



Establishment of soil water content monitoring system and development of smart agricultural water management system in the Kingdom of Tonga

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Due to recent climate change and adverse climatic effects, the frequency and intensity of extreme events are increasing in various regions of the world. It is difficult for the Pacific Islands to secure sustainable water resources due to climate change, sea level rise, and El Niño / La Niña. Because agriculture in Tonga is cultivating crops on the heavily cultivated land in almost all farms except for some commercial farmers, long-term drought will cause severe crop damage in most farms where irrigation facilities are not available.

Due to the actual El Niño impact from 2014 to 2015, severe droughts have occurred throughout Tongatapu Island and have severely damaged overall agricultural production. The Ministry of agriculture in the Kingdom of Tonga actively participated in and collaborated with APCC during the project. The soil water content (SWC) and soil water potential (SWP) sensors were installed in the crop cultivation area (Vaini Farm, Fua'amotu Farm) to monitor changes in soil moisture. The correlation between SWC and SWP in each cultivation area during the low rainfall period was linearly correlated with $R^2 = 0.9$ or more.

The Soil-Water-Atmosphere-Plant (SWAP) model has been used to assess the SWC at the observation sites. Soil samples were collected and analyzed by sieve and hydrometric analysis tests and the results were input to the ROSETTA model to estimate the hydraulic parameters (θ_r , θ_s , K_s , α , n). Based on the physical characteristics of the Vaini clay and Lapaha clay soil representing Tongatapu Island, and the growth information of Taro, Cassava and Yam, we constructed a soil water content model. Finally, we plan to build a smart water management system to prepare for the drought situation in Tongatapu Island.