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

Dear Readers,

It is my great pleasure to greet you through this newsletter. I have served as Director of NOWPAP CEARAC since this past July.

Oceans and seas are one of the main working areas of the United Nations Environment Programme (UNEP), and Regional Seas Programme under it functions as a regional mechanism for conservation of the marine and coastal environment. Northwest Pacific Action Plan (NOWPAP) launched in 1994 as part of Regional Seas Programme to contribute to conservation of the Northwest Pacific. There are four Regional Activity Centres (RACs) in respective member states (China, Japan, Korea and Russia), and Special Monitoring and Coastal Environmental Assessment Regional Activity Centre (CEARAC) is located in Toyama, Japan as the Northwest Pacific Region Environmental Cooperation Center (NPEC) and was appointed as a RAC of Japan in 2002. As its name tells, CEARAC mainly conducts various monitoring and assessment of the marine and coastal environment of the NOWPAP region with special monitoring methodologies and tools such as remote sensing.

Prolonged worldwide COVID-19 pandemic has restricted people's life and travel all through the year of 2021, and it was inevitable for CEARAC to meet people online. Actually, all pre-meetings and meetings were held virtually. Even under such constraints, in 2021, CEARAC proceeded with planned activities, including assessment of the distribution of tidal flats and salt marshes in the NOWPAP region, case studies of estimating seagrass blue carbon in selected sea areas in the NOWPAP region, and organization of the 5th training course on remote sensing data analysis. The training course is designed to provide its trainees with both lectures and hands-on sessions of data processing with computer tools, and CEARAC organized it virtually for the first time.

Remote sensing technology has progressed remarkably in recent years, and CEARAC has kept pace with its advancement as well as continuously put our efforts on addressing environmental issues in the NOWPAP region: loss of marine biodiversity, climate change, and marine litter, and so on.

This 18th issue of the newsletter introduces the progress of CEARAC activities in 2021. I hope you enjoy reading every article and get more interested in CEARAC activities and the marine and coastal environment of Toyama Bay and wider NOWPAP region.

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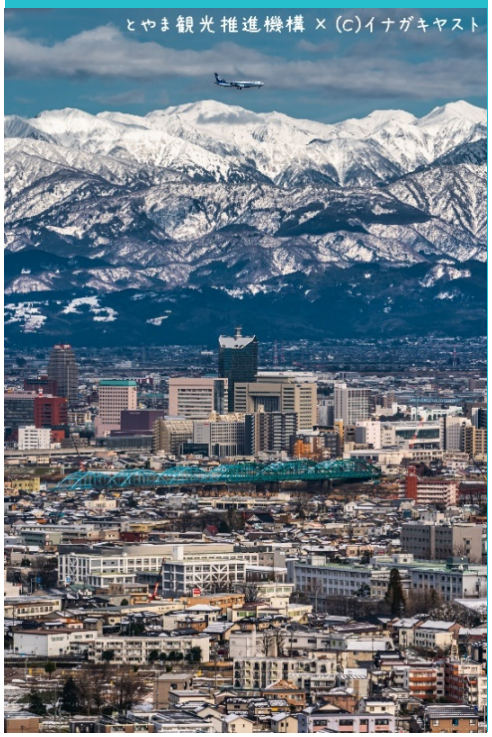


1. Activities in 2021 Organization of Meeting

The 18th NOWPAP CEARAC Focal Points Meeting

The Eighteenth NOWPAP CEARAC Focal Points Meeting (FPM) was held on 24-25 August 2021.

This was the first online CEARAC FPM and there were 12 people joined the virtual meeting including CEARAC focal points from the four NOWPAP member states, representatives of Regional Coordinating Unit (RCU) and Marine Environmental Emergency Preparedness and Response Regional Activity Centre (MERRAC) as well as a representative North Pacific Marine Science Organization (PICES).

There were two main agendas for the meeting: The first one was reviewing the progress of implementation of CEARAC activities for the 2020-2021biennium, and the second one was discussion on proposals for CEARAC activities for the 2022-2023 biennium.

For more details, please visit CEARAC website, Meeting Report Page.

2. Reports of main projects for 2020-2021 biennium

2-1. Assessment of the distribution of tidal flats and salt marshes in the NOWPAP region

CEARAC developed the CEARAC Medium-term Strategy for Marine Biodiversity Conservation (BIO MTS) in 2019. The BIO MTS presents the basic policy for marine biodiversity activities of CEARAC. In the BIO MTS, three high priority topics were selected, and one of them is conservation of biological habitats including tidal flats, salt marshes and seagrass/seaweed beds in the NOWPAP region.

