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Validation of a new disjunct sampler design through field comparison of conventional and disjunct eddy covariance fluxes

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While Eddy Covariance (EC) is the most direct method to assess trace gas flux at ecosystem scale, it is still limited to a small number of species as it requires fast response analyzers. Alternative approaches have been introduced to relax the constraint on analysis time. An interesting alternative method is the Disjunct Eddy Covariance (DEC) technique, which allows longer integration times (1 s - 10 s) for a small (and therefore acceptable) reduction of flux estimate accuracy. DEC relies on the same assumptions as EC but sub-samples the time series. As a result, it gives more time for concentration measurements between quickly grabbed samples. An innovative design for a disjunct sampling system was developed and tested. The prototype named MEDEE features two pressure regulated reservoirs and chemically inert materials. Built in a 19" rack, this system is suitable for tower based or airplane DEC measurements. It is compatible with most analyzers with relatively slow response (up to 10 s) as it transfers samples continuously at constant pressure. Here we present the results from a validation campaign. DEC and EC measurements of CO_2 and water vapor fluxes were performed concurrently with different analyzers over a winter wheat crop. Fluxes measured by the two techniques were in good agreement and encourage the use of this prototype for measurements of species were EC is not applicable. A similar validation campaign will be conducted in July 2012 on the French ATR-42 aircraft. The system is prone to be used in the CHARMEX project on biogenic volatile organic compound (BVOC) emissions in the Mediterranean area, which are known to play a significant role in atmospheric chemistry (e.g. in photo-oxidant pollution): the CHARMEX project.