

## ***Interactive comment on “Temporary and net sinks of atmospheric CO<sub>2</sub> due to chemical weathering in subtropical catchment with mixing carbonate and silicate lithology” by Yingjie Cao et al.***

### **Anonymous Referee #2**

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The authors investigated major ion chemistry in Beijiang river water in China and calculated chemical weathering and CO<sub>2</sub> consumption rate in the basin. They distinguished chemical weathering of silicate and carbonate and their agents; carbonic and sulfuric acid. I agree that some previous studies have ignored "anthropogenic" weathering and this difference is important to elucidate the global carbon cycle on different timescales, about which the authors used phrases of "temporary and net sink of atmospheric CO<sub>2</sub>". The subject of this paper is good for the journal.

I understand that the authors have collected abundant data in different sampling stations and seasons. However, I have serious concerns over the description of the data

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and calculation methods. For example, the mass and chemical parameters of rainwater are not provided, and I couldn't assess the results. There are no information about analytical errors. The authors seem to confuse alkalinity, DIC, and [HCO<sub>3</sub><sup>-</sup>], which have totally different definitions (although I understand that these parameters are similar at pH 8 in the river waters, HCO<sub>3</sub><sup>-</sup> is the main topic of this paper and the authors should calculate and explain accurately). Are the chemical parameters of the river (and relevant calculation results) weighted average over 12 months? What kind of methods do the authors use to calculate the area of silicate/carbonate outcrops or river water discharge?

The background of this study is unclear, and the authors should provide more basic information. What is "hyperactive region"? I recognize that Beijiang River is a major tributary of the Pearl River, but this river is relatively small compared to other world major river such as Amazon or Changjiang River. How does this river contribute the global carbon cycle? In addition, I have no idea why the authors compared total chemical weathering rate with latitude.

Furthermore, there are also some previous studies about the Pearl River and its tributaries, some of which have already taken into consideration anthropogenic weathering in some way. Do the author's HCO<sub>3</sub><sup>-</sup>-basis calculation methods and their results make a difference? I think the last section in discussion is too descriptive. I also have a concern that temporary and net sink of CO<sub>2</sub> show large spatial variations, but in the discussion, the authors mentioned these values only in the SJs station (lowermost part).

Overall, the data and subject of this paper are good, but I'm regret to say that there are many problems for the description. At this stage I couldn't recommend publication of this paper.

Question: as shown in equation (21), silicate weathering by sulfuric acid does not affect the concentrations of HCO<sub>3</sub><sup>-</sup> in the river. However, in equation (23) and (24),

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[SO<sub>4</sub><sup>2-</sup>]<sub>ssw</sub> seemed to be described as  $\alpha_{CSW} \times \alpha_{SCW} / \alpha_{CCW} \times [\text{HCO}_3^-]_{riv}$ . Would you please explain this calculation?

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