Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

AHW27-01 Room:301B Time:May 24 09:00-09:15

Groundwater leakage and river runoffs in a tectonic and forested catchment

CHIKITA, Kazuhisa[1*] ; HOSSAIN, Md motaleb[2] ; SAKATA, Yoshitaka[1] ; MIYAMOTO, Takuto[2] ; OCHIAI, Yasuhiro[2]

[1]Faculty of Science, Hokkaido University, [2]Graduate School of Science, Hokkaido University

In order to understand how groundwater leakage in a tectonic catchment occurs and is connected to river runoffs, a water balance was estimated and a runoff analysis was performed in the geologically active and forested (88.3% in area) Oikamanai River catchment (area, 62.6 km2), Hokkaido, Japan. The geology in the catchment is early Miocene to Pliocene sedimentary bedrocks with many faults and forest soils include permeable, late Pleistocene pyroclastic deposits. Daily evapotranspiration, E, in water balance was calculated by applying the one-layer model to meteorological data in the rainfall season of 2011-2012. Then, topographic effects on heat balance of the catchment were explored. The coupling with the short-term water balance method for river runoff events allows us to estimate groundwater leaking to the other catchments. As a result, the leakage occupied 50-80 % of effective rainfall (=P-E: P, rainfall) in 2011, while it was nearly zero in 2012. The tank model with consideration of the leakage was applied for simulating daily mean hydrographs. The large leakage in 2011 and nearly zero leakage in 2012 were produced by the modelling.

Keywords: groundwater leakage, fault, actual evapotranspiration, water balance, runoff analysis, heat balance

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AHW27-02 Room:301B Time:May 24 09:15-09:30

Sediment loading processes in a geologically active and forested catchment

HOSSAIN, Md motaleb[1*] ; CHIKITA, Kazuhisa[2] ; SAKATA, Yoshitaka[2] ; MIYAMOTO, Takuto[1] ; OCHIAI, Yasuhiro[1]

[1]Graduate School of Science, Hokkaido University, [2]Faculty of Science, Hokkaido University

Exploring fluvial sedimentary processes on catchment scale is useful for studies on the forest management, material cycle and ecosystem of short time scale and topographic evolution of long scale. The fluvial transportation of sediment is also related to sedimentation, material cycle and ecosystem in coastal regions. Erosion and sedimentation process decline soil fertility and decrease agricultural yields. A considerable portion of suspended sediment discharging into a costal lagoon, the Oikamani Lagoon, Tokachi, Hokkaido annually is contributed by the forested Oikamanai River catchment with many tectonic faults. It is important to find out the sediment source in such forested catchments. Here, we have tried to find how sediment load occurs by rainfall and snowmelt runoffs in the forested (ca. 90% area) catchment. Grain size and mineralogy of catchment soil and stream sediment, survey techniques, and turbidimeters provide the information that allows us to understand fluvial sedimentary processes and the sediment source and its availability. Here, a semi-distributed model, ArcSWAT2012, was applied to time series of discharge and sediment load, which were obtained in 2011 to 2013. In ArcSWAT2012, the total basin area (62.48 km2) was divided into 3 sub-basins, as subbasin into hydrological response unit (HRU) based on soil type, land use and slope classes that allow a high level of spatial detail simulation. In this study we have used the data of discharge, Q (m3/s), suspended sediment concentration (SSC; mg/L) and sediment load, L (kg/s) of April 2011 to November 2013 on non-frozen period of these three years, weather data of 2008 to 2013, and soil data. Every year soil water content and water storage in soil are different because the amounts of snowfall and snowmelt are different, so we have utilized our model at seasonal base. The semi-distributed SWAT model is applied to model discharge and spatially distributed soil erosion/sedimentation processes at daily time step. The simulations of sediment load time series indicate that most of the sediment input is coming from sub-basin 2. Hourly sediment load time series indicates that most of the time except at pick discharge sediment load at upstream (R3) is greater than of downstream, main outlet of watershed (R1), it suggests that the most of the sediment is deposited between R1 and R3. At present, the interpretation of the quantitative results is not yet satisfactory, because of lack of model parameterization at a local scale in the SWAT model. This results from the fact that the information on hydrological structures of soil and bedrock is not sufficient. Thus, a comparison with the other modelling is essential to understand the sediment loading processes on catchment scale.

Keywords: forested, fluvial, sediment, erosion, SWAT, tectonic

Japan Geoscience Union Meeting 2015
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AHW27-03 Room:301B Time:May 24 09:30-09:45

Soil Loss and sediment yield assessment from 1974-2012 in the some west-coast river catchments, Penang Island Malaysia

MOHD NAJIB, Sumayyah aimi[1*] ; A. RAHAMAN, Zullyadini[1]

[1]Universiti Sains Malaysia

Soil erosion is a worldwide problem because of its economic and environmental impacts. Many human-induced activities, such as mining, construction, and agricultural activities disturb land surface , resulting in accelerated erosion. There are many land clearing activities in catchment areas that could add an enormous amount of sediment to rivers. Nowadays, land has become one of limited resources in Penang due to the topography of the hilly and flat area. Penang Island is a city of rapid industrialization and density, and in order to face future challenges caused by rapid economic development, there is a high demand for flat land requirements. Land clearing activities contributes to the total concentration of sediment, affecting the health of the catchment area. To estimate soil loss, soil erosion model such as Universal Soil Loss Equation (USLE) is used to estimated average soil loss generated from splash, sheet and rill erosion. Use of the USLE has recently been extended for predicting soil losses and plan control practices in the agricultural catchment by effective integration of Geographic Information Systems (GIS) based on procedures to estimate the factor values in a grid cell basis. This study was performed to predict soil loss by USLE/GIS and the factor to calculate soil loss is Rainfall erosivity (R), Soil erodibility factor (K), Topographic factor (LS), Land cover management factor (C) and Conservation practices factor (P). Result shows that soil loss was 100.7 t/ha/year and sediment yield was 2336 t/km^2/year in 2012, 84 t/ha/year and 1907 tan/km^2/year in 2004; 144 t/ha/year and 1889 tan/km^2/year in 1984 and 1974 the soil loss was 61 t/ha/year and the sediment yield was 1272 tan/km^2/year.

Keywords: Soil Erosion, Soil loss and sediment yield assessment, USLE, GIS, Penang Island, Malaysia

Japan Geoscience Union Meeting 2015
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AHW27-04 Room:301B Time:May 24 09:45-10:00

Assessment of the impacts of abandoned cultivated land on material flux in hilly and mountainous watersheds

SHIMIZU, Yuta[1*] ; ONODERA, Shin-ichi[2] ; MATSUMORI, Kenji[3]

[1]National Agriculture and Food Research Organization / JSPS Research Fellow, [2]Graduate School of Integrated Arts and Sciences, Hiroshima University, [3]National Agriculture and Food Research Organization

Agricultural land-use has been reduced by mainly urbanization and devastation in Japan. The objective of this study is to evaluate the impact of the decline of agricultural land-use on flood risk and material flux in hilly and mountainous watersheds using Soil Water Assessment Tool. The results indicated that increase of flood risk due to abandonment of agricultural land-use. Furthermore, the abandonment of rice paddy field on steep slope areas may have larger impacts on sediment discharges than cultivated field. Therefore, it is suggested that prevention of expansion of abandonment of rice paddy field is an important factor in the decrease of yields of sediment and nutrients.

Keywords: material transport, hilly and mountainous watersheds, SWAT model

Japan Geoscience Union Meeting 2015
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AHW27-05 Room:301B Time:May 24 10:00-10:15

Climate change impacts on groundwater recharge on an agricultural island, western Japan, estimated by SWAT/Hydrus model

JIN, Guangzhe[1*] ; SHIMIZU, Yuta[2] ; ONODERA, Shin-ichi[1] ; SAITO, Mitsuyo[3] ; MATSUMORI, Kenji[2]

[1]Hiroshima University Graduate School of Integrated Arts and Sciences, [2]National Agriculture and Food Research Organization, Western Region Agricultural Research Center, [3]Graduate School of Environmental and Life Science, Okayama University

Estimation of groundwater recharge, quantity, and water balance is important for efficiently managing groundwater resources. It is particularly important in regions with little rain, which face the risk of water shortage. However, the water balance of a watershed is sensitive to climate variability and change. Climate changes due to global warming may alter rainfall patterns and increase the occurrence of extreme events (floods and droughts), it will significantly affect the sustainability of water supplies in the coming decades, clarify the future water budgets will be necessary and important. The objective of this research is to estimate water balance and clarify the drought impact on groundwater recharge rate in an agriculture catchment using the SWAT Model, and validate and estimate the groundwater movement using the Hydrus Model.

The study catchment (IKS) is located in the central Seto Inland Sea. Groundwater resources are important water supply resources for irrigation. However, due to the small annual precipitation with large inter-annual variation, and steep sloping topography, the island faces a risk of water shortage, especially in the drought season. As input to SWAT Model, topographic data (10 m grid), soil map (1/25000), land use map of 2006 (100m grid) and weather information were used to build and calculate the SWAT Model. Evaporation was estimated by the Penman-Monteith method. Simulation time periods is 2000-2013, including warm up period of 2000-2003 and calibration period of 2003-2004. The calibration was conducted using the Sequential Uncertainty Fitting (SUFI2). The calibration and validation results of Nash-Sutcliffe efficiency (NSE), RMSE-observations standard deviation ratio (RSR), and percent bias (PBIAS) indicate the parameters are evaluated as acceptable. For input into Hydrus 1D, the groundwater recharge rate was obtained from the value in related sub basin from the SWAT model. The simulated groundwater level data were compared with observed groundwater level data from a 15m depth observation well in the downstream area of the IKS catchment.

