Modeling Nitrate and Uranium Co-contamination in Groundwater in Kansas

Musabbir Turjo[a] , Jeeban Panthi[b]
[a]Department of Civil Engineering, Kansas State University; [b]Department of Geology, Kansas State University
turjo@ksu.edu

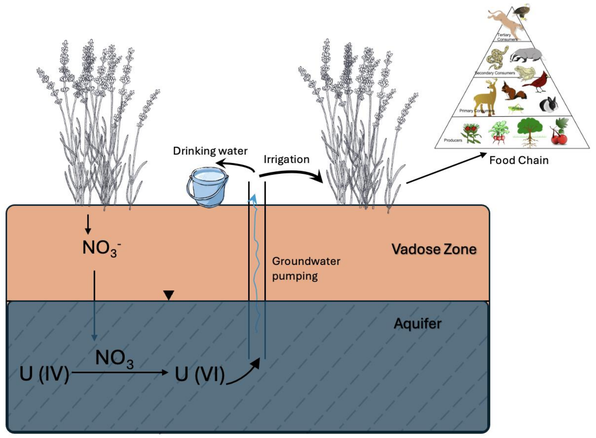
Governor's Conference on the Future of Water in Kansas

Panthi HydroSystem Lab

Kansas State University

Background

- The concentration of nitrate in groundwater in Kansas has increased considerably over the past 40 years primarily because of fertilizer use (Lane et al., 2019).
- Nitrate in aquifers oxidizes uranium (IV) to soluble uranium (VI) by oxidative dissolution of minerals which can enter the food chain by water pumping (showed in the schematic diagram bellow).
- Previous study examined the spatial correlation of nitrate and uranium until 2015 and found; some regions show higher correlation (Nolan and Weber, 2015).
- Yet the mechanistic process of 'How' nitrate cause the uranium to mobilize in the aquifers remains unresolved.
- To refine the previous study, we added recent contaminant concentration dataset in this study.

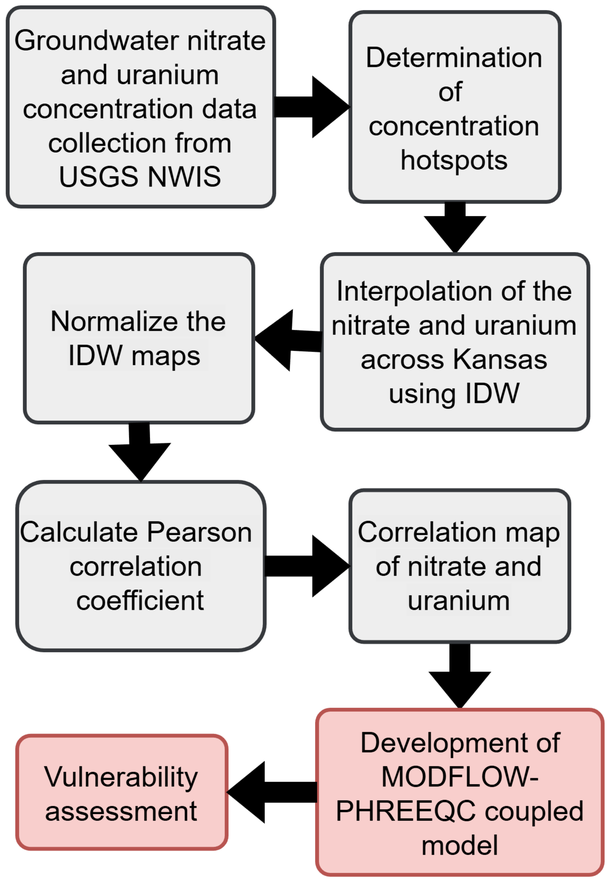


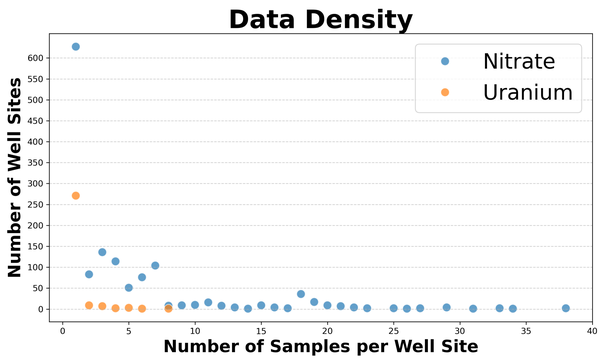
Objective

➢To examine current condition of Nitrate and Uranium across Kansas to find out concentration hotspots.

