* was observed but disappeared soon. PSP was reported in Korea, and the causative species were *Alexandrium catenella* and *Alexandrium pacificum*.

Russia: 12 causative species were observed by the monitoring survey in Amur Bay. In 2021, bloom events caused by *Pseudo-nizschia* species were recorded four times in Amur Bay. An accumulation of domoic acid was detected in the samples of the bivalves *Modiolus kurilensis* and *Crenomyytilus grayanus* after bloom events caused by *P. multistriata* and *P. delicatissima*.

S-HAB proposed a workshop and a topic session for the next Annual Meeting in 2023. The topic of the workshop is “Control of HAB”, and NOWPAP/CEARAC is expected to be a co-sponsor. CEARAC published a report on countermeasures against HAB in 2007, which introduce various control methods including clay spray and others. 15 years have passed from the publication; therefore, it will be a good opportunity to update the report by adding the latest control techniques to be introduced at the S-HAB workshop and/or a topic session.

At the S-HAB meeting, CEARAC staff introduced our current activity on HAB: collecting information on HAB events from 2009 to 2020 in the NOWPAP member states as well as scientific papers in the region, and updating the HAB Integrated Website and HAB Reference Database.

2-2. Google Geo for Good Summit 2022

Google Earth Engine organized its annual conference, Geo for Good Summit 2022, on October 4-6 at Mountain View, CA, USA. The conference was held in a hybrid manner, and Dr. Genki Terauchi and Dr. Eligio de Raús Maúre of CEARAC attended the event virtually. The conference is designed for non-profits, scientists and other changemakers to inform and facilitate the use of mapping tools for positive impact in the world. CEARAC staff members have attended the event since 2016 to learn about the Google’s mapping toolset and their application around the world. This year, 300 people attended in-person and about 2,000 virtually. During the meeting, Google announced that Google Earth engine will be available to businesses and government users with charge.

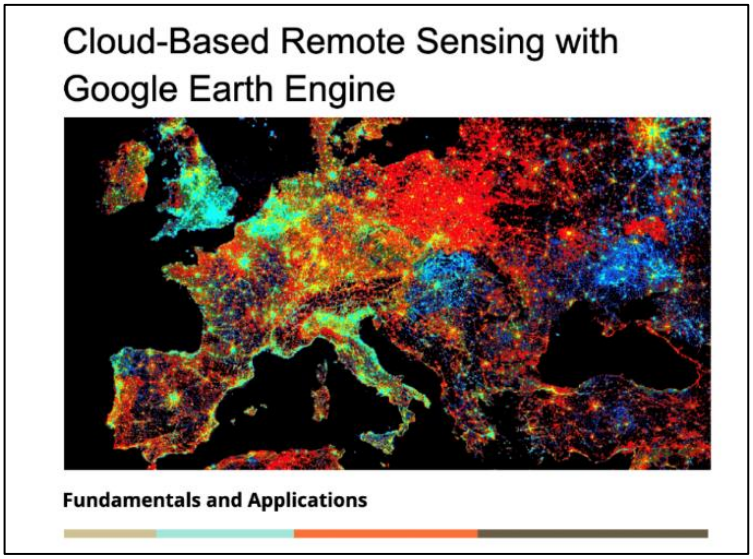
Google Earth Engine has been widely used among by private sectors in recent years, especially many supply chains for satellite image analysis. It was impressive that TraceMark, part of NGIS Australia, introduced their monitoring technology with satellite imagery of oil palm plantations and the state of deforestation to help supply chains to contract with environmentally-friendly farms. they evaluate producers of palm oil, beef or soy beans from the aspect of risk of deforestation, leading to give positive impact on business operations.

Then, "Dynamic World”, a new near realtime land use/land cover dataset with a ten-meter resolution, developed by Google through a partnership with the World Resources Institute, was introduced. Dynamic World regularly updates its dataset, which are openly and freely available. Training data of Dynamic World is largely collected under the National Geographic Society – Google – World resources Institute Dynamic World project.

Among other presentations, Skytruth, non-profit environment organization, introduced SkyTruch Alerts, collections of maps developed using change detection techniques to show environmental incidents which have recently occurred. When Dr. Terauchi tried out the alert system on Toyama Prefecture, Japan where CEARAC is located, erosion of coastal lines and the location of deforestation were shown on the maps, and he confirmed the quality of that global dataset.

It was also announced that the Google Earth Engine textbook will be developed and published at the beginning of 2023 from Springer. It is unfortunate that the current textbook does not include enough contents on marine and coastal environments, yet, as they improve the contents in the future, CEARAC will encourage Google to add ocean application contents such as CEARAC’s Global Eutrophication Watch.

Visual of the textbook



2-3. World Seagrass Conference 2022 and the 14th International Seagrass Biology Workshop (WSC2022 & ISBW14)

Participants of the Seagrass Workshop and Mr. Xuan Truong Trinh at the center holding his laptop showing Dr. Terauchi attending online from Japan.

World Seagrass Conference 2022 and the 14th International Seagrass Biology Workshop (WSC2022 & ISBW14) was held in Annapolis, MD, USA on 7-12 August 2022, and Dr. Terauchi, senior researcher of NOWPAP CEARAC, joined the conference to introduce Seagrass Mapper which was originally developed by CEARAC in the 2020-2021 biennium to map the distribution of eelgrasses in the NOWPAP region.

