# Assessing the effect of climate change on the hydrology of the Wainganga River basin using VIC model

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Climate change is one of the most important global environmental challenges, which affects the entire earth system in terms of negative impacts on food production, water supply, health, livelihood, energy, etc. The study aims to assess the long-term impact of on the streamflows in the Wainganga basin at Ashti station for period 1951-2014. The Wainganga basin is the biggest sub-basin of the Godavari and accounts for nearly 1.56% of the total geographic area of India and 16.45% of the total area of the Godavari basin. Wainganga is an agricultural basin with around 51% under cultivation land. Changing climate can have huge impact on the livelihood of the people. Precipitation has decreased by 7.95% in the basin during the study period while temperature have increased by 0.48^{o}C. Variable Infiltration Capacity (VIC) model was used for simulating streamflows. 20 years' durations were selected as calibration (1970-1989) and validation (1990-2009) periods. Daily NSE, COD and RE of 0.85, 0.92 and 2.6% and, 0.84, 0.92, and 1.45% were obtained during calibration and validation of the model respectively. Analysis demonstrates a significant decreasing trend in the basin showing 15.02% decrease in mean annual flows. The decrease is due to decrease in precipitation and increase in losses due to increased temperature. The study contributes to the knowledge and understanding of the climate change impact on the local catchment level.

Keywords: Climate change, hydrological modelling, VIC model, streamflow
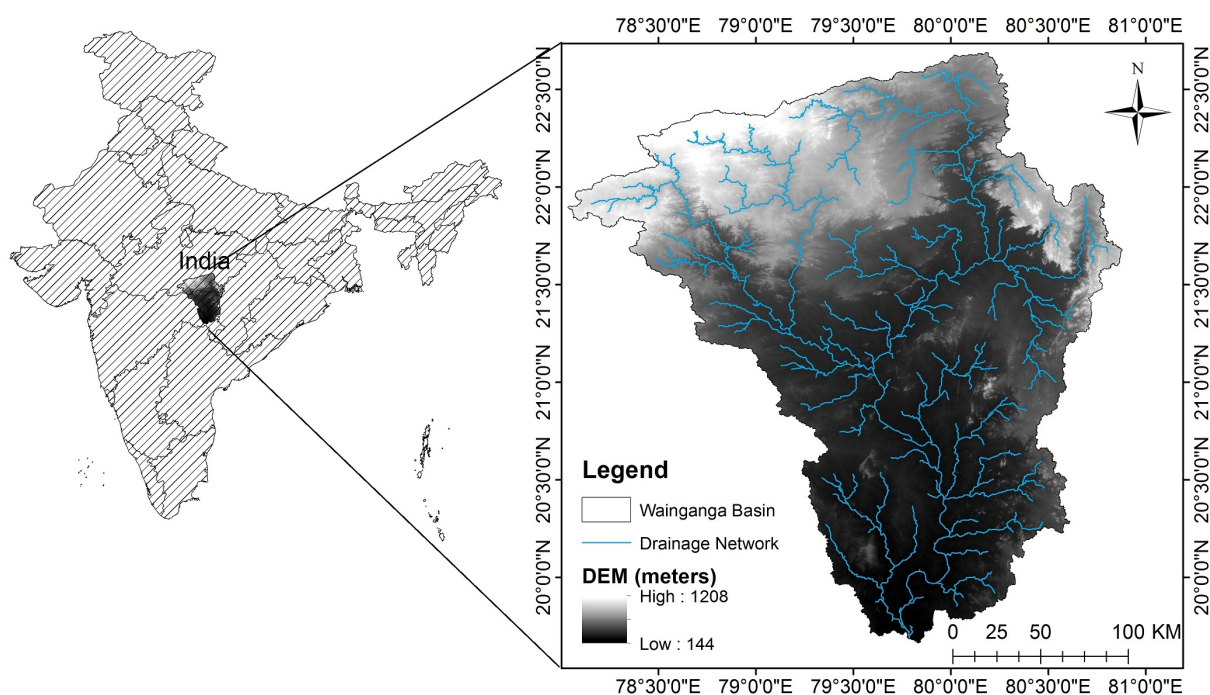
Numerical simulation of the climate effect of high-altitude lakes in the Tibetan Plateau

