Review of the paper esurf-2016-50.

This paper is dealing with the role of the application of chemical and organic fertilizers on carbonate weathering in a karst area. Their approach was based on a laboratory experiment using a soil column including two carbonate (limestone and dolostone) rock tablets over one year on the field. The authors discussed the loss (or gain) of weight of each rock tablets in term of variability of carbonate weathering under various fertilizer treatments. The authors concluded that the main NH4 fertilizers induced the most important carbonate weathering, while the other fertilizers have a much lesser effect. The topic as such should be well suited for a publication in Earth Surface Dynamics, but this manuscript is not, at least in its present state. Compared to the first version, there are some improvements, but some parts need some clarifications. I would suggest minor revisions of the present manuscript.

Here are my comments and suggestions:

In some paragraphs, the English writing may be slightly improved.

In the field, how are placed the different experimental columns? Did you have a random position, mixing the different modalities?

The authors mixed "perfectly" the chemical fertilizers with the sieved soils. It was not directly spread on the field/columns. This may be an artefact compared to the natural field, where fertilizers are spread on the soils, relatively far from the rock. In the last part of the discussion, this point may be highlighted, as the authors compared their data with the literature… This way, their weathering rate may be (slightly) overestimated. This other point is that in the literature most studies approach the weathering estimate from riverine data as the authors discussed.

- L41 – 42 : "(…) processes including the reaction between carbonates and ~~the~~ protons derived (…)".
- L 45 and 47: you may be more specific on the origin of sulfuric acid, and the role of acidic soil in the carbonate – proton relationship. "Acidic soil" is still too broad.
- L55, you may add the increase proportion of mineral fertilizers (increase by 365%), in order to compare with the 3.3% worldwide increase… I was wondering what was the cause of such sharp increase in chemical fertilizers consumption. Is it just an effect of the increase of the size of agricultural land or is it a consequence of a change of fertilizer habit (more NO3 or NH4 fertlizers)?
- L118-119: You worked on Guizhou area where the consumption of chemical fertilizers increased by about 26% (far less than the increase of fertilizer consumption at the scale of the whole country).
- L121: Could you be more specific for the soil classification, more precise than B horizon?
- L123: did you crush (ground) the sample before to pass it through 2 mm sieve? Or did you pass the air-dried soil through 2 mm sieve, and after you crushed it… this may seem to be a detail, but it is really important.
- L141: Did you have any silt or clay loss with a 0.5 mm net at the bottom of your column? Did you add some quartz wool in addition to the sand "filter" above the PE net?
- L142-143: "Two different carbonate rock tablets were buried in the bottom of each soil column"; by this, do you mean that you put only one tablet of two different carbonate rocks? So the carbonate rocks are different, or are they two aliquots of the same rock type?
- L145-150: How did you determine the weight of each chemical fertilizer applied on each soil experiment?

- L151-152: you did mix each fertilizer with air-dried soils. So the fertilizer was not spread on the column? As soil and fertilizers were perfectly mixed, did you also crush the chemical fertilizers or did you leave them in their original shapes?
- L158-159: you used 2 carbonate types: a limestone and a dolostone. Did you put one tablet of each carbonate in the same column, or did you put 2 tablets of the same carbonate (in order to have duplicates) in the same column?
- L176: This is at this point that we know that you have triplicates. How did you obtain these triplicates: did you use different columns for replicates, or are they in the same columns… It is important in order to understand on which data you performed a statistical analysis. How many columns did you in total?
- You should add "respectively" at the end of your sentence when you're listing some results…
- L189: the "rest treatments"? do you mean the other chemical fertilizers other than NH4NO3, NH4Cl, (NH4)2CO3, NH4HCO3?
- L206: you explain that there is no difference in the weathering behavior of limestone and dolostone, however the control experiment show different behavior. Did you test this similarity?
- L213-215: you may present these 3 equations in the following order: (5) > (4) > (3), following an increasing pKa (or pH).
- L218: H2CO3 is not only formed in the soil, it is first formed in the atmosphere with the dissolution of atmospheric CO2(g) into rain droplets and rain, as CO2aq and then H2CO3. The concentration of H2CO3 is exacerbated into soil because of the presence of organic CO2 from respiration. And yes, one of the main control of carbonate dissolution is the amount of rainfall. That's why is it important to know how the different columns were placed in the field, randomly or the same modalities were placed together (L223-224). If randomly, you can say that rainfall may not be consider an a controlling effect for your experiment.
- L231-232: you may be more precise for "CO2 degassing"… Issued from carbonate dissolution? For respiration?
- L244: the year of the publication from Singh et al is missing.
- L305: you did calculate the initial fertilizer –derived NH4 per unit. But it would be interesting to have the initial rate of fertilizer spread in the field and to compare it with what it is really applied in the Chinese agricultural watersheds.
- L396-397:
- Table 2: what is the significance of a, b, c behind the numbers (ANOVA)?