

Interactive comment on “Application of thermal dissociation-laser induced fluorescence (TD-LIF) to measurement of HNO_3 , Σ alkylnitrates, Σ peroxy nitrates, and NO_2 fluxes using eddy covariance” by D. K. Farmer et al.

D. K. Farmer et al.

Received and published: 22 June 2006

We thank the referee for his/her comments and review. We agree with the referee that the flux patterns are interesting, and have submitted a short paper describing a more detailed explanation of the upward fluxes, and are preparing further papers describing the observations, and timescales involved, in more detail. The referee suggests an alternate pathway for upward HNO_3 fluxes via re-emission of nitrogen oxides. While, as the referee cited, there have been several papers describing mechanisms for this “reNOxification”, these mechanisms all describe a way for NO_x to be released from surfaces, either through photolysis of HNO_3 on surfaces or by stimulating direct emis-

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sion from plants. While the NO_x emitted could contribute to the observed NO_2 flux, and thus to chemistry within the canopy, we can find no references to mechanisms producing HNO_3 that could be released to the atmosphere.

The specific comments from the reviewer are useful suggestions that will help to clarify the points we make in the text, and we will address each of them in detail in the revised manuscript. With regards to the time lag calculations, we will clarify our wording as this is clearly a source of misunderstanding. We calculated lagtimes for each of the four individual channels for each pump/tubing configuration using lagged covariance plots to identify appropriate, typical lags. The sample lagged covariance plot, and its associated noise, was a typical example. Because we did not calculate a lagtime for each individual half hour of data, but applied a 'typical' lag, we included the potential underestimation of the flux due to sensor separation as a conservative error estimate. We will add more details in the revised manuscript about the exact set-up of the inlet and modifications made for the eddy covariance set-up. As a previous paper describing the TD-LIF instrument (Day et al., 2002) contains a diagram of a similar inlet system, we have not included the additional figure in our paper, and instead will reference that paper.

The referee's suggestion of including information on a maximum possible deposition velocity (V_{max}) is an interesting one, and we have made those calculations based on observed windspeed and friction velocity. The calculated V_{max} are larger (on order of 7 cm s^{-1}) than the observed V_{dep} (2.5 cm s^{-1} for HNO_3), and show more variability in the winter than summer. This will be described in a revised manuscript. All of the technical comments will also be addressed in the revised manuscript.

References.

Day, D. A., Wooldridge, P. J., Dillon, M. B., Thornton, J. A. and Cohen, R. C.: A thermal dissociation laser-induced fluorescence instrument for in situ detection of NO_2 , peroxy nitrates, alkyl nitrates, and HNO_3 , J Geophys Res-Atmos, 107, 2002.

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