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The effects of typhoon on nitrate concentration in stream water during storm and post-storm

SHINOMIYA, Yoshiki[1*], KOBAYASHI Masahiro[1], TSUBOYAMA Yoshio[1], TAMAI Koji[1], SAWANO Shinji[1], OHDOSHI Kunio[2], YOKOYAMA Yuichi[3], NAKAYAMA Kenji[3]

[1]Forestry and Forest Products Research Institute, [2]Kochi University, [3]Yonden Consultants Co., Inc.

The nitrogen is an important resource in the forest ecosystem, and the nitrogen constituent that flows out outside from a forested catchment through stream water becomes a loss for the forest ecosystem. It is undesirable that the nitrogen flows out from a forest voluminously from the viewpoint of the water quality control of the river. In general, the nitrogen runoff from a forested catchment tends to increase as the rainfall increases. Therefore, it is expected that a large amount of nitrogen flows out when there is a large amount of rainfall by the typhoon. A long term influence, the nitrate concentration in stream water rises for several years after the typhoon, was reported. According to the climatic change, the increase of frequency of a more powerful typhoon is pointed out. In this study, the short-term (during storm and post-storm) influence of the typhoon on the nitrate concentration in stream water was investigated based on the observation in two or more domestic forested catchments.

Our study carried out in four experimental basins. YS and HT catchments are located in Kochi Prefecture and KFC and KHC catchments are Ibaraki Prefecture. At each catchment, the amount of the runoff water was measured and the stream water during the typhoon was collected with the automatic water sampler at chiefly 1-2 hours intervals. After it had filtered it, nitrate concentration was analyzed by the ion chromatography methods. The sampling at the runoff according to the typhoon of the total rainfall 133 mm July, 2011 in KFC and the KHC catchment of the total rainfall 212 mm May, 2011 in the HT catchment of the total rainfall 247 mm June, 2004 in the YS catchment and total rainfall 289 mm August of the same year, total rainfall 742 mm August of the same year, and total rainfall 133 mm September of the same year and total rainfall 206 mm September of the same year was done.

The nitrate concentration in stream water at KFC and the KHC catchment rose as the amount of the runoff water increased the concentration, and became the maximum concentration around the discharge peak. Afterwards, the concentration has decreased gradually decreasing in the amount of the runoff water. This variability pattern looked like nitrate concentration variability pattern that had been observed at the runoff of the total rainfall 189 mm of Ohrui et al., (1992) and of the total rainfall 291 mm by Muraoka and Hirata(1988). On the other hand, although the nitrate concentration in stream water increased during the former half of the deluge, it decreased remarkably at mid to the latter half of that in YS and HT catchments. An extremely low concentration continued for at least one week or more. A remarkable decrease in nitrate concentration of the runoff water by the typhoon was similar to the case with Zhang et al.(2007) with the total rainfall 182 mm. As mentioned above, it was shown that the influence of the typhoon on nitrate concentration in stream water during typhoon and post-typhoon was different domestically. In YS and HT catchments, the runoff of the nitrate is not generated during several days at least after the typhoon. The difference of the response of such a catchment may influence the annual nitrogen exports. It is expected that the influence of the typhoon on the concentration of nitrate in stream water is different because of not the original characteristic of each catchment but the regional characteristic of such as a geology, terrains, and soils, judgement from that same variation patterns are observed in the same region.

Keywords: typhoon, streamwater, nitrate