

## Sustainability of freshwater lens in small islands under climate change and increasing population

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### Abstract

Groundwater and rainwater are the only sources of freshwater in small islands as many islands lack surface water sources. Groundwater occurring in the form of freshwater lens floating on denser seawater is highly dependent on natural recharge from rainfall. A sharp interface numerical model for regional and well scale modeling is selected to assess the sustainability of freshwater lens in the island of Tongatapu. In this study, 29 downscaled General Circulation Model(GCM) predictions are input to the recharge model based on water balance modelling. Three GCM predictions which represent wet, dry and medium conditions are selected for use in the groundwater flow model. Total freshwater volume and number of saltwater intruded wells are simulated under various climate scenarios with GCM predicted rainfall pattern, sea level rise and pumping. Simulations indicate that the sustainability of the freshwater lens is threatened by the frequent droughts which are predicted under all scenarios of recharge. The natural depletion of the lens during droughts and increase in water demands, leads to saltwater upconing under the pumping wells. Implementation of drought management measures is of utmost importance to ensure sustainability of freshwater lens in future.

**Keywords : Droughts, Small islands, Freshwater lens, Numerical modeling**

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