The result shows in the low precipitation year, the groundwater recharge and surface run off decreased to 25% and 30%, respectively. Both river discharge and groundwater recharge fluctuated between the high and low precipitation years compared to average water balance, and these variations are larger than the precipitation fluctuation. The simulated groundwater level data shows the quick response to variation of precipitation. Under different rainfall intensities, groundwater levels gradually decreased and responded to the changes in groundwater recharge with no precipitation supplied. The groundwater level was also highly related to precipitation variability and the groundwater supply is highly related to heavy rainfall events and the obviously decreasing groundwater resources in the drought season. As result of global climate change, an increasing fluctuation trend between extremely low rainfall and extremely high rainfall has been observed across Japan. The annual precipitation from the Ikuchi Island suggests that years of low rainfall have become more frequent since 1976. A decreasing trend of precipitation from 5-year average data is shown, with rate of 103mm/100years. In consideration of this decreasing trend in precipitation, we estimate the annual groundwater recharge rate had considerable inter-annual variations and decreased on an average by 140mm/100years, which is relatively larger than the trend of precipitation. The groundwater level in drought years decreased with an estimated decrease of 1.2m/100years. This may indicate the drought impact on groundwater resources will increase in the future. The recharge resources will decrease and groundwater storage will decline under the trend of decreasing precipitation in the future.

Keywords: climate change, drought impact, groundwater recharge rate, water balance, SWAT Model, Hydrus Model

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AHW27-06 Room:301B Time:May 24 10:15-10:30

Seasonal variation of the stratified structure in agricultural reservoirs and its effect on the nutrient cycle

OKUBO, Kenji[1*] ; SAITO, Mitsuyo[1] ; FUNAOKA, Ryohei[1] ; ONODERA, Shin-ichi[2] ; JIN, Guangzhe[2] ; MARUYAMA, Yutaka[2] ; ARITOMI, Daiki[2]

[1]Okayama Univ., [2]Grad., Hiroshima Univ.

Agricultural reservoirs have been used as important water resources in agriculture areas of little rain. Intensive agriculture increases the load of nutrients to surface water and groundwater, which usually causes serious eutrophication and phytoplankton blooms in small-scale reservoirs. For sustainable water use in agricultural areas, it is important to evaluate the cycles of water and nutrient in reservoirs. We aimed to examine on the seasonal variation of the stratified structure in agricultural reservoirs and its effect on the nutrient cycle. The seasonal variation of the stratification was examined using the multi-depths water temperature variation in the 4 ponds located on an island which is highly influenced by agricultural activity. DO, Chlorophyll-a, light photon, nutrients data were used for the evaluation of ecosystem condition. Water temperature was clearly different between the surface layer and the bottom layer from early spring to early autumn in some reservoirs characterized by relatively deep bathymetry or groundwater inflow from the bottom, which indicates that the thermal stratification was formed. Vertical profiles of Chlorophyll-a and DO show the significant seasonal variations from spring to winter period. However, these pattern were unique in the pond influenced by groundwater inflow.

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AHW27-07 Room:301B Time:May 24 10:30-10:45

Water quality characteristics and the material circulation in Lake Issyk-kul and its catchment,in Kyrgyz

SAITOH, Kei[1*] ; KODERA, Koji[2] ; MAEMOKU, Hideaki[2]

[1]Graduate Student , Hosei Univ., [2]Department of Geography, Hosei Univ.

1. Introduction

Saline Lake is relatively less number than freshwater lakes, also because it is present under the harsh environment of arid regions, are said to have relatively fewer studies than freshwater lakes, A.Lerman 1984.

In the case of Lake Issyk-kul , affect to how Lake Issyk-kul substance to be transported from the catchment various rivers, with the decrease of water level, discussion of whether water circulation of the lake is going to change how the very few. In addition, clarification of water quality mechanism in polar regions is, it can be said that there is significance in elucidating the Earth system, a comparative study of the freshwater lake. In this study, in order to clarify the mass balance of Lake Issyk-kul and its catchment area, a study was conducted for the dissolved substance of the inflow rivers to the lake.

2. research methods

The rivers and groundwater, lakes was carried out three times over the summer in 2012 - 2014 the local observation at the center in Lake Issyk-kul. Survey sites in 42 point, 31 point rivers, lakes 9 point, the groundwater two points were carried out. Temperature, water temperature, EC, pH and the field observation, measurement of TOC from samples brought back and subjected to principal component analysis dissolved by ion chromatography.

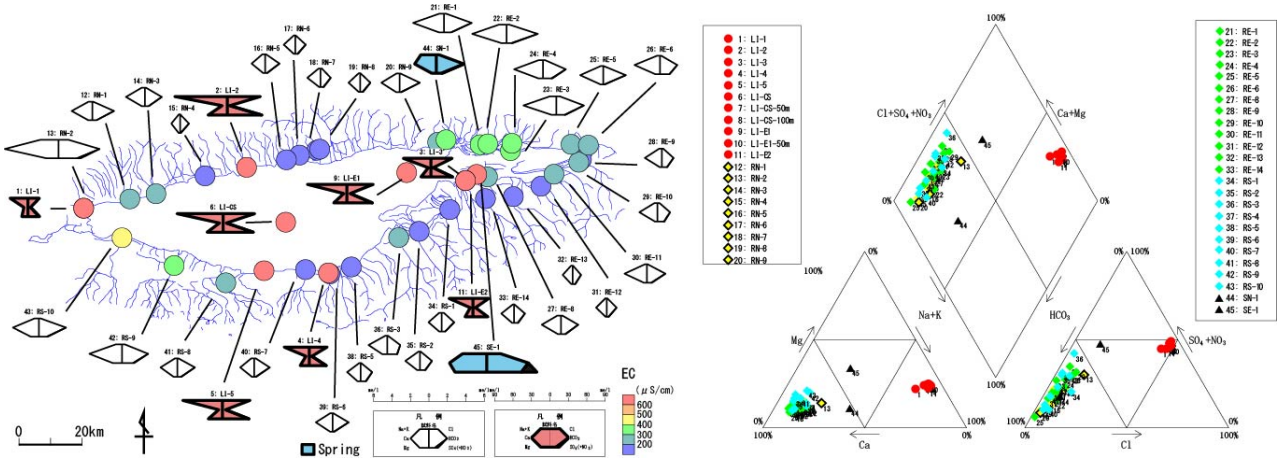
3. Conculusion

Generally the river is a Ca-HCO_3 type, in Lake north and south Among them,ion concentration of dissolved substances is low. On the other hand, high ion concentration in the lake east and west, the difference of the geology of the influence of the difference of basin characteristics were observed. In comparison with the water quality composition of salt lakes of the world, water quality composition of Lake Issyk-kul is a Na-Mg-Cl-SO_4 type, balance of salts that are relatively dissolved is good. This is, through the catchment rivers and groundwater, I considered carbonate is because it has been supplied many from the catchment. Also, seen many geology of igneous system in Hunan part, I believed to be one of the causes also the supply many of SO_4^{2-}.$Ca^{2+}$and HCO_3^- For, it has been suggested that precipitated as $CaCO_3$ and $CaSO_4$. If we examine these solubility product, although a supersaturated state, considering that it is a natural waters, it is considered reasonable, it is necessary to further verification.

Reference

A.S.Karmanchuk(2002):WaterChemistry and Ecology of Lake Issyk-Kul,NATO ScienceSeries,13,13-26

Keywords: Saline Lakes, Closed Lake, Arid Region, Water Quality



Japan Geoscience Union Meeting 2015
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AHW27-08 Room:301B Time:May 24 11:00-11:15

Sand grain producing and transport processes in downstream reaches of the dams-constructed Tenryu River, central Japan

UTSUGAWA, Takako[1*] ; SHIRAI, Masaaki[1]

[1]Department of Geography, Tokyo Metropolitan University

Introduction

Dams hold not only water resources but also detritus produced in upstream reaches, and have been considered the cause of social problems (significant decrease in sediment supply, coastal erosion and so on). Several artificially-sediment transport countermeasures as dredging has already been carried out, however, these countermeasures are generally based on the assumption that detritus grains have experienced only ”transport and deposition” processes. We focused on changes in roundness of gravels and sands, which the latter could be results of ”crushing and abrasion of gravels”, and attempted to reveal the influences of dam reservoir on ”sand grain producing and transport” processes in downstream reaches.

Study area

There are fifteen dams in the watershed of Tenryu River had the largest amount of sediment discharge among all Japanese rivers (Ashida,2008), and the Sakuma dam which is the largest one, has completely prevented gravel/sand grains from transportation. In downstream reaches lower than this dam, the Misakubo River joins between the Sakuma and Akiha dams and the Keta River joins between the Akiha and the Funagira dams. These are often considered as the tributaries having the largest sediment supply to downstream reaches.

Methods

Sediment samples were obtained from downstream side of the Funagira dam, nearest the river mouth (downstream site), and from two tributaries (upstream sites). We investigated the sediments based on both field survey and on measurements with a digital microscope and a particle image analyzer. Roundness of shale grains were measured following ”Krumbein chart” with ca. 200 grains in each phi scale from 128 to 0.5 mm in diameter (cobble to coarse-grained sand).

Results and discussion

The roundness of shale grains in the downstream site tends to be more angular than in the upstream site. Considering the sand grain producing process, it implies that sediments, in particular, very-coarse sand (2 to 1 mm in diameter) and coarser fractions, have not been transported across the Funagira dam, and at downstream reaches, sand grains are newly produced from shale gravels deposited before dams construction. While, on the coarse-grained sand fraction (1 to 0.5 mm in diameter) of the downstream site, rounded and sub-angular grains are coexisting. It implies that the transport across the Funagira dam may occur on and smaller than coarse-grained sand fraction.

