Biogeosciences Discussions

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Reply on RC1

Sparkle L. Malone et al.

Author comment on "Gaps in network infrastructure limit our understanding of biogenic methane emissions for the United States" by Sparkle L. Malone et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2021-256-AC1, 2021

Authors would like to recognize the thoughtful comments provided by the Reviewer which led to several important changes in our approach. We clarified the goals of this study, we focused on tower infrastructure currently measuring CH4, and we better explained how we are measuring representativeness.

Reviewer 1 highlights the need for greater detail in the approach taken to measure representativeness and our overall goal. In response to this comment we increased the level of detail in the methods section and provide here a summarized response.

The primary goal of this work is to determine key regions where we need CH4 infrastructure within the US. We do this by identifying the gaps in active research infrastructure and evaluating where infrastructure can be adapted to include CH4 measurements. To address this goal, we used a combination of climate data and dominant land cover types to guide the scientific community on how we can develop a distributed observing network for the US and provide a template for the development of similar networks in other regions. We focus here on EC flux towers because they are essential for a bottom-up framework that bridges the gap between point-based chamber measurements and airborne platforms and are therefore a useful basis for identifying gaps in the current network of CH4 observations. Although we initially focused on all tower infrastructure, we now focused on the towers measuring CH4 (n=100) and we distinguished between towers providing data to Ameriflux (yes =49, no = 51) and tower activity (active = 70; inactive = 30).

To understand the landscape representativeness across geographic clusters, we measured dissimilarity (previously called distance to the medoid) based on climate and land cover type. It is important to note that at the ecosystem scale a tower is representative of the ecosystem type and the region where it is stationed (Desai, 2010; Jung et al., 2011; Xiao et al., 2012; Chu et al., 2021); however, the landscape representativeness analysis done here uses a coarser classification of land cover classes that are more emblematic of regional disturbance regimes, resource availability, and factors that influence how ecosystems function, not the specific ecosystem type where the tower is situated. Chu et al., 2021 examined the land-cover composition and vegetation characteristics of 214 AmeriFlux tower site footprints. They found that most sites do not represent the dominant land-cover type of the landscape and when paired with common model-data integration approaches this mis-match introduces biases on the order of 4%–20% for EVI and 6%–20% for the dominant land cover percentage (Chu et al. 2021), making it essential to

consider landscape characteristics in the design and evaluation of network infrastructure. Tower representativeness at the landscape scale is indicative of the capacity to upscale information by climate and the dominant ecosystems of locations within a landscape. We also calculate cluster representativeness by the towers' vegetation type to understand the sampling intensity of each vegetation type within a cluster, which is also an essential component of scaling CH4 fluxes (Knox et al., 2019). In this analysis we used the reported International Geosphere-Biosphere Programme (IGBP) vegetation type classes that are listed for each tower in the Ameriflux data base, where we also checked to ensure towers were currently active and providing data to the network.

We attached our detailed response to the main comments.

Please also note the supplement to this comment:
https://bg.copernicus.org/preprints/bg-2021-256/bg-2021-256-AC1-supplement.pdf