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A new eddy covariance technique for methane measurements applied at a Ponderosa pine plantation in California

C.J.P.P. Smeets (1), R. Holzinger (1), I. Vigano (1), A.H. Goldstein (2), T. Röckmann (1)

(1) Institute for Marine and Atmospheric research Utrecht (IMAU), Utrecht, The Netherlands, (2) University of California at Berkeley, Department of Environmental Science, Policy, and Management, USA (c.j.p.p.smeets@phys.uu.nl)

Methane (CH_4) is second only to carbon dioxide (CO_2) in importance as a greenhouse gas. Although its abundance is far less than that of CO_2, it has a 25 times higher greenhouse warming potential per molecule resulting in a 20% contribution to the current enhanced greenhouse effect (IPCC, 2007). Long term methane flux measurements are mostly performed with closed gas chamber techniques. Being relatively simple in operation and inexpensive these measurements are on the other hand not continuous, only monitor a very small surface area, and the technique itself is prone to a variety of potential errors leading to seriously biased results. Alternatively, the eddy covariance technique has the advantage of delivering continuous measurements over a larger, and, on ecosystem level, more representative area. New methane analyzers have become available that allow applying the eddy-covariance method to measure fluxes of methane. We deployed the DLT-100 Fast Methane Analyser (FMA) from Los Gatos Research (LGR) Ltd, a closed path methane analyzer with a response rate up to 20 Hz. The instrument is easy to use, relatively inexpensive, and very stable over longer periods. We present results from an experiment at a Ponderosa pine plantation at the Blodgett Forest site in central California. The noise level of our 10 Hz sampled data has an amplitude of $\pm$ 5 ppbv – much larger than typical half hourly variation of the observed methane concentration. As a result, the high frequency end ($>$0.2 Hz) of the power spectra is dominated by a white noise signature. Nevertheless, in the frequency

range that dominates turbulent exchange, the co-spectra of methane fluxes compare very well with those of sensible, latent heat, and CO_2 flux. The diurnal variation of the methane concentration was up to 50 ppbv and nicely related to the clear diurnal cycle of the local valley wind system. The daily averaged fluxes during the 6 day experiment were about -90 ng $m^{-2}s^{-1}$) which is at the high end of a recent global inventory of warm temperate forest sites. Further field studies with this system are planned in tropical ecosystems to check on a recent hypothesis that postulates higher methane emissions especially from the Amazon basin.