References

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Krumbein, W. C. 1941. Journal of Sedimentary Petrology 11: 64-72

Keywords: gravel, sand, roundness, crush-abraion, dams construction, Tenryu River

Japan Geoscience Union Meeting 2015
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AHW27-09 Room:301B Time:May 24 11:15-11:30

Nitrogen issues induced by human activities: A big issue in Earth system beyond watersheds

HAYASHI, Kentaro[1*] ; EGUCHI, Sadao[1] ; ASADA, Kei[1] ; YOSHIKAWA, Seiko[1] ; ABE, Kaoru[1]

[1]National Institute for Agro-Environmental Sciences

Nitrogen (N) is indispensable for agriculture. Crop production has increased drastically since the Harber?Bosch process which provides chemical N fertilizers. Nitrogen fertilizers support the global population and increase meat production in many countries. Nowadays, approximately a half of the global population depend on the Harber?Bosch process. In contrast, it is estimated that crops uptake only approximately 25% of applied N to croplands as a global average (approximately 40% in Japan). Although a part of the remaining N can be stored in soils as organic matter, most of which turns into environmental N loads to soil, water, and air. Livestock waste also results in N loads to the environment. Nitrogen in the environment changes its chemical forms in its cycling (so-called nitrogen cascade). We see various environmental consequences due to the human-induced N loads, e.g., water pollution, air pollution, effects on global radiative forcing, stratospheric ozone depletion, eutrophication, and acidification. We collectively call it N issues.

A typical N issue in Japan is water pollution of groundwater, lake water, and enclosed coastal water due to excess N fertilizers in croplands, livestock farming, and miscellaneous drainage. However, N in water bodies is also connected to other environmental media through the N cascade. For example, atmospheric N deposition inputs N to watersheds. Nitrous oxide produced by nitrification and denitrification in soils, sediments, and water bodies is a potent greenhouse gas and simultaneously a strong ozone depleting substance when emitted to the atmosphere. Japan is a small and densely populated country, and highly depends on imports for food and feed (self-sufficiency ratios: food, 39%; feed, 26%). Recently in Japan, a huge amount of food is discarded without being consumed. Such the food waste is estimated to 5?8 Tg $yr^{?1}$, which is larger than the food for aid in the world (4 Tg $yr^{?1}$). A large proportion of N is eventually loaded to the environment without being recycled. Japan is one of the world's biggest countries in terms of N loads per unit area of land.

Maximizing N use efficiency and minimizing environmental N loads are dilemma important for the sustainability of food production, energy consumption, and Earth system. Therefore, N issues are receiving increasing attention in the world. The International Nitrogen Initiative (INI) organizes Nitrogen Conferences every three years and implements N assessments for major regions in the world. OECD is developing indicators to assess N issues in collaboration with INI. UNEP and INI are preparing an international project of the Global Environmental Facility, the International Nitrogen Management System to establish a system connecting science and policy to address N issues. The Future Earth starting in full from 2015, a huge international project involving all stake holders, situates the sustainable food production as a major theme, in which resolution of the N dilemma is an important research component.

Relevant efforts of Japan seem delayed in comparison with the world situation. A variety of respective studies of water quality, air quality, and global environmental issues have been progressed, whereas efforts to comprehensively understand the N dynamics in the N cascade and to share and discuss study results with other sectors like policy makers are still insufficient. We will present the current situation of N issues in Japan and the world efforts against N issues. And then, we aim to suggest the establishment of Japanese Nitrogen Expert Group to tackle with N issues. It is supposed that the N expert group will consist of several subgroups (e.g., agriculture, freshwater, marine, atmosphere, land, and industry) because of a variety of sectors involved in the N issues. We hope that relevant experts are interested in and join in the group.

Keywords: Nitrogen, Water quality, Air quality, Eutrophication, Global environment, International Nitrogen Management System

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AHW27-10 Room:301B Time:May 24 11:30-11:45

Dissolved organic nitrogen dynamics in forested watersheds with different nitrogen inputs

KOBAYASHI, Masahiro[1*] ; ITOH, Yuko[1] ; SHINOMIYA, Yoshiki[2]

[1]Frestry and Forest Products Research Institute, [2]Tohoku Research Center, Frestry and Forest Products Research Institute

Increasing atmospheric nitrogen deposition often causes nitrogen saturation in forest ecosystems around Kanto plain in Japan. To clarify the mechanism of nitrogen saturation, we have observed the dissolved nitrogen of bulk precipitation, throughfall, litter leachate, soil water, and stream water in Katsura experimental forest (KEF) with low nitrogen deposition and Tsukuba experimental forest (TEF) with high nitrogen deposition. In the present study, we focused on the flux and discharge of dissolved organic nitrogen (DON) in the studied forest ecosystems. The seasonal variation of the ratio of DON to the total dissolved nitrogen (TDN) was observed for the litter leachate both in KEF and TEF. The DON/TDN ratios for litter leachate, stream water were lower in TEF than in KEF. It may be caused by the high rate of mineralization in TEF with excessive nitrogen.

Keywords: Forest, dissolved organic nitrogen, flux, discharge

Japan Geoscience Union Meeting 2015
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AHW27-11 Room:301B Time:May 24 11:45-12:00

Atmospheric nitrogen deposition on a forest watershed in the Hokuriku district

ITOH, Yuko[1*] ; OGURA, Akira[2] ; TAKASE, Keiji[3]

[1]FFPRI, [2]Research Center for Agricultural and Forestry, Ishikawa Prefecture, [3]Ishikawa Prefecture University

Increase of air pollutant inflow from Asian continent with the rapid economic development is concerned about its influence on the environment. In future, in the forested area of the Hokuriku district, the disturbance of elements cycling such as nitrogen saturation may occur as well as surrounding area in the Kanto region. Therefore it is necessary to elucidate the influence on elements cycling within forest ecosystems in these area. However, it was difficult to observe the elements dynamics in forest watersheds through the year due to the heavy snowfall. In this study, we investigated the atmospheric deposition of nitrogen through rainfall and snowfall to a small forest catchment in Ishikawa prefecture.

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AHW27-12 Room:301B Time:May 24 12:00-12:15

Simple method to estimate pollution loads from non-point sources and its applicability

YOSHIKAWA, Seiko[1*] ; MOCHIZUKI, Hidetoshi[2] ; TAKAHASHI, Hidehiro[2]

[1]National Institute for Agro-environmental Sciences, [2]NARO Western Region Agricultural Research Center

Radical nitrogen has been increasing mainly by nitrogen fixation under the manufacturing of chemical fertilizers. This has resulted in increasing water pollution, eutrophication, and greenhouse gas emissions. Nutrient loads to the environment from non-point sources are difficult to quantify, although those from point sources are almost all regulated in Japan. The aim of this study was to propose a simple method to estimate pollution load (especially N load) units of river water and groundwater for each land use, and to verify its applicability.

The study area consisted of 26 watersheds (1,342 km^2) covering 72% of Kagawa Prefecture in Japan. We estimated NO_3-N concentration factors in groundwater for upland fields, paddy fields, forests and urban landuse types by performance of a multiple regression analysis of the watershed-mean groundwater NO_3-N concentrations and the landuse ratios in each of the 26 watersheds. The results showed that the NO_3-N concentration factor, which was gained as the partial regression coefficient for the multiple regression analysis, in groundwater was 15.2 mg L^{-1}, 10.3 mg L^{-1}, 2.3 mg L^{-1}, and 2.5 mg L^{-1} for the upland fields, paddy field, forests, and urban landuse types, respectively. N pollution loads runoff for river water and groundwater were calculated by multiplying total-N concentration factors for river water by river flow rate, and by multiplying NO_3-N concentration factors for groundwater by groundwater flow rate. The total N pollution loads runoff were 26.6 kg ha^{-1} y^{-1}, 12.6 kg ha^{-1} y^{-1}, 2.8 kg ha^{-1} y^{-1}, and 8.8 kg ha^{-1} y^{-1}, for upland fields, paddy fields, forests, and urban areas, respectively.

Applicability was investigated for one river watershed, where spring water quality was measured in the periods 1994-1995 and 2007-2008. NO_3-N concentration increased with stream downward in 1994-1995, however, the tendency diminished in 2007-2008. River T-N concentrations were 2.5 mg L^{-1} and 2.4 mg L^{-1}, and groundwater NO_3-N concentrations near the coast were about 8 mg L^{-1} and 6 mg L^{-1} for the two periods, respectively. On the other hand, cropland ratios were 23.8% and 21.4%, and surplus-N from croplands (applied-N - absorbed-N by crops) was calculated as 31.1 kg ha^{-1} and 27.2 kg ha^{-1} from cropland, and surplus-N from the whole watershed was 43.2 kg ha^{-1} and 39.7 kg ha^{-1} for the 2 periods, respectively. The arrival of N loads to the sea by river and groundwater was calculated to be 51% and 48% of the whole surplus-N in the watershed for the 2 periods, respectively. These results are in line with other reports in which pollution load arrival is about half or below half of the pollution load generated.