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Lakes regulate the water and heat exchange between the ground and the atmosphere on different temporal and spatial scales. However, studies of the lake effect in the high-altitude Tibetan Plateau (TP) are gradually performed until recently and little attention was paid to modelling of frozen lakes. In this study, we employ the WRF v3.6.1 model to conduct the three groups of long-term simulation experiments of Ngoring Lake basin in the TP (original experiment, experiment with a tuned model, and no-lake experiment). Based on these experiments, we evaluate the effect of model improvement on the simulation in the high-altitude lake basin, and investigate the influence of lake on the regional climate. After the lake depth, the roughness lengths and initial surface temperature are corrected in the model, the simulation of the air temperature is distinctly improved. In the experiment with a tuned model, the simulated H on the lake surface is also clearly improved, especially during the periods of ice melting (from late spring to early summer) and freezing (late fall). However, the H on the lake ice is predominantly negative, which exhibits a relatively large difference from the observation. The improvement of LE is primarily manifested by the rapid increase in the correlation coefficient between the simulations and observations, whereas the improvement in the averaged LE is relatively small. The initial surface temperature improvement shows most prominent effect in the first year, and which distinctly weakens after a freezing period. After the lake becomes the grassland in the model, the daytime temperature clearly increases during the freezing and melting periods, the nocturnal cooling appears in other time, especially from September to October. The annual mean H increases by 6.37 times in the regions of original Ngoring Lake and Gyaring Lake areas, and the LE declines by 56.17%. The sum of H and LE increases from 71.23 W m-2 (with lake) to 84.58 W m-2 (without lake). For the entire simulation region, the sum of H and LE also increases slightly. After the lakes disappear, the air temperature increases significantly over the two lakes from June to September, and a typical abnormal convergence field forms. At the same time, the precipitation clearly increases in the original two lakes and surrounding areas, whereas the precipitation generally decreases in other regions. The pattern of the precipitation increase region is consistent with the inter-annual variation of the convergence field.

Keywords: lake effect, Tibetan Plateau, frozen lake, latent heat flux, precipitation

Meteorological drought change evaluation using comparative standardized precipitation index with d4PDF future and past experiments

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Meteorological drought defines a baseline for the other droughts, such as hydrological, agricultural, and socio-economic droughts. Meteorological drought indices are simply derived using only the meteorological variables, such as precipitation and temperature. The standardized precipitation index (SPI) is used by national meteorological and hydrological services around the world to characterize the meteorological droughts on multiple timescales longer than 1 month. The SPI is computed as follows. The cumulative distribution function (CDF) of the gamma distribution is fitted with the aggregated precipitation dataset at a desired timescale. The fitted CDF is converted to the standardized normal distribution, and the SPI value is computed as the standard score, or Z-score, of the corresponding precipitation. Due to the standardization, the 50th percentile value of precipitation is converted to SPI=0, and the 84.13th and 15.87th percentile values are converted to SPI of +1 and -1, respectively. The SPI values less than -1 are generally treated as the meteorological drought.

The comparative SPI (cSPI) is an extension of the SPI and was developed for meteorological drought assessment under climate change as well as monitoring drought hazards by dividing the input dataset of precipitation into the reference and target datasets. The CDF parameters are estimated with the reference dataset, and the precipitation of the target dataset is converted to the Z-score of the standardized normal distribution related to the CDF using the parameters estimated from the reference dataset. This cSPI approach enables us to estimate the shift of the central condition of the target dataset and the probability changes of dry and wet conditions in the target dataset on the basis of the reference dataset.

The d4PDF (database for Policy Decision-making for Future climate change) consists of three sets of experiments using a general circulation model with 60-km horizontal grid developed by Meteorological Research Institute of Japan: historical climate experiment (100 runs, 60 years from 1951 to 2010), non-warming past experiment (100 runs, 60 years), and +4K future climate experiment (90 runs, 60 years). We compute cSPI of the non-warming past and +4K future climate experiments on the basis of 100 members of the historical climate ensemble experiment, respectively. We demonstrate the changes in the central conditions and in the probabilities of dry and wet conditions with cSPI due to the anthropogenic global warming in future (+4K vs. historical) and past (non-warming vs. historical) climate experiments.

References:
Hasegawa, A., M. Gusyev, T. Ushiyama, J. Magome, and Y. Iwami (2015) Drought assessment in the Pampanga River basin, the Philippines --- Part 2: A comparative SPI approach for quantifying climate change hazards, in "MODSIM2015, 21st International Congress on Modeling and Simulation", ISBN:978-0-9872143-5-5, 2388-2394, http://www.mssanz.org.au/modsim2015/L13/hasegawa.pdf.
Hasegawa, A., M. Gusyev, and Y. Iwami (2016) Meteorological drought and flood assessment using the comparative SPI approach in Asia under climate change, J. of Disaster Research, 11(6), 1082-1090, DOI:10.20965/jdr.2016.p1082.

Keywords: meteorological drought, comparative SPI, anthropogenic impacts, climate change, d4PDF

- AHW34-P03 -

Evaluating Dynamically and Statistically Downscaled Climate Model for Rainfall Extreme: A Case from Karnali Basin in Western Nepal

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It is well agreed that the climatic extremes events are increasing in last few decades and many scenarios have predicted that those events will increase also in future. There are is an agreement among the climate models on the future increase in temperature, however in case of rainfall, there is a high uncertainty. The global climate models are downscaled either by using the local topography (dynamic) or by establishing a relationship of local weather with the large scale atmospheric phenomenon (statistical). In this paper we attempt to analyze the rainfall extreme events with the dynamically downscaled regional climate models and GCM informed statistically downscaled models for a data scare region of Nepal-Karnali basin. We tested the performances of CORDEX South Asia data and downscaled at the station scale using the SDSM 5.2 (Decision Centric) by providing the GCM informed climate scenarios.