CEARAC started an activity on seagrass/seaweed bed in 2014, and developed a manual for the mapping of seagrass and seaweed bed distribution with satellite images in 2018. Using the developed manual, CEARAC monitored the distribution of seagrass in the selected areas of the NOWPAP member states.

Tidal flats and salt marshes are also significant coastal habitats for marine biodiversity conservation. In the NOWPAP region, wide tidal flats are distributed in coastal areas of China, Japan and Korea, and small tidal flats are distributed in the coastal area of Tatar Strait of Russia. Many marine species including endangered species of member states are living in these tidal flats. To protect such significant environment, CEARAC started a new project on mapping tidal flats/salt marshes in the NOWPAP region in the 2020-2021 biennium.

To map the distribution of tidal flats and salt marshes in the NOWPAP region, a tool developed by Dr. Nicholas Murray, the James Cook University is used: Global Intertidal Change (GIC) developed for global mapping of tidal flats. GIC is unique for combining remote-sensing classification with a machine learning method. GIC is developed for global mapping, therefore, it is necessary to improve it to suit the NOWPAP region. The experts of the NOWPAP member states collected information/data on the tidal flats/salt marshes distribution in each country, and based on the provided data, Dr. Murray improved the mapping tool for the NOWPAP region.

The first map was developed in June 2021. As there are misdetections in the first map, the experts reviewed and corrected them. Through several exchanges between Dr. Murray and the experts, the final map of the distribution of tidal flats and salt marshes in the NOWPAP region was developed in October 2021 (Figure 1).

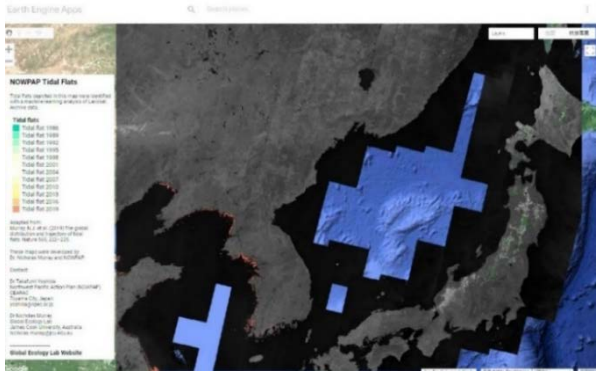


Figure 1

The map and GIS data will be opened from CEARAC website soon.

In addition, CEARAC will publish a summary report on this project including explanation of GIC methodology and gaps/limitation of mapping in the NOWPAP region in early 2022.

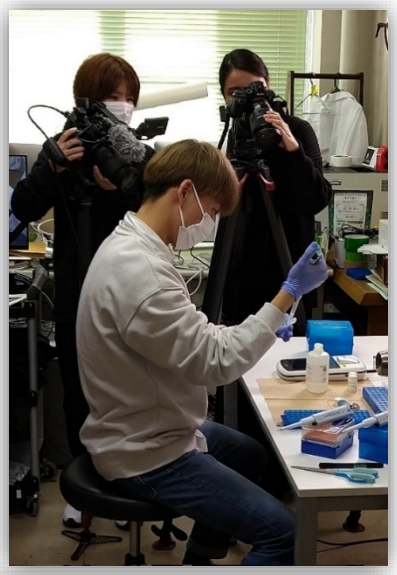
2-2. Organizing a Training Course on eDNA Analysis

In the CEARAC Medium-term Strategy for Marine Biodiversity Conservation, environmental DNA was selected as one of high priority topics. eDNA is the latest analytical method which was developed in molecular biology. It has potential to monitor organisms without conducting harvest surveys, and it is expected to be used for biodiversity conservation. However, eDNA techniques were developed rapidly in the last decade, and the methodology has not been standardized internationally yet. The level of its application is quite different among the NOWPAP member states. Japan is one of the leading countries in this field, so can introduce the knowledge and technology to the other NOWPAP member states.

CEARAC Secretariat proposed to organize a training course on eDNA analysis, and the proposal was approved at the CEARAC FPM and NOWPAP Intergovernmental Meeting.

