

Interactive comment on “The importance of mineral determinations to PROFILE base cation weathering release rates: A case study” by Sophie Casetou-Gustafson et al.

Anonymous Referee #1

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Abstract I found the abstract quite hard to understand as I am not familiar with A2M – I suspect that other readers may have a similar issue.

Introduction Whilst the authors do highlight the sensitivity of the PROFILE model to the mineralogy inputs as determined by Hodson et al (1996) and Jonsson et al, (1995) any discussion of the PROFILE model and its use probably merits reference to the paper of Hodson et al (1997) Water, Air and Soil Pollution paper published by workers at what is now the James Hutton Institute (i.e. the same institute where the current authors work) which highlights significant problems with the model including (relevant to the paper reviewed here) issues related to assumed mineral composition within the default

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PROFILE database

Hypothesis (1) – I struggled with this – the “reference weathering rates are those determined using measured mineralogies. In hypothesis 1 it is stated that rates calculated using site specific mineralogies are more similar to the reference rates than those using regional mineralogies but aren’t the site specific mineralogies those actually measured, i.e. they are quantitative so the hypothesis makes no sense. I’m sure I must have simply misunderstood what the authors mean but I wonder whether they could try and clarify this.

Materials and methods Whilst values are kept constant between model runs to allow comparison the authors use Warfvinge and Sverdrups equation to calculate surface area. It is probably relevant to cite the work of Hodson et al (1998) Geoderma who showed that this equation was flawed in case others less familiar with the literature start to use this equation routinely. It also seems that rather than using the relative surface area of different minerals as required by the model the authors have used the relative weight % of the minerals. Almost everyone does this because the relative surface area of the different minerals present is almost impossible to determine and for the comparison exercise this isn’t an issue but again I think it should be acknowledged that in principle the “wrong” inputs have been used

Materials and Methods / Results / Discussion I’m a firm believer that all the data necessary to understand a paper should be in a paper, not in supplementary material or other papers. I may have missed it but I struggled to find a note of the regional mineralogy / bedrock type assumed for the sites and a list of the minerals determined in the actual mineralogical measurements. I think this should be added. I mention this because Art White (e.g. White et al, 2017, Geochim, Cosmochim Acta) did a lot of work looking at the importance of calcite in release of Ca during the weathering of granite, despite the presence of Ca-bearing plagioclases. In this paper there is discussion about the relative importance of plagioclase, apatite and epidote for Ca release in the profile model. Given the relative abundances and known dissolution rates of calcite,

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apatite and epidote and White's findings I find it extremely unlikely that calcite wasn't important. Was it that no calcite was detected by the XRD / estimates of mineralogy? Is that likely given the rock types? I'd like to see a fuller discussion of the issue of trace concentrations of calcite resulting in high Ca release rates.

Concluding remarks Final bullet point seems to agree with the Hodson et al (1997) paper so again reference to that paper might be appropriate

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