Keywords: landuse, non-point source, pollution loads, groundwater, river water

Japan Geoscience Union Meeting 2015
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AHW27-13 Room:301B Time:May 24 12:15-12:30

Spatial distribution of nitrogen load and its impact on coastal environment from bay area in Kyushu

BAI, Jiahui[1*] ; SHIMIZU, Yuta[2] ; ONODERA, Shin-ichi[1] ; SAITO, Mitsuyo[3] ; JIN, Guangzhe[1]

[1]Hiroshima University Graduate School of Integrated Arts and Sciences, [2]National Agriculture and Food Research Organization,Western Region Agricultural Research Center, [3]Graduate School of Environmental and Life Science, Okayama University

Human activity has obviously changed the global nitrogen (N) cycle, with an increasing amount of N applying to the environment. Clarify N load and N cycle has become more important and necessary. Kyushu area is one of the main agricultural area in Japan. It is an important region which could comprise over one fifth of total agriculture products of Japan. The production of vegetable and beef has rapidly increased in past 30 years after the negotiation with Pacific Strategic Economic Partnership Agreement (TPP) for agricultural products. On the other hand, the increasing amount of fertilizer into farmland and livestock have increased the regional N load into coastal area, which may increase the costal stress of eutrophication and enhance eutrophication in enclosed bays. In this research, it is aimed to estimate the N load in coastal bay watersheds of Kyushu area for the past 30 years. Especially, it is estimated the spatial variation of the current N load into environment, and the water quality of related enclosed bays for identifying N budget in the areas where severe water pollution might be occurred.

The three coastal watersheds, the Yatsushiro Bay, Kagoshima Bay and Omura Bay, are selected as research area. A GIS based N flow model was developed to estimate the N budget in of 1km x 1km scale in this research. The N cycling model includes simple water budget model with the N pathways of agriculture, livestock and human impacts. The estimation was the agricultural production, food consumption, ammonia volatilization and the accumulation of soil in each region, finally to calculate the N load in the water environment and the total N load in the watershed of

Results shows a sharply increasing in N load from 1975 to 2005 in Yatsushiro bay watershed. The estimated total N load in 1975 and 2005 were 133 kg/ha and 214 kg/ha, respectively. It was indicated that relatively higher N contribution from livestock compared to population and crop based on the analysis in 1995; the total N load of crops, resident and livestock were 18.0 kg/ha, 53.7kg/ha and 62.3 kg/ha, respectively. However, the resident became the dominant source of total N load in 2005. While it increased to 204 kg/ha, the crops and livestock decreased to 6.86 kg/ha and 6.89 kg/ha, respectively. The dominant of N load has changed from livestock to resident in 2005. This may due to the change of N structure; with the improvement of people's living standard, the amount of food untaken by resident has increased. The average protein consumption per capita has increased from 30.0g/day in 1975 to 370g/day in 2005. In addition, the Kyushu area has abundantly precipitation which lead to a significant large surface water discharge. It shows a larger portion of N will finally discharged into the related coastal area through rivers compared to groundwater. For example in 2005, the N pathway ratio of surface water/groundwater is 5.5:1. Approximately 8.26 x 10^3 tons of the N could be discharged from land into the bay. The increasing trend of N discharge in past 30 years may contributes to the increasing eutrophication events in related bays. On spatial variation, there shows a series of high N load area along the coastal area, the historical variation of N load shows these area has shown high and constant in last 30 year, the plankton shows high level near these area compared to the low discharge area.

Keywords: N flow model, nitrogen contamination, fertilizer, agricultural production, water pollution, eutrophication

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

AHW27-14 Room:301B Time:May 24 12:30-12:45

Nitrification and Denitrification of Groundwater in Ryukyu Limestone Aquifer

NAKANO, Takuji[1*] ; YASUMOTO, Jun[1] ; HIJIKAWA, Kento[1]

[1]University of The Ryukyus

In recent years, drinking water due to excessive fertilization and domestic waste water, nitrate nitrogen pollution of groundwater has occurred in many places, it has become one of the most pressing challenges for conservation water environment. on the other hand, Ryukyu limestone the distribution areas, from surface geology characteristic is a high permeability of porous, groundwater pollution such as nitrate nitrogen is also easy to progress, water pollution by nitrate nitrogen concentration has been reported. The study area is located in the southern part of Okinawa Main Island, Japan, where Ryukyu limestone is extensively distributed.In this study, from the point of view that contribute to the proper use of groundwater, including the future of water quality management, using the water quality data, the elucidation of understanding and water quality formation mechanism of nitrification-denitrification dynamics of limestone aquifer groundwater areas are carried out. It is suggested that nitrogen load from agricultural land in this area influences the long-term fluctuation of NO_3^--N concentrations in groundwater. It is recognized that groundwater level participates annual fluctuation of NO_3^--N concentrations in groundwater. It is considered that NO_3^--N concentrations are influenced by nitrogen load accompanied with groundwater flow from the upstream to the downstream of the study area. It is also found that NO_3^--N concentration formation is assumed to depend on two factors, that, mixing-inflow actions and denitrification-dilution actions under conditions of groundwater flow caused by completion of the subsurface dam. Through advection action and diffusion effects associated with the event changes in groundwater flow triggered by the precipitation, after the equilibrium state of the dissolved substance is lost, nitrogen component to keep the equilibrium state by adsorption, creation, annihilation action and dilution and concentration effect. The hydrological condition and groundwater flows may cause the redox diagram of nitrogen so that patterns of electron donors and acceptors also play important role on nitrification and denitrification processes. It is considered that transport of nitrate sources tends to determine the nitrification and denitrification of potential as extend nitrate is transported as conservative substance through the aquifer. Nitrification reaction rate constant in the Ryukyu limestone aquifer is 0.031 ˜0.089h-1, denitrification reaction rate constant is 0.008 ˜0.145h-1, both nitrification reaction rate constant is higher than the literature value of field soil oxidation state a value, denitrification rate constant has been shown to be not less than paddy soil of reduced state, has revealed that it has a high nitrification-denitrification potential.

Keywords: Nitrification, Denitrification, Groundwater, Ryukyu Limestone Aquifer

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

AHW27-15 Room:301B Time:May 24 14:15-14:30

Spatial distribution of arsenic in shallow alluvial aquifer in northwestern part of Bangladesh: Implication for arsenic

REZA, Selim[1*]

[1]Department of Geology and Mining, University of Rajshahi

Concentrations of As in groundwater sampled from the 38 shallow tube wells at different depths spanned three orders of magnitude, from 0.5 μg/L to 164 μg/L (Mean 20 μg/L$\pm$ Std. 36.46 μg/L). Groundwater As concentration generally increased with depth starting from the shallowest monitoring well, peaked at 15 m and 20 m at different sites, and then declined again towards the deeper part of the shallow aquifer. The dominant groundwater type is Ca-HCO_3 with high concentrations of As and Fe but low levels of NO_3^- and SO_4^{-2}, while As is not correlated with Fe (R2=0.05) and positively correlated with Mn (R2=0.126) in groundwater. The positive correlations along with results of sequential leaching experiments suggest that reductive dissolution of FeOOH and MnOOH mediated by anaerobic bacteria represents mechanism for releasing arsenic into the groundwater. Poor correlation between As and Fe as well as As and Mn concentrations in groundwaters suggest that probably siderite (saturation indices 1.53-4.21) and/or rhodochrosite (saturation indices 1.34-2.97) precipitated as secondary mineral on the surface of the sediment particles. Factor analysis was performed on hydro-chemical data. The results show that a few factors adequately represent the traits that define water chemistry. The first factor of Ca, Mg and Na reflects the hardness of groundwater, which is confirmed by the hydrochemical facies analysis. Cl and SO_4 are grouped under the second factor representing the groundwater contamination due to anthropogenic activities. The third factor, represented by As, Mn and K is related to As mobilization processes. K may be derived from anthropogenic activities which may be responsible for the mobilization of arsenic mobilization. The fourth factor of Fe and HCO_3 is strongly influenced by bacterial Fe(III) reduction which would raise both Fe and HCO_3 concentrations in water. Groundwaters in Barogoria village contain low concentration of As below the WHO standard ($<$10 μg/L), and this type of water is generally suitable for extraction for domestic uses though this is Holocene aquifer. Spatial evolutions help in better understanding mechanisms of As mobilization and in developing effective strategies for ensuring drinking water safety. Possible solutions are to install tube wells in the deeper Pleistocene aquifers or use clean surface water sources such as reservoirs or rain water. The investigation suggested that monitoring of groundwater As should be routinely carried out to ensure the drinking water safety in the As-affected areas.

Keywords: Northwestern Bangladesh, arsenic mobilization, siderite / rhodochrositeprecipitation.

Keywords: Fe-oxyhydroxides, Mn-oxides, Bacterial reduction

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

AHW27-16 Room:301B Time:May 24 14:30-14:45

Seasonal change of the major and trace elements of Red river water, northern Vietnam.

INOUE, Ryo[1*] ; MASUDA, Harue[1] ; YONEZAWA, Go[2] ; TRUONG, Xuanluang[3] ; NAKANO, Takanori[4]

[1]Graduate School of Science,Osaka City University, [2]Graduate School of Creative Cities,Osaka City University, [3]Hanoi University of Mining Geology, [4]Research Institute for Humanity and Nature

Red River ,originated in Yunnan, China, is running through Vietnam along Red River Fault, and forms Red River Delta in its downstream. In Vietnam territory, there are big towns along the Red River such as Lao Cai at the border with China, Bao Ha, Yen Bai, Capital Ha Noi, and Nam Dinh. It has been clear that arsenic contaminated ground waters have spread in and around the Red River Delta since 2000's. The arsenic must be carried to the aquifer through the river, although the transportation process is not well understood. In order to trace the process, we analyzed major and minor dissolved components including arsenic concentration and the oxygen and hydrogen isotopes of river water samples; 29 in rainy season (2013.7.26-2013.8.4) and 45 in dry season (2014.4.11-2014.4.21).