The training course was originally planned to organize in March 2021. However due to the pandemic of COVID-19 in the world, it was postponed to March 2022. Pandemic is still continued and international travel is restricted. The main part of the training course is hands-on practices using the leading-edge equipment. Therefore, it is difficult to organize a training course online. Then, CEARAC Secretariat proposed to cancel the training course in the 2020-2021 biennium and re-proposed it for the 2022-2023 biennium. This proposal was approved at the 18th CEARAC FPM held virtually in August 2021, and CEARAC FPs asked the Secretariat to develop education materials on eDNA. Following their suggestions, the Secretariat is now making a video manual on eDNA analysis (including PCR and Data analysis) with strong support from Prof. Toshifumi MINAMOTO, Kobe University and Prof. Akihide KASAI, Hokkaido University. At the end of November, video was shot at the Kobe University.

The developed video manual will be opened on the CEARAC Website and YouTube in February 2022.



2-3. Case studies of estimating seagrass blue carbon in the selected sea area in the NOWPAP region

In recent years, the potential of blue carbon (carbon sequestration in ocean) for its function to mitigate climate change has gotten attention worldwide. National experts nominated by CEARAC Focal Points have been carrying out case studies on estimating seagrass blue carbon in selected sea areas (table 1) in the NOWPAP member states using the Seagrass Mapper and Seagrass Trainer, cloud-based mapping tools developed by NOWPAP CEARAC and Ministry of the Environment of Japan.

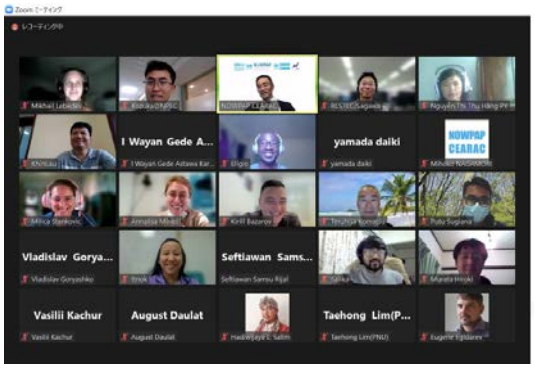
In some selected sea areas, samplings of seagrass leaves and their growing sediments were taken in their luxuriant growth period to estimate the amount carbon captured in seagrass ecosystem. Summary of the case studies will be introduced in a booklet for seagrass conservation in the NOWPAP region to be published from NOWPAP CEARAC in 2022.

Table 1 Lists of national experts for case studies of estimating seagrass blue carbon in the NOWPAP region

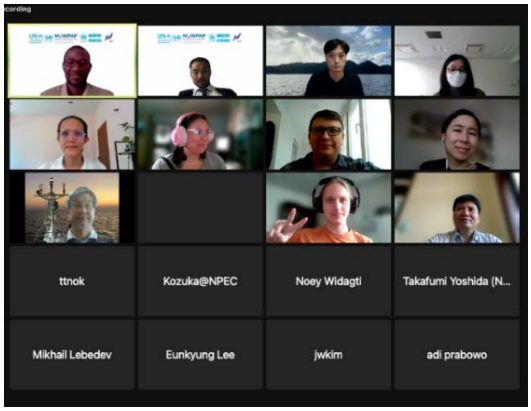
Experts	Organization	Country	Case Study Area
Dr. Qinghui XING	National Marine Environmental Monitoring Center	China	Swan Lake
Dr. Gregory N NISHIHARA	Nagasaki University	Japan	Ohmura Bay
Dr. Seung Hyeon KIM	Pusan National University	Korea	Dongdae Bay
Dr. Vasilii ZHARIKOV	Pacific Geographical Institute, FEBRAS, Russia	Russia	Srednyaya Bay

2-4. Organization of the 5th NOWPAP Training Course on Remote Sensing Data Analysis

Capacity building in the field of ocean remote sensing in the NOWPAP region is one of the mandated tasks of CEARAC. CEARAC organized the 5th NOWPAP remote sensing training, our first remote sensing data analysis training in a webinar style in December 2021. Webinar 1 for mapping seagrass by optical sensors was organized from November 30 and December 2, and 18 people from 5 countries received the certificate of participation. Seagrass habitats are a valuable coastal ecosystem in terms of maintaining marine biodiversity and mitigating climate change by absorbing and storing carbon. During the webinar, participants learned key factors for accurate mapping of seagrass habitats and got familiar with the Seagrass Trainer and the Seagrass Mapper.



