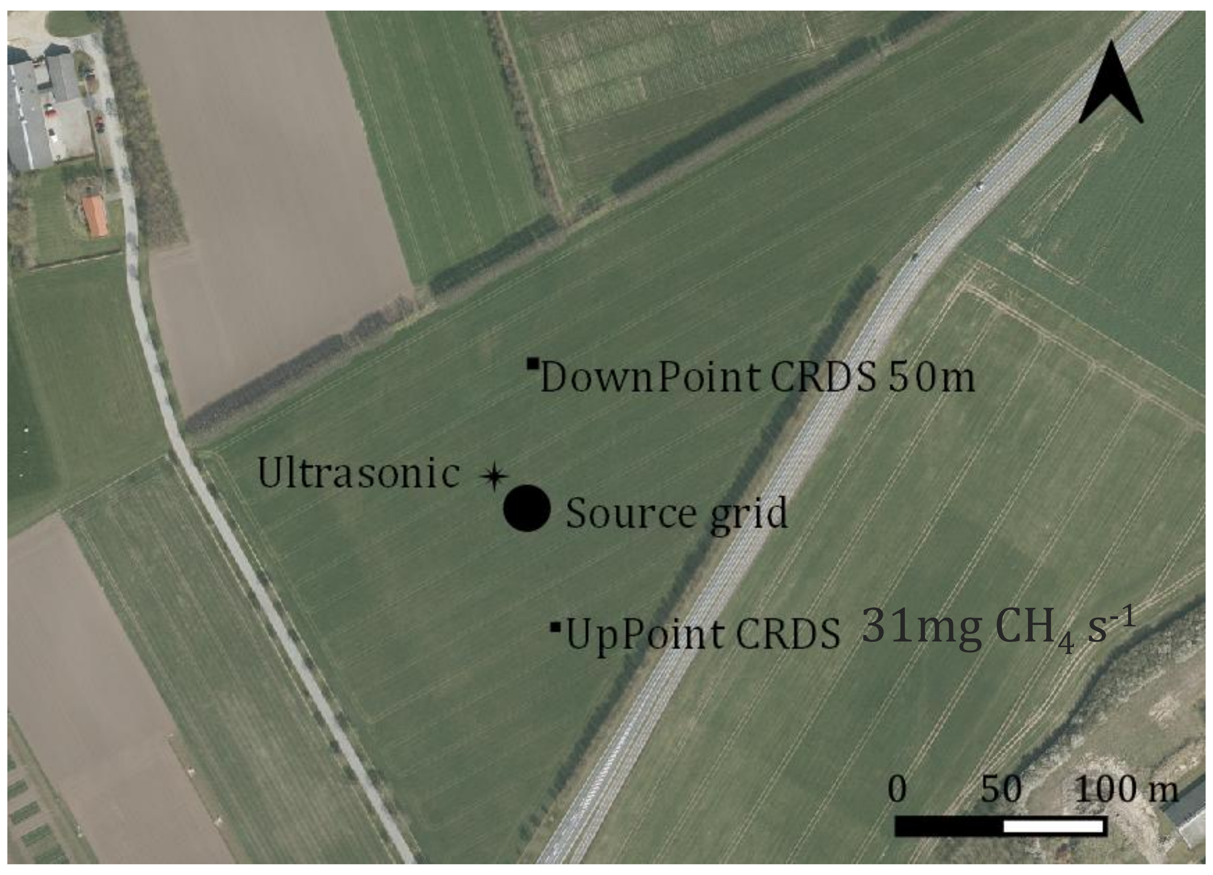
Controlled release of methane to validate sampling line for emission estimates with inverse dispersion modelling

