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Atmos. Chem. Phys., 9, 981-994, 2009
www.atmos-chem-phys.net/9/981/2009/

The use of disjunct eddy sampling methods for the determination of ecosystem level fluxes of trace gases

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Abstract. The concept of disjunct eddy sampling (DES) for use in measuring ecosystem-level micrometeorological fluxes is re-examined. The governing equations are discussed as well as other practical considerations and guidelines concerning this sampling method as it is applied to either the disjunct eddy covariance (DEC) or disjunct eddy accumulation (DEA) techniques. A disjunct eddy sampling system was constructed that could either be combined with relatively slow sensors (response time of 2 to 40 s) to measure fluxes using DEC, or could also be used to accumulate samples in stable reservoirs for later laboratory analysis (DEA technique). Both the DEC and DEA modes of this sampler were tested against conventional eddy covariance (EC) for fluxes of either CO_2 (DEC) or isoprene (DEA). Good agreement in both modes was observed relative to the EC systems. However, the uncertainty in a single DEA flux measurement was considerable (~40%) due to both the reduced statistical sampling and the analytical precision of the concentration difference measurements. We have also re-investigated the effects of nonzero mean vertical wind velocity on accumulation techniques as it relates to our DEA measurements. Despite the higher uncertainty, disjunct eddy sampling can provide an alternative technique to eddy covariance for determining ecosystem-level fluxes for species where fast sensors do not currently exist.

Final Revised Paper (PDF, 729 KB) Discussion Paper (ACPD)

Citation: Turnipseed, A. A., Pressley, S. N., Karl, T., Lamb, B., Nemitz, E., Allwine, E., Cooper, W. A., Shertz, S., and Guenther, A. B.: The use of disjunct eddy sampling methods for the determination of ecosystem level fluxes of trace gases, Atmos. Chem. Phys., 9, 981-994, 2009. Bibtex EndNote Reference Manager