Webinar 2 for Monitoring and Assessment of Water Quality by Ocean Color Remote Sensing was organized from December 14 to 16, 2021, and 20 people from 7 countries received the certificate of participation. Water quality monitoring is becoming an increasingly important aspect of protecting marine resources and coastal ecosystems from human related eutrophication that result in their degradation. During the webinar, participants were introduced to several tools developed by CEARAC to help protect the coastal marine environment. One of the tools is the Global Eutrophication Watch running on Google Earth Engine. It is used for rapid screening of coastal eutrophication with satellite-derived chlorophyll data. The other is the online match-up tool that will help improve satellite data product algorithms through collection of ground truth data.



Participants were also introduced to data processing and analysis of ocean color remote sensing data. They learned how to download the data provided by the Marine Environmental Watch of NOWPAP, how to create temporal composites, animations, and how to extract point or box time series. The instructor, Dr. Elígio de Raús Maúre of CEARAC, also demonstrated how they can use the time series data to extract additional information such as finding temporal trends. This training should help people working in coastal water management get the required skills to use ocean color data from satellite remote sensing.

2-5. Improvement of the NOWPAP Eutrophication Assessment Tool (NEAT) for assessment and monitoring of eutrophication using satellite-derived chlorophyll-a

Coastal eutrophication is an issue of global concern. Therefore, UNEP is making efforts to create a global index of coastal eutrophication. However, the application of satellite ocean color data for the screening of coastal eutrophication is still in early days. The NOWPAP Eutrophication Assessment Tool (NEAT) is the only tool globally that uses satellite data in its screening of coastal eutrophication. Currently the application of the NEAT is contingent upon a single sensor that might reach end of life at any moment although in recent years the number of available ocean color sensors have increased significantly. For this reason and to make sure the continuity of the NEAT activity, CEARAC is working on the NEAT refinement project.

The project aims to incorporate satellite data products from recent ocean color sensors. In collaboration with experts from the NOWPAP member states, CEARAC is working on in-situ data collection that will help improve ocean color data product algorithms and will help generate a long-term consistent dataset to be applied with the NEAT. The data collection is done through the online match-up tool that was developed to help with ocean color data product validation. The final outcome of this project will be a long-term consistent satellite ocean color dataset useful for assessment and monitoring of eutrophication.

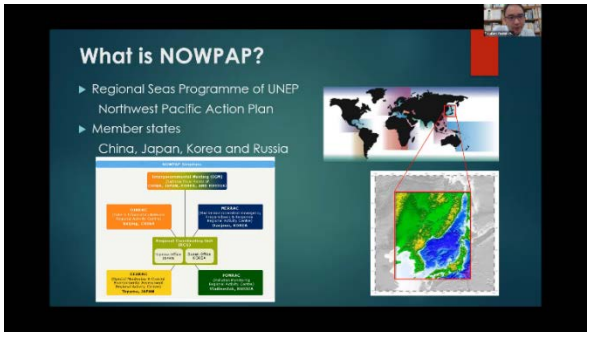
3. Cooperation with NOWPAP partners and organizations

3-1. PICES 2021 Annual Meeting

PICES Annual Meeting in 2021 was held virtually due to the pandemic of COVID-19. As same as past years, CEARAC was invited to PICES Business Meetings. Meetings which CEARAC Secretariat participated are as follows;

-**AP-NIS Business Meeting (27 September)**

The Advisory Panel on Marine Non-indigenous Species (AP-NIS) focus on the non-indigenous species in the North Pacific Region. They are interested in the new technology, eDNA for monitoring non-indigenous species easily. AP-NIS is one of the partners of the training course on eDNA analysis, and CEARAC Secretariat discussed with the members of AP-NIS on holding a joint training course. Unfortunately, the training course in the 2020-2021 biennium was canceled due to COVID-19, however, AP-NIS kindly agreed to support a training course to be held in 2023. CEARAC Secretariat will invite the members of AP-NIS to the Steering Committee in order to discuss the program of the training course.



-S-HAB Business Meeting (28 September)

The Section on Ecology of Harmful Algal Blooms in the North Pacific (S-HAB) is a long-time partner for CEARAC. During the meeting, the current situation on HAB in the member countries were reported. Members of S-HAB focused on the future collaboration with a new Working Group on Climate Extremes proposed by UN project. Marine heat wave is one of climate extremes and it influences HAB occurrences and the distribution of HAB causative species.

For the next PICES Annual Meeting, S-HAB members agreed to propose to organize a workshop: The Expansion of Harmful Algal Blooms from lower to higher latitudes, and a topic session: The effects of ocean acidification and climate change stressors on the ecophysiology and toxicity of harmful algal species.

