Geophysical Research Abstracts
Vol. 21, EGU2019-13119, 2019
EGU General Assembly 2019

Methods for calculating nitrous oxide and methane from non-steady state automatic chambers.

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The closed chamber method is widely used in greenhouse gas (GHG) flux measurement. However, the method has temporal resolution limits, which could be compensated by implementing an automated system. To have a more accurate estimation of the fluxes, automated systems are usually proposed. In opposition to manual chamber measurement, automated systems produce large amounts of data that need to be processed. Fast development of online techniques for the measurements of GHG fluxes leads to the growing amount of high temporal resolution and precision data and brings new challenges for data processing and post-processing.

An automated chamber system of an online cavity ring-down spectroscopy for GHG flux measurement was set up in the hemiboreal deciduous forest in Estonia in 2017. Twelve chambers were installed covering the maximum micro-topological variability. From the twelve chambers, four were transparent and the rest opaque. Here we present an algorithm for data processing and flux calculation and an overview of the calculated GHGs (CO_2, N2O, CH4) flux measurements from 2017-2018.

A script in Python was written to merge the different data produced (chamber identification, concentrations and temperatures). Fluxes were then calculated in R using different models (linear and non-linear). The goodness-of-fit of the different models was compared. The main results of the calculated fluxes show a strong dependence on the chosen model, length of the fitting period, starting and ending point of a fitting window, chamber function stability and season.