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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Theory of the generalized chloride mass balance method for recharge estimation in groundwater basins characterised by point and diffuse recharge" *by* N. Somaratne and K. R. J. Smettem

Anonymous Referee #1

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Unfortunately, it appears that no amount of logical reasoning can bring this discussion to a sensible conclusion. I can only appeal to the editors to consider the damning reviews on this and the previous manuscript and ensure that these notions are not allowed to enter the debate and policies around recharge to the water-limited areas of their case studies, and potentially for other areas in the world that have the misfortune to adopt this corrupted methodology and eventually exhaust groundwater resources as a result.

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Two points, amongst many others, irrefutably show that this method is entirely indefensible, from both a mass-balance test and a practical sense.

1. For Uley South, the simple mixing calculation (Cl value for diffuse only recharge is 147 mg/L and diffuse-only recharge is 56 mm/year; Cl for point recharge is 14.2 mg/L and point recharge is 75 mm/year), deemed "interesting" by the authors, is rather an irrefutable mass balance for the water entering Uley South. It is completely inconceivable that the dozens of Cl measurements (none of which are somehow remarkably monitoring at the watertable as indicated by the author's "Why the Conventional CMB Fails in Karst") can be avoiding this huge influx of freshwater (75 mm/yr of Cl 14.2 mg/L) that the authors are suggesting. The piezometers mostly go to the bottom of the unconfined aquifer and there are dozens of them. None of them find water of the average mixed portion (71 mg/L), or fresher. Not a single one. There is no hope that karst passageways are magically weaving their way around the piezometers. If there is 75 mm/y of 14.2 mg/L and 56 mm/yr of 147 mg/L, then half of the aquifer contains water of 71 mg/L or less, apparently. Yet, the lowest Cl is >100 mg/L. The authors have created recharge that they can't defend from the perspective of the aquifer's Cl values. Mass balance is violated, and it has nothing to do with the monitoring strategy, it occurs because the authors eliminate salt mass flux through sinkholes. It is incomprehensible that something so obvious can continue to be a sticking point for the authors.

2. The method is NOT a generalised Cl method. It requires an estimation of catchment Runoff, which according to the authors ALL ends up as recharge. This is a ridiculous notion. All catchment runoff can never become sinkhole recharge, unless the catchment is, literally, a bathtub. What's more, the method requires a characterisation of diffuse recharge Cl and sinkhole Cl, neither of which is obtained for the cases they present. In Uley South, there is no clay between the upper and lower aquifers in places - mixing occurs between upper and lower aquifers, and the lower aquifer is connected to basins to the north. There is simply no way that their diffuse Cl values can be taken from Cl measurements around the basin's perimeter. Without unsaturated zone Cl val-

HESSD

11, C262–C264, 2014

ues, the method is entirely indefensible, and therefore impractical without considerably more measurements. Runoff (becoming sinkhole recharge) and diffuse recharge Cl are beyond the capacity of the authors to obtain, and hence they have invented values that, intentionally in my view, produce recharge to Uley South that is excessive for the purposes of commercial gain.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 307, 2014.