Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

ACG35-01 Room:101A Time:May 22 15:45-16:00

Carbon dioxide dynamics in coastal regions of Osaka Bay

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Measurement technique of CO_2 for coastal seas is developed and applied to elucidate CO_2 dynamics in the coastal regions, where the photosynthetic rate is far larger than that in the open sea and the short-term change is significant. Continuous measurements of salinity, pH and DO were conducted at three stations in Osaka Bay. The values of CO_2 related terms were calculated using a classical method that uses pH and total alkalinity. Dissolved inorganic carbon (DIC) and DO fluctuated with high correlation (R^2 = 0.97). This suggests that CO_2 system can be measured by this method in coastal regions. DO and pCO_2 (CO_2 partial pressure) records in the eastern Osaka Bay, where primary production is significant, indicated prominent diurnal variations which correspond to diurnal irradiation variations. In contrast, magnitudes of DO and pCO_2 variations were smaller in a well mixed reason in the western Osaka Bay.

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Sediment phosphorus content and its potential release in the coastal area of Seto Inland Sea Japan

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Eutrophication is an important world-wide problem and became a heated debate recent years. In many costal sea areas around the world, Such as Tokyo bay and Baltic Sea, the Phosphorus (P) plays a key role in this process; the Kojima bay is located in Okayama prefecture and is an important water flow to the Seto inland sea .the P load to the Seto inland sea appears to have important effect to the eutrophication in this area. Kojima Lake is formed by enclosing the dike in 1959, so research of the effect of P formation to the environment is important and interesting. Our studies is mainly focused on the effect of phosphorus in sediment and the overlying water samples in Kojima bay and Kojima Lake

Surface and core sediment samples were collected both in Kojima bay and Kojima Lake in this study. the surface sediment samples were collected by box sampler, the core samples in Kojima lake were taken by piston core sampler while the cores in Kojima bay is taken by diver .using acrylic tubes(7-8 cm diameter) . Pore water samples were also extracted by centrifuge and the nutrient in pore water, near bottom and surface water samples were determined in the laboratory with a spectrophotometer (Bltec Swaat autoanalyser). We use the ^{210}Pb activity and ^{137}Cs activity to determine the sedimentation and dating data of the core samples. In this study, a Six step extraction method of P in sediment was used to describe the chemical species of P. by divided the P into active forms (loosely sorbed P, Redox sensitive P) and immobile forms (Oxide metal bound P, apatite P and residue P),

The sediment phosphorus content in surface sediment samples are higher in the lake samples(average 27micro mol/g in 7 sites) than in the bay samples(average 14micro mol/g in 20 sites), while the higher pore water samples and water samples both showed higher in bay samples than in lake, It may indicate that the higher stabilization form of Phosphorus in Kojima Lake surface sediment with lower possibility of transportation in releasing to pore water and overlying water. P fractionation results shows that redox sensitive P forms is the critical P forms leading the variation of phosphorus which related to the iron content in sediment, dissolved Iron and Manganese showed the lower content in lake water volume. The core samples showed that phosphorus content showed decreasing after it was deposited with the increasing of P content in pore water, The redox sensitive phosphorus content decrease sharply with the increasing of loosely sorbed phosphorus, pore water phosphorus and salinity at the down core, This represents the releasing of phosphorus content form sediment after the sediment deposited with the low oxygen condition and higher salinity in the deep layer of the sediment. The relatively high Salinity with pH in Kojima bay will inhibit phosphate adsorption onto Fe oxides/hydroxides. Also, the concentration of Fe oxides/hydroxides is reduced in sulfide environments by the formation of solid Fe sulfides and if sulfate-reduction rates are controlled by sulfate concentrations. This may be able to be one of the main reasons for the variations of phosphorus content in coastal bay and lake sediment. The relatively high concentrations of dissolved P associated with riverine inputs in Kojima Bay are to some extent buffered by the relatively high concentrations of suspended sediments resulting from tidal flows. Phosphorus may be released during transport to the sea due to decreases in the active phosphorus forms, increases in salinity and release from bottom sediments as a result of low oxygen conditions.

Keywords: Sediment, Kojima Bay, Phosphorus, Fractionation, Release

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Impacts of the 3D nutrient-transport by the Kuroshio on the land-sea biogeochemical interaction in the western North Pac

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The Kuroshio, the western boundary current in the North Pacific, plays major roles in transporting heat and organic/inorganic materials from the subtropical region to the subarctic one, and moreover from the coastal region to the offshore one. The Kuroshio undoubtedly must impact on the ecosystem in its neighboring and downstream regions, however it is generally recognized as a mere boundary between the oligotrophic Subtropical waters to the south and the more productive coastal or subarctic waters to the north. Surprisingly neither quantitative nor qualitative researches have advanced to clarify the actual distribution of nutrients in the Kuroshio region with focus on the impacts of the jet, the core of the current maximum. The transport of nutrient and its impacts on the ecosystem have been still unknown mainly because of lack of simultaneous measurement of both horizontal and vertical fluxes of nutrients around the jet.

