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Characteristics and factors affecting water quality of Todoroki River in Ishigaki Island, Japan

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1. Introduction
Ishigaki Island is located in a subtropical region and has greatly different natural environment from other part of Japan because it has coral limestone, highly erodible red soils and high rainfall intensity. Some coastal areas with valuable coral reefs of this island have been designated as a national park. The various and characteristic landscapes are important resources for sight-seeing and so on. From 1950s, the red soil erosion and runoff problems have been occurred and caused loss of fertile topsoil and deterioration of marine ecosystem through the development of land reclamation in Okinawa Prefecture including Ishigaki Island. In 1995, the prefecture applied the bylaw to restrain the soil discharge. However, because it does not include agricultural activities, the reduction ratio of soil erosion from cropland is still low.
Generally, the river water quality, such as soil particles and nutrients concentrations, of agricultural catchment is strongly affected by agricultural activities. The purpose of this research is to clarify the characteristics of river water quality and the factors affecting them.
2. Material and methods
Todoroki River catchment is located on a south-eastern part of Ishigaki Island, in Okinawa Prefecture. The area is about 10.9km^{2}which is consist of sugarcane field (36%), grassland (30%), forestland (11%), paddy field (5%), others (18%: including pineapple field (4%)). The population is very low.
The field surveys of water quality and flux were carried out at the three upstream sites, three midstream sites and one downstream site on one or two times per one month. The monitoring instruments of water velocity, water depth and concentration of suspended solid were set at the two points where the flood monitoring were carried out. The pH, EC, water temperature and turbidity were measured. Concentrations of suspended solid, total nitrogen, total phosphorus, nitrate, phosphate, and major inorganic ions which were detected by ion chromatography were analyzed also. Meteorological elements, GIS data and some parts of water flux were taken from Okinawa Prefecture.
3. Results and discussion
The ionic compositions of river water were classified into Na-Cl type at two upstream sites, and Ca-HCO_3type at the other five sites. Further, the percentages of inorganic nitrogen ((nitrate-nitrogen + nitrite-nitrogen + ammonium-nitrogen)/total-nitrogen) at upstream sites were relatively lower than midstream and downstream sites.
The geology of upper area of the catchment is gravel and basic schist. The two small catchments which characterized by Na-Cl type have high percentages of forest slope land, and the sites are about 2km from shoreline. According to these situations, the river water qualities of these two sites are affected by deposition of airborne salt. In contrast, the geology of midstream to downstream is mainly limestone. It is presumed that the sites excluding upper two are influenced by groundwater characterized by Ca-HCO_3type. The percentages of organic nitrogen originate from litter are high at the forest areas. On the other hand, the percentages of inorganic nitrogen originate from fertilizer and agricultural activities are high at the agricultural areas. It is assumed

that the impacts of human activities increase toward to the downstream.

Keywords: river, water quality, agricultural area, Todoroki River, Ishigaki Island