Assessment of spatio-temporal variations in Doorndraai dam water quality for sustainable water resource management

(持続可能な水資源管理のためのドールンドラーイ・ダムの水質の時空間変動の評価）

Hokkaido University, Graduate School of Environmental Science,

Division of Environmental Science Development, Course in Global Environmental Management

Mmasabata Dolly Molekoa

Abstract

Water is one of the most essential resources provide by nature to sustain life for all living things such as human beings, animals and plants. In this regard, water quality monitoring in Doorndraai Dam was a necessity as it will help in taking measures that will assist responsible departments with proper management strategies for sustainable water resource development. Remote sensing data based Suspended Particle Matter (SPM) and Modified Normalized Difference Water Index (MNDWI) were calculated for 2015-2020 using Google Earth Engine (GEE). Results shows an increasing trend of SPM during the dry season and decreasing trend during the wet season, respectively. MNDWI based water covered area shows a decreasing trend with the dam boundary for both dry and wet seasons. Landuse/Landcover (LULC) showed that this study area is covered by more than 80% of agricultural lands. Thirteen water samples were collected in Doorndraai Dam at 5 random sampling points for in-situ measurements in dry and wet season. The parameters were analysed at CapriVet Laboratory. All parameters fell within permissible limit of South African Water quality guidelines for both dry and wet seasons except turbidity that exceeded the limit in both seasons. Turbidity was further correlated with SPM as they both focuses on particulate matters in water. They were both high during dry season and lower in wet season despite exceeding the limit. Water Quality Index (WQI) has been widely used to be considered as a key element in order to derive the water resource management from lakes, dams, rivers and other water various waterbodies. It has been successfully applied in Doorndraai Dam, showing that water quality ranges from good to excellent during wet season while in dry season shows poor water quality. Statistical analysis was applied with reference to Piper Diagram and Correlation matrix. Piper diagram indicates Ca-HCO_3- type water during the dry and wet season. Correlation matrix shows all parameters have a positive correlation among each other except SO_4^{2-} which showed a non-significant correlation with all parameters. The development of dams serves many important purposes on people such as flood control, water supply, sedimentation control, irrigation and many more. With no scientific study that was done in Doorndraai dam, it was important to monitor Doorndraai Dam in order to preserve it for future generation with respect to Sustainable Development Goals (SDGs)# 6.