[EE] Evening Poster | A (Atmospheric and Hydrospheric Sciences) | A-HW Hydrology & Water Environment

[A-HW20]Materials transport and nutrient cycles in watersheds; Human and climate impacts

convener:Mitsuyo Saito(Graduate School of Environmental and Life Science, Okayama University), Shin-ichi Onodera(Graduate School of Integrated and Arts Sciences, Hiroshima University), Takahiro Hosono(熊本大学大学院先導機構, 共同), Adina Paytan(University of California Santa Cruz)
Mon. May 21, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)
This session aims to synthetize watershed sciences in order to understand dynamical processes of materials transport and nutrient cycles in watersheds from headwaters to coastal seas focusing on human and climate impacts. The session will be integrating a variety of research disciplines including limnology, ground water hydrology, coastal oceanography, meteorology, pedology, sedimentology, forestry, agriculture, fishery, social science and more. The watershed sciences also challenge us to solve environmental issues emerged in the watersheds through our profound understanding of relations between humanity and nature. For instance, on one hand, human land uses alter water resources, dynamics of sediments, nutrients and pollutants in waters and soils on watershed scales, while changing climates may alter water cycle, the frequency and intensity of materials transport and natural disaster, sometimes having catastrophic effects on the watershed systems. This session also calls for ideas on new methods for the watershed sciences, such as tracer and molecular technique, hydrological modeling, paleontological approaches, laboratory and field experiments, social-scientific evaluation of ecosystem services and social-ecological systems, and so on, in order to elucidate physical, chemical and biological mechanisms for shedding light on natural phenomena and their changes over time in complex and dynamic watershed systems. Through this session, we would like to facilitate interdisciplinary collaboration among participants to create new knowledge on watershed sciences.

[AHW20-P08]Annual Variation in Sediment Yield and Nutrient Load in Chugoku Region, Western Japan

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Keywords:SWAT Model, Sediment yield, Nutrient Load, Water balance estimation, Gonokawa River, Ota River

Introduction

There are many of enclosed bays have faced environmental issues of eutrophication, pollution, and oligotrophication. In addition, the threat of a shortage of water resources and serious flood on a watershed scale has been found in the world under a climate change. Thus, a relevant concern to clarify this issue is emphasized. Rivers has a great impact on biological production in coastal zones as a nutrient source, as well as human activities as water resources or flood disaster. To conserve environments of enclosed bays and their catchments, it is important to confirm production processes and long-term variations of streamflow quantity and quality. To understand and clarify hydrological and biogeochemical processes and variations in the complicated systems as catchments with various natural and human environments, the hydrological and biogeochemical were examined model to the Japanese enclosed bay catchments. The Soil and Water Assessment Tool (SWAT) was chosen for water, sediment, and nutrient discharge modeling to apply in the Ota river basin and the Gonokawa river basin. The objectives of this

study are: (1) to estimate hydrological element rates on a steep and forested catchment (2) to estimate the water balance of the Ota River and the Gonokawa River. (3) to confirm the sensitive parameters on a monthly and daily basis (4) to estimate the suspended sediment, and nutrient load (total nitrogen) in the Ota river catchment by considering the extreme storms and flood events.

Methods

The SWAT-CUP SUFI2 was used for model calibration and validation which confirmed by sensitivity analysis. The model calibration was performed for the period (2006-2010), with three years of warm-up period (2003-2005), then the model was validated for four years (2011-2014). Evapotranspiration was estimated by the Penman-Monteith method. To evaluate the competence of the model, six objective functions are observed: p-factor, r-factor, R^2, NSE, RSR, and PBIAS.

Results and Discussion

The results show very strong correlation and agreement of simulated and the observed data during calibration and validation periods on the monthly and daily basis. The SWAT model had shown significant results to estimate hydrological element rates on a steep and forested Japanese catchment. So, the model is probably applicable to a steep and forested Japanese catchment. In future, the SWAT model application can be extended to another place in Japan Based on the simulated model, the evapotranspiration rate ranges from 39.7% to 41.7%, discharge ranges from 45.7% to 51.9%, and groundwater recharge ranges from 5.6% to 9.1%. The difference was caused by the precipitation variation, and it is spatial distribution. There are three sensitive parameters that be found in the simulated model: CH_K2, CN2, HRU_SLP. Based on these results, the surface runoff/overland flow parameter and the topographic aspect is potentially considered to be relevant in these catchments. For example, HRU_SLP is a sensitive parameter to adjust the lateral flow rate. When the parameter was in default values, the lateral flow reaches 48.9% of the total water budget. In these case, controlling lateral flow was required. After modified this parameter, the amount of lateral flow was decreases up to 5.7%. The assessment of water quality estimated to be 119.5 tons/year of total nitrogen and 4,769.6 tons/year of sediment in 2014, especially calculated to be 8,4 tons and 394.7 tons in August in 2014 with serious disaster. The average annual value of nutrient and sediment are 115.7 tons 4,290.6 tons, respectively. In addition, the average monthly value of nutrient is 8.8 tons and sediment is 285.6 tons. However, it is important to validate by the other methods in the future studies. More reliable observed data with daily resolution and improvement of the model were needed to get the acceptable value of water quality estimation to understand the natural-environmental processes and relationships.