Geophysical Research Abstracts
Vol. 17, EGU2015-11720, 2015
EGU General Assembly 2015

The role of vegetation on freshwater lens sustainability in small coral islands facing climate change

Jean-Christophe Comte (1), Jean-Lambert Join (2), Olivier Banton (3), and Eric Nicolini (2)

(1) University of Aberdeen, School of Geosciences, Aberdeen, United Kingdom (jc.comte@abdn.ac.uk), (2) University of Reunion Island, Laboratoire Geosciences, Saint Denis, La Reunion, (3) University of Avignon, Laboratoire d'Hydrogeologie, Avignon, France

Small islands are commonly densely vegetated despite a near absence of surface water and a limited fresh groundwater resource (freshwater lenses) subjected to widespread seawater intrusion. Due to both the shallow depth of the water table, and the low water storage capacity of the soils, vegetation roots abstract water directly from groundwater. Where groundwater contains dissolved salt, roots selectively uptake freshwater which results in salt concentration in groundwater. Groundwater dynamics and salt transport are therefore coupled with vegetation activity and dynamics. However, roots cannot tolerate high levels of dissolved salt due to its phytotoxicity. This results in a buffer mechanism where vegetation regresses, and therefore groundwater uptake decreases, with increased salinization. A numerical groundwater model is applied to a monitored small coral island in the western Indian Ocean to simulate the freshwater lens behaviour and its response to climate changes. A phytotoxicity model is coupled with the groundwater model. Simulations assessed against field observations show the major control currently exerted by the vegetation with regards to the freshwater lens morphology. In particular, thinnest lenses and seawater intrusions observed in the island depressions can be explained by high vegetation activity due to the shallowest water table. Simulation of the response to predicted long-term changes in both groundwater recharge and sea level shows general lens regression by salinization associated with a simultaneous decrease in vegetation activity. Interestingly, the salinization is far less important than when omitting phytotoxicity processes. This demonstrates the need to couple groundwater and ecohydrological models when modelling the impact of climate changes on groundwater resources in small islands.