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Interactive comment on “Evaluating sensitivity of silicate mineral dissolution rates to physical weathering using a soil evolution model (SoilGen2.25)” by E. Opolot and P. A. Finke

Anonymous Referee #2

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The m/s “Evaluating sensitivity of silicate mineral dissolution rates to physical weathering using a soil evolution model (SoilGen2.25)” by Opolot and Finke addresses the impact of various soil-forming processes, specifically the physical weathering, on the silicate mineral dissolution. The authors have followed up their previous work Finke (2012) and presented the sensitivity analysis in this m/s. Despite some interesting results from the sensitivity analysis, the overall contribution of the m/s is limited. Some results and figures have directly been lifted from Finke (2012). Additionally, authors claimed to assess the impacts of intrinsic (mineral composition, mineral surface area) and extrinsic factors (climate, physical weathering, clay migration, plant uptake, hydrology) on silicate mineral dissolution rates, but they have evaluated only the effect of par-

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ent materials and soil texture. I feel that this m/s has a potential for getting published in Biogeosciences, but more work is needed. I suggest that authors should demonstrate the validity of their assumptions and model in a chronosequence site, before describing the sensitivity analysis.

Some specific comments are as follows:

1. Line 18, page 13890 – what are other soil forming processes?
2. Line 1, page 13891 – change asses to assess
3. Line 15-17, page 13891 – “the measured soil data (Finke, 2012; van Ranst, 1981) and other reconstructed model input data (Finke and Hutson, 2008) were readily available for this site.” Then, why authors did not test their model on this soil? Why did they resort to random sample textures from the USDA textural triangle? I wonder if authors let their model spin up with no clay and no silt (as initial conditions) what will happen? Will their model come to any of textures selected from USDA textural triangle?
4. Line 19, page 13891 – change to - objectives (1 and 2) of this study are
5. Line 3, page 13895 and Line 6, page 13896 – Eqs 3 and 6, do they have different notations for i ?
6. Lines 11-15, page 13891 – “pH is generally higher in basalt and peridotite parent materials than granite but only in the first 5000 years of simulation (i.e., up to 10 000 years BP). The trends are however reversed in the subsequent years especially in Model A.”

What do authors mean by reversed trends? Does it mean pH is higher in granite after 5000 years?

7. Lines 2-4, page 13891 – “The higher dissolution rates (especially in the beginning) of albite and K-feldspar observed in granite compared to basalt and peridotite could therefore be due to lower pH observed in granite than in Basalt and Peridotite at that

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point in time”

These two statements (above) contradict each other.

8. Section 3.3.4 – It is not clear how interactive effects of selected soil forming processes on chemical weathering rates were evaluated. Was it done – one factor (process) at a time? Which period was chosen to evaluate the effect for each soil forming process?

9. Page 13916, Table 1 – provide names of the classes selected from the USDA textural triangle. Also, provide a reference for the USDA classification.

10. In Table 1, how do you justify clay % more than 44, 67, 80 at the beginning of the simulations? It seems a fully developed soil, which may be at quasi-steady state. It may be interesting for readers to know the texture at the end of simulations (after 15,000 years).

11. Page 13917, Table 2 needs references.

12. Page 12919, Fig 2 – this figure has directly been lifted from Finke (2012). May be this figure can be replaced by a table. I have some questions out of curiosity regarding these boundary conditions. For example, why bioturbation is constant after 7000 years? What is the % OC during these years?

13. Page 13920, Fig. 3, pH fluctuates in the range 4 to 7 for Basalt? Does it ever come to steady state?

14. Figure 4(a) is also not original finding from this study. Either remove it or change it to a table or so.

15. For flow simulations, what are the parameters used in Richards’ equation for hydraulic conductivity (or permeability). How was the change in the texture during the simulation (during the soil forming process) was handled?

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