In order to clarify the 3D distribution of the water properties in the Kuroshio region and to estimate horizontal and vertical fluxes of nutrients and their impacts on the productivity in the surrounding and downstream regions, an intensive observation was conducted in Apr. 2009 and historical hydrographic data were analyzed. The observation was carried out by the R/V Tansei-maru at intervals of 10 miles along the 5 lines crossing the Kuroshio south of Japan. It obtained the 3D distribution of the water properties by CTD with multi- profilers and bottle-samplings, the horizontal velocity by the shipboard and lowered ADCP, and the vertical turbulent diffusivity by the microstructure profiler. As a result we detected that maxima of nitrate, silicate, phosphate and AOU were located along the jet on the isopycnal surface of 24.5-26.0sigma-theta. It is the first detection of the nutrient/AOU maximum along the Kuroshio jet, and the structure is analogous to the characteristic one well-known as Nutrient Stream found in the Gulf Stream region. Moreover, the nutrient/AOU maximum along the Kuroshio jet was also detected on the 24.5-25.5sigma-theta surface in spring in the whole region of the Kuroshio, by analyzing the historical data of JODC.

It should be emphasized that the nutrient concentration on the isopycnal surface of 24.5-25.5sigma-theta gradually decreases along the jet toward the downstream region. It implies that the high nutrient water is originated from the upstream and its adjacent coastal regions and transported downstream epipycnally along the Kuroshio as is the case with the Gulf Stream. Our observation estimated the maximum of the epipycnal nitrate flux at 10mmolNm^{-2}s^{-1} around the 26.0sigma-theta surface just beneath the current maximum of the Kuroshio jet. A part of the flux is served out to both the northern and southern sides of the jet due to eddy diffusivity, and especially on the northern side the nutrient transport is important for the new production under sufficient irradiance.

Moreover our observation clarified quantitatively that nutrient is supplied upward more intensively on the jet and its inshore side than the offshore side due to higher diapycnal mixing observed by direct measurement of microstructure. The diapycnal flux of nitrate amounts to 3.0x10^{-6} mmolNm^{-2}s^{-1} at the 25.0-25.5sigma-theta just above the core of the epipycnal flux, indicating that the high nutrient transported epipycnally along the jet is supplied efficiently upward by the strong diapycnal mixing and that it contributes significantly to the spring new production around the Kuroshio.

Importantly, on the northern side of the Kuroshio Extension the water mass of 25.0-25.5sigma-theta is distributed at the upper part of the euphotic layer in spring, as a result the nutrient flux via the Kuroshio jet contributes the high productivity around the region, where enhanced concentration of chlorophyll can be seen from the ocean-color map and favorable habitats are formed for various pelagic fishes.

Keywords: Kuroshio, Nutrient Stream, diapycnal flux, epipycnal flux

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Dynamic response of a sporadically opened lagoon to land and sea

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Four coastal lagoons in Tokachi, Hokkaido, are sporadically opened to the Pacific Ocean by breaking gravel bars due to overflow. One of the lagoons, Oikamanai Pond, is opened to the ocean about four times per year. The water budget of the lagoon was estimated by hydrological and meteorological observations. As a result, during non-rainfall periods, the net groundwater output to the surrounding marsh was evaluated, of which the magnitude exhibited the linear relationship with the water level (m asl) of the pond. Hence, it is suggested that the groundwater output to the sea thourgh the gravelly confined aquifer prevais rather than the unconfined groundwater output to the marsh.

Keywords: coastal lagoon, sporadical opening, water budget, marsh, Pacific Ocean

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Variabilities of isotope ratios and turbidity of the Yangtze River water and their impacts on the East China Sea

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Water discharge and suspension load of a river are potentially recorded in sediments in the drainage and / or the river mouth. Isotope composition of fossil calcareous skeletons and detrital provenance and flux reconstructed from the sediment samples could provide us useful proxies for paleoclimatic study. Sediment load from the Yangtze River to the East China Sea (ECS) from the delta to the Okinawa Trough have been widely used to reconstruct the East Asian summer monsoon (EASM) in the past since the water discharge from the Yangtze would be highly affected by monsoon rain, which could deliver much fresh water and sediment to the ECS. The past impact of fresh water from the Yangtze could be reconstructed from stable oxygen isotope signal recorded in the fossil calcareous skeletons found in the ECS sediments, which has also been used as proxy for EASM.

Theoretically, sediment provenance and its yield could be changed from time to time depending on the distribution of precipitation which would control the balance of water discharges from the tributaries. Change in the precipitation distribution also affects the water isotopic composition of each tributary and then the main stream of the Yangtze. Although such variability could change the end-member composition and concentration of the fresh water and sediment load provided to the ECS, paleoceanographic studies in this region have not considered well about the potential change in the basic condition. Therefore, we need to know the water isotope and sediment budget along the Yangtze main stream with regards to the inputs from its major tributaries in order to understand the potential effects from the change in the distribution of the EASM precipitation.

For this purpose, we have started a systematic sampling of the Yangtze River water to determine the stable oxygen and hydrogen isotope ratios and suspension loads as well as the ECS surface water since summer in 2011. We will report the seasonal variations of isotope and turbidity of the River water in comparison with the distribution of surface water mass in the ECS.

Keywords: Yangtze, Oxygen isotope, Hydrogen isotope, Suspended matter, East China Sea, East Asian monsoon