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

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Impact assessment of the Seto-Inland Sea Water Profile Based on CMIP5 Model Ensemble

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1.Introduction

This study uses the Regional Ocean Modeling System (ROMS) to project environmental changes of the Seto-Inland Sea in Japan based on the Coupled Model Intercomparison Project Phase 5 (CMIP5) ensemble. The IPCC-AR5 WGI (referred to as AR5) was published in September 2013 and made great progress in impact assessment for future climate changes. Uncertainty of these future projections can mostly be attributed to either greenhouse gas emission scenarios or the precision of the projection model (e.g. GCM). Emission scenarios such as Representative Concentration Pathways (RCP) have been considered and the uncertainty in the model is assessed by the model ensemble mean, which assumes that results are scattered around the true value (IPCC, 2013). Although there are many impact assessments on global or large scale changes in the coastal ocean environment, there are few studies on smaller scale changes, for example in Japan. Further, examination of local scale change has not been consistently discussed in the AR5 large scale impact assessment.

This study analyzed CMIP5 for near-sea surface global and local ocean areas. It also examined the projection of physical environmental changes of the Seto-Inland Sea in Japan by numerical downscaling with CMIP5 forcing.

2.Analysis of CMIP5

CMIP5 was analyzed for present climate named historical, future climate named RCP 4.5W/m^2 scenario (RCP4.5) and RCP8.5. It focused on ten ocean areas, including global areas and locations in east Japan (E125 degrees-E136 dgrees, N27 degrees-N35 degrees). The objective variables of CMIP5 are atmospheric temperature, cloud fraction, humidity, wind speed, sea level pressure, shortwave radiation and longwave radiation, which were analyzed by a 61 GCMs ensemble. Spatial distribution of sea surface temperature (SST) showed a consistent increase overall, with local non-homogeneity; for example, analysis projects an increase greater than 4 degrees increase in the northwest Pacific. The monthly mean of SST in west Japan was projected to change with a maximum increase of 3.5 degrees in June and 2.8 degrees in January. The projected increase is higher than that of the global annual mean. While a constant cloud fraction is projected on the global scale, the model projects a decrease in cloud fraction in west Japan.

3.Future Change of Water Profile in the Seto-Inland Sea

This study calculated the long-term analysis as 2093 using ROMS as downscaling model with forcing variables from CMIP5 results to project future environmental changes in west Japan's Seto-Inland Sea. The projection results in present climate condition were compared with observed results (Tanaka et al., 2013) similarly calculated in 2004. Topography data was taken from Japan GSI, with 1km resolution. Lateral boundary conditions were obtained from FRA-JCOPE. The atmospheric conditions were implemented using hourly results of CMIP5 analysis for temperature, SLP, short wave radiation, cloud fraction and wind speed. In the summer, the SST shows a remarkable increase of about 1.6 degrees. An increase of the same kind of water profile was projected in both shallow and deep areas of Hiuchinada and Kitan straits. A difference between the areas is increasing trend near the sea surface. Remarkable warming near sea surface in Hiuchinada contrasts with constant warming over all layers in Kitan straits.

4.Conclusions

CMIP5 analysis projected a decrease in cloud fraction in the western part of Japan despite projecting a constant cloud fraction on the global scale. Furthermore, although results project an increase in short wave radiation in west Japan. They project a global average decrease.

Using ROMS with forcing from CMIP5 analysis projected an SST increase of 1.6 degrees in the summer. Finally, the water profile tends to remarkably increase in shallow water, such as in Hiuchinada.

Keywords: the Seto-Inland Sea, water profile, ROMS, CMIP5, cloud fraction, short wave radiation

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AHW26-02 Room:301A Time:May 27 09:15-09:30

Study on origin of high- pH spring in Yuzawa Geopark, Akita

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Yuzawa Geopark, located in the southeastern part of Akita prefecture, is famous for geothermal activity and various types of hot springs. In addition, there are many springs that are recharged by huge amount of snow in this area. A high-pH spring (pH>9) is located in a Neogene hill. There is no hydrological study on the high-pH spring. Therefore, this study aims to clarify the origin and groundwater quality evolution process of the high-pH spring. We will show the results of major dissolved ions and stable isotopes of springs that were collected in September and November of 2014.

