Renewable and Sustainable Energy Institute
4001 Discovery Dr n321
Boulder, CO 80303

Emily R. Stuchiner
(917) 435-5371
emily.stuchiner@colorado.edu

March 7, 2024

Dear Journal of Geophysical Research: Biogeosciences Editor:

Please consider our enclosed manuscript, **Hot or not? An evaluation of methods for identifying hot moments of nitrous oxide (N_2O) emissions from soils** for publication as a Method Article in Journal of Geophysical Research (JGR)-Biogeosciences.

In agroecosystems, soil N_2O emissions are characterized by short-lived, large pulses, called hot moments, which contribute disproportionately to annual N_2O budgets. These N_2O hot moments are prime targets for of the development of agricultural land management practices to reduce agricultural soil N_2O emissions, as these are a large portion of global anthropogenic N_2O emissions. However, there currently is no standard approach for identifying and quantifying hot moments, and, the implications of different approaches on hot moment identification and quantification have not been evaluated. In this work, we evaluated different approaches for identifying and quantifying hot moments of N_2O using 16 annual autochamber datasets with hourly flux measurements varying in flux magnitude and frequency distribution. Among three methods for determining threshold flux values to identify hot moment fluxes, we found that the 4 standard deviation method yielded hot moment threshold values too high, and the isolation forest method yielded threshold values too low, leading to missed N_2O hot moments or low net N_2O fluxes mischaracterized as hot moments, respectively. Using the 1.5x the interquartile range of the upper bound of the N_2O flux (1.5x IQR method) led to the most accurate identification of hot moments. We also found that seasonally subdividing the annual datasets facilitated identification of smaller hot moments in the lower-flux times of year, but it led to overall lower annual estimates of hot moment contributions. From our analysis, we recommend using the 1.5x IQR method on whole year datasets as the standard approach for hot moment identification and quantification.

We declare no conflicts of interest, and all funding sources have been included in the acknowledgements. All major contributors to this paper received authorship. Thank you for considering our work for publication in JGR-Biogeosciences.

Sincerely,

Emily Stuchiner

Emily R. Stuchiner
Research Scientist
Renewable and Sustainable Energy Institute
University of Colorado Boulder

Additional information:
1) Manuscript length: approximately 13.5 PUs (4772 words, 1 figure, and 3 tables spanning approximately 26 pages). 2) Supplemental information: 8 pages including 7 figures.