

# Seawater intrusion vulnerability indicators for freshwater lenses in strip islands

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## ABSTRACT

Freshwater lenses on small islands have been described as some of the most vulnerable aquifer systems in the world. However, there is little guidance on methods for rapidly assessing the vulnerability of freshwater lenses to the potential effects of climate change. We address this gap using a simple steady-state analytic modelling approach to develop seawater intrusion (SWI) vulnerability indicator equations. The vulnerability indicator equations quantify the propensity for SWI to occur in strip islands due to recharge change and sea-level rise (SLR) (incorporating the effect of land surface inundation (LSI)). Freshwater lenses are conceptualised as either flux-controlled or head controlled. A number of inferences about SWI vulnerability in freshwater lenses can be made from the analysis: (1) SWI vulnerability indicators for SLR (under flux-controlled conditions) are proportional to lens thickness (or volume) and the rate of LSI and inversely proportional to island width; (2) SWI vulnerability indicators for recharge change (under flux-controlled conditions) are proportional to lens thickness (or volume) and inversely proportional to recharge; (3) SLR has greater impact under head-controlled conditions rather than flux-controlled conditions, whereas the opposite is the case for LSI and recharge change. Example applications to several case studies illustrate use of the method for rapidly ranking lenses according to vulnerability, thereby allowing for prioritisation of areas where further and more detailed SWI investigations may be required.

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