

Analysis of Sustainability of Groundwater Resources in Rote Island, Indonesia under HADCM3 Global Model Climate Scenarios: Groundwater Flow Simulation and Proposed Adaptive Strategies

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Abstract : Developing tailored management strategies to ensure the sustainability of groundwater resource under climate and demographic changes is critical for tropical karst island, where relatively small watershed and highly porous soil nature make this natural resource highly susceptible and thus very sensitive to those changes. In this study, long-term impacts of climate variability on groundwater recharge and discharge at the Oemau spring, Rote Island, Indonesia were investigated. Following calibration and validation of groundwater model using MODFLOW code, groundwater flow was simulated for period of 2020-2090 under HadCM3 global model climate (GCM) scenarios, using input data of weather variables downscaled by Statistical Downscaling Model (SDSM). The reported analysis suggests that the sustainability of groundwater resources will be adversely affected by climate change during dry years. The area is projected to variably experience 2.53-22.80% decrease of spring discharge. A subsequent comprehensive set of management strategies as palliative and adaptive efforts was proposed to be implemented by relevant stakeholders to assist the community dealing with water deficit during the dry years. Three main adaptive strategies, namely socio-cultural, technical, and ecological measures, were proposed by incorporating physical and socio-economic characteristics of the area. This study presents a blueprint for assessing groundwater sustainability under climate change scenarios and developing tailored management strategies to cope with adverse impacts of climate change, which may become fundamental necessities across other tropical karst islands in the future.

Keywords : climate change, groundwater, management strategies, tropical karst island, Rote Island, Indonesia

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