

Uncertainty of eddy covariance flux measurements over an urban area based on two towers
Järvi et al.

General comments:

This paper presents a comparison analysis between two identical EC systems in central Helsinki to understand uncertainty of a single point EC measurement of the cumulative vertical fluxes of momentum, sensible and latent heat, and carbon dioxide in a highly dense urban area using several statistics and variables such as stationarity (FS), skewness (SK) and kurtosis (K), relative random uncertainty (RRE), TKE, turbulent transfer efficiencies ($|r_{uw}|$, $|r_{wt}|$) and power and co-spectra. As the authors stress this is the first study using a combination of two close EC systems conducted in a densely built urban area, this research is a step forward for understanding the impact of complex urban structure on fluxes and provides a useful guideline in general for other similar urban EC measurements.

However, there are some aspects that need to be illustrate more clearly to improve the manuscript. Please address the comments below and hopefully reflect them into the revised version.

Specific comments:

1. P5 L25. The RRE calculation equation (Eq. 3) is inconsistent with that in Lenschow et al. 1994, which they presented as:

Thus, the relative error is

$$\frac{\sigma_F(T)}{|F|} = \left(\frac{2T_f}{T} \right)^{1/2} \left(\frac{1 + r_{ws}^2}{r_{ws}^2} \right)^{1/2}. \quad (48)$$

In Eq. 3, the square root seems missing.

And variables in Eq. 3 are not expressed clearly. i.e. What's the exact formula for calculating the integral time-scale (Γ_f) or does it have a relation to the averaging period (30min) or have a specific value? How to calculate the correlation coefficient (r_{ws})? Moreover, the expression (r_{ws}) is confusing with that of the turbulent transfer efficiencies in Eq. 5 and 6, are they indeed the same or different?

2. P6. For the calculation of spectra and co-spectra (Eq. 7-9), do they have any citations? What do the variables $S_x(f)$ and $S_{xw}(f)$ represent and what are their formulas? Why are spectra divided

into 76 bins? How to determine the frequency f (HZ)?

Could you explain all these aspects more clearly, so that potential readers can better understand this work?

3. P6 L24. It's confusing that the angles outside the flow distortion areas are so small: $5-18^\circ$ for EC1 and $2-15^\circ$ for EC1. Why aren't these angles ranges excluding the flow distortion area, i.e. $0-40$ and $150-360$ for EC1, $0-230$ and $340-360$ for EC2?

4. P8 L19. For daytime (Fig. 6a), the lowest RRE is sensible heat rather latent heat.

5. P8 L23. What's the possible reason for the contrary results between those previous studies (RRE lowest with momentum flux)?

6. P11 L8. Except the summer SK_C and K_C shown in Fig. 8, how about other months?

7. P16 L5. What does inertial subrange mean? How to distinguish between negative and positive contributions? What do $-4/3$ slope and $-2/3$ slope represent in Fig. 10 and what's the basis to clarify between solid and open circles in Fig. 10a? How about other months except Jult=y 2014?

Technical corrections:

P2 L21. Replace "paid on" with "paid to". Also in P21 L17.

P3 L26. "the systems are located at 60.3 m", isn't it 60 m?

P5 L1. " 10 min^{-1} ", what does the space between 0 and 1 mean?

P5 Eq. 4. the prime over v is missing.

P7 L12. "correlation coefficient (R^2)", I think it's determination coefficient.

P12 L10. Typo: ldecreased.

P12 L23. Typo: hgreater.

P13 Fig. 7. To make it more clear, legend is recommended to add into the figure.

Fig. 6 and Fig. 7. It would be better to use the same definition for daytime and nighttime. Either based on solar elevation angle (Fig. 6) or hour ranges (Fig. 7).

P17 L17-18. The directions 250-330 and 50-130 are still not changed.