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Acetone and acetaldehyde exchange above a managed temperate mountain grassland

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Acetone and acetaldehyde fluxes were quantified above a temperate mountain grassland, managed as a hay meadow, in the Stubai Valley (Tyrol, Austria) during the growing seasons 2008 and 2009. Half-hourly fluxes were calculated by means of the virtual disjunct eddy covariance (vDEC) method using 3-dimensional wind data from a sonic anemometer and methanol volume mixing ratios measured with a proton-transfer-reaction mass spectrometer (PTR-MS). Largest perturbations of the exchange of the two species were caused by the cutting of the meadow, causing peak emissions of 12.1 nmol m^{-2} s^{-1} for acetaldehyde and 10.1 nmol m^{-2} s^{-1} for acetone. During most of the two-year investigation period no clear diurnal cycles could be observed, both species exhibiting close-to-zero or noisy fluxes. However, both species exhibited a clear diurnal cycle during certain time periods: Distinct emissions of acetaldehyde and acetone were observed in October 2008, with emission rates of up to 3.7 nmol nmol m^{-2} s^{-1} for acetaldehyde and and up to 3.2 nmol nmol m^{-2} s^{-1} for acetone. Uptake of both acetaldehyde and acetone could be observed in late May 2009, with rates up to 1.8 and 2.1 nmol nmol m^{-2} s^{-1}, respectively. The investigated grassland was a net source of acetaldehyde in both years, emitting 1.0 and 0.5 g C m^{-2} d^{-1} over the whole growing season in 2008 and 2009, while it was a net source of acetone in 2008 with emissions of 0.7 g C m^{-2} d^{-1} and a sink in 2009 with an uptake of 0.5 g C m^{-2} d^{-1}. Possible causes for the observed exchange patterns and the influence of management events like cutting and the fertilization using liquid manure as well as challenges for future research are discussed.