



Temporal variability of methane emissions from a closed landfill at Denmark

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Methane (CH₄) emissions from landfills contribute to global warming, impacting significantly the environment and human health. Landfill CH₄ emissions strongly depend on changes in barometric pressure, inducing short-term CH₄ emission variation of several orders of magnitude. Estimating the temporal variability of CH₄ emitted into the atmosphere could help us reducing the uncertainties of annual emission estimates from landfills. In this study, we focus on the temporal variability of CH₄ emissions under the impact of barometric pressure changes.

CH₄ emissions of a closed landfill (Skellingsted, Western Zealand, Denmark) were measured with two different methods from December 2019 to June 2020; continuously with the eddy covariance method (EC) and discretely with the dynamic tracer dispersion method (TDM). The EC method allows continuous measurements from a confined surface area, with most likely limited representativeness of the whole landfill site due to the considerable horizontal heterogeneity. The TDM method is able to quantify the emission from the whole site insensitive of the topography with the limited representativeness for the temporal variability.

CH₄ emissions to the atmosphere measured by the TDM and fluxes measured by the EC ranged from 0 to almost 100 kg h⁻¹ and from 0 to 10 μmol m⁻² s⁻¹, respectively. The CH₄ fluxes measured continuously using the EC method were highly correlated with the emissions from the periodic measurements using the TDM and fluctuated according to the pressure tendency. Under decreasing barometric pressure the highest CH₄ emissions were observed, while increasing barometric pressure suppressed them almost to 0.

Our results demonstrate the value of implementing two different complementary measurement techniques in parallel that will help to quantify total annual CH₄ emission from a landfill. EC method provides continuous measurements describing accurately the temporal variation of emissions, while TDM method is able to quantify emissions from the whole site.