-MEQ Business Meeting (29 September)

The Marine Environmental Quality Committee is the parent committee of AP-NIS and S-HAB. NOWPAP RCU and CEARAC participated in the MEQ meeting and CEARAC introduced the current and future projects which are related to MEQ activities. There are many common topics such as HAB, marine microplastics and eDNA; therefore, MEQ and NOWPAP agreed to strengthen collaboration.

-AP-CREAMS (30 September)

The Advisory Panel for a CREAMS/PICES Program in East Asian Marginal Seas (AP-CREAMS) is also an old CEARAC's partner. They supported to organize the past training courses of CEARAC. CEARAC asked AP-CREAMS to support the 5th NOWPAP Training Course on RS data analysis.

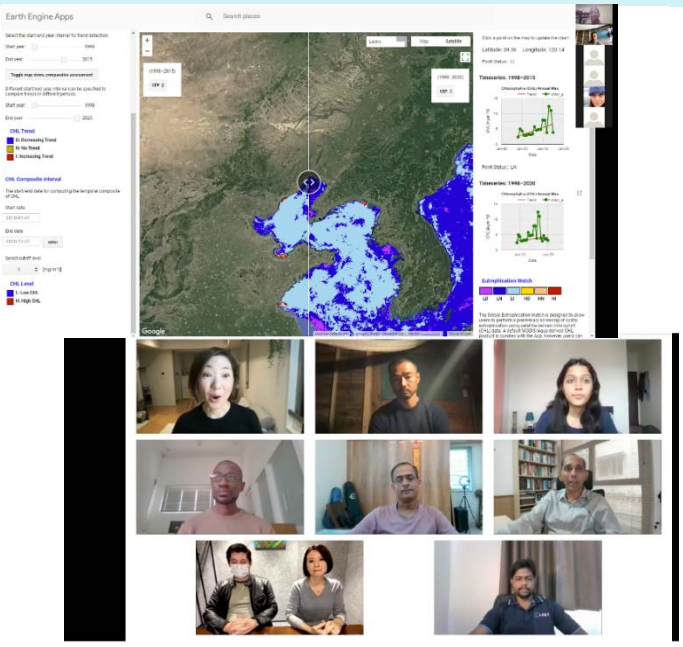
PICES expert Groups started how to contribute to the UN Decade of Ocean Science for Sustainable Development (UN Decade). UN Decade started in 2021 and it is expected that scientific information on ocean will contribute to the Sustainable Development Goals (SDGs). NOWPAP is UN family, thus we also have to contribute to UN Decade. It is expected strong cooperation between NOWPAP and PICES in the future.

In addition to the participation in the business meetings, the CEARAC Secretariat participated in the Workshop: Monitoring Essential Biodiversity Variables in the coastal zone held on 19 October, and introduced CEARAC's tidal flat mapping project. Essential Biodiversity Variables (EBVs), defined as the derived measurements required to study, report, and manage biodiversity change, focusing on status and trend in elements of biodiversity should play the role of brokers between monitoring initiatives and decision makers (GEO BON). Tidal flats/salt marshes are not EBVs' indicators, but they relate to several EBV classes. So, EBVs may be useful and applicable in the future CEARAC's activities.

3-2. Google Geo for Good Summit 2021

Geo for Good Summit is an annual conference organized by Google, LLC and it is geared toward nonprofits, scientists, government agencies and other change-makers who want to leverage mapping tools and technology for positive impact in the world. CEARAC has been attending this conference since 2016 trying to utilize Google Geo tools such as Google Earth Engine and Google Earth to promote CEARAC activities using remote sensing techniques.

Same as the last year Geo for Good 2021 was virtually organized from Nov 17 to 20 this year. Dr. Genki Terauchi and Dr. Eligio de Raús Maúre gave lightning talks to introduce Google Earth Engine based web apps Seagrass Mapper and Global Eutrophication Watch. A virtual meet up was also hosted by CEARAC to further develop Global Eutrophication Watch.

