

## ***Interactive comment on “A European map of groundwater pH and calcium” by Michal Hájek et al.***

### **Anonymous Referee #2**

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General Comments. This paper describes the development of models estimating shallow groundwater Ca concentrations and pH and maps of the predictions made with these models across Europe. Random forest models developed were based on lithology, soil pH, and precipitation. Authors note that improvements can be made, but the data is a significant improvement over current data sources, and is usable for understanding expected water chemistry in shallow groundwater ecosystems. The data clearly meets the requirement of being unique, useful, and complete. There are a few instances where a little more detail or explanation would make the process used and resulting models easier to understand. A bit more discussion of predictors not included in the model would help guide later efforts to build upon this work.

Specific comments Ln 98-100: This may be a good place to also mention the dominant

C1

role lithology plays in determining groundwater chemistry that would also cause soil pH to be a poor predictor of groundwater dependent habitats. Ln 187: May be worth noting that the resulting equation is similar to what was observed elsewhere (e.g., Hem JD. Study and interpretation of the chemical characteristics of natural water. Department of the Interior, US Geological Survey; 1985) Ln 240-241: The decision on which resolution to use could be explained in more detail. Also, how were multiple observations within a single cell handled? Ln 280-285: Partial dependence plots of each variable should be summarized (i.e., state direction of effect) here, and plots themselves included here or in supplemental material. See R package ‘pdp’. Ln 329-330: Inferring potential mechanisms could be misleading without knowing direction of effect from a partial dependence plot. Ln 331-335: Although precipitation amount has an effect on residence time, slope also has a large effect and probably should have been considered as a predictor. Dilution of shallow groundwater by increasing precipitation is another more direct potential cause of lower Ca concentrations. Ln 346-347: It seems that this pattern in pH and Ca could be closely related to temperature, with warmer temperatures leading to faster weathering rates (White, A. F., and A. E. Blum (1995), Effects of climate on chemical-weathering in watersheds, *Geochim. Cosmochim. Acta*, 59, 1729–1747). Ln 400-401: Could call for more work developing high resolution maps of geochemistry like the ones developed for Germany (Le TD, Kattwinkel M, Schützenmeister K, Olson JR, Hawkins CP, Schäfer RB. Predicting current and future background ion concentrations in German surface water under climate change. *Philosophical Transactions of the Royal Society B*. 2019 Jan 21;374(1764):20180004.)

Technical corrections: Ln 70-73: this sentence is difficult to follow. Ln 378: Not clear what is meant by “dispose”.

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C2