Range of total arsenic concentration of riverwaters from the main channel are 1.4-9.1μg/L in the rainy season and 2.2-92.9 μg/L in the dry season. Total arsenic concentrations were 9.2 μg/L in the rainy season and 33.9 μg/L in the dry season near Lao Cai. Although arsenic concentration is less than the WHO standard (10 μg/L) in the rainy season, the concentration in the dry season was much higher than the standard. Arsenic concentration decrease toward downstream from Lao Cai. Around Ha Noi, located in about 300km downstream, total arsenic concentration was 1.4 μg/L in the rainy season and 3.8 μg/L in the dry season. In both seasons, range of total arsenic concentrations of branches are lower than those of the main channel. 40% of arsenic was dissolved near Lao Cai, and the ratio of dissolved arsenic increase toward downstream. Finally, most of arsenic was dissolved near Ha Noi.

The oxygen and hydrogen isotope ratios of riverwaters were plotted on the GMWL (δ^2H=8$*\delta^{18}$O+10). Most of the δ^{18}O of branch waters were lower than those of main channel in the rainy season, while higher in the dry season. Inflow from the branches influenced the isotope compositions of main channel waters through the year, especially in the rainy season when precipitation was abundant.

Total arsenic concentration of main channel water decreased due to the inflow of diluted branch waters. Also, the arsenic would be removed from the riverwater in association with sedimented particles on the riverbed.

Keywords: Vietnam, Red River, Arsenic, Seasonal Change

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

AHW27-17 Room:301B Time:May 24 14:45-15:00

Arsenic in river waters of the Hokusetsu Area of Osaka Prefecture - Distribution, origin and transport process

EVEN, Emilie[1*] ; MASUDA, Harue[1] ; SHIBATA, Takahiro[1] ; NOJIMA, Aki[1]

[1]Osaka City University

Within the present study, extent of high arsenic concentrations is investigated in river waters of the Hokusetsu area of Osaka and Kyoto Prefectures where naturally As contaminated waters have been reported. For example, after the 1995 Kobe earthquake and the following years, waters of Ina and Yono rivers systems were reported with high concentrations (>10ppb) of arsenic.

The distribution of As in water (<1 to 38ppb) reveals a pattern related to the Ibaraki plutons that intrude the Permian to Jurassic sedimentary rocks (sandstone, shale, bedded chert); high As concentrations are found in the areas around the intrusive rock body, while concentrations are rather low in areas of sedimentary rocks far from the plutons. High concentrations in water correlate with high As contents in riverbed sediments (<2.5 to 55ppm) which are also distributed in accordance with the local geology of pyrite-rich sedimentary rocks.

Isotopic analysis of $\delta^{34}S_{CDT}$ of sulfate ions in river waters (+4.5 ‰ median) fall within the same range of previous studies, but these values seem to show river waters impacted by atmospheric depositions. One spring sample (+2.6 ‰) tends to confirm that the As origin is pyrite in shale rocks (-3.0 ‰ to +1.4 ‰) rather from pyrite in chert (-8.8 ‰).

Analysis of river concentrations in unfiltered, 0.7μm and 0.2μm filtered waters show that As remains mostly in the dissolved pool (<0.2μm) along the river course, while the particulate fraction of Fe, Mn and Al represent 68% of the total concentration in average. These results as well as Principal Component Analysis suggest that As is therefore not transported with clay particles and/or Fe/Mn/Al oxides as believed by many researchers.

Keywords: Arsenic, river water, source rock, sediments, transport

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

AHW27-18 Room:301B Time:May 24 15:00-15:15

Cesium decrease with groundwater residence time in natural spring drinking water

NAKAYA, Shinji[1*] ; PHAN, Hoang minh ha[1] ; IWAI, Yoshiki[1] ; ITOH, Akihiro[1] ; AOKI, Hideto[1] ; NAKANO, Takanori[2]

[1]Department of Civil Engineering, Shinshu University, [2]Research Institute for Humanity and Nature

It is known that the active Cs sorption onto colloidal-size clay minerals in groundwater is observed and the active Cs can be transported with the colloidal fraction of groundwater by water flows. However, the longtime behavior of radioactive and non-active Cs, contained in the flowing groundwater in the aquifers of groundwater source areas, is unknown in terms of the natural water cycle. Herein, we investigate the non-active Cs concentration in natural spring drinking water with the residence time in a groundwater source area of a mountainside composed of volcanic rock, compared with those of other trace elements. This investigation demonstrates that the observed Cs concentration in natural spring drinking water exponentially decreases slowly with the groundwater residence time (˜45 yr), while several trace elements, namely, P, V, Ga, and Ge, increase in concentration with the groundwater residence time through chemical weathering. The findings suggest that active Cs, contained in flowing groundwater in mountain water source areas, may decrease exponentially at the rate of one-tenth in twenty-two years, by sorption onto the aquifer through rock-water interaction excluding radioactive decay. For the sustainable management of water sources and ecosystems, the long-term (˜50 yrs.) monitoring of the active Cs in groundwater is needed in mountain water source areas where radioactive cesium has been dispersed at times of nuclear power plant accidents.

Keywords: Cesium, Groundwater, Residence time, Sulfur hexafluoride, Yatugatake

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

AHW27-19 Room:301B Time:May 24 15:15-15:30

Groundwater dating in southern Hamadori region, Fukushima, Japan

KASHIWAYA, Koki[1*] ; MUTO, Yuta[1] ; KUBO, Taiki[1] ; KOIKE, Katsuaki[1] ; SHIBASAKI, Naoaki[2] ; YABUSAKI, Shiho[2] ; NAKAYA, Shinji[3] ; IKAWA, Reo[4] ; MARUI, Atsunao[4]

[1]Kyoto University, [2]Fukushima University, [3]Shinshu University, [4]AIST

Understanding of groundwater system characteristics, that control groundwater flow and mass transport in the system, is helpful for various purposes such as conservation of groundwater amount and quality, vulnerability assessment of groundwater system to pollution, and prediction of temporal and spatial variation of polluted condition. National Institute of Advanced Industrial Science and Technology conducted "Study on Risk Evaluation of Groundwater Pollution" to assess distribution of groundwater resources, characteristics of groundwater systems, and to utilize the information for reconstruction from the Great East Japan Earthquake. The authors participated this project and carried out groundwater survey in southern Hamadori region, Fukushima Prefecture (Muto et al., 2013). Residence time of groundwater is significant to estimate flow regime, and sulfur hexafluoride (SF_6) and tritium were analyzed in addition to major dissolved components, heavy metal elements, hydrogen and oxygen isotopes, etc.

Study area was Iwaki and Hirono in the southern Hamadori region. Groundwater samples were collected at 39 wells in Iwaki and 27 wells in Hirono. SF_6 was detected at all wells except for one well, and exceptionally high SF_6 concentrations were measured at four wells. These exceptionally high SF_6 concentrations were presumably caused by local source contamination because such concentrations cannot be explained from equilibrium between groundwater and modern air. Considering that SF_6 was industrially produced after 1953 (Maiss and Brenninkmeijer, 1998), the results imply that groundwater from the almost all wells contain fraction recharged after 1953, at least partly. 25 percentile of residence time assuming piston flow was 18.9 years, median was 21.8 years, and 75 percentile was 26.8 years. Analytical results of tritium are compared with SF_6 based on lumped parameter models (Zuber and Maloszewski, 2001), and regional characteristics of the estimated residence times are shown in the presentation.

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Keywords: groundwater, residence time, tritium, sulfur hexafluoride, Fukushima, The Great East Japan Earthquake

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

AHW27-20 Room:301B Time:May 24 15:30-15:45

Active and Partial River-Groundwater Interaction and the Influence of Nutrient Cycle in the Asahi River Floodplain

MARUYAMA, Yutaka[1*] ; ONODERA, Shin-ichi[1] ; SAITO, Mitsuyo[2] ; KITAOKA, Koichi[3]

[1]Graduate School of Integrated Arts and Sciences, Hiroshima University, [2]Graduate School of Environmental and Life Science, Okayama University, [3]Okayama University of Scienece

Estimation of the groundwater flux and the groundwater residence time in a local actively River-Groundwater interaction field is difficult, although it is important to understand river and groundwater quarity. In this study, to make a model of estimation of groundwater flux using temperature variation and validation of groundwater flux, to classify the River-Groundwater interaction fields using some tracers, and to estimate a nutrient mass flow. In the floodplain in the downstream area of the Asahi River watershed in Okayama prefecture, the analyzed result of the river and groundwater temeperature in 2010-2012 estimated to groundwater flux as 2.9-6.5 m/d. Simulated horizontal temperature distribution showed that there is a limit to estimate groundwater flux. Delta 18-oxygen variations and chloride concentration variations gave support to the groundwater flux estimated by the temperature model. Furthermore, these tracers teached how to classify the River-Groundwater interaction fields; Zone A-C in the waterside land; Zone D in the others. In Zone A-C, groundwater discharge is 8.2% of the river discharge, though 10% of the river nitrate nitrogen mass flow and 5.9% of the river phosphate phosphorus mass flow. It might be influence for river habitats.

