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Assessment of methane emissions from a dairy farm using an inverse dispersion technique

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Quantification of gaseous emissions from diffuse sources, for instance from animal and waste operations (AWO) are challenging, e.g. due to their heterogeneity in space and time. Inverse dispersion techniques are a promising option and are becoming more important in determining gaseous emissions from AWO as it is a low-cost and flexible to use method. One possible approach is to use a simple backward Lagrangian stochastic (bLS) model (Häni et al., 2018). To apply this model, a horizontal flat and homogeneous surrounding without any nearby sources is presupposed. However, these criteria are often not fulfilled. In the presented study, the applicability of the bLS model was tested under non-ideal model conditions on methane (CH_4) emissions of a natural ventilated dairy housing with 40 cows in Switzerland. For the up- and downwind CH_4 concentration measurements, open-path tuneable diode laser spectrometers (GasFinder3.0, Boreal Laser, Inc., Edmonton, Alberta, Canada) were used. Data was collected during 30 days in autumn and 20 days in winter 2018. Results for the autumn and winter campaign were compared with simultaneous in-house CH_4 emission measurements conducted with a tracer ratio method. The tracer ratio technique is well-established to quantify diffuse emissions and has shown high accuracy in an extended validation study (Mohn et al., 2018). Therefore, this campaign provides the unique opportunity to compare temporal trends of CH_4 emissions and interpret bLS results with respect to non-ideal model conditions.

Literature cited:

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