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Hydrology and Earth System Sciences
Discussions

Interactive comment on "From days to decades: numerical modeling of freshwater lens response to climate change stressors on small islands" *by* S. Holding and D. M. Allen

Anonymous Referee #2

Received and published: 14 November 2014

This paper is an interesting study of climate-change induced recharge changes and seawater inundation on a small-island freshwater lens. The study uses the numerical models SEAWAT, HydroGeoSphere, and HELP to simulate recharge and freshwater lens dynamics, all appropriate techniques. The paper is generally well written and concise and the figures and table support the article well.

Due to the uncertainty of much of the available data, the conclusions should be couched in more generalized terms and include a discussion of the uncertainty. Questions about the timing and amount of inundation, method and timing of draining, amount of recharge following the inundation, and geology (effective porosity, storage, etc) sug-

gest that these results might just be one realization of many possible outcomes. It would be good to have a feel for how these results fall into the range of reasonable possible results.

Specific Comments:

Recurrent mention of atolls in the South Pacific seems to exclude atolls in the Central and Western Pacific.

Add a definition of lens thickness. Do you mean 50% seawater concentration? 90% or something else?

Each well was screened at 5 m b.g.s., corresponding to the maximum depth of most wells/wellfields on Andros Island. Do you mean screened from the water table down to 5 m bgs?

Using salt for rainfall of 0 g/L may be too low. The final simulated concentration underestimates the observed concentration in fig 10. Using a higher concentration for recharge (assuming salt spray on ground, higher rainfall salinity during storms) might be more realistic.

Define running the model to steady state. Do you mean no change in concentration over time?

You didn't explicitly define "potable" water in the text.

What is the sensitivity of the recovery results to changing porosity? It seems the timing of the plume migration would be highly dependent on the porosity used in the model. It might be fairer to present a range of recovery times based on a range of porosity given the uncertainty of this parameter.

Pg. 11463 Factor 6. Along with possible other storm surges, the passage of other hurricanes undoubtedly provided non-average rainfall to the island.

Pg. 11464 Ln 10 Doesn't the hydraulic conductivity control the gradient, not the topog-

raphy of the land surface?

Pg. 11465 Conclusion 1: Generally not good to add a new thought with a reference in the conclusions

Conclusion 5: I would argue that trench systems make it easier to drain the saltwater off the surface than on an island without open trenches even though they provide an open pathway to the water table. On most other islands there is little opportunity to drain off the inundated water so it will get into the lens anyway, just delayed. So the net benefit might be higher to have open trench systems.

Technical Comments:

Perhaps just a stylistic preference on the reviewers part but a few instances of simpler wording could be used i.e. use “about” instead of “approximately”, delete the word “located” and “situated” throughout as it is generally not needed, use “most of” instead of “the majority of”

Pg. 11460 Ln 4 change “might” to “would”

Pg. 11461 Ln 11 replace ”between” with “compared to” or something similar. Otherwise this can be confused with the physical location between two trenches

Pg. 11462 Ln 12 Reword to “The amount of recharge that speciiňĄcally occurred on Andros Island may have been different during 2004-05.”

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 11439, 2014.