Introduction

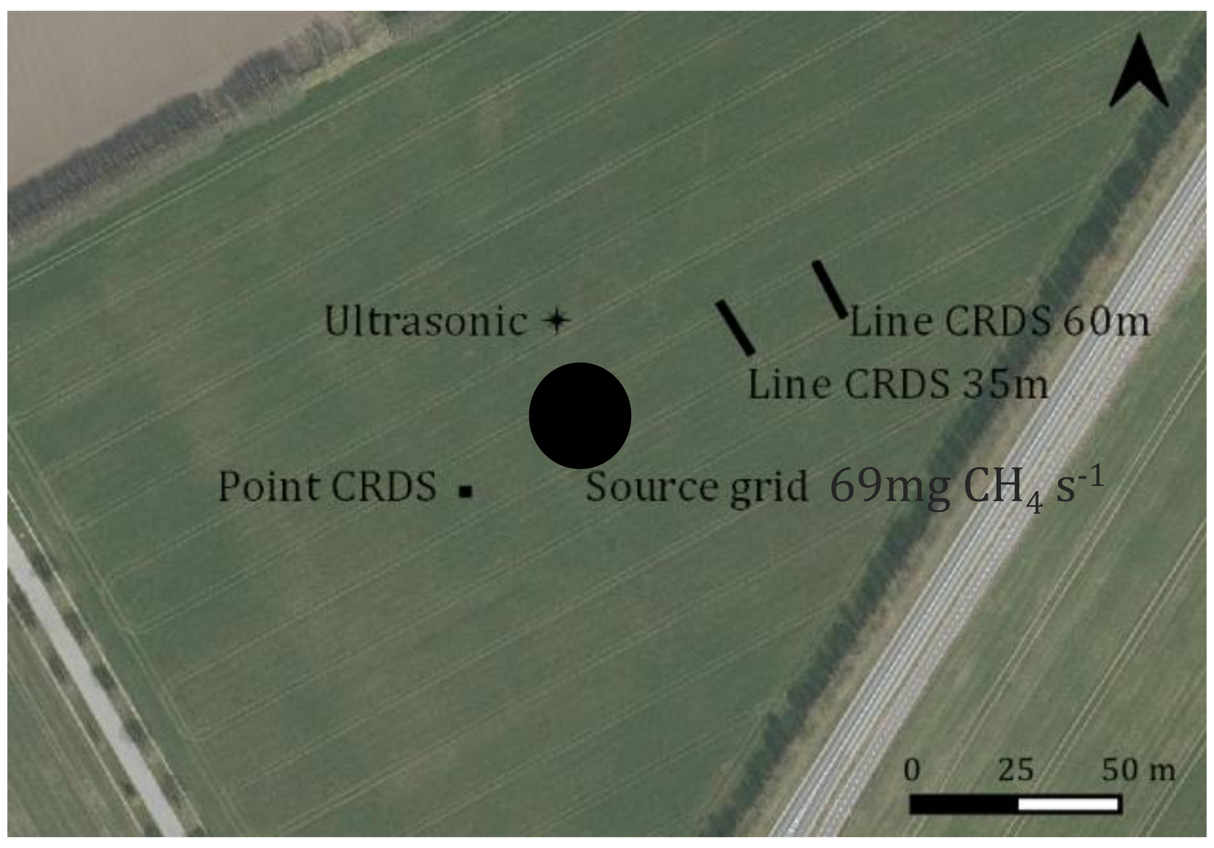
- The bLS model (Flesch et al., 1995) has been used to estimate emissions in two controlled release experiments with point and line integrated concentration measurements using cavity ring-down spectroscopy (CRDS).
- The inert gas methane is released from an artificial source of 24 critical orifices covering 254 m^2.
- Emissions are estimated in 15 min averaging intervals over 2 hours of release for each position.
- Required inputs for the bLS model are wind statistics, position of source and instruments, and up- and downwind concentration.

