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Spatial variability of methane emissions in a *Phragmites australis (Cav.) Trin. Ex Steud.* dominated restored coastal brackish fen

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Methane is a major greenhouse gas that significantly contributes to global warming with a global warming potential 25 times higher than carbon dioxide over a 100 year time horizon. Recently, closed chamber measurements of methane are replaced by ecosystem based Eddy Covariance measurements where possible. However estimates of emission factors for single vegetation units still need chamber based measurements. The resulting emission factors may be influenced by the arrangement of measurement spots in the ecosystem. Here, we analyze the spatial variability of annual emissions estimates based on dynamic closed chamber measurements in pure and mixed stands of *Phragmites australis (Cav.*) *Trin. ex Steud.* in a restored coastal brackish fen.

Annual methane emissions per measurement location vary largely between 76.54 and 1332 kg ha^{-1} a^{-1} CH_4 but they do not differ significantly between pure and mixed stands of *Phragmites australis*. Mantel tests show no correlation of distances between spots and the variation in methane emissions ($p<0.05$). Instead, spatial correlation of water levels and annual methane emissions is substantial albeit not significant. Empirical variograms suggest that variance in methane emissions is not increasing with increasing spatial distance. However, spots that share larger distances may differ considerably in their annual methane emissions while close spots–that share even larger distances than typical in common closed chamber measurement setups–exhibit smaller differences in their annual methane emissions.

The typical clustered arrangement of measurement locations in closed chamber studies may miss a huge part of the natural variation in annual methane emissions. Therefore, we suggest that measurement locations should cover a wide spatial extent to improve the reliability of annual emission estimates per vegetation type and ecosystem.