

Interactive comment on “Observations of the scale-dependent turbulence and evaluation of the flux-gradient relationship for sensible heat for a closed Douglas-Fir canopy in very weak wind conditions” by D. Vickers and C. Thomas

R. Staebler (Referee)

ralf.staebler@ec.gc.ca

Received and published: 26 May 2014

General comments

This is an excellent paper that provides some carefully analyzed and much needed evidence that flux-gradient relationships can be reliably applied in forest subcanopies. The authors present eddy covariance fluxes of momentum and sensible heat above, within and below a Douglas fir canopy, analyze their time scale dependence, and relate them to bulk flux parameterizations based on wind speed and vertical temperature differences, showing convincingly that, despite

C2746

the miniscule magnitude of the subcanopy fluxes, they are well behaved and can be well characterized.

This adds nicely to the growing body of evidence that fluxes can be measured in various ways even in places that do not fit dogmatic perfection, and that, if micrometeorological techniques are thoughtfully adapted to special circumstances, they can lead us to useful new insights.

The paper is well written and requires essentially no corrections. Below are a few comments.

Specific comments

3.1. Why would the “relatively” large momentum fluxes at 16m go away during the day (Figs. 2 and 3)? If they are due to wake shedding, these small eddies should also be observed in daytime. I wonder whether these signals are statistically significant; they are rather small, and noise may start becoming a problem at these magnitudes. Can an uncertainty (error bars) be provided on the spectra in Figs. 2 and 3? Any idea whether the negative wu and wv signals at 1000s in the last panel of Fig.3 are meaningful?

3.4. I completely agree that the heat flux resolution is truly remarkable. This shows once again the power of compositing large data sets, and pushing our instruments to their limits!

3.6. The countergradient Stanton number relationship in Fig. 11 is so strong that someone might be tempted to interpret this as having predictive value! It is of course mostly due to the much larger diurnal amplitude of Ta_{38m} than TS_{2cm} and the fact that it is anti-correlated with the diurnal heat flux signal. What is the r^2 ?

4. It would be interesting to compute Stanton numbers above various forests with different LAI to determine whether the argument of more efficient heat transfer due to higher leaf area densities can be supported.

Technical corrections

2.2 No need to tease the reader with the gas analyzer information if no gas fluxes are discussed.

Figures: None of the figures are superfluous; if anything had to be cut, either Fig. 6 a) or b)

C2747

(but not both) could go. The x-axis labels in Fig. 7, 9 and 11 might be identified more clearly as products in the following form: $(U_{4m})(TS_{2cm} - Ta_{4m})$, $[C m s^{-1}]$

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 11929, 2014.

C2748