Keywords: Rainfall, Himalayas, Extreme, Models

Evaluation of Uncertainty in Long-term Rainfall-Runoff Forecast for Development of Long-term Prediction Based Water Management System

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The needs for probabilistic long-term forecast is growing more urgent than ever recently with climate change, because of the greater uncertainty in precipitation, the heightened frequency and intensity of natural disasters such as flood and draught, and the increased social demand for stable water supply. Korea Meteorological Administration, a governmental agency, is currently running a long-term forecast using GloSea5, a global seasonal prediction system, but few research has been done on utilization and application of said system in water management. In this study, we focused on Yongdam Dam and Namgang Dam, the most notable multipurpose dams in Korea's Geum and Nakdong river watershed, respectively; extracted GloSea5's long-term rainfall forecast data (for max. 6 months) for these areas; compared the data with observations and conducted bias correlation on the quantitative differences by the quantile delta mapping (QDM) method; and thereby assessed and measured the accuracy of and the uncertainty in the GloSea5 predictions. In addition, we conducted a long-term runoff analysis taking into account the uncertainty in long-term forecasts, by means of K-DRUM, a distributed rainfall-runoff model generally adopted in dam operations, seeking to establish a long-term plan for dam operation. Our analysis results suggested we could considerably mitigate the quantitative gap between observations and long-term forecasts using the QDM method. The outcome also showed representable patterns comparatively similar to observations. And the result of long-term runoff verification included the observation data within its confidence interval after considering the uncertainty, sufficiently supporting the feasibility of a long-term operation plan for dams. This study concludes it is possible to maintain stable water storages and to plan for water level management by utilizing long-term forecast techniques.

Keywords: GloSea5 Model, Long-term Prediction Forecast, Distributed Rainfall-Runoff Model, Evaluation of Uncertainty

Using HECHMS and WASH123D for operational water stage forecasting of KaoPing River in Taiwan

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Extreme typhoon rainfall over Taiwan usually causes severe flood damage. Since the impacts of flooding may include social, economic and environmental problems, it is very important to establish a local flood warning system to prevent or mitigate flood disasters.

In 2010, Taiwan Typhoon and Flood Research Institute (TTFRI) started Taiwan Cooperative Precipitation Ensemble Forecast Experiment (TAPEX) that was designed for providing skillful typhoon predictions to related agencies such as CWB, NCHC, SWCB, WRA, and NCDR. To date, TAPEX has included 26 members and is run operationally 4 times a day. In each run, the 72 hours precipitation forecasts are provided.

The purpose of this study is to establish an operational local water stage forecasting system for KaoPing River in Taiwan using HECHMS as a runoff model and WASH123D as a 1D/2D coupling flood model. Precipitation forecasts provided by TAPEX are used in the forecasting system as the input rainfall data. The performance of the developed forecasting system is verified using rain gauge data and observed water stage data. In addition, a web based data monitoring system is constructed for not only collecting real-time observed data, but also displaying the model results compared with observed data.

Keywords: HECHMS, WASH123D, operational, TAPEX
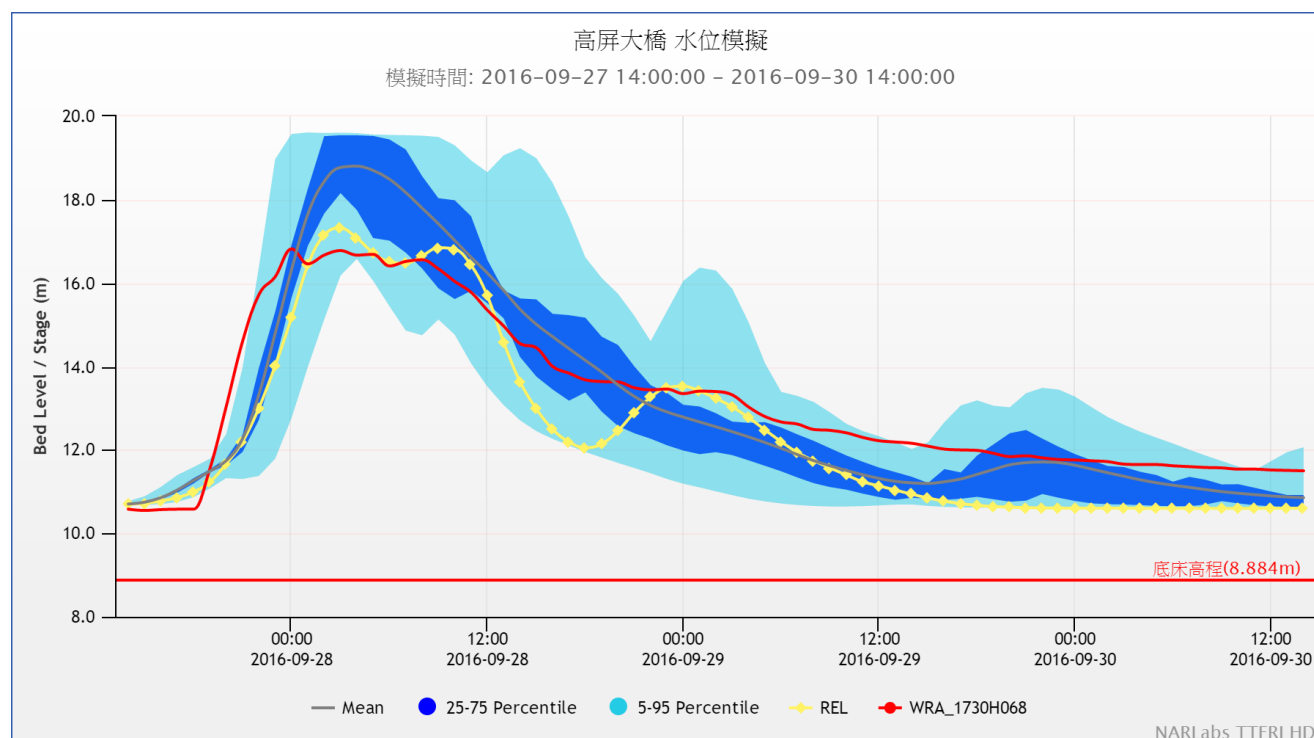
Infrared Sounding Observation of Soil Moisture and Relationship with Skin Temperature

