BVOC fluxes over a temperate mountain grassland

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Fluxes of biogenic VOCs 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 BVOC fluxes were calculated by means of the disjunct eddy covariance (vDEC) method using 3-dimensional wind data from a sonic anemometer and concentrations of selected BVOCs measured with a proton-transfer-reaction mass spectrometer (PTR-MS).
The cutting of the meadow was found to represent the largest perturbation of the VOC exchange rate for some of the compounds, resulting in peak emissions of e.g. methanol (up to 144.5 nmol m^{-2} s^{-1}), acetaldehyde (12.1 nmol m^{-2} s^{-1}) and acetone (10.1 nmol m^{-2} s^{-1}) during/after cutting of the meadow, reflecting the wounding of the plant material. After the application of organic fertilizer elevated methanol emissions of up to 26.7 nmol m^{-2} s^{-1} were observed, likely reflecting enhanced microbial activity associated with the applied manure.
During (undisturbed) mature and growing phases methanol fluxes exhibited a clear diurnal cycle with close to zero fluxes during nighttime and emissions, up to 10 nmol m^{-2} s^{-1}, which followed the diurnal course of radiation and air temperature. A distinct diurnal cycle for acetaldehyde and acetone could only be seen in October 2008 with emission rates of up to 3.7 and 3.2 nmol m^{-2} s^{-1}, respectively, and in May 2009 with an uptake of up to 1.8 and 2.1 nmol m^{-2} s^{-1}.
Deposition fluxes of terpenes could be observed over several weeks after a hailstorm in July 2009, when high amounts of terpenes were transported to the site from a nearby coniferous forest, causing elevated volume mixing ratios. The cumulative carbon deposition due to monoterpenes over the course of one growing season reached 276 mg C m^{-2} and was similar to the amount of carbon associated with the emission of methanol (329 mg C m^{-2}). Therefore, monoterpenes could play a more significant role in the reactive carbon budget of grassland than previously assumed.