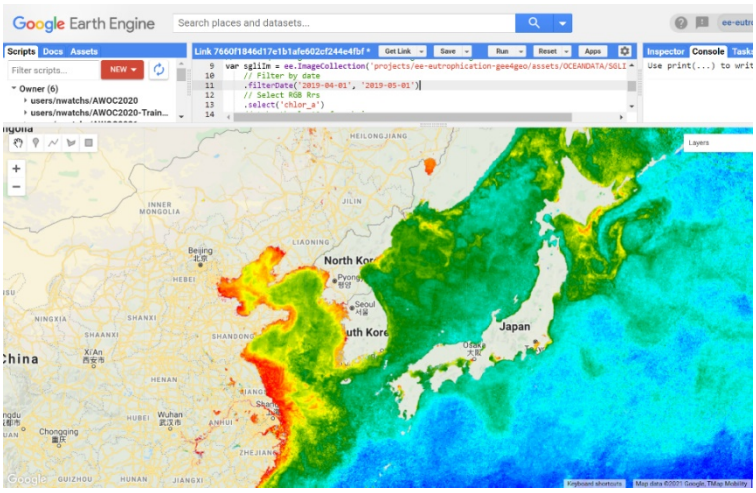


APAC Hour - Climate Science & Communication

3-3. Google Earth Engine for ocean color remote sensing research and applications: The case of AWOC/KJWOC

To promote the use of Google Earth Engine (GEE) within the ocean color community, Dr. Elígio de Raús Maúre of CEARAC introduced GEE to the Asian/Korea-Japan Workshop on Ocean Color (AWOC/KJWOC) community in 2018 when the 6th AWOC/15th KJWOC was organized by and held in the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) in Yokohama. In the presentation he provided introductory examples of the GEE potentials for large data processing to the community.

Due to the COVID pandemic, the first full online AWOC/KJWOC was organized in 2020 by JAMSTEC. During this 8th AWOC/17th KJWOC, the first GEE lecture with hands-on session was introduced to KJWOC/AWOC participants. Dr. Maúre was invited to deliver the training. Building upon past experience, in 2021, the organizing committee of the 9th AWOC/18th KJWOC, the Pusan National University, also decided to hold another series of GEE training and Dr. Maúre was again invited to provide the training to AWOC/KJWOC attendees on the applications of GEE in ocean color data analysis. These series of training are expected to continue in the future as the number of ocean color scientists interested in leveraging the use of the GEE for processing and analysis of ocean color data is increasing.



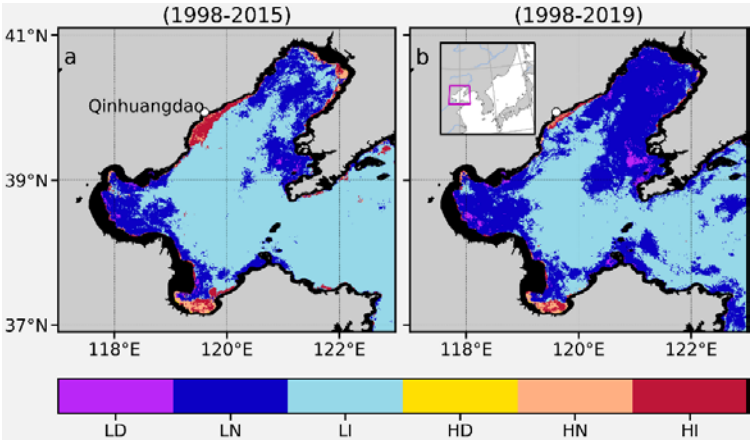
Screenshot of the SGLI monthly composite of chlorophyll data in April 2019 processed using GEE. The data has a spatial resolution of 250 m, which provide good advantages for applications in the coastal regions.

4. Hot News of 2021

Global Eutrophication Watch on “Nature Communications”

Dr. Elígio de Raús Maúre and Dr. Genki Terauchi of the Northwest Pacific Region Environmental Cooperation Center (NPEC), together with Prof. Joji Ishizaka of Institute for Space-Earth Environmental Research (ISEE), Nagoya University and members of Google LLC developed “Global Eutrophication Watch”, a planetary scale tool for a globally consistent assessment of coastal eutrophication and released it online.

Through the sole use of satellite derived CHL, a proxy for phytoplankton biomass, the tool evaluates the levels and trends of CHL of the world oceans and large lakes and classify them into six classes, that is, three associated with CHL trends (D-decreasing, N-no trend, and I-increasing) and two with CHL levels (H-high, L-low). In this way, a preliminary detection of eutrophication (LI, HI) and oligotrophication (LD, HD) potential waters throughout the world is enabled. Such a map provides coastal water managers with an indicator that help them decide where further assessment is necessary.



These results were published in the online edition of the British scientific journal “Nature Communications” on October 22, 2021.

Global Eutrophication Watch

https://eutrophicationwatch.users.earthengine.app/view/global-eutrophication-watch

Nature Communications

https://www.nature.com/articles/s41467-021-26391-9

5. 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. Nozomi SAKURAI	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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