Material and Methods

Point-measurement

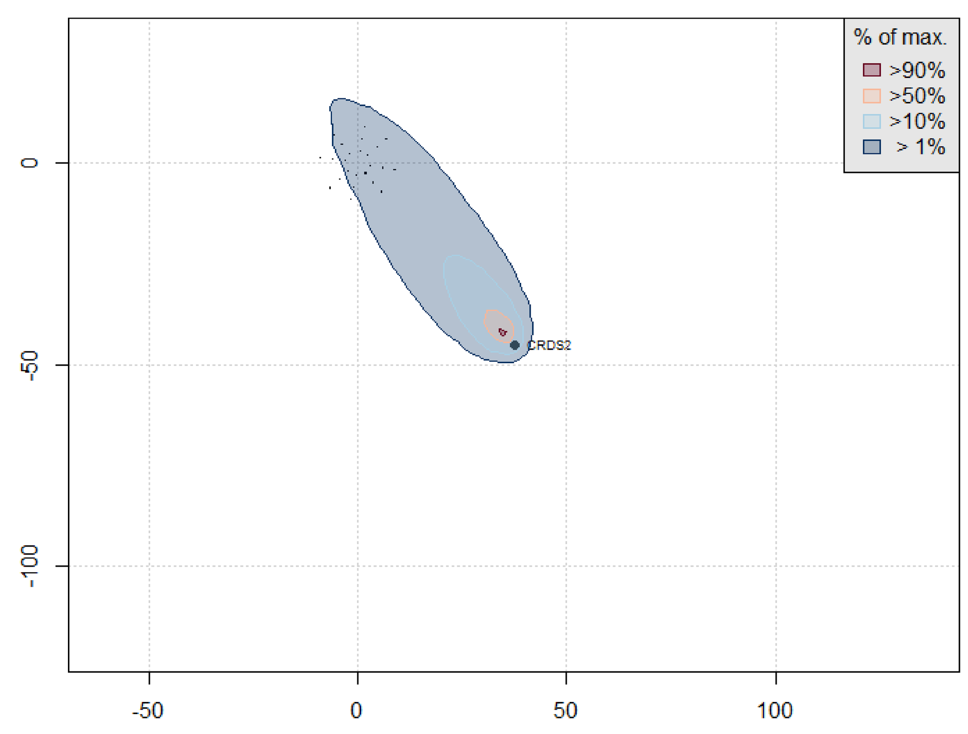


Line-measurement



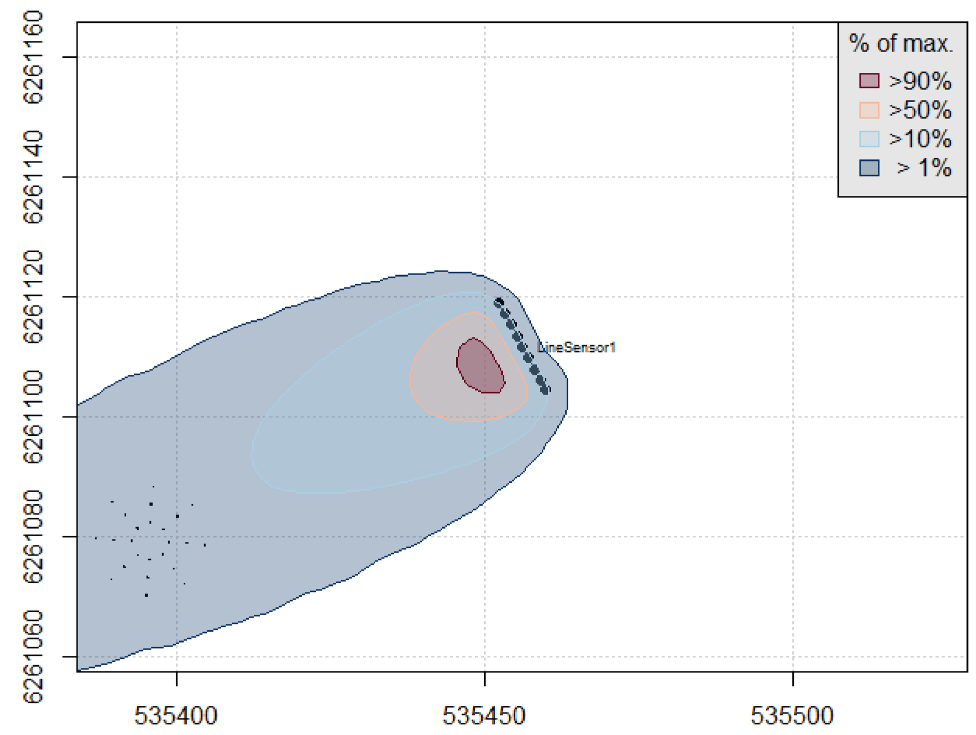
Flux Footprint

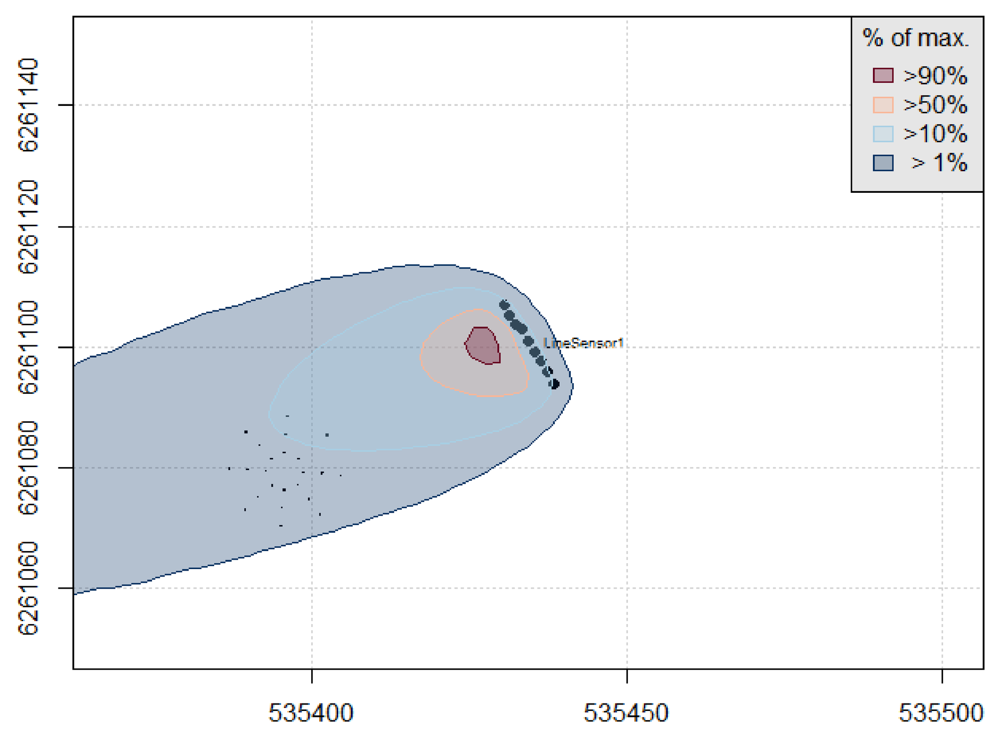
Point-measurement



Flux footprint (Kljun et al., 2015) is the "field of view" of the distance between the source and the instruments, and the measured turbulence flux over time. The maximum footprint (% of max.) is the spatial extend where the measured flux has the maximum contribution.