The high-pH spring discharges from joint of Neogene clay layer, and white deposit (calcite?) was found in the joint around of discharge point. pH and EC of the high-pH spring were 9.7 to 9.9 and 460 to 480 μS/cm, respectively. Groundwater quality showed Na-HCO_3 type. As for δ^{18}O and δD, the high-pH spring was located along local meteoric water line (d=20). Considering the correlation between isotopic ratios and elevation of discharge points that were obtained from the springs that were collected in wide area of the geopark, elevation of the recharge area of the high-pH spring was estimated more than 400 masl. However, this value was much higher than the elevation of topographical recharge area of the high-pH spring. The results of this study suggest that the high-pH spring may be recharged by regional groundwater flow system and may have long travel time.

Keywords: high-pH spring, multi tracer, environmental isotopes, Yuzawa geopark

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AHW26-03 Room:301A Time:May 27 09:30-09:45

A prompt report on influence and change on the river of around Mt.Ontake after eruption (140927)

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1.Introduction

Mt.Ontake located in the boundary of Nagano and Gifu erupted by phreatic explosion at about 11:53 a.m. on September 27, 2014. The volcanic ejecta which occurred by this eruption gets into the lake and the outskirts river of the mountaintop neighborhood, so naturally influence on water environment is thought about. Therefore our laboratory started a continuation investigation to check a change of the water environment of a river around Mt.Ontake by the eruption.

2.Survey method

The field work item is AT,WT,pH,RpH,EC. In addition, I performed the water quality measurement of the plumb direction using ALEC at some spots. Furthermore, I collect water and take a sample home with me and analyze TOC, major dissolved component in a laboratory.

3.A result and consideration

Volcanic ejecta flowed in Nigori river of the crater south side of Mt.Ontake and Outaki river after the Nigori river junction, and river water was able to observe a cloudy state. From result of a measurement of pH, the around Mt.Ontake river became the value before and after 7.0 generally, but showed a value before and after 3.5 and the strong acidity at the cloudy spot. In addition, the value of the EC is less than 20 mS/cm generally, too, but a value is big at the cloudy spot, and a value called 170 mS/cm is observed in Nigori river just after the eruption.

There is not a cloudy state, and a value of pH is around 7.0 in the river of the east side of Mt.Ontake. But a value of the EC is slightly big in a part river. In addition, with the Nobunaga Bridge whom there was near a mountain rising to a great height ropeway, pH was around 4.5 values and the value of the EC was relatively big. So I knew that influence of the eruption appeared on the east side of Mt.Ontake particularly in mountaintop neighborhood

The cloudy river water of Outaki river flows into the Ontake Lake made by a dam. As for the surface water of the Ontake Lake and a spot more downstream than the Ontake Lake, there was no great difference between pH, EC and the whole around Mt.Ontake river together at the stage of the investigation of October 8 just after the eruption. But when it was on October 31, a drop of pH and a rise of the EC were confirmed, and a similar change was seen. The volcanic ejecta which flowed into the Ontake Lake only deposited in the bottom of a lake at the stage of October 8, but I have lake water cycle in the Ontake Lake from here to October 31, and influence of the volcanic ejecta of the bottom of a lake appears in the whole lake, and it can call that such a water is discharged by the dam, and a change appeared in the downstream water.

4.Conclution

Influence and a change to the quality of the water of the around Mount Ontake river by the eruption became clear. I continue an investigation and investigate the crater lake of source area and the Mitake mountaintop as much as possible and will examine influence of the eruption more in future.