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We have developed a simple, yet effective scheme to derive volumetric soil moisture (VSM) using infrared (IR) land surface emissivity retrieved from satellite measured IR spectral radiance. This novel scheme is applied to a 10-year period of global IR emissivity data retrieved from MetOp-A Infrared Atmospheric Sounding Interferometer (IASI) measurements. The VSM calculated from these IR emissivity data (denoted as IR-VSM) is compared with that routinely retrieved from satellite microwave (MW) multi-sensor measurements (denoted as MW-VSM). Monthly-mean spatially-gridded climatology datasets are then generated to demonstrate VSM spatial variation as well as its seasonal-cycle and inter-annual variability. Positive agreement is shown to exist between IR- and MW-VSM. The relationship between soil moisture and surface skin temperature, as well as the skin temperature diurnal difference (denoted as dTs), were examined globally using the land surface skin temperature (denoted as Ts) retrieved from the same measurements of IASI. We are able to draw the conclusion that both skin temperature and skin temperature diurnal differences follow an inverse relationship with soil moisture.

Keywords: Remote sensing, Infrared, retrieval, soil moisture, skin temperature

Simulating soil moisture dynamics in the overexploited Indo Gangetic alluvium area in Central Punjab, India

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In arid and semiarid areas, accurate estimation of groundwater recharge is essential for sustainable management of water resources. In the Indo-Gangetic alluvial plains of Punjab region, India, groundwater is the main source of irrigation. Insufficient rainfall associated with intensive cultivation in the alluvial plains of this region has resulted in the degradation of groundwater regime both in quality and quantity. In view of moderate to low rainfall in the region, return flow from applied irrigation is likely to be a major source of groundwater recharge. In this study, we estimated the contribution of irrigation return flow on groundwater recharge in paddy fields by modeling water flow in the vadose zone using the HYDRUS-1D software and compared the results with the estimated recharge on a rainfed site by the injection of tritium.

Three representative sites in the alluvial plain were selected, one rainfed site and two fields under rice cultivation. For each site, soil moisture was monitored in situ by vertical neutron probe surveys. The hydraulic properties of the soils at the site were determined using in situ experiments and laboratory measurements. Tritium was injected at selected sites and groundwater recharge was estimated from the depth profile of tritium.

At each site, the 1-dimensional flow model was calibrated using climate, soil hydraulic property, and groundwater levels data, and was validated using the measured soil moisture content. Good agreement was achieved between the HYDRUS-1D simulations and field measurements of moisture content for both rainfed and paddy cultivated sites. Based on the calculated results, unsaturated moisture influx was estimated.

Keywords: Irrigation return flow, Soil moisture dynamics, Modeling

Development and Application of a Distributed Source Pollutant Transport Model Based on BTOPMC

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Agricultural non-point and industrial point sources are contributing nitrogen and phosphorus concentrations in Chinese catchments and these pollutants cause degradation of river water quality for a long distances. To evaluate these impacts, a distributed pollutant transport model was developed on the basis of BTOPMC (Block-Wise Use of TOPMODEL with Muskingum-Cunge Method), a grid-based distributed hydrological model. In this model, the water flow routing process of BTOPMC is the carrier of pollutant transport and these pollutants are washed off with a direct runoff. Pollutant flux for each grid is simulated based on mass balance of pollutants within the grid and pollutant transmission occurs between grids in the direction of the water flow on daily time steps. The model was tested in the study area of the Lu county area situated in the Laixi river basin in the Sichuan province of southwest China. The simulated concentrations of nitrogen and phosphorus are compared with the available monthly data at several water quality stations. These results demonstrate a greater pollutant concentration in the beginning of high flow period indicating the main mechanism of pollution transport. From these preliminary results, we suggest that the distributed pollutant transport model can reflect the characteristics of the pollutant transport and reach the expected target.