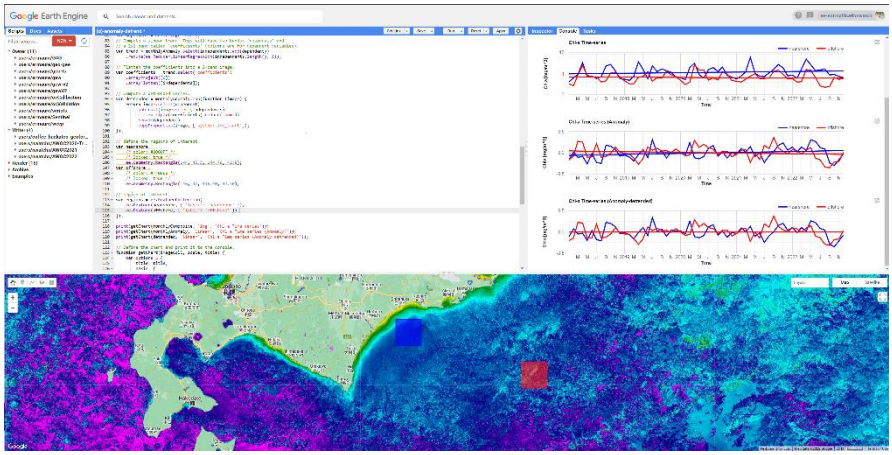
WSC and ISBW are biennial conferences organized by the World Seagrass Association. The events held in Annapolis was originally planned in 2020; however, because of the COVID-19 pandemic worldwide, they were postponed to 2022. Also, the meetings allowed a hybrid participation: in-person in general and virtual if necessary.

ISBW14 covered a range of topics from biological aspects of seagrass and its surrounding environment to monitoring mapping efforts. Dr. TERAUCHI virtually organized a workshop to introduced Seagrass Mapper, a Google Earth Engine based web tool for mapping seagrass on 12 August, with Mr. Xuan Truong Trinh of University of Tokyo who participated on site. There are 65 people participated in the workshop and learned how to prepare training data based on field-based information and the procedure of analyzing satellite images for seagrass mapping. For more information, please visit NOWPAP Remote Sensing Training Program website at https://nowpap-remote-sensing-training.org/npwd/ and WSC2022 & ISBW14 website: https://worldseagrass.org/ .

2-4. Exploring the potentials of Google Earth Engine (GEE) for ocean color research and applications: AWOC/KJWOC training in ocean color data analysis using GEE

Google Earth Engine (GEE)—a planetary scale tool for remote sensing data analysis—along with ocean color data allow can open the window for an unprecedented spatial and temporal scale analysis of water quality monitoring in a novel way. To explore these potentials offered by GEE to the ocean colour community, CEARAC has been promoting training in ocean color data analysis using GEE since 2019. In 2022, CEARAC joined again the 10th Asian/19th Korea-Japan Workshop on Ocean Color (AWOC/KJWOC) organized by IPB University, Indonesia and held online as COVID pandemic restrictions still prevail. On this occasion, CEARAC invited Mr. Simon Ilyushchenko—data ingestion lead for GEE—to give an introductory lecture about GEE prior to the training prepared by CEARAC. Following this lecture, CEARAC conducted a hands-on session to introduce participants with [practical examples of use of GEE and ocean color data.

The SGLI/GCOM-C data was used for the hands-on and examples of time-series around Hokkaido, where red-tides were observed in 2021, were given. Following that, Dr. Terauchi of CEARAC introduced examples of GEE based applications used worldwide for environmental conservancy including the Seagrass Mapper and Global Eutrophication Watch developed by CEARAC for seagrass mapping and coastal eutrophication screening, respectively. The training series are expected to continue in the future as part of capacity building contribution to the ocean color community.



Monthly time-series of chlorophyll-a obtained by the SGLI/GCOM-C.

2-5. International Webinar Series on Advancing Remote Sensing Applications for Ocean Sustainability

Drs Terauchi and Maúre of NOWPAP CEARAC joined a webinar series by IOC/WESTPAC (Intergovernmental Oceanographic Commission of the United Nations/Sub-Commission for the Western Pacific) on December 20 to discuss the applications of remote sensing technology to ocean sustainability held online by Burapha University, Thailand. In the webinar they introduced seagrass mapper—a cloud-based tool for mapping seagrass distributions using satellite remote sensing data—and the global eutrophication watch, another cloud-based tool for eutrophication screening using satellite-derived chlorophyll data. The two cases were introduced as examples and contributions of CEARAC to marine environment monitoring and protection.

3. Current List of CEARAC Focal Points

Country	*Name*	*Organization*
China	Dr. Liu XIHUI	China National Environmental Monitoring Center
	Dr. Jianchao FAN	National Marine Environmental Monitoring Center
Japan	Ms. Noriko TAMIYA-HASE	Ministry of Environment Japan
	Dr. Fumiaki OKAHARA	Ministry of Environment Japan
	Dr. Joji ISHIZAKA	Nagoya University
	Dr. Nobuyuki YAGI	The University of Tokyo
Korea	Dr. Bong-Oh KWON	Kunsan National University
	Dr. Jinsoon PARK	Korea Marine and Ocean University
	Dr. Hye Seon KIM	National Marine Biodiversity Institute of Korea
Russia	Dr. Vladimir SHULKIN	Far Eastern Branch of the Russian Academy of Sciences
	Dr. Tatiana ORLOVA	Far Eastern Branch of the Russian Academy of Sciences

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