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The role of cows on OVOC exchanges of a pasture

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The presence of cows on a pasture considerably modifies exchanges of biogenic volatile organic compounds (BVOCs). By regulating the biomass present, they can have an impact on the constitutive flux (exchanges from soil and grass that are not induced by leaf wounding or trampling by cows) but they can also cause direct emissions from exhalation and indirect emissions by leaf injury (grazing), trampling and wastes. In this study conducted on the ICOS pasture site of Dorinne (Belgium), we disentangled these different sources/sinks for three oxygenated BVOCs commonly exchanged on grasslands (methanol, acetaldehyde and acetone), using a combination of turbulent flux measurements, enclosure flux measurements, tools to detect the presence and activity of cows in the footprint of the turbulent flux measurements and a flux footprint model. Direct exhalation emissions were low, representing only 2.3% and 10% of the spring total flux of methanol and acetone respectively. Comparison of grazed and non-grazed enclosures pointed out that emissions following leaf wounding were significant for all studied BVOCs, decreased exponentially with time to become negligible after maximum five days. Cow indirect emissions at the pasture scale (turbulent flux measurements) were likely dominated by grazing and were shown to be a major component of the total diurnal flux for each of the three studied BVOCs. Comparison with a hay meadow also showed that the temporal dynamics of those BVOC emissions were very different according to the grass management type, calling for specific parametrization in up-scaling emission models.