Line-measurement

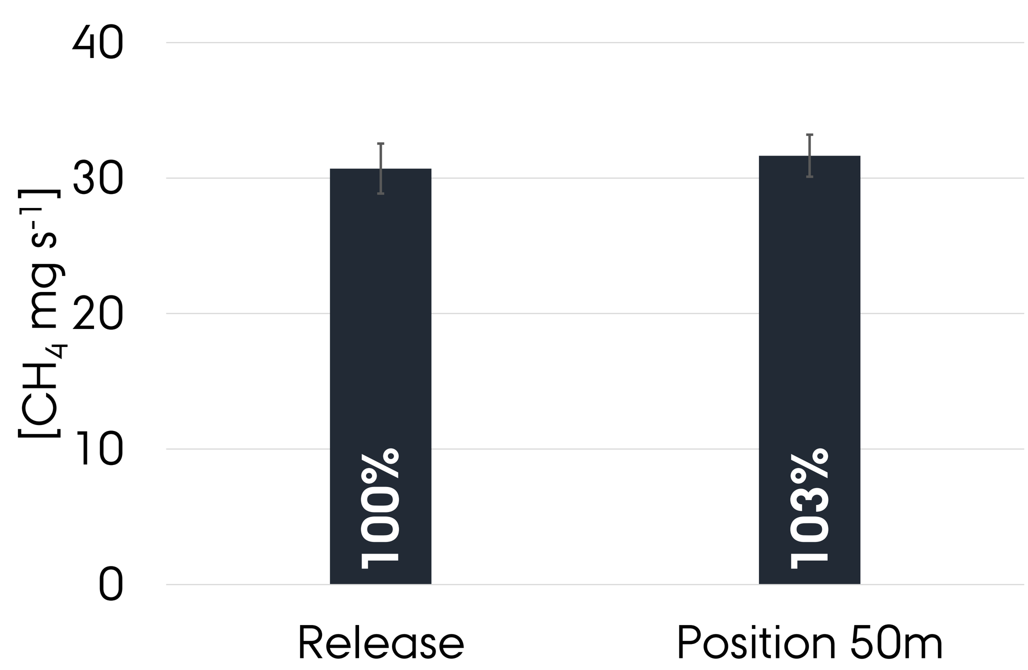




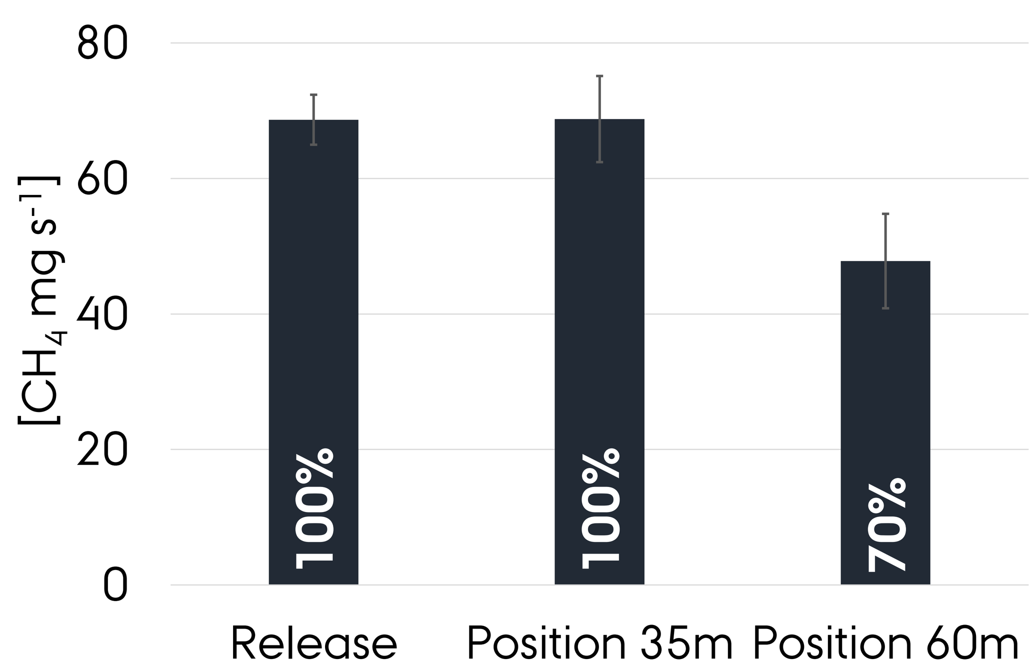
Released vs Measured

The collected data is processed in 15 min average of the 2 hours measured in each position.

Point-measurement



Line-measurement



Conclusion

- Point and line integrated concentration measurements for bLS provide good estimates of emissions.
- Line integrated measurements catch more of the plume from a source.
- Sensitivity limits the downwind distance from the source.

Reference

Flesch, T.K., Wilson, J.D., and Yee, E. (1995) Backward-time Lagrangian stochastic dispersion models and their application to estimate gaseous emissions. *J. Appl. Meteorol.*, 34, 6, p. 1320-1332

Kljun, N., Calanca, P., Rotach, M.W., Schmid, H.P., 2015. A simple two-dimensional parameterisation for Flux Footprint Prediction (FFP). Geoscientific Model Development 8, 3695–3713

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