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Downstream changes in water chemistry in Yura River, Kyoto: focusing on dissolved organic matter and dissolved Fe

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Forest in Japan, which covers about 68% of the Japanese archipelago, plays major roles in controlling streamwater chemistry in mountainous river. However, river water chemistry changes before reaching estuary mainly because land use changes downstream. The land use accompanied with human activities (such as arable land, paddy field, residential area, etc.) has a strong impact on river water chemistry, and characterizes river and marine ecosystems. We studied the spatial distribution of river water chemistry, especially of nitrogen, phosphorus, dissolved organic matter (DOM), and dissolved iron, in the Yura River system from mountainous headwaters downstream to the estuary. We also analyzed the relationship between the water chemistry and watershed land use. This study was conducted as part of the Kibunka Project, which is introduced in the other presentation by Yoshioka et al. (this volume).

Yura River drains an area of 1880 km^2in the northern part of Kyoto Prefecture, central Japan. In June and October 2009, we collected 15 water samples in Yura main river, and about 30 water samples in its tributaries. Water samples were filtrated with Teflon syringe filters (0.45 micro-m) into 50 mL polyethylene bottles for measuring inorganic nitrogen (nitrate and ammonium), and dissolved iron (DFe) concentrations, and into 30 mL amber glass vials combusted at 450 degs. for 4 hours for measuring dissolved organic carbon (DOC). The three-dimensional fluorescence excitation-emission spectra of DOM were also measured and characteristics of DOC were evaluated by parallel factor analysis (PARAFAC) of the excitation-emission matrix (EEM). The land use data of the Yura River system was obtained from the vegetation map derived from the 5 th national survey on the natural environment (vegetation survey) conducted by the Ministry of Environment. The area of each land use type and its percentage within the watersheds were calculated with ArcGIS.

In both main river and the tributaries, DOC concentration widely ranged at small forested headwater catchments (<1 km^2), suggesting that soil properties and topography can be strongly influenced on DOC loss in these watersheds. The concentrations of DOC and nitrate increased as the Yura main river runs down and agricultural land use increases. In contrast, the downstream trends in the fluorescence properties of DOM and DFe concentrations were different from the concentrations of DOC and nitrate. Therefore, downstream changes in river water chemistry are primarily caused by human activities within watersheds, but there are different trends among solutes (e.g. N vs DOM or Fe). This suggests that human impacts on river and marine ecosystems may be complicated from the viewpoint of nutrient dynamics.

Keywords: Yura River system, dissolved organic matter, dissolved iron, nitrogen, land use