

IMBeR West Pacific Symposium 2021

Session 8: Ecosystem, Biogeochemistry, and Interventions in the Western Pacific and its Marginal Seas: Beyond the Disciplinary Borders

November 22, 2021

Session Introduction

Anthropogenic perturbation is inducing the degradation of marine ecosystem services, which are the foundation of human society, and have affected economic activities and the welfare of coastal residents. Science-based policymaking is necessary for the sustainable use of marine ecosystem services under the on-going pressures. Preparing the best scientific knowledge to decision makers is an emergent request from society to scientists.

Co-moderators: Hiroaki Saito and Ying Wu

Rapporteur: Yixue Zhang

Number of Oral and Poster Participants: 23 (26 in the original plan)

Keynote speech (Jie Yin)

Flood Modeling and Emergency Response in Coastal Cities

-The study revealed the time series of annual maximum water levels and the evolvement of flood protection in Shanghai, the flood inundation is likely to occur in low-lying and poorly protected periurban/rural areas of the city even under the present-day sea level

-The pluvial flood modeling is able to accurately capture the general patterns of inundated areas at the city scale and the details of inundated areas at the street level.

Oral Presenter 1 (Masahiko Fujii)

-With high CO₂ emission scenario, calcifiers will suffer from too warm and too sour conditions in summer and winter, respectively, by the end of this century.

-It may be helpful that local coastal industries take adaptation strategies, such as raising calcifier larvae artificially in low CO₂ conditions.

Oral Presenter 2 (Charles Addey)

-This study adds to the current knowledge of the Northwest Pacific Ocean as a net sink of CO₂.

- The surface pCO₂ are most likely affected by the combined impacts of numerous dynamical processes such as the Kuroshio Current, lateral and vertical mixing, surface wind, and typhoons.

Oral Presenter 3 (Eun Young Kwon)

-Stoichiometric ratio of exported organic matter was proposed, and export C:P is up to 100% larger for the DOM than POM.

-Stoichiometric plasticity has large influence on net primary productivity and CO₂ uptake in oligotrophic gyres including the Northwest Pacific.

Oral Presenter 4 (Miaolei Ya)

-Different contributions of fossil fuel and biomass to PAH species were proved and the $\Delta^{14}\text{C}$ of PAHs were controlled by river input, atmospheric deposition, and coastal currents.

-Fluvial erosions and urban oil spills affect the $\Delta^{14}\text{C}_{\text{perylene}}$ in the estuary, and estuarine inputs and coastal currents affect the $\Delta^{14}\text{C}_{\text{perylene}}$ on the coasts.

Oral Presenter 5 (Chia-Jung Lu)

-Physical mixing and photobleaching resulted in the decline of FDOM in Otsuchi Bay.

-Excitation-emission matrix and parallel factor analysis (EEM-PARAFAC) makes it possible to distinguish DOM and POM into bio-labile and refractory organic matters and their sources.

Oral Presenter 6 (Weiqi Li)

-Sufficient light and nutrients in the transitional waters caused highest Chl a concentration between the plume front and sediment front off the Changiang river estuary.

-The distinct reduction of nutrient supply resulted in a relatively low Chl a in shelf water zone.

Oral Presenter 7 (Kristina Cordero)

- By means of a one-dimensional coupled physical-biological individual-based model, it was revealed the nutrient availability and copepod grazing were the main drivers the formation of the SCM in the Philippine Sea.

-It was estimated that the deepening of the SCM and the shift of the plankton population in response to an increase in temperature will happen.

Oral Presenter 8 (Zhixuan Feng)

-The regional hydrodynamic-ecosystem model makes it possible to reproduce nutrient and phytoplankton dynamics in the southern East/Japan Sea.

-East Korea Warm Current, the northward-flowing branch of Tsushima Warm Current, causes nutricline tilting and facilitates upward nutrient supply on the SE Korean coast via bottom Ekman transport.

Oral Presenter 9 (Siyu Jiang)

-The high phytoplankton growth rate in the oligotrophic central North Pacific was a result of the utilization of DON by dominated *Prochlorococcus*.

-At the equatorial EIO, the surface phytoplankton bloom was initiated by physical events induced nutrient enrichment and ceased by nutrient exhaustion.

Oral Presenter 10 (Young-Je Park)

-GOCI &GOCI-II data are useful to monitor *Saragassum* blooms in ECS and YS due their frequent and low-noise observations.

-Significant inter-annual variability in both location and density are observed for years between 2011-2021, and massive blooms in ECS was observed since 2012.

Oral Presenter 11(Hee Yoon Kang)

-An improved energetic balance in overwintering clams in warmer winters ensures the replenishment of nutrient reserves and the fast gamete development, consequently advancing the timing of spawning.

-Despite physiological benefits from warmer winter temperatures, the phenological shifts may make the clam populations more vulnerable to collapse as a result of a mismatch with seasonal food availability.

Oral Presenter 12 (Goutam Kundu)

-Intensification of TWC will reduce benthic-pelagic coupling.

-Pelagic food webs are more prone to the predicted environmental changes, and in future, fisheries could shift from pelagic to benthic.

