[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)

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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-P21]What is difference between orthophosphate and SRP in lake waters?

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1. Introduction

In view of phosphorus as an important macronutrient in aquatic ecosystem, accurate determination of P species, especially bioavailable P form (orthophosphate ions: PO_4^{3-}), is a prerequisite for understanding biogeochemical cycling of the element. Current accepted method for analyzing dissolved inorganic phosphorus concentration is spectrophotometric analysis using phosphomolybdenum blue complex (soluble reactive phosphorus, SRP), and has been shown to be interfered with other chemicals, which will result in overestimation or further misunderstanding phosphorus species transformation in a lake. In this study, we selectively determined dissolved phosphate (orthophosphate) concentrations by ion chromatography in lake waters and compared with those by the most widely used method (SRP), to clarify environmental factors, which may influence the difference between orthophosphate and SRP concentrations.

2. Materials and Methods

Water samples were monthly collected at inlet, outlet, and the surface and just above the bottom of a pelagic site in Lakes Yanagihira and Hira, and at inlet, outlet and shore site in Lakes Hasuike and Kohoku-Nodanuma, all of these lakes are connected to Lake Biwa, the largest lake in Japan, from Jul. to Dec. 2016 and Feb. to Oct. 2017. Water temperature, pH, and DO were measured with a multi-parameter water quality meter

(Horiba, U-50). The water samples were used for measuring chl.*a*, SS, TN, PN, NO_2-N, NO_3-N, NH_4-N, TP, TDP, SRP and orthophosphate. SRP was measured with an auto-analyser (BRAN+LUEBBE: AACS II). Orthophosphate was measured by ion chromatography (Column: Thermo Scientific AS-23A) with electrochemical suppression in external mode. Some metal ions were also determined with an ICP-AES (SII: SPS3100). We calculated dissolved organic phosphorus (DOP) by subtracting SRP from TDP.

3. Results and Discussion

SRP and orthophosphate concentrations varied below detection limit (BDL) – 4.69 μM and 0.004 - 2.57 μM, respectively. Both SRP and orthophosphate (both called as DP) in Lakes Yanagihira and Hira decreased from inlet through the lakes and toward outlet sites at almost sampling dates excluding Feb. 2017. In Lake Hasuike, DP concentrations were always lower than those in other three lakes (<1.35 µM). In Lake Kohoku-Nodanuma, DP concentrations were steadily high during the study period (0.52 – 2.92 µM), and mostly increased from inlet to outlet sites through the lake. SRP was always higher than orthophosphates in all the lakes studied. Orthophosphate/SRP ratios varied 0.11-1.04 (Ave. 0.56), suggesting that inorganic phosphate concentrations as SRP were always overestimated. In Lakes Yanagihira and Hira, these ratios spatially and temporally varied, with the greatest values in Oct. and Nov. 2016 (mean: 0.8) along water flow. In Lake Hasuike, the ratios ranged 0.2-0.93 with no significant trend along with the waterflow throughout all sampling period. In Kohoku-Nodanuma, the ratios ranged 0.29-0.86, being always higher within the lake than those at the inlet and outlet except for Jul. and Aug. 2017.
Large gaps in concentrations between orthophosphate and SRP were observed in this study. To some extent, differences between orthophosphate and SRP can be represented as dissolved acid hydrolysable phosphorus (DAHP) including both organic and inorganic origins, because of hydrolysis under the colorimetric method. Correlation analysis showed that orthophosphate/SRP ratios were negatively correlated with the differences between them, e.g. DAHP, and chl.*a* concentrations, while no relationships with calculated DOP and mostly metal ions measured. These relationships were somewhat different among the lakes, e.g. no correlation with chl. *a* in Lakes Hasuike and Kohoku-Nodanuma. These results suggest that the DAHP may include mainly organic origins but not inorganic ones. DOP calculated in the usual manner might be conservative estimation, not indicating real values.