Keywords: Pollutant transport, BTOPMC, Distributed hydrological model, Muskingum-Cunge Method, Modeling

Reexamination of Nitrogen Loading in Inbanuma Basin

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1.Introduction

Nitrogen circulation is mentioned as one of the most serious environmental factors due to global nitrogen excess and nitrogen saturation. In Japan, we are planning to improve the water quality by establishing Lake Water Quality Conservation Plan against the eutrophication problem of closed watershed. Inbanuma Lake in Chiba Prefecture is one of the designated lakes, and the generated pollutant load amount using the unit loads is calculated in the Lake Water Quality Conservation Plan. However, since it uses the same unit loads for the past 30 years, it is considered necessary to reevaluate, and new values were proposed for some items in Fujimura (2015). Therefore, in this study, I prepared two nitrogen load amount distribution maps of the Inbanuma basin from the unit loads of the Lake Water Quality Conservation Plan and Fujimura (2015) unit loads, and compared the load amounts of the two distribution maps and studied the unit loads.

2.Research method

First, the nitrogen load amount was calculated for each section divided by the administrative circle and catchment area for each incoming river. Nitrogen load amount was calculated by multiplying the unit loads by the 2010 statistical data provided by the Water Quality Conservation Division of the Environmental Department, Chiba Prefecture. The load amount can be classified into living load from residential land, animal husbandry load from livestock, natural loads which are surface source pollution loads such as forest and upland field, and work site load from workplaces. Next, in the 2007 land use map created by the Inbanuma Basin Water Circulation Revitalization Council, I set the living load amount in the residential land, the livestock load amount in the field, the work site load amount in the urban area, and the natural load amounts were allocated for each land classification such as forest and upland field. Finally, nitrogen load amount distribution maps were created by dividing into 250 m mesh. In order to investigate the adequacy of the load amount in two distribution maps, I set catchment areas with the water quality measurement points of the total nitrogen concentration as the outlet, and compared the nitrogen load amount in the catchment areas with the measured nitrogen outflow at the outlets. Nitrogen outflow was calculated from the total nitrogen concentration measured by the Water Quality Conservation Division of the Environmental Department, Chiba Prefecture and the flow rate measured by the Inbanuma Basin Water Circulation Revitalization Conference.

3.Result and Discussion

Since a good linear relationship was shown between the nitrogen load amount and the nitrogen outflow in each catchment area in the Inbanuma basin, it was shown that the nitrogen load amount in the catchment area increases the nitrogen outflow of the river. When the unit loads of the Lake Water Quality Conservation Plan was used, the slope of the regression line was 1.40, and the nitrogen outflow greatly exceeded the nitrogen load amount, so there is a possibility that the nitrogen load amount is largely underestimated. On the other hand, when using the proposed unit loads of Fujimura (2015), the slope was 1.09, and the nitrogen load amount was approximately proportional to the nitrogen outflow. However, there is a possibility of underestimating the nitrogen load amount obtained in the proposed unit loads, since in the actual outflow process, nitrogen is considered to be decreased by the denitrification process, and it is unlikely that the nitrogen outflow exceeds the nitrogen load amount. In addition, the nitrogen outflow used in this study was calculated from the observed value at the time of flat water, and

the nitrogen outflow caused by the first flash at rainfall was not considered. Therefore, there is a possibility that the value is underestimated not only in the unit loads of the Lake Water Quality Conservation Plan but also in the proposed unit loads.
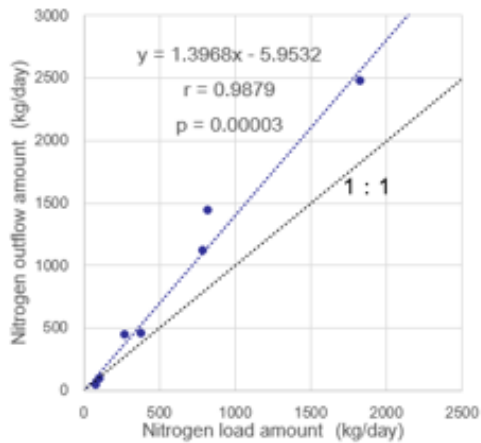
Keywords: nitrogen circulation, unit load, denitrification
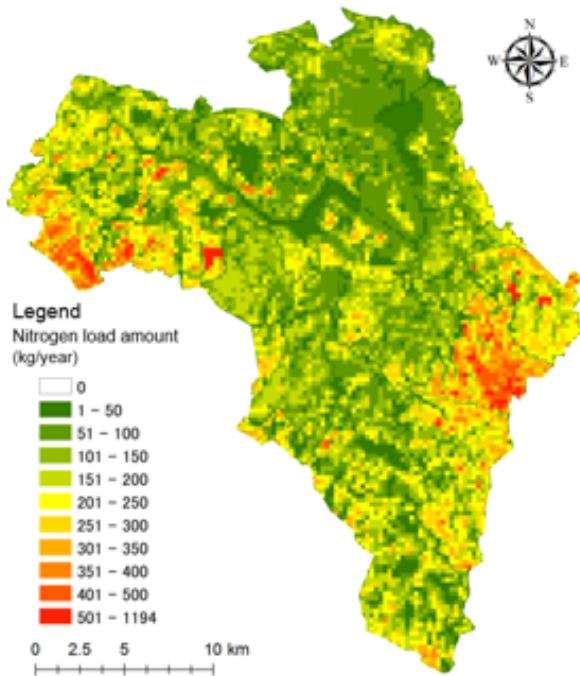
Nitrogen load amount distribution map
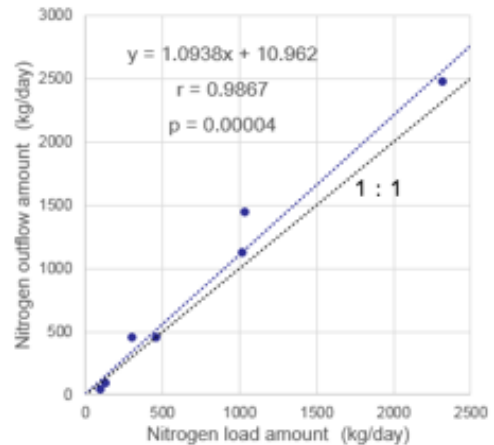~Unit load of Lake Water Quality Conservation Plan~
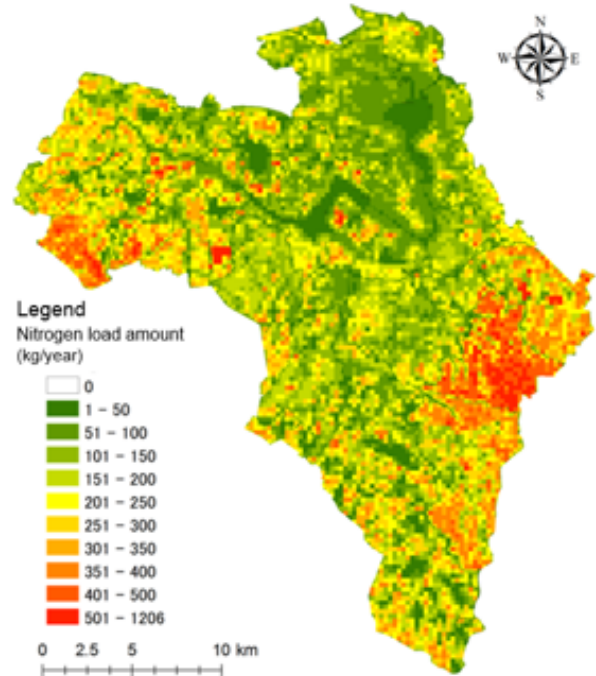
Nitrogen load amount distribution map
~Unit load of Fujimura (2015)~

