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Recovery rates from line-integrated NH_3 and CH_4 measurements using backward Lagrangian stochastic dispersion modelling

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Inverse dispersion modelling, i.a. backward Lagrangian stochastic (bLS) dispersion modelling, has become a popular way to estimate trace gas losses from field measurements (Harper et al., 2011).

Numerous investigations using bLS modelling include methane (CH_4) and ammonia (NH_3) emission estimations based on experimental plots with dimensions between approximately 10^2 to 10^4 m^2.

Whereas for CH_4 deposition processes can be neglected, NH_3 has a strong affinity to any surface and is therefore efficiently deposited. In general, bLS models treat the modelled gases as inert gases. Such a standard bLS approach will underestimate NH_3 emissions due to the neglecting of the dry deposition process.

We conducted a release experiment with an artificial source that consisted of 36 individual orifices mimicking a circular area source with a radius of 10 m. We released a gas mixture consisting of 5% NH_3 and 95% CH_4. We simultaneously measured line integrated NH_3 and CH_4 concentrations upwind and downwind of the source using open-path measuring systems (miniDOAS, Sintermann et al., 2016; GasFinder, Boreal Laser, Inc., Edmonton, Alberta, Canada) and calculated corresponding recovery rates using a bLS model (Flesch et al., 2004). With the direct comparison of calculated NH_3 and CH_4 recovery rates we can quantify the amount of NH_3 deposited. An attempt was made to include a simple dry deposition scheme in the bLS model.

References

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