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Discussions

Interactive comment on "A post-wildfire response in cave dripwater chemistry" *by* Gurinder Nagra et al.

Anonymous Referee #1

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The authors present an excellent multi-year cave monitoring study that uniquely provides insight into the response of cave dripwater isotope and geochemical compositions to POST-fire vegetation dynamics. The authors argue the increasing amounts of evaporation during the post fire interval drive increasing d18O values over the 5 year post-fire interval, and that decreasing (increasing) amounts of transpiration drive lower (higher) concentrations of most elements at Sites 1 and 2. The authors argue that increasing SO4 and K trends reflect increasing amounts of leaching of burned biomass.

Overall, the manuscript does not present a rigorous, integrated argument. Many of the interpretations come across as speculative without rigorous constraint or consideration of alternative hypotheses. Furthermore, the use of groundwater and cave dripwater monitoring in another cave is used as a pre-fire baseline is not compelling nor necessary, as the authors should be focusing on the response of dripwater to the recovery

of the ecosystem following the fire, not to the fire itself. That is, the authors argue that a progressive decrease elemental concentrations reflects a gradual decrease in transpiration due to tree death - however, a fire would result in a dramatic, instantaneous decrease in transpiration not a prolonged, multi-year response. It is recommended that the authors switch their perspective from "response to the fire" to "response to the recovery from the fire".

Line item comments are below:

L72 – is there a way to quantify "intense wildfire" and put it into context of the range of wild fires in the region or historical time interval? This seems pertinent to understanding the magnitude of the event when thinking about its implications for interpreting past events from cave deposits.

L193 – What is 3 years based on? Another study? A best guess?

L201-205 – It seems that the authors tuned parameters of a forward model to best match modeled and observed drip hydrology. What observational window/interval was used? 2005-2011? I assume that the model was tuned to observations at Yonderup, not Golgotha, correct? Is it possible that multiple parameterization schemes could result in similar comparison between observations and data?

L240 – Does a bivariate plot of dH vs d18O support evaporative enrichment of these dripwaters? I.e., trend off the local meteoric water line with lower slope?

L270 – What does "it" refer to?

L332 – Is Golgotha Cave further inland, and therefore have less aersol Cl deposition?

L329-331, 338-340 – A fire is an abrupt event that likely decimated vegetation instantaneously. How can this be reconciled with a gradual trend of increasing dilution? If the fire resulted in a shut down of transpiration, a flushing of transpiration-concentrated poor water might be expected followed by relatively dilute concentrations until vegetation reestablished and transpiration lead began to concentration waters again. This might explain a gradual increase in solute concentrations (as seen at Site 2a and noted in L340-342), but not decrease. However, increasing solute concentrations with increased transpiration assumes that vegetative nutrient uptake is reliable relative to concentration due to transpiration.

L346 – How would increased surface evaporation induce PCP? L349 – Secession of microbial and root respiration should be abrupt and coincident with the fire, not a gradual signal.

L364-386 – This discussion seems highly speculative with very limited constraints on the proposed interpretation.

L397-398 – How does model dripwater d18O agree with observed d18O? They look to be substantially offset. Additionally, it is not clear how simulation of dripwater d18O supports the interpretation that tree death gradually reduced transpiration resulting in gradual decrease in solute concentrations.

L399 – A bit of context would be helpful – does this apply to a single tree? A stand of trees? At this (fire-affected) site? In this region?

L400 – it is not clear what "this potential" refers to, nor is it clear what gradient (i.e., from where to where) is being referred to. . .. How does a hydraulic gradient maintain high Cl concentrations?

L408-410 – It is not clear how a fire in Feb 2005 results in a sharp increase in evaporation in the Mar 2007.

L419 – d18O reflecting more evaporation but lower solute concentrations tracking less concentration (more dilution) due to less (evap)transpiration does not make the most compelling argument.

L243-276 – It is not clear how modeling d18O contributes to this study. The results are not well integrated into the interpretations, and it is not clear why a model tuned to the drip hydrology does so poorly in accounting for observed dripwater d18O. Is

this meant to support the interpretation that evaporation of infiltrating water occurs somewhere between the surface and drip site, and that evaporation might also play a role in dictating solute compositions? If so, this does not come across clearly.

L436 – use of groundwater and nearby cave dripwater as pre-fire conditions is not compelling, nor necessary. The argument that the recovery of an ecosystem after a disturbance is potentially reflected in cave dripwater is compelling on its own.

L441-444 – The case supporting these statements is not compelling.

L446-447 – How has the vegetation forcing been delineated from the climate (i.e., CWB) signal?

L448 – Increasing K and SO4 trends are not obvious from Fig. 3, and why would the degree of leaching increase with time from fire? It might be expected that there would be a pulse of K and SO4 following the fire, than leaching would decline after the initial pulse.

L449 – This is vague and not all that helpful of a conclusion.

450 – No evidence to support this was presented in this manuscript so it is a bit odd to present as a conclusion.

453 – It is not clear how/why the modeled d18O represents a control (no fire) scenario.

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