Poster Presenter 1 (Yosuke Iida)

-The method of reconstruction was potentially used for evaluating sea-air CO₂ flux and carbon sink in the seas around Japan in combination with a proper atmospheric CO₂ product.

Poster Presenter 2 (Yunia Witasari)

No presentation

Poster Presenter 3 (Yan Chang)

-Use of $\delta^{82/76}\text{Se}$ values in ancient marine sediments as a proxy for the oxygenation history of the oceans and atmosphere make no allowance for fractionation of Se isotope by processes internal to the oceans, assuming that all Se isotope fractionation recorded in marine sedimentary rocks reflects oxidative weathering on the continents.

Poster Presenter 4 (Jing Zhang)

-Most produced PON exports to sediments, while some moves to the Tsushima Strait.

-Increasing DIN from the Changjiang puts environmental pressure on the outer shelf, and contributes 12-42% to the ECS carbon sequestration.

Poster Presenter 5 (Yoonja Kang)

-The polynomial regression models illustrated that the diatom-dominated microplankton biomass declined with increasing temperature and ammonium, while cryptophyte-dominated nanoplankton and cyanobacteria-dominated picoplankton biomass increased with a temperature increase.

-Small phytoplankton (nanoplankton and picoplankton) play a substantial role in the bay ecosystem, in which concerns regarding declining water quality and reduced nitrate are ongoing.

Poster Presenter 6 (Yi Xu)

- Trend analysis reveals that Chl tends to decrease during the SeaWiFS periods (1998-2007), and increase from 2008-2019 in the MODIS periods. This tendency is consistent with the sea surface temperature (SST) and wind stress curl trends, which suggest that the biology variability are attribute more to the oceanic processes.

Poster Presenter 7 (Kailin Liu)

-In the Gulf of Anadyr and Kamchatka Strait, phytoplankton high microzooplankton grazing rates were observed, indicating a strong top-down control.

-In the oceanic Bering Sea, the phytoplankton growth was not limited by macronutrient, but could be limited by Fe availability

Poster Presenter 8 (Yixuan Li)

-Significant variation in diel vertical distribution of mesoplankton communities indicates the diel vertical migration (DVM), of which the pattern differed between the continental shelf and continental slope.

-The ratio of rRNA and rDNA revealed metabolically active lineages as Acantharia and Ciliophora in the continental shelf, and Annelida in the continental slope, which were highly affected by temperature and nutrient concentration.

Poster Presenter 9 (Sang Rul Park*)

No presentation

Poster Presenter 10 (Subrata Kumar Ghosh)

-Temperature changes drive significant dysbiosis in the gut and skin microbiota of chum salmon with potential risk to its immunity.

-Chum salmon microbiota is assembled by environmental selection due to temperature change in the gut.

Poster Presenter 11 (Sk Istiaque Ahmed)

-Some clusters of fish determined by eDNA analysis are only distributed in either upstream or downstream and controlled by the Kuroshio front.

-The dominant species in each cluster co-exists with some other species which indicates ecosystem functioning of that area.

Poster Presenter 12 (Ben Li)

-Wind farms should not only be avoided in natural coastal wetlands, i.e., the four important habitats for waterbird conservation on the Chongming Islands, but also in a

buffer zone (800-1300 m) behind these natural wetlands defined according to the characteristic movements of waterbird species.

Poster Presenter 13 (Hyun Je Park)

No presentation

Poster Presenter 14 (Florina Richard)

-The oil palm area in Betong increased by 60.72km² from 2013 to 2018 and decline in fish population may be linked to the OP land use change

-There is a promising potential in using Landsat-8, ML techniques and the Open Data Cube to detect oil palm land use.

Session Summary

Marine ecosystems are under anthropogenic perturbations such as global warming, ocean acidification, coastal development. However, our understanding on the complex and diverse ecosystem structure and dynamics of the biogeochemical cycle, and their response to climate change is limited. As well as remote sensing sensors and molecular biological techniques, mathematical simulation of marine system progress a lot in recent years. However, the lack of data (eg. nutrients in rivers, coastal topography, stable isotope composition) prevent the data assimilation of the models. Development of fine-scale or end-to-end models with high predictability is a emergent issues to understand the mechanisms of ecosystem response to anthropogenic forcing, forecast the future and support best decision making. To advance the study, it is essential the combination of the study to understand the mechanisms of ecosystem change and development of state of art models beyond the disciplinary borders. IMBeR provides a great platform for inspirations of new ideas and many collaborative studies. The future efforts could focus on the model applications to ecosystems and human systems, to meet the emergent risk of global warming and other issues.

New IMBeR West Pacific Marine Biosphere Research projects/directions for the next three years from this session (one or two bullet points)

- ✓ Accelerate the studies of the structure and dynamics of marine ecosystems in the western Pacific and its adjacent seas where rapid economical growth and increase in population degrade the marine ecosystem services.
- ✓ Development and improvement of the biogeochemical and ecosystem models and its application to ecosystems and human systems.
- ✓ Data collection by each scientist, organization, country and the promotion of data sharing to realize better data assimilation in mathematical models.