Long term variations in nutrient discharge with considering the interaction of river and groundwater in watersheds of 1000km2

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Previous studies had clarified that the direct interaction of river and subsurface water, that is hyporheic effect, causes various chemical changes and that has great impacts on material circulation in a watershed. However, the application of hyporheic effects to large watershed has not been examined still enough. Therefore it is necessary to evaluate the influence of the interaction in various catchment scales to mass transport and to integrate the results to apply the interaction to a much larger basin. In addition, in a viewpoint of a nutrients discharge to the ocean, it is important to confirm factors controlling the long-term variation as well as to consider the interaction in a large basin. But there are few researches that evaluated a long-term variation in discharge including artificial impacts.

In this study, it aimed to confirm the nutrients discharge with considering the interaction of river and groundwater in a different scale. In addition, it purposes to evaluate its long term variations considering influences of human activities. The study watershed is Ashida River, which is the first-grade river flowing into the Seto Inland Sea. The problem of eutrophication there has not yet been remedied. In Ashida River watershed, we were supplied the long-term data of runoff and water quality for last 3 decades from Ministry of Land, Infrastructure and Transport etc. Then we analyzed these data by the nutrient balance model for the effect of the natural interaction and human activity such as the land use and population on the nutrient discharge variation.

Results analyzed by a nutrients balance model indicated that the TN flux in a unit area tended to decrease with expanding of watershed area, especially the expansion of one order in area caused the increase of two order in nitrate reduction. This suggests that the area, where the hyporeic effect acts on, increases with the expansion of watershed area. In addition, nitrate flux variation was greatly related with population growth but agriculture area.

As for TP and SiO_2, an obvious hyporeic effect was not confirmed in any scale. However, it was estimated that in particularly TP flux by groundwater equals to that by river in the river delta area. This groundwater is also recharged by the river water on the upstream area. Therefore, the groundwater can be determined as the hyporheic effect. That is, it was suggested that TP flux increased by interaction in an estuary. On the other hand, the SiO_2 variation in the river indicated that the discharge decreased by the trapping effect of the dam constructed on the midstream area in 90's.