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Ammonia emissions of a rotational grazing system

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Intensive agricultural livestock production is the main source of air pollution by ammonia (NH3). Grazing is considered to reduce emissions significantly. However, ammonia emissions measurements on pastures are very rare and most emission models base their emissions factors for grazing on studies from the 1990s, which report a large emission range from 2.7% to 13.6% of the applied total ammonia nitrogen (TAN).
We present first results of the Posieux pasture experiment in 2016 where NH3 concentration and fluxes were measured during the grazing season. The applied methods include an eddy covariance system with a two channel reactive nitrogen (Nr) converter measuring in parallel the sum of oxidized Nr species and the sum of the total Nr species. The difference of the two channels corresponds to the sum of reduced Nr species. Furthermore four MiniDOAS instruments for line integrated concentration measurements without an inlet system were used. The fluxes were estimated by applying a backward Lagrangian stochastic model (bLS) to the concentration difference of paired MiniDOAS up- and downwind of a sub-plot of the field.
Monitoring of dung (visual survey) and urine patch locations (with soil electrical conductivity sensor) was carried out after each grazing rotation on selected sub-plots. It helped to compute statistics of the dung/urine patch distribution on the pasture.
The experimental setup and the environmental conditions resulted in high temporal and spatial dynamics of NH3 concentrations and fluxes. The calculated fluxes were used to estimate the total net emission during the grazing period. Based on the average dung/urine patch distribution on the field an emission factor for the pasture was computed and compared to results from the literature. We discuss the applicability and limitations of the two measurement systems, reconsider the main emission drivers and explain differences in the results.