

## ***Interactive comment on “Deepening roots can enhance carbonate weathering” by Hang Wen et al.***

### **Anonymous Referee #2**

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The authors study the difference between chemical weathering in grassland and woodland soils through the application of simulations of a model calibrated in the grassland soil region. They aimed to understand the effect of deepening roots on carbonate weathering. In general, the manuscript is well written and structured; the geochemical model and simulation results are well described, using kinetic and thermodynamic equations. It deserves to be published because it deals with some relevant aspects that should be considered in studies dealing with the critical zone, which is the weathering of carbonate minerals and its link with the ecosystem; it also discusses the effects on the global carbon cycle and regional long-term simulations. Nevertheless, from what the title of the manuscript implies, I was expecting an extensive discussion about the deepening roots and their connection with weathering of carbonates, with

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a well representation in the geochemical model. The authors did not create a model where it explicitly represent the rhizosphere nor biogeochemical processes besides respired CO<sub>2</sub>, despite that the last one was found to be one of the most important variables controlling weathering of carbonates. From my perspective, the deepening roots in the model were represented as pure hydrological feature, their only influence the flow path but not the flow itself, which can vary from plant species (not all plants will have the same water requirements). Although they discussed most of the before mentioned issues under model limitations, this subsection was somehow unclear. I would suggests a revision of the objectives or the model limitations in order to publish the manuscript. Specific comments: Why did the authors not include organic acids in the model or in the discussion? Is it because a small effect on weathering is expected? The long-term simulations displays a change in porosity, is this change considered in the short-term model? The calibration was done using grassland data, but the water uptake of plants depends also on the species, might it be the case that the roots take more water in woodland soils? Under model limitations, the flow partitioned is well explained, however, the points given above are not present, including the difference in water balance (water uptake by plants) among species. Technical comments: Units are usually separated from the number, including in percentage or permil; line 56-57, I did not understand completely this sentence; figure S1 should include coordinates in x and y axis; line 198, the symbol '>' may be changed into words; the unit for year is commonly written as 'a' not 'yr'.

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