Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

ACG035-01 Room:201A Time:May 27 10:45-11:00

Effect of Climate Change on Nutrient Discharge to Coastal area, Western Japan

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This study investigates the effect of climate change on nitrogen and phosphorus discharges from a watershed in western Japan. Numerical simulations for a 30 year period (1977-2007) demonstrate annual precipitation has decreased over the study period as well as loads of nitrogen and phosphorus. Nutrient fluxes were estimated using the SWAT model. The estimated phosphorus flux is more highly correlated with precipitation than nitrogen flux. The results suggest a high correlation between phosphorus and discharge but during high precipitation years phosphorus loads have decreased. A sensitivity analysis of parameters for phosphorus discharge showed the most sensitive parameter is support practice factor. Consequently, phosphorus flux would decrease from the Asahi River watershed in the future, because precipitation has decreased and as such so has the driving force for soil erosion, the primary source of the nutrients.

Keywords: Climate Change, Nutrient, SWAT, Seto Inland Sea, Asahi River

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ACG035-02 Room:201A Time:May 27 11:00-11:15

Difference in supended transports of the Ishikari and Tokachi Rivers affected by seasonal precipitaion varability

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Most of rivers in Japan are rapid rivers characterized by steep riverbed and strong ability for erosion. Rapid rivers can transport a large amount of materials to the ocean in spite of their small size, especially, on the high discharge events. Japanese Islands are situated under the influence of the east Asian summer monsoon which brings a lot of rain by frontal activity and typhoon. Northern part of Japan is also characterized by heavy snow in winter that is brought by very moist cold air mass from the east Asian winter monsoon wind passing on the warm current in the Japan Sea. The snow melt water in spring also promotes another high discharge event there. Thus, the rivers in Hokkaido, a northern island of Japan, are characterized by two seasonal discharge events both of which are controlled by the east Asian monsoon climate. Such condition of rivers in Hokkaido enables us to examine the relationship between discharge events and abilities of material transport under control of monsoon climate.

During high discharge (flooding) event promoted by typhoon rain, the Tokachi river exhibited highly erosive feature where the concentration of suspended materials was proportional to a square of water discharge. A single flooding event could transport more than half of total transport of suspended matter in a year. These case studies suggests the significance of turbulence of flow on suspension transport, which controls the total amount of materials transported to the ocean.

Snow melt discharge event occurs more gently than peaky flooding event promoted by heavy rain, but the duration is long lasting for two months. In the case of Ishikari River, suspended matter is dominantly transported during snow melt season, which is different from the case of the Tokachi River. This is because the concentration of suspended matter of the Ishikari River is approximately linearly proportional to the water discharge. Though the significance of high discharge events for suspension transport is common for small rivers in Japan, it is still difficult to distinguish snow melt event from heavy rain event. We need to be careful to interpret the reconstructed riverine flux as winter signal or summer one.

Keywords: river, suspension transport, precipitation, monsoon, Ishikari River, Tokachi River

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ACG035-03 Room:201A Time:May 27 11:15-11:30

The effects of river fluxes on river plume behaviors: Yukon River and Bering Sea

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Satellite images show that the sediment plume is developed off the estuarine delta of the Yukon River, Alaska. In order to explore how the river fluxes affects the plume behaviors off the Yukon delta, time series of discharge, sediment load and chemical flux were obtained at a downstream point of the Yukon River, Alaska, and marine observations were performed off the delta in June 2007 ? September 2009. Meanwhile, the plume area was obtained by using three near-infrared bands of MODIS/Aqua. As a result, there is the significant correlation between the plume area and the Yukon discharge or sediment load in spite of the northern winds opposite to the advance of the plume.

