
[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 synthesize 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-P20]Effects of agricultural practices in rice crop systems on the diversity of periphyton and phosphorus dynamics in streams of the Yasu River watershed

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Keywords:phosphorus loading, rice paddy, stream periphyton

Phosphorus is an essential element for all living organisms, and its availability often limits the productivity of many freshwater ecosystems, such as streams, rivers, and lakes. However, human activities often influence the phosphorus loading to freshwater ecosystems, which may exceed the threshold level that triggers the regime shift from oligotrophic to eutrophic conditions in the systems. Moreover, human-induced excess phosphorus can impact both the community structure and physiological P demand of aquatic organisms, thereby affecting the ecosystem function (e.g., P uptake) of those systems. However, knowledge on effects of human-induced P loading on the community structure and ecosystem function in streams is still limited.

We performed a field study in the Yasu River watershed to clarify the effects of agricultural practices on the diversity of periphyton and phosphorus dynamics in streams during May and June 2016. The Yasu River watershed is mainly composed of three lithological classes: accretionary complex, granite, and sedimentary rock. In the sub-watersheds where sedimentary rock predominates, a large amount of particulate phosphorus originated from rice paddy fields is exported with muddy water to nearby streams during the surface soil paddling period. In contrast, agricultural practices in rice crop systems seem to have relatively minor

influences on phosphorus loading to adjacent streams in the sub-watersheds where the other lithological types predominate. We established sampling sites in streams of both sub-watersheds to analyze the P concentration and the community structure of periphyton attached on the streambeds. In addition, we performed the enzyme-labeled fluorescence (ELF) assay for periphyton samples to determine the cell-associated alkaline phosphatase activity (a common marker of P demand) in response to phosphorus loading from rice paddy fields.

In this presentation, we show that the rice crop practices in sedimentary rock areas greatly influenced the total phosphorus but not soluble reactive phosphorus concentrations in streams. The results suggest that agricultural practices (e.g., soil paddling) interacted with geological characteristics to affect the transport of particulate phosphorus (PP) from rice paddy fields. The present study also shows how such human activities influence the diversity and community structure of stream periphyton, as well as their physiological P demand. The results will clarify the effects of agricultural practices in rice crop systems with contrasting geological types and the resultant consequences for ecosystem structure and function in streams of agricultural watersheds.