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# Comment on hess-2021-338

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Referee comment on "Reactive transport modeling for supporting climate resilience at groundwater contamination sites" by Zexuan Xu et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2021-338-RC1, 2021

***# General comments***

This is a very interesting and resourceful paper to read. Authors integrated climate data in hydro-geochemical modeling to investigate climate resilience at groundwater contamination sites under different scenarios. By simulating reactive transport in groundwater, they found what geochemical mechanism plays a major role in uranium transport. The results would help decision-makers to manage the site and prepare for potential risks from climate change. Since this paper overarches from the general concepts (e.g., resilience) to specific mechanisms in modeling (e.g., dilution and remobilization), I would like to ask some questions that help people to have a better understanding of this paper:

***# Specific comments***

1) The definition of climate resilience authors made is clear. How would you connect the results to the climate resilience? Are you able to quantify the climate resilience as an environmental metric? e.g., contaminants' concentrations or pH at an environmentally sensitive location.

2) What is the difference between enhanced and monitored natural attenuation for the target contamination site? Do you mean the construction and destruction of the funnel-and-gate system?

3) I understand that the flow and transport model is well established to describe spatio-temporal evolution of the contaminants of concern. Nevertheless, I am wondering about the limitation of the model as well, e.g., is the sorption model able to capture all sorption

mechanisms?

4) The flow and transport model assumed that hydrogeological properties are homogeneous within each unit, and there is no dispersion. However, dispersion could have some impacts when the flow rate is slow, e.g., decreasing recharge scenarios. What impact would you expect on the results if the model considers dispersion due to natural heterogeneity of subsurface (e.g., permeability)?

5) Could you explain why there is the nonlinear relationship between recharge and uranium concentrations (around +20~30%?) with specific pH values? You already explained it clearly with specific mechanisms (pH buffering from kaolinite and goethite). However, in decreasing recharge cases, it is much easier to understand because I could compare the pH range of gibbsite formation (>5.4) with simulation results.

6) What do you mean by the uncertainty (in line 652)? Do you mean annual variability mentioned in line 543? Is the variability of net infiltration also the same across all climate scenarios?

***# Miscellaneous comments***

1) You might want to mention "total recharge" instead of "total runoff" in line 267

2) You can specify ET is evapotranspiration before first mentioning it in line 643