Unit load of Lake Water Quality Conservation Plan
Diagram showing the relationship between nitrogen load amount
and nitrogen outflow amount

Unit load of Fujimura (2015)
Diagram showing the relationship between nitrogen load amount
and nitrogen outflow amount

Mercury speciation in fish muscles from Lake Biwa and human health risk assessment

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Fish are exposed to metals via both aqueous and dietary routes. Some metals such as mercury (Hg) come mainly from dietary sources, with accumulation from aqueous routes providing a small contribution to the total Hg burden. Many studies have been conducted to understand the Hg accumulation focused on marine fish, however, only a few study has been conducted in fresh water. People who live near lake may also eat fresh water fish as well as marine fish. Therefore, it is important to understand the mercury concentration in fresh water fish as well as marine water fish. In our study, mercury concentration and other metals in fish was measured caught from Lake Biwa, the largest lake in Japan. Result from mercury concentration in fish, we estimated the human health risk caused from fish intake. Sampling was conducted during May 2011 to May 2012 sampling campaign. 82 fish sample, plankton sample, and water sample were sampled in Lake Biwa. Mercury concentration in fish muscle tends to be high as the trophic level going up.

Keywords: mercury, fish, Lake Biwa

Regional characterization of river and spring waters by trace element signature

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Development of analytical techniques for chemically specifying the production place of foods are expected for food safety. We have been developing analytical techniques for the provenance analysis of foods. From last year, we started an investigation of river water and spring water designated "the best 100 natural water sources in Heisei period1)" Water is a key material for provenance analysis of agricultural and forest commodities, because water is one of essential resources in the cultivation of vegetables and agricultural crops. It is thus expected that trace element information of water will be an important indicator for distinguishing the production area. The purpose of the present study is to confirm the idea that trace element signature of water reflect the local geology and hence that of a plant reflects the geology of the area.

Natural water samples from 40 points (16 rivers and 24 springs) were collected into polyethylene containers with 3% Nitric acid and have been stored in a cold dark place (~4℃). Any precipitates in water samples were removed by a filtration using a membrane filter (pore size 0.45 μm) prior to the analysis. Na, Mg, K, Ca, and Si were analyzed by using ICP-AES (inductively coupled plasma emission spectrometer: SPS3520UV), other trace elements were analyzed using a quadrupole ICP-MS (mass spectrometer: Agilent 7500c). REE (Rare earth elements) were concentrated before analysis with Novias chelate resin. 115In was added to each water sample as an internal standard. Concentrations of more than 20 elements in the water samples were quantified by a calibration method.

