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Field investigation to assess nutrient emission from paddy field to surface water in river catchment

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In order to maintain good river environment, it is remarkably important to understand and to control nutrient behavior such as Nitrogen and Phosphorus. Our former research dealing with nutrient emission analysis in the Tone River basin area in Japan, in addition to urban and industrial waste water, nutrient emission from agricultural activity is dominant pollution source into the river system. Japanese style agriculture produces large amount of rice and paddy field occupies large areas in Japanese river basin areas. While paddy field can deteriorate river water quality by outflow of fertilizer, it is also suggested that paddy field has water purification function. As we carried out investigation in the Tone River Basin area, data were obtained which dissolved nitrogen concentration is lower in discharging water from paddy field than inflowing water into the field.

Regarding to nutrient emission impact from paddy field, sufficient data are required to discuss quantitatively seasonal change of material behavior including flooding season and dry season, difference of climate condition, soil type, and rice species, to evaluate year round comprehensive impact from paddy field to the river system. In this research, field survey in paddy field and data collection relating rice production were carried out as a preliminary investigation to assess how Japanese style paddy field contributes year round on surface water quality. Study sites are three paddy fields located in upper reach of the Tone River basin area. The fields are flooded from June to September. In 2014, field investigations were carried out three times in flooding period and twice in dry period. To understand characteristics of each paddy field and seasonal tendency accompanying weather of agricultural event, short term investigations were conducted and we prepare for further long term investigation.

Each study site has irrigation water inflow and outflow. Two sites have tile drainage system under the field and TD water can be sampled for infiltrating water measurement. We installed monitoring wells to measure ground water level and water quality. Inflow, outflow, flooding water, infiltrating water, and ground water were measured and sampled. Regarding to parameters, temperature, pH, EC, DO and COD, main ions were measured to understand characteristic of water quality and transformation processes. Inorganic forms of nitrogen and phosphorus were also measured, as behavior and balance of nitrogen and phosphorus are focused on.

We observed following points by taking data of water quality; seasonal trend, changes occurred according to agricultural events like irrigation and fertilization. Nitrogen in ground water tends to high in June due to fertilizer. It is thought because farmers fertilize the filed before transplanting at the beginning of flooding season. Regarding to dissolved inorganic nitrogen, higher concentrations were observed in inflow water than in flooding water and outflow water. Though it needs discussion in loads as well as flow measurement, this suggests that nutrients are absorbed in paddy field and less nutrients are emitted after irrigation water passing through paddy field. Based on this research we are planning continuous investigation to assess environmental impact from paddy field.