Keywords: Mt.Ontake, eruption, volcanic product, Ontake Lake, matter cycle

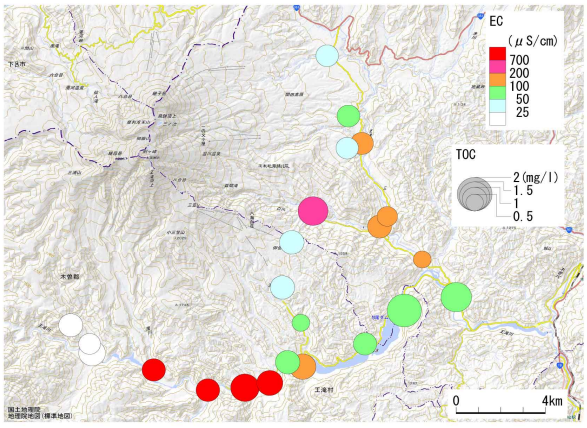

figure1 Distribution of EC and TOC

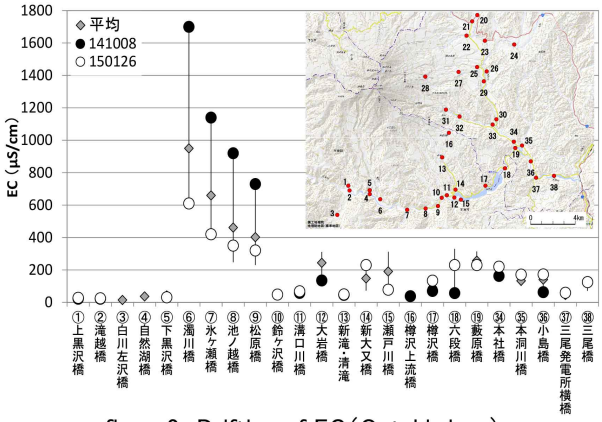

figure2 Drifting of EC(Outaki river)

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AHW26-04 Room:301A Time:May 27 09:45-10:00

Loading Processes of Chemical Matters in a Forested River Catchment : Observations and Modeling

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River water is one of the most important natural resource for our live and has much influence for lake and the earth because of fast transport velocity. Especially, outflow of chemical matters in river is related with river ecosystem and make lake eutrophication. We targeted Oikamanai river basin, forested catchment in Hokkaido. In this catchment, landuse is 88.3 % forest and 10.6 % farmland. Geology is the Neogene Miocene mud and sand stone, half of which is composed by marine deposit.We got the data on concentration of chemical matters and time series of discharge, electric conductivity (EC) and MET data. Fresh water's EC monitoring is new technology, so there are few reports. In this study, we calculated time series of concentration of chemical matters and chemical matters load using co-relation of concentration of chemical matters and EC. We analyzed discharge route using Tank-model. Using this result, we calculated chemical matters load at each discharge route. We discuss mechanism of outflow of chemical matters in forested catchment with these data.

In this study, we targeted Mg^{2+}, Ca^{2+}, Na^{+}, ${SO_4}^{2-}$, ${HCO_3}^{-}$ because they have much influence for EC. As a result of Tank-model, baseflow is distinguished, 68.3 % and surfaceflow is distinguished in high discharge events. ${HCO_3}^{-}$ analysis intended soil water tend to cultivate to underground. ${HCO_3}^{-}$ was more dissolved in river water in high discharge events, this is insisted to be caused by river erosion. ${SO_4}^{2-}$ analysis showed iron pyrites is oxidized in weathered mantle and upper basin and organic matters is bitten by microbe. Ca^{2+}, Na^{+} , Mg^{2+} analysis suggested ionic exchange with H^{+} occur in soil.

Keywords: forested river basin, chemical matter, Tank-model, L-Q equation

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AHW26-05 Room:301A Time:May 27 10:00-10:15

Evaluation of Land cover change and Flow regime change in upper area of Dong Nai river basin, Vietnam

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Vietnam is considered as one of the top countries to be severely affected by climate change, particularly in coastal areas. That by 1 m sea level rises, Vietnam would lead to flooding of up to 20,000 km^2 of the Mekong river delta and more than 1 million people would be directly affected in there and it is also predicted economic loss up to 10% GDP (Dasgupta *et al.*, 2007). In rainy season a combine of SLR and rainfall increase to make a serious impact on low-lying coastal areas. It is also predicted that 40,000 km2 of coastal delta region, 90% of the Mekong delta will flood (Eastham *et al.*, 2008) and temperature is more significantly rise in the plateau region (MONRE, 2012).

