LETTER

New records of very high nitrous oxide fluxes from rice cannot be generalized for water management and climate impacts

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As scientists working at the International Rice Research Institute and other institutions that have investigated greenhouse gas emissions from rice fields, we read the recent article in PNAS by Kritee et al. (1) with great interest. The observed N_2O emissions from rice fields in South India including previously unknown high rates definitely constitute an important finding that warrants being reported. We also agree that recommendations on farming practices should give close attention to timing and rates of N fertilizer application in relation to water management.

Other generalizations in this study, however, are largely unfounded and speculative. We raise several critical issues that are further substantiated by information in a supplement to this letter (https://doi.org/10.5061/dryad.h11125b).

Field Design

A major concern is that the field experiments did not encompass a control treatment with continuous flooding. The ramified "baseline" and "alternate" treatments in this study impede any conclusion on cause–symptom relationships between water regimes on N_2O emissions. The study sites had high percolation rates, so floodwater levels had to be replenished frequently. This is a usual practice in soils with low clay content but is not tantamount to alternate wetting and drying, a deliberate management practice applied in rice fields where the conventional practice is continuous flooding (2).

Sampling Frequency

The article suggests—at least implicitly—that previous studies have missed recording high N_2O emissions due to their insufficient sampling frequency. This argument is unjustified given the high number of field observations and the diversity of sampling strategies applied. Several studies with manual sampling comprise high frequencies [e.g., in daily intervals (3)]. Moreover, automated measurements provide continuous measurements of N_2O emissions in subdaily intervals from rice fields, including those in tropical Asia (4–7).

Interpolation Errors

The study by Kritee et al. (1) uses a nonlinear interpolation method, but individual emission spikes are still reflected as broad peaks. The impacts of such observation gaps in N_2O records have clearly been shown by comparing manual vs. automated records (3) as well as distinct permutations of sampling intervals based on automated N_2O records (8). These inherent uncertainties in manual sampling should not lead to discarding the computed seasonal emission rates, but to questioning their use as a benchmark for assessing accuracies of other records.

Model Development

Model development in this study is limited to the initial step of multiple regression but omits the decisive step of model validation with an independent data set. Multiple regression alone can be done with almost any given dataset, so this will not automatically entail more reliable extrapolations of N_2O emissions.

Interpretation of Risks

Kritee et al. (1) conclude that their newly recorded emission rates translate into a high risk of underestimating N_2O emissions. While this logic appears sound, this finding remains weak as long as there is no concomitant information on the likelihood of such a risk. On the same grounds as arguing in favor of increasing regional and global estimates, these individual field records of high emissions could also be interpreted as statistical outliers or anomalies.

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The authors declare no conflict of interest.

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