

Study on Characteristics of groundwater and its chemistry in Sunagawa and Nakahara Catchment in Miyako Island, Japan

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Groundwater is a critical resource especially in remote islands where rainfall can hardly meet the demands for life and agriculture. A subsurface dam is one of efficient ways to solve the issue in the world. In order to study the effect of subsurface dam operation on both groundwater quality and quantity, field works were carried out from November 2015 to October 2017 in Sunagawa catchment and Nakahara catchment, Miyako Island, Okinawa, Japan. There is no subsurface dam in Nakahara catchment, but a subsurface dam in Sunagawa catchment where the porous Ryukyu limestone has been developed as an artificial aquifer since 1998.

Operation of subsurface dam is associated to available rain and water demands for agriculture in the island. Accordingly, there were two low water stage periods from 2014 to 2015 and after June 2017, and one high water stage period from January 2016 to May 2017 in the study areas. In general, The spatial and temporal distributions of chloride ion in the groundwater of Sunagawa catchment are more complicated than that of Nakahara catchment because of the spatial heterogeneity of permeability of the Ryukyu Limestone. The groundwater in Miyako Island is Ca-HCO₃ type. Concentrations of Ca and HCO₃ are higher in Sunagawa catchment than that in Nakahara catchment, indicating weathering rate of limestone aquifer becomes high after the dam has been constructed.

NO₃-N concentration had a closed negative correlation with the water table in Nakahara Catchment in the study period. However, the correlation between NO₃-N concentration and the water table in Sunagawa Catchment was found negative in the wet period, but nothing in the other period. During the low water stage period, the NO₃-N concentration ranged from 4.7-7.5 mg/L in Sunagawa Catchment and from 2.3-7.9 mg/L in Nakahara Catchment. In comparison, the NO₃-N concentration ranged from 2.3-8.0 mg/L in Sunagawa Catchment and from 2.3-9.4 mg/L in Nakahara Catchment during the high water stage period.

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