

Atmos. Chem. Phys. Discuss., referee comment RC2  
<https://doi.org/10.5194/acp-2021-564-RC2>, 2021  
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## Comment on acp-2021-564

Anonymous Referee #2

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Referee comment on "A novel pathway of atmospheric sulfate formation through carbonate radicals" by Yangyang Liu et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-564-RC2>, 2021

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The authors provide a strong case that carbonate radical reactions could contribute substantially to the atmospheric production of sulfate from SO<sub>2</sub>. I have no argument with all of the very extensive laboratory and theoretical studies. It makes good sense.

However, when we get to the field study data, the hypothesis does not seem to hold up. In Figure 5 we are presented with the experimental "correlation" of sulfate and carbonate ions in daylight and at night. To call the correlation "weak" is being very generous. In fact, I would argue there is no demonstrated correlation at all.

I think the authors ought to re-write their paper conclusion to highlight the lack of any observed correlation, even though there ought to be one based on all of the laboratory work. They could speculate on why the field study failed to find the expected relationship, and suggest more field studies to resolve the issue.

The paper is well written, but I found some English grammar issues:

Line 35 "such as" amines

Line 92 and elsewhere: "phy-chemical" ought to be physico-chemical

Line 95 change "better applicability in" to "simulate"

Line 97 "This result allows us to consider that in addition to alkaline environment alternative important force resulting in the remarkable increase of sulfate yield upon irradiation is expected within the carbonate-containing system." Change to "This result allows us to assert that the carbonate-containing system contains another important mechanism for sulfate generation beyond the production of an alkaline environment."

Line 223 "stemmed" should be "produced"

Line 238 "none" should be "no"

Line 270 "complement" should be "complementary"

Line 292 "photo-response" should be "photo-generated"