Effect of frequent storms on nutrient discharge in a mountainous coastal catchment, western Japan

Shinichi Onodera[1]; Mitsuyo Saito[2]; Misa Sawano[3]; Koji Yoshida[4]

[1] Integrated Sci., Hiroshima Univ; [2] Grad., Biosphere Sci., Hiroshima Univ.; [3] none; [4] Grad.,Biospheric Sci.,Hiroshima Univ.

http://home.hiroshima-u.ac.jp/sonodera/

The number of storm event has been increasing and the rainfall intensity has been rising during last 20 years in a temperate, humid region. On the other hand, both of a number and intensity of draught has also been increasing. These climate changes would act on nutrient discharge as well as water discharge in a watershed. Japanese river catchments are generally characterized by relatively steep gradient and those have mountainous headwater areas and alluvial fan with coarse grain sediment. To forecast the nutrient discharge in a steep catchment in future, it is necessary to confirm the variation in nutrient discharge by not only river but also groundwater in various climate conditions, such as storm and drought.

The objectives of this research are to confirm the variation in nutrient discharge by river and groundwater, using long-term records of water quality and runoff, and to evaluate the effect of frequent storm on the nutrient discharge. The study area is located in Ashida river catchment, flowing to Seto Inland Sea, western Japan. The area of the catchment is about 1000km2. In this research, we analyzed the long-term records in a large river catchment, using the simple model. In addition, we confirmed the relationship between river runoff and wetness in various slope gradients and estimated the relation between groundwater and river runoff in a various wet condition, using the simple water balance model.

The groundwater level distribution at the delta area indicated stable groundwater flow from river to ocean in both periods of wet and dry. The seasonal variations of water level were about 1m. Groundwater flux during the dry season was estimated to be about a half of that during wet season by the simple model. This relationship of groundwater flux and river runoff by the model supported that groundwater discharge decreased but the flux to ocean existed during the drought period in the river. On the other hand, it was suggested that river runoff increased in the magnitude of more than 2 orders but groundwater flux increased only several times even in the maximum. These results indicate that groundwater discharge was dominant in the draught period, but river discharge was dominant and more than 100 times of groundwater. The nutrient component of river and groundwater was nitrogen rich and phosphorus and silica rich, respectively. The groundwater was also contaminated by nitrate under the agriculture land as well as river water, but the nitrate elimination occurred with groundwater flow. Therefore, it was estimated that nitrate discharge with groundwater was little. Consequently, nutrient discharge was suggested that phosphorus and silica discharge by groundwater during a drought period and nitrogen discharge by river during a flood period were dominant, respectively.