Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

AHW28-P01 Room:Convention Hall Time:May 22 18:15-19:30

Hydrologic Responses to the changes in watersheds environments from Meiji-era to present

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Two sub-basins were selected from within the Kasumigaura watershed for this study. Currently one basin (Sonobe) is mostly a rural area which was covered forests in Meiji period; thus changes are mainly from forests to agricultural fields. Another basin (Onogawa) is more of a sub-urban area which used to be forest/grass lands. A hydrologic model was applied to each of the basins; the model was calibrated against discharge and flux data in this area. After the calibration, two sets of land use were applied to the model, one representing Meiji period and one current condition, while the meteorological forcing data were kept the same by assuming no change of climate.

By comparing the two sets, decrease in evapotranspiration, and net radiation, and increase in discharge, and rise in water table were found until now in comparison to the case in Meiji at Onogawa.These changes can be summarized as follows: about 30% decrease in evapotranspiration, more than twice increase in discharge, about 15% decrease in net radiation, and about 30% decrease in latent heat flux. From inspection of the distribution maps of these variables in watershed, the above changes were identified to have occurred at the areas where forest changed into urban, or agricultural areas. It was considered that the main reason of the decrease in evapotranspiration was the decrease in canopy storage, which cased increase in discharge. Also, increase in surface runoff occured due to increase in impermeable area; increase in sensible heat flux was due to glass, and urban area that has high albedo. On the other hand, in the comparison with the Sonobegawa results, it was clearly found that there is a difference of impact on water and heat balance due to difference of increase rate of urban, agricultural area.

Especially, in the Onogawa watershed, the rate of increase of urban area was larger in upstream area. Also agricultural area increase was most common in midstream area, and paddy field area was abundant in downstream areas. These land uses were distributed as a mass in Onogawa, while in Sonobegawa changes occurred in scatter, which impacted on the water and heat balance changes.

Keywords: semi-distributed hydrological model, Land use change, Lake Kasumigaura, catchment water budget

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AHW28-P02 Room:Convention Hall Time:May 22 18:15-19:30

Developing and improving a simple runoff model of dissolved organic carbon considering soil infiltration and river runof

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Estimation of dissolved organic carbon (DOC) runoff from forested watershed is important for carbon cycle researches and water quality control. Empirical regressional models or process-based models have been proposed up to now, however, those are not yet ready for general use because of lack of internal processes as well as the complexity of parameterization. I proposed a simple DOC runoff model considering both soil processes, i.e. soil infiltration and seasonal changes, and river runoff processes assuming DOC source area. Two years' data for model development were collected from three different scale-stations in the Mizugaki research watershed. In soil sub model, dry-wet cycle in soil was successfully simulated by advection-diffusion and dissolution formulation and soil water movement was significantly responsible for overestimation especially for dry soil. In runoff sub model, the results from soil sub model being imported, DOC source area was assumed by hydrograph separation and wetland ratio. The model was highly applicable upstream, however, overestimated downstream due to error in quantifying riparian zone as DOC source area. In addition, hydrological model (TOPMODEL) was introduced for the further improvement.

Keywords: DOC, runoff model

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AHW28-P03 Room:Convention Hall Time:May 22 18:15-19:30

Acidification of the soil by air pollution and the relation of withering of trees.

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Trees wither by sulfuric acid of air pollutant. Sulfuric acid generates by combustion of fossil fuel. Sulfuric acid moves by wind and adheres to trees. Adhered sulfuric acid is added to the soil of root with rain. The soil dissolves the metal of ingredient by sulfuric acid. Dissolved metal ion is absorbed into water in trees. The absorbed metal ion combines with phosphoric acid in the trees. As the metal phosphoric acid compound which combined has very low solubility, the work as phosphoric acid becomes impossible. Trees become the same phenomenon as the shortage of phosphoric acid and decline. As for the tree which weakened, creation of the defense ingredient to an insect becomes impossible. As for a pine, the generation of resin decreases. Tannin combines with metal and detoxifies a Japanese oak. As a result, trees become the food and residence of an insect. Insects increase so much and trees wither. The main cause of withering is by the acidification of soil. Withering is saved by neutralizing the acidified soil. As for the method of neutralization, it is optimal to use charcoal. Trees include Na, K, Ca, Mg and P. Those remain as carbonate or oxide into charcoal and if rain is added to charcoal, it will become an alkaline solution and it neutralizes acid soil. The remaining elements are contained at the rate which the tree needs . As a result, they become an ideal nutrient. Charcoal becomes a moisture absorbent and the breeding place of soil bacteria. As a result, the soil is activated and can prevent withering of trees.