Dong Nai river and Mekong delta downstream are located in and supplied the major water resources to the whole Southern of Vietnam. Continuous changes in water resources due to climate changes and several controversies about the potential impact of sediment transport and river flows downstream due to either the cascade hydroelectric power plant system or dam construction in the upper of Mekong delta being continuous. In addition, water resources from Dong Nai river is the resource that only controlled by Vietnam. On the other hand, solving the problems of water shortage in the dry season and flood control in rainy season are also important for issues of water management at Dong Nai river basin. Therefore evaluation of flow regime change by the affect of climate change and human activities is an urgent issue in Vietnam.

That forest area decreased as a human activity is the big problem in Vietnam. In the period from 2002 to 2009, 620 km^2 of forest land lost on average per year and 250 km^2 of forest land was converted to other land use (Vietnam Forest Protection Agency, 2010). The main reasons of deforestation are unsustainable logging and agricultural land development (Hoang M. H. *et al.*, 2010). In most cases the forest vegetation lost, runoff increases conversely forest vegetation growing, runoff often decreases (Maita and Suzuki, 2008).

The river flow regime was analyzed from 1989 to 2009 runoff data at 3 observation stations in study area. The Landsat images in 2014 and 2005 were used to classify to 5 majors of land cover such as the dense-forest, spare-forest, crop-land, bare-land and water body.

Dong Nai river basin area is 14,713.5km^2 with the main land cover types are dense-forest 35%, spare-forest 26% and cropland 24% in 2005. From 2005 to 2014, the large area of forest (both in dense and spare) was converted to crop-land and bare-land; a part of spare-forest had became dense-forest. Especially the majority of bare-land (7%) had been converted into the other land cove types. The ratio land cover was dense-forest 33%, spare-forest 16% and cropland 39%. We can see that deforestation has occurred in the study area from 2005 to present.

As the inflow of Tri An dam, the flow regime at Tri An (basin outlet) slightly increased in all the flow rates of normal discharge, low-water flow and drought flow but slightly decreased in hosui flow. Flow regime of Ta Lai point, where affected by deforestation, hosui flow and normal discharge is slightly increased but change trend of low-water flow and drought flow were not observed. As the inflow of upper stream dam, the flow regime at Da Nhim increased in all the flow rates of hosui flow, normal discharge, low-water flow and drought flow.

Keywords: Dong Nai river basin, Flow regime, Land cover change

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Characteristics of groundwater temperature distribution of deep wells in Aizu basin

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The Shibasaki Laboratory of Fukushima University has conducted a joint research, 'Analysis on Geological Structure of Quaternary and Hydrological Structure in Aizu basin' with the Shallow Geothermal and Hydrogeology Team, AIST. The laboratory has carried out studies on groundwater flow and groundwater temperature. Considering popularization of ground-source heat utilization system, comprehension of groundwater flow will be able to design more efficient system.

In this study, we collected continuous monitoring data of groundwater level and groundwater temperature. We also measured pumped water temperature and its quality from sprinkling snow-melting wells, and depth-wise temperature at an interval of 2 m in deep wells.

Groundwater level of deep wells and some shallow wells showed reduction of groundwater levels in winter. This is because snow-melting wells were operating. Most of their depths range from 150 to 200 m and their strainers are installed at multiple layers, so groundwater is pumped from several aquifers. Groundwater temperature of snow-melting wells found to be higher in the eastern part of Aizu basin. The similar trend was identified in temperature distribution maps prepared by Kaneko et al. (2014).

There are some snow-melting wells with artesian flow at the periphery of Aizu Basin and their temperatures are higher than the neighboring snow-melting wells. This is because upward movement of groundwater occurs in artesian wells. In general, temperature should be higher in the western part of the central Aizu basin which lies in downstream area. However, groundwater temperature was higher in eastern part.

Moreover, snow-melting wells in the eastern part of the basin showed higher temperature, although there is no artesian flow. In these places, the thickness of Quaternary system is small and groundwater may be pumped from not only Quaternary system but also Neogene system.

For further investigation, we will examine chemical composition of groundwater by ion chromatography.