The estimation of CO_2 flux in subtropical coastal ecosystems using a numerical model

*Hirotada Moki[1], Akio Sohma[2], Takashi Shibuki[3], Takeshi Toyoda[3], Anirban Akhand[1], Kenta Watanabe[1], Tatsuki Tokoro[1,4], Tomomi Inoue[5], Hiroya Yamano[5], Masayuki Bannno[1], Yasuyuki Nakagawa[1,6], Hiroyuki Matsuda[7], Tomohiro Kuwae[1]

1. Port and Airport Research Institute, 2. Osaka City University, 3. Mizuho Information and Research Institute, Inc., 4. National Research Institute of Fisheries and Environment in Inland Sea, 5. National Institute for Environmental Studies, 6. Kyushu University, 7. Yokohama National University

Coastal ecosystems can play a role in climate change mitigation. One of the appropriate way to accurately quantify and predict the role is the utilization of numerical models. The mitigation effects can be facilitated by CO_2 uptake by net primary producers such as mangroves, zooxanthella in coral reef and seagrasses.

In this study, we developed a new ecosystem model that incorporates the biogeochemical processes of mangroves, tidal flats, seagrass meadows, lagoons, and coral reefs. We estimated CO_2 fluxes between air and the ecosystems and carbon burial rates in Yaeyama islands, Japan, which is the model site. In the future prediction, we selected two scenarios of representative concentration pathways, low emission (RCP2.6) and high emission (RCP8.5), adopted in IPCC 5th Assessment Report and compared the model results in 2010 and 2100. The output of HadGEM2-ES from CMIP5 models were used as the boundary data.
Our model results showed that the mangrove absorbed CO_2 more than other ecosystems because of direct uptake of CO_2 from the air. The maximal carbon burial rate was found in the mangrove. Additionally, the inflowing of open waters affected the air-ecosystem CO_2 flux and carbon burial rate near the open boundary. We will also present the result of comparisons between the model results and observed data.

Keywords: Ecosystem model, Subtropical coastal ecosystem, Air-ecosystem CO2 flux, Carbon burial rate, Future prediction