Keywords: Yukon River, Bering Sea, glacier-melt, MODIS, river plume

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ACG035-04 Room:201A Time:May 27 11:30-11:45

spatial variations and chemical characters of sediment phosphorus in an artifical lake and Kojima bay

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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 accumulation rates (SAR) and the sedimentation of P in Kojima lake (SAR=4300g m^{-2} y^{-1} , P=140.1mmol m^{-2} y^{-1}) are higher than that in Kojima bay (SAR=3500g m^{-2} y^{-1} ,P=82.4mmol m^{-2} y^{-1}). The sediment phosphorus content in both surface and core samples are higher in the lake samples than in the bay samples, while the pore water samples and water samples both showed higher in bay samples than in lake, It may indicate that the P supply of Ashahi River is at very high level than Kurashiki and Sasagase River. While the retention of P is lower in Kojima bay because of the high water flow of Ashahi River. After the dike constructed .the Kojima Lake seems to act as a trap for material transported from the open sea. Kojima Lake seems has richer phosphorus content than in the Kojima bay.

In Kojima bay the surface sediment P fractionation and sediment core seems to be more uniform and of same size of P pool rather than P fractionation in Kojima lake .this could also indicate that the early diagenetic process may have enough time to transform the deposited P into the more immobile forms and at last buried forms. The content and the more rivers supply leads more uniform quality and quantity of P resources deposited in the sediment in Kojima bay. The low SAR value in Kojima bay may suggest that it is more vulnerable to be the transportation of sedimentation process. The more uniformed and immobile phosphorus forms in Kojima bay than in Kojima lake leads to a higher burial efficiency of phosphorus at 55% in Kojima bay sediment compare to that of Kojima lake (35%), The efflux of losing P through the time at a prediction value of is lower in Kojima bay at 0.71 mmol m^{-2} $y^{-1}$is lower than the inner site 0.97mmol m^{-2} y^{-1}

In this study, the Kojima bay and part of bay changed to Artificle Lake 50 years ago, the environment changes leads to a very interesting results. The Kojima Lake has higher sedimentation value than the bay samples. But with lower burial of P and higher efflux of P, P fractionation revealed that most part of P sediment in sub layer of sediment is in forms prone to be stable with the depth increasing. While in surface layer is prone to be release under anoxic condition or other digenetic process.

Keywords: sediment, phosphorus, fractionation, artifical lake

Japan Geoscience Union Meeting 2011
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ACG035-05 Room:201A Time:May 27 11:45-12:00

Nutrient discharge in a large tidal slope

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To clarify spatial variation of nutrient discharge in one of a largest tidal slope of Seto Inland Sea, we observed subsurface flow and dissolved nitrogen, phosphorus, and silica, using piezometer and tracer method. The study area is located on Saijo city, Ehime prefecture, western Japan. The tidal slope has the width and length of 1km. We installed three piezometers for observing water potentials, collected pore water samples at the about 50 plots, and monitored 222Rn of seawater at the edge of the tidal slope.

The 222Rn and salinity of pore water indicated that discharges of shallow groundwater at the landside and deep groundwater at the shoreside of the tidal slope, respectively. The discharge volume was larger in shallow groundwater than in deep groundwater. The nutrient included the nitrogen as well as phosphorus and silica. Based on this observations, the large contribution of nutrient was confirmed from groundwater to coastal area.

Keywords: tidal slope, nutrient, groundwater, seawater, Radon

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ACG035-06 Room:201A Time:May 27 12:00-12:15

Movement of hypoxia in strongly enclosed waters of ports and harbor

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We conducted field observations in relation to hypoxia which occurs in strongly enclosed waters, such as ports and harbors, and examined generation mechanism and movement of hypoxia. Diurnal variations in hypoxia were driven by tide and wind in the strongly enclosed waters in the head of Osaka Bay. It was found that processes of the organism decomposition, oxygen consumption and carbon dioxide generation were different in and out of the ports. In the spring and summer when the water column is stratified, surface water absorbs CO_2 and bottom water stores CO_2 in strongly enclosed waters. On the other hand, in the end of summer, the stored CO_2 upwells to the surface and causes spontaneous emission because the north wind induces the upwelling.

