

Biogeosciences Discuss., referee comment RC2
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Comment on bg-2022-116

Anonymous Referee #2

Referee comment on "From soil to sea: sources and transport of organic carbon traced by tetraether lipids in the monsoonal Godavari River, India" by Frédérique M. S. A. Kirkels et al., *Biogeosciences Discuss.*, <https://doi.org/10.5194/bg-2022-116-RC2>, 2022

This study by Kirkels et al. investigates sources and transport processes of the presumed soil biomarker branched GDGTs in the Godavari river (India) and associated soils and sediments during wet and dry seasons. They provide ample evidence that additional riverine and marine sources hamper the use of brGDGTs for paleoreconstruction at this site. Their results are discussed in light of previous findings and differences to other monsoonal systems are highlighted. This is a well-written paper with a thorough and balanced discussion, which despite its length and number of complex figures does not feel lengthy.

To make this paper a more attractive read, I suggest to change the title and headers of the discussion from "descriptions" to actual statements that reflect the main findings. For instance, the title currently does not really reflect the main finding that soil brGDGT signals are overprinted by riverine and marine in situ production.

Ln 67: We now know of several bacteria that synthesize brGDGTs (Halamka et al., 2021 doi: 10.7185/geochemlet.2132; Sinninghe Damsté et al., 2018). Therefore, I wouldn't doubt that bacteria are truly their source and consequently would use another word than enigmatic.

Ln 70-73: There is recent evidence that there are also bacteria that do not produce iso-diabolic acids that synthesize brGDGTs (Halamka et al., 2022 <https://doi.org/10.31223/X5WD2C>), therefore, I suggest to be more careful with the statements made here.

Ln 75: Please also acknowledge the work of Halamaka et al. (2021) here.

Ln220 onwards: Does this mean that these samples (dry season SPM, riverbed sediments, and fine fractions of soils) were not saponified, while wet season SPM and bulk soils were saponified? Why were these samples treated differently? Saponification may release also some IPL-GDGTs as core GDGTs and affect ratios, also of isoGDGTs to brGDGTs. Have the authors considered the effect of this? Also, there is no reference for the Al₂O₃ column separation, was this tested for the effectiveness (and yields) for core GDGTs?

Ln 239: Change to APCI

I find many of the titles in the discussion bland. To keep the reader excited I suggest to instead mention the main finding in the title. For instance instead of "Spatial variations in GDGTs in Godavari soils" you could say "The effect of moisture and temperature on the spatial distribution of in GDGTs in Godavari soils" or instead of "Sources of GDGTs in the Godavari River" you could say "6-methyl-brGDGTs indicate in situ production in the Godavari River"

Ln 539: replace "tears" with "teases"

Ln 550: Please indicate that you are now also referring to Fig. 6a and not only 6b.

Ln 573: Please also give credit here to the paper by Halamka et al., 2021 (doi: 10.7185/geochemlet.2132)

Ln576: How was it shown that the brGDGT producing bacteria were heterotrophic?

Ln 600: Did the authors see higher absolute amounts of crenarchaeol to confirm a higher activity of ammonia oxidizing archaea?

Fig. 7: Can you indicate in this plot again where the border of the Lower and Upper Godavari Basin is and where the North and East Tributary regions are? There is a red dashed line, I assume this is supposed to separate the two basins?

5.3 and 5.4 onwards: Again, I recommend to choose more meaningful titles so the reader is informed on the most important points. Suggestions are "5.3.2 Low mineral associations during river transport" "5.3.3 The marine sedimentary brGDGT composition reflects the lower Godavari basin" or "5.3.4 Absence of size-related sorting in the Godavari River"

Ln 710: Do the authors have any idea why the depth profiles of the Godavari River look different to other monsoonal rivers?

Ln 741: Refer to correct figure here.