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

AHW27-21 Room:301B Time:May 24 15:45-16:00

Phosphate oxygen isotope analysis to study phosphorous cycling

OKUDA, Noboru[1*] ; CID, Abigail[1] ; TAYASU, Ichiro[1] ; IDE, Jun-ichiro[2]

[1]Research Institute for Humanity & Nature, [2]Institute of Decision Science for a Sustainable Society, Kyusyu University

Phosphorus (P), which is an essential element for all of life on the earth, often limits the productivity of aquatic ecosystems, especially of freshwater ecosystems, because of its scarcity relative to other macronutrients. In modern society, anthropogenic P loadings have caused serious eutrophication and deteriorated ecosystem services all over the world, stimulating social needs for studies on P cycling. Although identification of the primary P sources can provide useful information for designing the best ecosystem management practices to control eutrophication, standard methods have not yet been established because P-involved chemical processes are complicated and P has only one stable isotope, therefore, P isotope ratio is not available as natural tracers. With traditional P transport models, for instance, we have difficulty in estimating the relative contribution of P loadings from a variety of sources. Recently, however, a new isotopic technique has been developed to measure oxygen isotope ratio of dissolved inorganic phosphate ($\delta^{18}O_P$), which distinguishes different phosphate sources and also reflects the degree of phosphate turnover by organisms. Here we apply this isotopic technique to identify natural and anthropogenic P sources and evaluate its relative importance to biological P recycling in a watershed ecosystem.

Keywords: Temperature-dependent isotope exchange equilibrium, Kinetic isotope fractionation, Thermal conversion/elemental analyzer, Pyrophosphatase, Phosphate oxygen isotope ratio

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

AHW27-22 Room:301B Time:May 24 16:15-16:30

Last 10,000 years variation in phosphorus supply to a coastal region in a western Japan

ONODERA, Shin-ichi[1*] ; JIN, Guangzhe[1] ; TAKEUCHI, Toru[2] ; JIGE, Mayumi[3] ; KITAOKA, Koichi[4] ; YAMAGUCHI, Kazuhiro[4]

[1]Integrated Sciences, Hiroshima University, [2]Geology Fujita Co., [3]Osaka Otani University, [4]Okayama Science University

Some enclosed seas have a eutrophication issue, most of causes is due to anthropogenic supplies such as agriculture or human waste. But it is necessary to consider the background value or geological stock of nutrient in coastal regions. We aimed to confirm the geological stock and supply variation of the phosphorus in an alluvial plain for 10,000 years. Our research area is located on Okayama Alluvial Plain, western Japan. We drilled and collected the boring core of 6m to 19m at 4 sites. The each core was carried out the dating at the 2 depths, using 14C and volcanic ash. The core at the site of the mountain foot has sandy sediment, whereas another three cores at the coastal side has thick Holocene clay layer. The high phosphorus contents were found at the Holocene clay deposited in around 6,000 to 8,000 years ago under the sea level rising. These periods had rapid warming trend after the Last Glacial period, the increase of rainfall was also suggested. The increase of rainfall would cause the increase of sediment yield. The organic matters in soil are accumulated more in a headwater areas under the cooler climate because of the low decomposition rate, as compared with warmer climate. Based on the results and general present aspects, such high phosphorus content in the sediment is suggested that the organic matters including the phosphorus accumulated in the Last Glacial Period were eroded in headwaters and supplied to the coastal regions with the enclosed sea during the period from around 6,000 to 8,000 years ago with the warming and humid trend. After that, the organic phosphorus had been gradually decomposed, mineralized and released to the groundwater and sea. Such type of background phosphorus would also control the eutrophication and ecosystem environment in the enclosed sea.

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AHW27-23 Room:301B Time:May 24 16:30-16:45

Bed load transport by floods based on the sedimentological analysis of river bed deposits sampled in Chikugo River

INAZAKI, Tomio[1*]

[1]Public Works Research Institute

Sedimentological analysis was conducted to the cores sampled before and after floods at the same points in the estuary of the Chikugo River, Kyushu, southwest Japan. The analysis consisted of sedimentary structure observation to lacquer peels and digital soft X-ray images of the cores, dense and detailed grain size distribution analysis at 2 cm intervals, and susceptibility measurements. The purpose of this study was to understand sediment transport along the channel of Chikugo River, which is the largest river flowing into Ariake Sound where has taken place such severe environmental deteriorations as devastating decrease in fishery production, depletion of dissolved oxygen concentration, and enrichment of mud contents in the bottom deposits. Analyses of the river bed cores sampled at the mouth of the Chikugo River revealed 5 cm erosion of the surficial bed along with accretion of 36 cm thick sand-dominant deposits during the 5 months including 4 time flood events. It is possible to interpret that the sand rich surficial deposits, classified into medium to coarse sand, were transported through the channel to the mouth even by small to medium scale floods.

Keywords: Chikugo River, river mouth, sediment core, flood, bed load

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

AHW27-24 Room:301B Time:May 24 16:45-17:00

Seasonal variability of water hydrogen and oxygen isotopes of the Yangtze and East China Sea

IRINO, Tomohisa[1*] ; YOSHIKAWA, Hisayuki[1] ; NEMOTO, Kazuhiro[2] ; LUO, Chao[3] ; HE, Mengying[3] ; SAITO, Keita[4] ; SUZUKI, Yoshiaki[4] ; TADA, Ryuji[4]

[1]Hokkaido University, [2]Japan Meteorological Agency, [3]Nanjing Normal University, [4]University of Tokyo

The control mechanism of a long-term variability of the East China Sea (ECS) surface water properties in relation to the East Asian Monsoon variation has been eagerly investigated through the reconstruction of the sea surface temperature (SST) and oxygen isotope of ECS water in the past using assemblage and geochemical proxies of calcareous fossils such as foraminifers and corals. It is generally believed that the past oxygen isotope value of the East China Sea surface water could be a good indicator of the salinity which is strongly affected by the fresh water discharge of the Yangtze originated from the summer monsoon precipitation. Therefore, appropriate interpretation of the relationship between SST and oxygen isotope of ECS surface water reconstructed from calcareous fossils is crucial to understand the East Asian Summer monsoon variability as well as oceanographic changes there. Temperature and salinity as well as oxygen isotope of ECS surface water in modern times are determined by complex mixture of various water mass such as the Kuroshio, the Taiwan Warm Current, and the Chanjiang Diluted Water and their seasonal variability are large. This fact has introduced some uncertainty in the paleoceanographic interpretation of the reconstructed surface water properties of ECS.

In order to establish more precise interpretation scheme for oxygen isotope information reconstructed from sediment archive in this region, it is necessary to summarize the seasonal and spatial differences of the isotopes in the Yangtze drainage and the ECS water columns and clarify the basic controlling factors. For this purpose, we collected river waters from main stream and major tributaries of the Yangtze and multi-layer water samples from five stations across the Kuroshio in both summer and winter.

The oxygen isotope of the Yangtze main stream increases from -15 permil VPDB at upper reaches to -8 permil VPDB at lower reaches, being diluted by tributary waters higher in isotope values, and summer value is ˜1 permil higher than in winter. Although the salinity-oxygen isotope relationship looks simple mixing from the Yangtze river mouth to the ECS shelf water, the relationship among temperature, salinity, and oxygen isotope of the seasonally variable Taiwan Warm Current, Kuroshio, and their subsurface water is complex, which makes the detection of the influence from the Yangtze fresh water to the ECS.

Keywords: Yangtze, East China Sea, Hydrogen isotope, Oxygen isotope

Japan Geoscience Union Meeting 2015
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AHW27-25 Room:301B Time:May 24 17:00-17:15

Evaluation of groundwater discharge in a seagrass meadow of coastal area

SAITO, Mitsuyo[1*] ; ONODERA, Shin-ichi[2] ; KOMORI, Asahi[1] ; OKUBO, Kenji[1] ; ARITOMI, Daiki[2] ; JIN, Guangzhe[2] ; MARUYAMA, Yutaka[2]

[1]Okayama Univ., [2]Grad. Hiroshima Univ.

Previous studies have pointed that submarine groundwater discharge (SGD) is one of the important pathways for nutrients to the coastal environment. Nevertheless, its effect on coastal ecosystems such as seagrass meadows is not well examined. In the present study, we aimed to evaluate the groundwater discharge in a seagrass meadow of coastal Seto Inland Sea, western Japan.

In summer periods, the types of eelgrass and green algae covered from the coastline to about 100 m offshore in the study area. Distributions of salinity and radon (^{222}Rn) in seawater and pore water suggest that SGD occurs near the coastline with spatial and temporal variations. The coverage of seagrass meadow tends to increase in the area characterized by lower salinity and higher concentrations of radon and nutrients in the pore water. It suggests the possibility of that SGD effects on the seagrass meadow in the study area.

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Japan Geoscience Union Meeting 2015
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AHW27-26 Room:301B Time:May 24 17:15-17:30

Estimation of nutrient load via to the sea effect of nutrient enrichment on calcification of hard coral

YASUMOTO, Jun[1*] ; YASUMOTO, Ko[2] ; HIROSE, Mina[3] ; NAKAMOTO, Kazuki[1] ; NAKANO, Takuji[1]

[1]University of the Ryukyus, [2]Kitasato Univ. School of Marine Bioscience, [3]Tropical Technology Plus

Coral reef degradation resulting from various types of stress such as nutrient enrichment and inflow of red sand in coastal waters is of increasing global concern. In general, tropical and subtropical seawaters are poor in nutrients and thus oligotrophic. Therefore, the above-mentioned stresses result in the decline of environments favorable to coral growth. Especially phosphate has been considered to possibly inhibit the formation of coral skeleton due to its ability to bind to calcium carbonate. Despite many studies about the effects of nutrients on coral, a clear consensus on how nutrients negatively affect coral still does not exist.

In this study, we estimated the nutrient load through groundwater to the coral reefs sea region of Okinawa through field measurement and numerical simulations, and investigated the effect of phosphate on in vivo skeleton formation of primary polyp for hard coral Acropora digitifera.