Keywords: Air pollution, Withering., Charcoal., Metal phosphate., Tannic acid iron, Acidification of soil.

Japan Geoscience Union Meeting 2013
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AHW28-P04 Room:Convention Hall Time:May 22 18:15-19:30

Evaluation of the acid deposition on to Aya forest, the UNESCO biosphere reserve forest in Miyazaki, Japan

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The Aya forest is located at the northern limit of the evergreen broad-leaved forest zone in East Asia. In addition, it has various endemic species in Japan. People who live near Aya forest have been using these natural resources with a sustainable way for more than five decades until now. In July 2012, Aya forest was designated as a UNESCO biosphere reserve, the Man And the Biosphere programme (MAB). In order to preserve this area and its culture, we evaluate the effect of long-range transport air pollution on to the Aya forest ecosystem. The research was conducted in two years, from 2010 to 2012. We installed bulk deposit samplers and Ogawa passive samplers both in-canopy and the outside of forest experimental site. After collecting samples, we measured major ion concentration for wet deposition and NO, NO_2, NH_3, O_3 and SO_2 gaseous concentration for dry deposition, respectively. In addition, to evaluate the actual deposition amount on to Aya forest, we collected conifer needle tree leaves from six trees, which grow up in this area.

During this experimental campaign, we found following things. In 2010, the effect of eruption of Mt. Shin'moe was observed. However, we couldn't find the effect of long range transport of air pollution from East Asian continent which was shown in Yakushima Island experimental site. The result of conifer needle tree leaves provide us the different SO_4^{2-} concentration level between north and south side of leaves which were collected from the same tree. This tendency was observed in all collecting samples.

Keywords: Aya biosphere reserve, Atmospheric acid deposition, Long range transport, Man And the Biosphere, conifer needle tree

Japan Geoscience Union Meeting 2013
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AHW28-P05 Room:Convention Hall Time:May 22 18:15-19:30

Toward the continuous development of hydrological and flux monitorings in terrestrial ecosystems

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Interactions between water/chemical cycles and terrestrial ecosystems are the most important base supporting our irreplaceable planet. A close collaboration of the geoscience for climate and tectonic activities with ecosystem sciences for biological responses is needed for this interdisciplinary subject. This highly requires continuous monitorings in ecosystem study sites, but the organized system has not been established. The strategy is discussed.

Keywords: terrestrial ecosystem, hydrological monitoring, flux, continuous observation, gas exchange between land and the atmosphere

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AHW28-P06 Room:Convention Hall Time:May 22 18:15-19:30

Characteristics of Water Chemistry in Degraded Peatland Groundwater and Riverwater in Indonesia

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Tropical peatland forests in Southeast Asia are considered to be one of the most important parts of larger ecosystems due to the huge amount of carbon stock and biodiversity they contain. Yet, recent rapid and intensive deforestation to procure timber and land for commercial plants or crops (Oil palm or rubber plantations) must have induced fundamental changes in the material cycling.

We focused on the effects of human impacts such as deforestation, plantation, and manmade fires on groundwater chemistry in the degraded peatland area in East part of Sumatra Island, Indonesia.

We measured dissolved organic and inorganic matters in peatland groundwater both in wet and dry seasons by using piezometers which are installed in degraded peatland sites. We compared the results of both bare land site after the deforestation and the fires and oil palm site planted after the fire.

Keywords: Tropical Peatland, Groundwater, Biogeochemistry, Dissolved Organic Matter