At first we look for possible sources of characteristic trace elements in water samples detected by our analyses. We have observed that concentrations of Li were characteristically high in the river water samples from Arakawa river (Fukushima Pref.), Kanna river (Gunmma Pref.), and Kinpusan Mizugakiyama (Yamanashi Pref.). We have noticed that source rivers of these rivers flow granite geology. It is found that concentrations of Li in the other river waters running without granitic geology were not so high. Therefore, it is possible to say that Li may reflect the granite geology. It is found that spring water of "Yuminosyouzu" in Toyama prefecture shows high concentrations of REEs. Sedimentary rocks are widely distributed in the vicinity of "Yuminosyouzu". It is estimated that weathering of apatites contained in the sedimentary rocks may elute REE as phosphates2). Similarly, the highest concentrations of Mg and Ca among analyzed samples were observed in water samples from the "Matsumoto Joukamati Yuusuigun" in Nagano Pref. Mg is thought to be influenced by tuff stone accumulating in the vicinity of the source Utukushigahara Plateau and Ca is considered to be influenced by limestone3).

From these observations, it is found that trace element compositions of the spring and river waters tend to reflect their background geology. We will further analyzed water samples all over Japan to find key elements which may reflect origin of water and to apply these information for provenance analysis of foods and woods.

1) S. Yabusaki et al.: Journal of Groundwater Hydrology 51, 127-139 (2008) (in Japanese).
2) S.J. Köhler et al.: Chemical Geology 222, 168-182 (2005).
3) S. Yabusaki: Bulletin of Geo-Environmental Science, 13, 33-41 (2011) (in Japanese).

Keywords: water, trace element, ICP-MS / AES

Relation between water component and geological conditions in Izu Islands

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The relationship between the geological characteristic and groundwater compositions was investigated. 147 water samples were collected from Izu Islands, including Izu Oshima, Toshima, Miyakeshima, Hachijoshima, Niijima, and Kouzushima. The water samples were analyzed for cations and anions by using Ion Chromatography and Inductively Coupled Plasma Atomic Emission Spectroscopy.

Chemical composition of rock samples at 83 locations on each islands were analyzed by using a X-ray fluorescent spectrometry.

As a result, the water samples in the basaltic volcanic area showed high Mg^{2+} value to compare with the seawater ratio.

Also, it was found that the Mg^{2+}/Ca^{2+} ratio of the water samples in the basaltic volcanic area and the Mg^{2+}/Ca^{2+} ratio of the rock composition are almost the same. However, cation of water samples collected near Fudeshima in Oshima had higher value of Mg^{2+} content, which seams to be related with weathering process of highly porphyritic rocks of Fudeshima volcano.

In addition ,comparing the seawater composition ratio of SO_4^{2-}/Cl^- with the water sample, it was found that the water some samples from Oshima and all samples of Miyakejima contained a large amount of SO_4^{2-} originated from volcanic SO_2.

Keywords: spring water, groundwater, basaltic volcano, rhyolitic volcano, Izu Islands

A comparative Study on Water Environment of Isolated Islands - Focusing on Islands in Nagasaki Prefecture -

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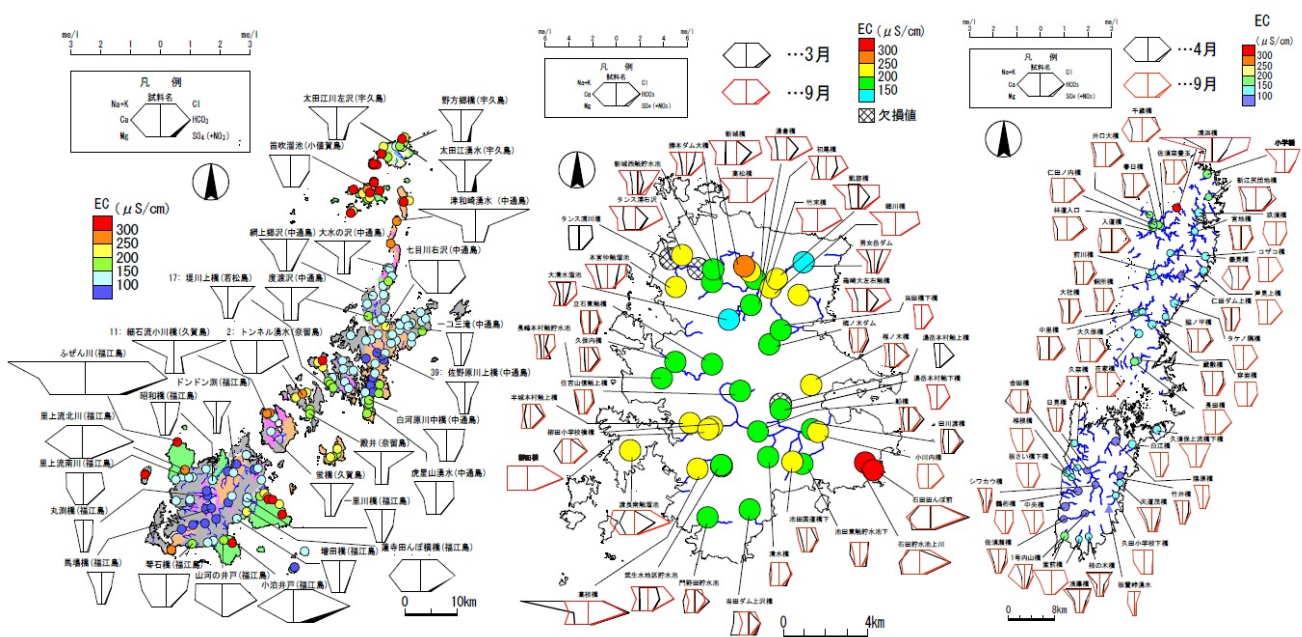
1. Hosei University Lab.Hydrogeography