Keywords: nutrient Enrichment, groundwater, calcification of hard coral

Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

AHW27-P01 Room:Convention Hall Time:May 24 18:15-19:30

Transportation and precipitation characteristics of toxic element in river and its bottom sediment in Asama-yama area

ISHIKAWA, Mistunori[1*] ; NAKAYA, Shinji[1] ; HAI, Chi[1] ; KUJIOKA, Tomoko[1] ; MASUDA, Harue[2]

[1]Shinshu University, [2]Osaka City University

Some toxic trace elements are often transported to agricultural land by some water system and move to bottom clayey soil by precipitation. Therefore, it is important issue on prevention of health hazards to clarify the mechanism for transportation, precipitation and concentration of toxic elements in a water system.

In this study, in order to clarify the mechanism for transportation, precipitation and concentration of toxic trace elements in a water system, river waters and bottom sediments were sampled at 18 points in a small river of Asama-yama volcanic mountain area. From the correlation between major elements and toxic trace elements, major attracter elements are found in a river. The following conclusions are obtained: 1) The toxic trace elements (Cu, Pb, Co, Sr) in bottom sediments are with compatible major attracter elements; K_2O for (Cu,Pb), (T-Fe_2O_3) for Co, Al_2O_3 for Sr, 2) The toxic trace elements (Cu, Pb) in river waters are with compatible major attracter elements; (Al, Ti) coloid for (Cu, Pb), 3) No attractor for Sr in river water, 4) Fe-colloid is a attractor of (Al, Ti) in river water.

From the described above, it is modeled that first, (Cu,Pb) are transported by Fe-colloid, that is attractor of (Al,Ti), second, Fe-Al-Ti-colloid precipitate with (Cu, Pb), third, (Cu, Pb) are attracted by K_2O, and move to bottom sediment, finally, Fe-Al-Ti-colloid released (Cu, Pb) moves from bottom sediment to river water. These processes are repeated, and (Cu, Pb) are move from water to bottom sediment. Co will move with Fe-colloid, because Fe-colloid is a compatible attractor of Co.

Keywords: toxic trace element, bottom sediment, river

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Modeling transportation of noxious trace elements in rivers by means of colloidal iron interaction

HAI, Chi[1*] ; NAKAYA, Shinji[1] ; ISHIKAWA, Mistunori[1] ; KUJIOKA, Tomoko[1] ; MASUDA, Harue[2]

[1]Shinshu University, [2]Osaka City University

Toxic elements in water systems can expose crops to dangerous levels of contamination through irrigation and soil pollution. Therefore, it is of vital importance to ascertain the dynamic state of noxious trace element as they are carried by soil colloids via river systems. However, the behavior of toxic elements varies depending on their current state. Possible states consist of the colloidal state, in which the element is attracted to some colloids by sorption, or water-soluble state where the element exists as an ion or a complex ion.

The study focuses on two rivers with headwaters in volcanic rock areas near Mt. Asama and Mt. Yatsugatake in Saku, Nagano. The concentrations of both major elements and trace elements are measured before and after filtration. By comparing the concentrations before and after filtration, the current state (water-soluble or colloid) of the toxic elements (Arsenic, Cadmium, Cesium and Lead) in river may be determined. From correlations between the various elements, the parameter that explains the effect of the concentration and transportation of toxic trace elements can be elucidated.

As a result, 1) The current state of toxic trace elements in Mt. Asama area is: Arsenic (water-soluble state), Cadmium (colloidal state), Cesium (water-soluble state), and Lead (colloidal state). The state of toxic trace elements in Mt. Yatsugatake area is: Arsenic (water-soluble state), Cadmium (colloidal state), Cesium (colloidal state), and Lead (colloidal state). 2) When the current state of trace elements is colloidal state, the parameter which explains the effect of the concentration and transportation of toxic trace elements is sorption by Fe-Al-Ti colloid. When the current state of trace elements is water-soluble state, the parameter is pH. 3) The model of transportation of noxious trace elements by means of colloidal iron interaction is formed. The model has two types. Type 1: In Y-river in Mt. Yatsugatake area which does not contain much iron, toxic trace elements are attracted to Fe-colloid by sorption. Type 2: In A-river in Mt. Asama area which largely contains colloidal iron, toxic trace elements are also attracted to Fe-colloid by sorption. However, there are some colloidal irons without toxic trace elements.

Keywords: noxious trace elements, river, colloid, Yatuga-take, Asama-yama

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The comparative study of watershed environment and material circulation -In case small basins of the Goto Islands-

IKEGAMI, Ayaka[1*] ; KODERA, Koji[2]

[1]Undergrad. student , Hosei Univ., [2]Department of Geography, Hosei Univ.

1. Introduction

In general, water composition of the land water is expected to have a relationship between the geological and the surrounding environment. In the case of the islands it is also conceivable to greatly affected by sea salt from its geographical reasons (Goto other 1989). Therefore, this study is to clarify the current status of each island of water environment in Goto Islands, and small watershed of each of its rivers and is obtained by comparing the discussed material circulation in.

2. Regional Overview

Goto Islands islocated in the westernmost of Kyushu. They are over about 80km from the southwest side to the northeast side, consisting of 52 inhabited islands and 11 uninhabited islands. Population is about 70,000 and the total area is 420.87km2. In addition, they have a wide variety of coastal landscapes such as sea cliff and drowned valley. For geology, it is constituted by sandstone and mudstone deposited on the Neogene Miocene called Goto layer group and solute tuff.

3. Investigative method

The local hydrological observation of rivers, mountain streams, groundwater and reservoirs in the Goto Islands went twice at 82 points from 3 to 5 in May and 179 points from 27 to 31 in August, 2014. Observation items is AT, WT, EC, pH and R-pH. Also, the those samples were analyzed to the measurement of total organic carbon and the main dissolved component.

4. Results and Discussion

The value of the EC were many places showing almost 200μS/cm. In contrast, EC showed more than 300μS / cm in agricultural reservoirs and fields near the river Uku Island and Ojika Island and the river near the ranch of Fukue Island. With regard to total organic carbon, those points are showed a relatively high value of 4-6 mg / L. The overall values are lower in August than May. This reason is considered to be because the influence of dilution by precipitation in summer. Also, the major components dissolved rivers are totally the type of Na-Cl except for some, it is understood that it is under the influence of sea salt. The groundwater such as well shows the type of Ca-HCO_3, it is considered to be a circulating water.

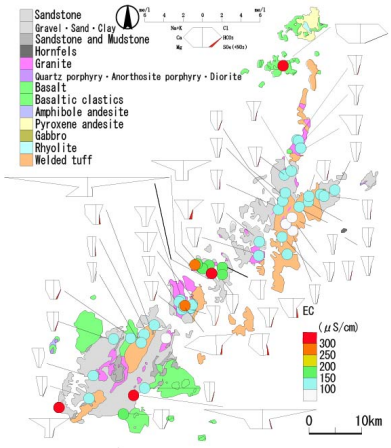
5.Conclusion

Some degrees could be related to the geological feature of the island and the basin, the difference in the environment of the land condition and the water quality clearly by the former study. I'd like to conduct a field survey more in detail by the special by which a typical basin was selected and deepen consideration about a relation between the basin environment and material recycling from now on.

Reference

Goto, H. and Noma, Y.(1989):Stream water geochemistry and estimation of the effect of sea salt in Tokunosima. *Bull. Geol. Surv. Japan*, vol.40(11), p.625-633

Keywords: Goto Islands, Material circulation, Water quality, Main dissolved component



Japan Geoscience Union Meeting 2015
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AHW27-P04 Room:Convention Hall Time:May 24 18:15-19:30

Estimation of the climate change effect on the long-term variation in river temperature in a snow-covered watershed

MARUYAMA, Yutaka[1*] ; ONODERA, Shin-ichi[1] ; KITAOKA, Koichi[2] ; SAITO, Mitsuyo[3] ; SHIMIZU, Yuta[4]

[1]Graduate School of Integrated Arts and Sciences, Hiroshima University, [2]Okayama University of Scienece, [3]Graduate School of Environmental and Life Science, Okayama University, [4]National Agriculture and Food Research Organization, Western Region Agricultural Research Center

According to the effect of climate change such as global warming, it is possibly predicted that seasonal precipitation, snowfall, and river ecosystem changes in a watershed scale. Therefore, the estimation of climate change effect on river environment especially in a snow-covered watershed is important. In the present study, two different trends were found in the river temperature in western Japan; monthly decreasing trends and annual increasing trends. These trends could be explained by the hydrological process such as increase of snowfall and rainfall in the headwater area during winter seasons and increasing of the groundwater discharge to the river in summer seasons, respectively. An estimation of the temperature of river water by an extrapolation model in 2011-2050 indicates that annual temperature will increase.