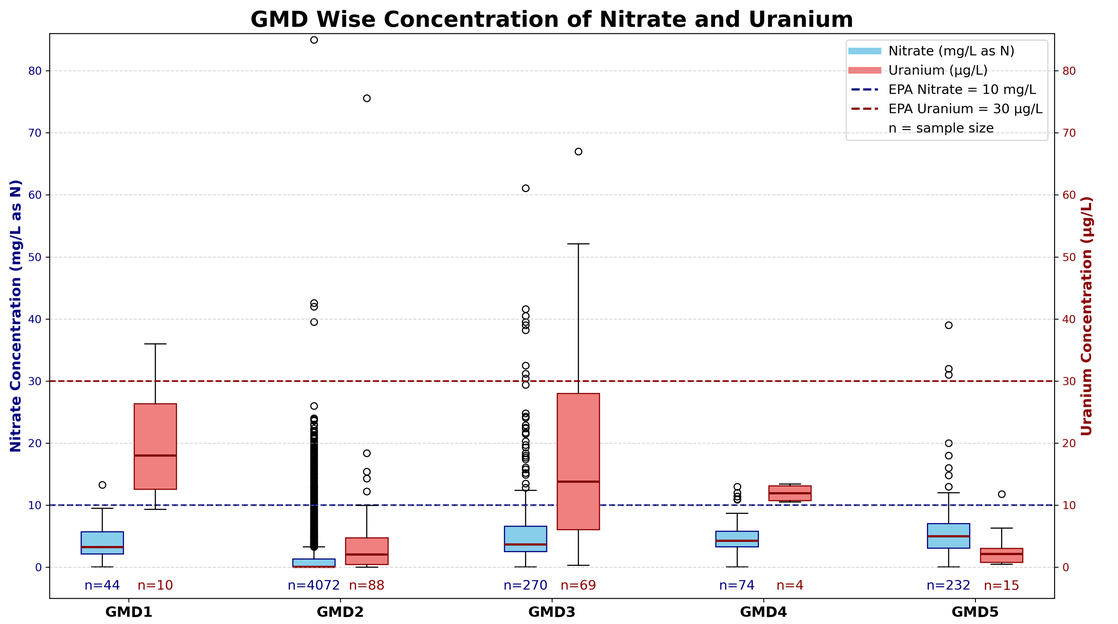
➢To analyze spatial correlation of nitrate and uranium in groundwater in Kansas

Method

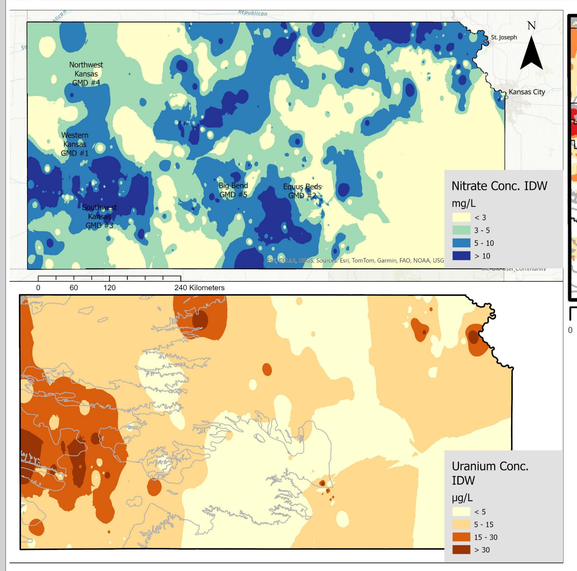


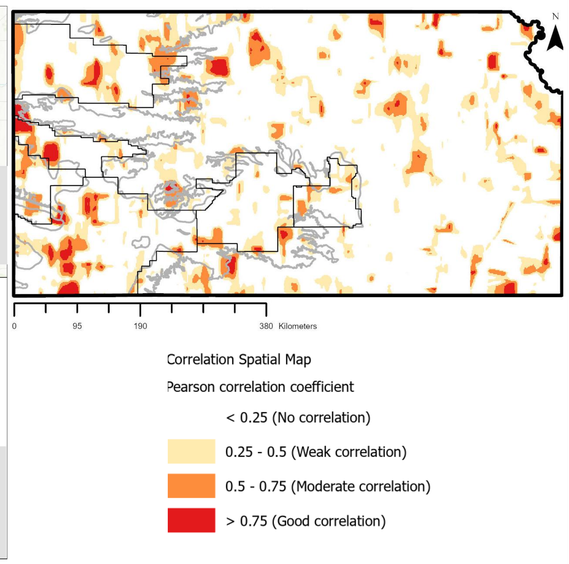


Results (*Preliminary*)



Spatial variability and correlation of nitrate and uranium in groundwater:





Conclusion & Future Research

- Nitrate and uranium concentration often exceeds the EPA MCL standard in groundwater in Kansas; and they are correlated in higher concentration zones.
- Development of coupled MODFLOW-PHREEQC model to simulate groundwater flow and reactive transport of uranium.

References

Lane, A. D., Kirk, M. F., Whittemore, D. O., Stotler, R., Hildebrand, J., & Feril, O. (2019). Long-term (1970s–2016) changes in groundwater geochemistry in the High Plains aquifer in south-central Kansas, USA. Hydrogeology Journal, 28(2), 491–501. https://doi.org/10.1007/s10040-019-02083-z

Nolan, J., & Weber, K. A. (2015). Natural uranium contamination in major U.S. aquifers linked to nitrate. Environmental Science & Technology Letters, 2(8), 215–220. https://doi.org/10.1021/acs.estlett.5b00174