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Virtual disjunct eddy covariance measurements of organic compound fluxes from a subalpine forest using proton transfer reaction mass spectrometry

T. G. Karl^{1,*}, C. Spirig^{1,2}, J. Rinne^{1,3}, C. Stroud¹, P. Prevost¹, J. Greenberg¹, R. Fall⁴, and A. Guenther¹

¹National Center for Atmospheric Research, Boulder, Colorado, USA

²Eidg. Forschungsanstalt für Agrarökologie und Landwirtschaft, Zürich, Switzerland

³now at: Centre National de Recherches Meteorologiques, Toulouse, France

⁴University of Colorado, Boulder, Colorado, USA

* present address: ACD, NCAR, PO 3000, Boulder, CO, 80307, USA

Abstract. A 'virtual' disjunct eddy covariance (vDEC) device was tested with field measurements of biogenic VOC fluxes at a subalpine forest site in the Rocky Mountains of the USA. A PTR-MS instrument was used as the VOC sensor. Daily peak emission fluxes of 2-methyl-3-buten-2-ol (MBO), methanol, acetone and acetaldehyde were around 1.5, 1, 0.8 and 0.4 mg m⁻² h⁻¹, respectively. High pass filtering due to long sampling lines was investigated in laboratory experiments, and suggested that VOC losses in PTFA lines are generally governed by diffusion laws. Memory effects and surface reactions did not seem to play a dominant role. Model estimates of MBO fluxes compared well with measured fluxes. The results also suggest that latent heat and sensible heat fluxes are reasonably well correlated with VOC fluxes and could be used to predict variations in VOC emissions. The release of MBO, methanol, acetone and acetaldehyde resulted in significant change of tropospheric oxidant levels and a 10--40% increase in ozone levels, as inferred from a photochemical box model. We conclude that vDEC with a PTR-MS instrument is a versatile tool for simultaneous field analysis of multiple VOC fluxes.

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