Keywords: strongly enclosed waters, hypoxic water mass, carbon dioxide, wind drift, upwelling

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ACG035-07 Room:201A Time:May 27 12:15-12:30

Groundwater under the seabed

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A rapid increase of population in the world causes growth of water demands, and this may result worldwide water shortage in future. Especially, in the coastal area, water resource development becomes important because the half of the world population is concentrated in this area. Recently, countermeasures to mitigate climate change are discussed. Coastal area is one of the promising places for disposal of high-level nuclear waste or carbon dioxide capture and storage. Lots of development will be conducted in the coastal areas, however there are a lot of uncertainties remaining to understand the hydrogeological environment in there.

It has been said that salt water / fresh water interface is formed in the place where meteoric fresh groundwater and salt groundwater from the ocean meet, and there is a large amount of groundwater discharge on the seafloor of the end of this interface so far. Recently, there is a lot of research about this submarine groundwater discharge because of the protection of the coastal ecosystem. In addition, there is a report that fresh water under the seabed was discovered on the continental shelf away from a present coastline by tens of kilometers in many parts of the world, because recently offshore drilling technology has been improving. Classical theory about formulation of salt water / fresh water interface could not explain completely, and consideration of long-term geochemical process (e.g., sea level fluctuations) is needed to understand this mechanism.

Fresh (or brackish) groundwater under the seabed have been found on the investigation related to a seabed resources exploration in the field of coal mining, oceanic engineering works such as submarine tunnels, the atomic research, and the collection investigations of the basic data in the earth science field. A lot of fresh water under the seabed is confirmed on the offshore side from a present coastline as for these cases, and it is suggested that the end position of the salt water / fresh water interface (position of the submarine groundwater discharge) may appear on the seafloor. Moreover, neither the salinity concentration nor the groundwater age depends on depth. It is thought that it is because that the groundwater forms the complex flow situation through the change in a long-term groundwater flow system.

The technology to understand the coastal groundwater flow consists of remote sensing, geographical features analysis, surface of the earth investigation, geophysical exploration, drilling survey, and indoor examination and the measurement. Integration of each technology is needed to interpret groundwater flow system because the one is to catch the local groundwater flow in the time series and another one is to catch the long-term and regional groundwater flow in the general situation.

The purpose of this study is to review the previous research of coastal groundwater flow, and to integrate an applicable evaluation approach to understand this mechanism. In this presentation, the review of the research and case study using numerical simulation are introduced.

Keywords: Continental shelf, Water resource, Groundwater flow, Salt water / fresh water interface, Sea level fluctuations

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ACG035-08 Room:201A Time:May 27 12:30-12:45

Spatial distribution and seasonal variation of submarine groundwater discharge in the coastal area of Seto Inland Sea

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Recent studies have revealed that submarine groundwater discharge (SGD) is one of the important pathways for nutrients and the other dissolved materials such as carbon and trace metals from terrestrial area to the marine environment. Seto Inland Sea is the largest semi-enclosed coastal sea in Japan. Recently, some researchers tried to estimate SGD at the specific area of the Seto Inland Sea by field research and numerical model approach. Nevertheless, deep (confined) groundwater discharge was not evaluated in these studies. The objective of the study is to confirm the spatial distribution and seasonal variation of SGD including both of shallow and deep groundwater in the coastal area of Seto Inland Sea. The study area is southwestern part of the Hiuchi-Nada located in central part of the Seto Inland Sea, and has a size of approximately 30 km $*$ 13 km. We conducted the measurement of vertical profiles in salinity and water temperature at 13-15 sampling stations in July and November 2011. Radon-222 (222Rn) concentration was measured at surface and bottom layers using electronic radon detector (RAD7, Durridge Co.). Radon-222 (222Rn) is one of the useful tracers of SGD because groundwater has extremely high concentration in 222Rn compared with river water and seawater.

Vertical profiles of salinity and water temperature indicate the presence of stratification with a pycnocline at depth of about 5 m in July, whereas it was completely mixed in November. 222Rn concentration in the surface layer was relatively high in the several sites near the coast line. Meanwhile, in the bottom layer, high 222Rn concentration was detected in the offshore area at southern part of the study area in both July and November. Therefore, the result indicates that deep (confined) groundwater discharge from seafloor throughout the year.

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Keywords: submarine groundwater discharge, spatial distribution, seasonal variation, coastal area of Seto Inland Sea