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Eddy covariance flux measurements of methane over an urban area in the Alps

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Methane is considered as the second most important contributor to radiative forcing and thus makes it the most important non-CO_2 greenhouse gas originated from anthropogenic activities. The investigation of emission sources and the mitigation strategies of these is of major importance. One of several approaches quantifying methane emissions is the top-down eddy covariance flux measurement, which is used in the investigation here.

Long-term eddy covariance flux measurements of methane over urban areas can be used to constrain important urban emission sources. These include traffic, the residential, commercial and public sectors, industry, and biogenic sources. It is believed that a large fraction of methane emissions originates from fugitive emissions, but the magnitude and nature are still poorly constrained. Here we present initial results from long-term measurements at an Alpine city (Innsbruck, Austria), and compare methane fluxes with those available from other locations. We show that a statistical gap filling model allows to compare yearly top-down methane fluxes with bottom-up emission models. The temporal and spatial disaggregation of eddy covariance flux data can be used further to hunt down and identify potential urban emission sources, by combining these fluxes with additional tracer fluxes (e.g. NMVOC, NOx, CO_2). An analysis of the methane fluxes referring to heating degree days and weekday/weekend effect combined with similar analysis for trace gases like NOx, provides additional clarity about the origin of the methane emissions (e.g. traffic, residential combustion).

First results from the methane flux measurements performed during the years 2020, 2021 and 2022 are presented here.