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Evaluations of spatial distributions in groundwater recharge in an urban and suburban, Yamato river watershed

ONODERA, Shin-ichi[1*] ; SHIMIZU, Yuta[2] ; SAITO, Mitsuyo[3] ; ONISHI, Koki[4] ; MARUYAMA, Yutaka[1] ; JIN, Guangzhe[1]

[1]Integrated Sciences, Hiroshima University, [2]JSPS PD, NARO, [3]Okayama University, [4]Fukken Co

In coastal megacities, sever groundwater depression and land subsidence occurred. For sustainable groundwater use and risk management of flood, it is necessary to estimate not only groundwater recharge in upstream area of a megacity but flood discharge in subsidence area. In addition, spatial distributions of them would be especially expected in various annual precipitations. However, such estimations and predictions in future have not been fully done in previous studies. Therefore, we aimed to evaluate spatial distribution in groundwater recharge and flood discharge in an urban and suburban watershed of 1000km2 scale including Osaka metropolitan city. We applied SWAT model to predictions of floods and groundwater recharge from 1990 to 2013 in Yamato river watershed. It was calibrated by the daily river runoff data from 2003 to 2004 in Japanese Ministry of Land, Infrastructure and Transport and it was validated the data from 2008 to 2009. The daily variation in river runoff in 2012 indicated the typical increase at the rainfall event with the amount above 100mm, especially it was one of the largest flood on the end of June in 2012. According to these results, the increase of the flood risk on the Osaka megacity was suggested. Based on the river runoff simulation, the spatial distributions in groundwater recharge were also evaluated. The urban area indicated the low recharge rate but forest area had the high rate. For the sustainable groundwater use and decline of flood risk, it was suggested that we should keep the present percentage of forest cover.

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AHW27-P06 Room:Convention Hall Time:May 24 18:15-19:30

Effect of groundwater movement on nitrite variation and redox condition in groundwater

ARITOMI, Daiki[1*] ; ONODERA, Shin-ichi[1] ; SAITO, Mitsuyo[2] ; JIN, Guangzhe[1] ; MARUYAMA, Yutaka[1]

[1]Graduate School of Integrated Arts and Sciences, Hiroshima University, [2]Graduate School of Environmental and Life Science, Okayama University

Introduction

Nitrite pollution in groundwater from agriculture area has become a serious problem and it has been caused widely concern. On the other hand, denitrification works as purification action to decrease nitrite in the groundwater, which generally occurred under reduction condition with low dissolved oxygen. However, the research related to mechanism of groundwater movement on redox condition of groundwater is still not enough. In our research, we would like to focus on the redox condition affected by the variation of groundwater movement from a granite unconfined aquifer. And consider its possible impact on denitrification in groundwater.

Location

The study area is located on southern part of Ikuchi Island in central Seto Inland Sea, Japan. The catchment is characterized by steep topography underlain by granite and the bedrock outcrops in up streams area. There shows a small slope near coastal area with the slope of about 1/50. An alluvial fan is formed in the downstream area. As the land use, the orchard of citrus fruits is distributed widely in a basin.

Methods

The observation boreholes are installed at the depths of 15m and 30m in downstream site, the water levels and ORP of each borehole were monitored by automatic data loggers. And water samples were collected at the interval of one month from 2014/9 to 2015/2. During sampling, The DO and ORP were monitored onsite for the calibration of data. After sampling, the water sample were brought back for analysis, NO3-N concentration was analyzed by auto analyzer and Cl- was analyzed by Ion chromatography.

Result and Discussion

he results shows the redox potential showed relatively low level to during the periods between 2014/9 and 2014/12. Which related to the lower groundwater level resulting from small precipitation at that periods. It decreased the groundwater velocity and increased the retention time of groundwater, therefore, the redox condition would like to shift to reduction condition rather than the oxidation condition. NO3-N concentration of 15m borehole is about 9ppm and NO3-N concentration of 30m borehole is about 6ppm.Both of sample show relatively high DO. Therefore, denitrification cannot works actively. The detailed information of nitrate concentration variation accompany with the redox condition change will be shown in this poster.

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Factors controling elevated fluoride concentrations in groundwaters at the western part of Kumamoto area, Japan

HOSSAIN, Shahadat[1*] ; HOSONO, Takahiro[2] ; IDE, Kiyoshi[1] ; YANG, Heejun[1] ; SHIMADA, Jun[1]

[1]Graduate School of Science and Technology, Kumamoto University, [2]Priority Organization for Innovation and Excellence, Kumamoto University

Hydrogeochemistry of shallow and deep aquifer groundwaters collected from boreholes and wells (N=47) along the flow lines of western margins of Kumamoto basin, has been studied in order to evaluate the geochemical controls on fluoride concentrations. Kumamoto city, situated at the central part of Kyushu island in southern Japan, is considered as the largest urban groundwater city in Japan. 100% people of this city depends on groundwater for their drinking purpose. Groundwater aquifers are composed of Quaternary volcanic (pyroclastic) flow deposits. In both shallow and deep aquifers, groundwaters evolve along the down flow gradient from oxidizing conditions of recharge area to the reducing conditions of stagnant area of Kumamoto plain.

Groundwater pH is near-neutral to alkaline (7.05-9.45) while sodium and bi-carbonate is the predominant cation and anion respectively. Groundwaters are mainly Na-HCO_3 type along with few Na-Cl type samples. F^- concentration ranges between 0.1 to 1.57 mg/L with an average of 0.7 mg/L whereas 47% shallow groundwater and 21% deep groundwater exceeded the Japanese drinking water standard (0.8 mg/L). With respect to groundwater chemistry, high F^- concentrations were mainly observed in Na-HCO_3 type groundwater and low concentrations in Ca-HCO_3 type groundwater. F^- is positively correlated with HCO_3^- and Na^+, indicating that groundwater with high HCO_3^- and Na^+ contents help in dissolving of some fluoride-rich minerals. Groundwaters with higher F^-contents have relatively higher pH value, suggesting that alkaline environment favors the replacement of exchangeable F^- in fluoride-rich minerals by OH^- in groundwater. Different ionic relationships imply that the geochemical behavior of fluoride in groundwater is also influenced by the ion-exchange process which release Na^+ to the groundwater and removes Ca^{2+} ions from groundwater. Thermodynamic relationship between the activities of Ca^{2+} and F^- indicate that groundwater is undersaturated with respect to fluorite (CaF_2). However upper limit of fluoride (F^-) is controlled by the precipitation of Ca^{2+} ion. These observations reflect that fluoride concentration in Kumamoto groundwater is mainly controlled by the dissolution and precipitation processes of fluoride and Ca-rich minerals.

Keywords: Groundwater, Volcanic aquifer, Fluoride, Geochemical process, Kumamoto

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Monitoring Radioactive Cs Concentration in a Small Agricultural Pond

KUBOTA, Tomijiro[1*] ; SHIN, Moono[2] ; HAMADA, Koji[1] ; HITOMI, Tadayoshi[1]

[1]National Institute for Rural Engineering, [2]Tohoku Agricultural Research Center

Radioactive materials were released over wide areas around the Tokyo Power Fukushima Daiichi Nuclear Power Plant after the accident caused by the earthquake and tsunami on March 11, 2011. Radioactive cesium pollution in agricultural ponds that supply irrigation water in this region was a concern for the restart of farming. Therefore, it is important to determine the movement characteristics of radioactive cesium around agricultural reservoirs. In this ongoing study since June 2013, we measured the concentrations of radioactive cesium in inflow, outflow, and pooled water in a small agricultural reservoir located in the Abukuma Mountains. The area of the pond was 0.37 ha, and its pondage was 7500 m^3. The concentration of total radioactive cesium in the water was relatively high, around 1-3 Bq/kg, during the summer, but decreased to 0.2-1.5 Bq/kg after October. However, the concentration of total radioactive cesium of the outflow temporarily increased to 2.9-4.0 Bq/kg, when the water level decreased by 1.2 m in the middle of September. The increase in radioactivity was believed to be due to disturbance of the bottom water and sediment caused by relatively fast water flow. The dissolved radioactive cesium concentration in the inflow was 0.02-0.07 Bq/kg, whereas that in the outflow was 0.02-0.11 Bq/kg; both were considerably lower than the total radioactive cesium concentration. The ratios of dissolved radioactive cesium to total radioactive cesium were 1-5% in the inflow and 1-3% in the outflow. Thus, our results showed a positive correlation between the total radioactive cesium concentration in stored water and that in precipitation that occurred over the previous 5 days.

Keywords: radioactive cesium, agricultural pond, irrigation water

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Estimation for migration routes of coastal flatfish juveniles using a stable isotope analysis

HAMAOKA, Hideki[1*] ; HORI, Masakazu[1] ; ISHII, Mitsuhiro[2]

[1]National Institute of Fisheries and Environment of Inland Sea, Fisheries Research Agency, [2]Chiba Prefectural Fisheries Research Center

Coastal fish species migrate among many habitats depending on their ontogenetic changes with the resource requirement. The migration sometimes exceed several tens kilometers, and it is suggested that they play an important role which transport nutrients and materials among various habitats. Therefore, clarifying their migration route and resource use at stop-over sites is essential to understand a nutrient cycling in coastal ecosystems in large scale such as water sheds.

In North Pacific coastal areas, marbled flounder (*Pleuronectes yokohamae*) typically inhabit nearshore and estuarine areas at juvenile stages. In the life cycles, they gradually migrate to off-shore area in dependence on their growth after spending larva or juvenile period in nursery ground. Their migration is suggested to extend for several ten kilometers across ecosystem boundaries, although their migration route and resource use are still unclear. In this study, we tried to estimate the route of juvenile migration of marbled flounder in Tokyo Bay using stable isotope analysis.

We firstly revealed that geographic variation in delta^{13}C signature of organic materials of sediments in Tokyo Bay. Our analyses also clarified that delta^{13}C signature of juvenile marbled flounder well corresponded to that of the sediment in each area where they were caught by monthly census. Using these information and depth data of Tokyo bay, we analytically found two migration routes of the juvenile marbled flounder: Chiba coastal route and Tokyo-Yokohama route. Moreover, the result of our analyses indicated that the contribution of juveniles via Chiba route to the adult population of Tokyo Bay was higher than that via Tokyo-Yokohama route.

Keywords: coastal flatfish, juvenile, migration, stable isotope