Introduction There are many islands in Japan and each environment is unique because of its independent environment. From past research results, it is thought that land water of remote islands surrounded by the ocean is generally susceptible to sea salt influence (Goto et al. 1989), many of which are relatively small and limited It is thought that not only human activity such as agriculture but also the influence of fallout such as rainwater tends to be reflected largely because it is a space. However, there are relatively few things concerning Tsushima, Iki, Goto Islands. In this research, we aim to clarify the present condition of the water environment by comparing the characteristics of the water quality of the land and rain water of each island.

Research method We conducted hydrological observations in the spring and fall seasons from 2014 to 2016.Temperature, water temperature, EC, pH, RpH were measured locally, samples were taken home, TOC measurement and main dissolved components by ion chromatography were analyzed. For rainwater, samples taken every month were analyzed in the same way.

Results and Discussion As a result of survey and analysis, the effects of sea salt on the land water of almost all islands are seen, the contribution of geology to sea salt is larger than that of sea salt as the overall feature of inland water in Ikijima, Shimoshima differed in Shimojima's water quality composition Shimoshima has a remarkable influence of wind salt transfer, the contribution of geology to Goto Islands was seen by the area, it was clear that many nitrate was detected compared to Ikijima and Tsushima became. These are thought to be due to differences in geology, topography, and agricultural form.

Keywords: Iki Island, Tsushima Island, Goto archipelago, rainwater, water environment

A comparative study of the water environment around active volcano in Japan - mainly Mt.Ontake, Mt.Asama and Mt.Hakone

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There are many active volcanoes in the Japanese archipelago, but factors of formation and constituents of the mountains vary depending on the volcano. In addition, due to the influence of volcanic activity, it is expected that the water quality of rivers and spring water around the volcano will also change. Therefore, we report on the results of continuous water quality survey in three volcanic areas, Mt.Ontake, Mt. Asama and Mt.Hakone where activities have been active since 2014. The electrical conductivity was generally small in the surrounding rivers around Mt.Ontake, and the values tended to be larger overall in Mt. Asama and around rivers in Hakone. Dissolved components compared In the three regions, the tendency that the EC value is small tends to show the CaHCO3 type water quality composition, but the composition is different depending on the region at the point where the value is large. There are many water quality of SO4 type.

Keywords: Active Volcano, Eruption, Water quality, Dissolved component, Geology

The relationship between flow path of Beppu Onsen and S velocity distribution by microtremor array survey.

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In Beppu Onsen, Osawa et al. (1994) and Osawa and Yusa (1996) have revealed the flow path of hot spring water in the southern and northern part of Beppu hot spring area. These flow paths are classified into 3 to 4 types for each spring quality, and branching and inflection are seen while overlapping in three dimensions.
In order to clarify the relationship between these flow paths and the geological structure, microtremor array survey with a radius of 0.6 m to 350 m was conducted at 105 points and the three dimensional distribution of S wave velocity was obtained
As a result, in the southern area, it is clarified that Na - Cl type hot spring flow path is obstructed in the region with high S wave velocity, which is considered to be low permeability base at 300 m below sea level (b.s.l.), and rounds from both sides.
On the other hand, in the northern region, the Ca - Mg - HCO3 type flow path was inflected to the north by hitting a region with high S - wave velocity with low water permeability at an 100 to 200m b.s.l. And at 400 to 600m b.s.l., Na - Cl type hot springs flowed down to the east part of the region with relatively high water permeability and moderate S wave velocity.

Keywords: Beppu, microtremor array survey, Flow path of Beppu Onsen

Preliminary paleomagnetic results from the manganese wad deposit at the Niimi hot springs, Hokkaido.

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Paleomagnetic results are reported for the manganese wad deposit at the Niimi hot springs, Hokkaido, Japan. The hot spring is located at the foot of Mt. Shyakunage in the active Niseko volcanic area. The area is covered by Quaternary pyroclastics erupted from Mt. Syakunage. The manganese wad deposit was formed from the hot spring water by biomineralization processes. The hot spring's water emerges from a local spa that closed in March 2016 and forms two small waterfalls. Paleomagnetic analysis was done on 144 manganese wad specimens that were collected from a wall surface next to one waterfall. The wad was about ˜65 cm in thickness and oriented specimens were collected with 7 cc non-magnetic plastic cube at 14 levels between ˜5.5 cm and ˜62 cm in thickness. Alternating field step demagnetization appears to isolate either one or two stable characteristic remanent magnetization (ChRM) components. The lower coercivity component shows clustered ChRM directions at each sampling level and likely retains paleosecular variation. Conversely, the higher coercivity component shows scattered directions. When the observed ChRM directions are compared with the paleosecular variation records for Japan, the duration of the manganese wad deposition appears to have lasted at least 600 years. In other words, the regional hydrothermal system has been active for at least 600 years.

Keywords: Paleomagnetism, Manganese wad, Hydrothermal fluid