



## Large-Eddy Simulations of Methane Dispersion at the Utrecht University Campus

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Last June 2023 a controlled release experiment (CRE) of methane was conducted at the campus of the Utrecht University, the Netherlands, with the aim of improving models for emission quantification. The methane was released at different flow rates and subsequently measured in the local area (along closed paths of approximately 500 m length) using vehicle mounted sensors. In addition, several wind sensors were deployed at approximately 35 meters distance of the release location covering the dominant flow pathways between the buildings.

Although the setup enables us to relate the variability in wind direction and concentration peaks in the direct vicinity of the release, the limited spatial extent of the setup still makes it challenging to determine the dispersion of methane on the larger campus scale. Therefore, we explore the possibility to use meter-scale Large-Eddy Simulations (LES) in which the flow around the buildings is explicitly resolved with an immersed boundary method. With this approach, we aim to provide detailed information on the dispersion of methane ranging from the street-level to the campus scale.

Here, we will show the first results of our simulations and a comparison with the observations. The controlled release experiment and wind measurements serve as validation for the LES, with the LES ideally reproducing the observed concentrations and wind directions in a statistical sense. We will discuss the model complexity required to accurately model observed dispersion features and look at the dependence of this result to changes in model setup. For example, how the model result changes with respect to a change in the prescription of large-scale meteorological conditions.

Such validated urban LES may in the future be used not only for forward-in-time prediction of pollutant concentrations but also for inverse modelling to estimate the location of pollutant release, when only a limited number of observations are available.