46: TOLERANCE OF EDDY COVARIANCE FLUX MEASUREMENT

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INTRODUCTION

Micrometeorological flux have been widely monitored with the eddy covariance (EC) technique. The quality information of the flux is as important as those quantity itself because it is the indispensable matter to study addressing site intercomparison, model validation, and model-data synthesis. Henceforth we introduce a tolerance T, as a quality estimator for the EC flux, based on the hourly relative random error, and suggest its performance of a criterion for data filtering and a scale parameter for nonstationarity without site specification.

MATERIALS & METHODS

Experimental Site Information

Target vegetation: Tangerine orchard at Jeju, Korea

Geographical location: 33°30'28.47"N 126°40'51.29"E

Eddy Covariance Flux Measurement

Sonic anemometer: CSAT3, Campbell Scientific

Open-path gas analyzer: LI7500, LI-COR

Tolerance T and Relative Random Error ε

$$T = E\{\epsilon\} = \mathrm{Med}\{\epsilon\}$$

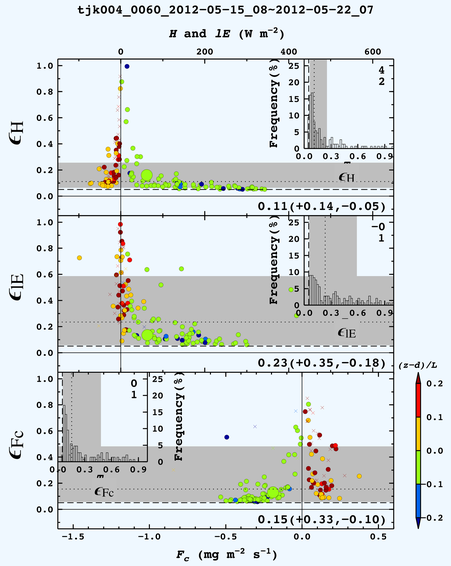
$$\epsilon = \frac{\sqrt{\mathrm{Var}\{\mathrm{Cov}\{x,y\}\}}}{\mathrm{Cov}\{x,y\}}$$

$$\mathrm{Var}\{\mathrm{Cov}\{x,y\}\} = \frac{1}{n}\left[\sum_{p=-m}^{m}\gamma_{xx}(p)\gamma_{yy}(p) + \sum_{p=-m}^{m}\gamma_{xy}(p)\gamma_{yx}(p)\right]$$

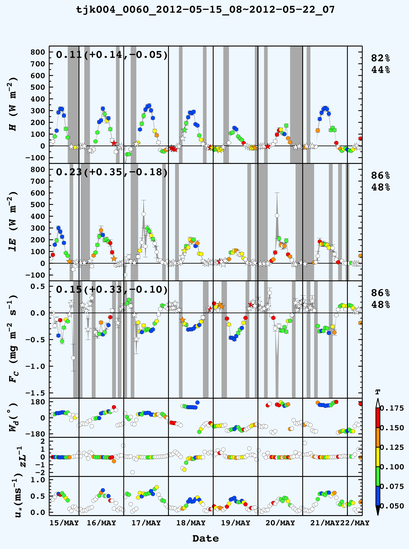
$$\gamma_{ab}(h) = \gamma_{ba}(-h) = \mathrm{Cov}\{a_t, b_{t+h}\}$$

RESULTS

Tolerance Estimated

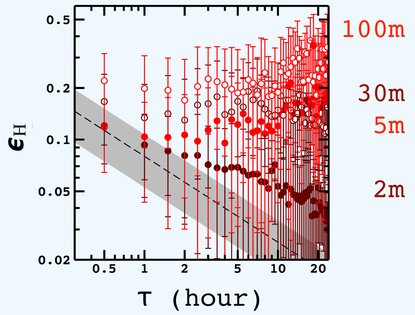


Flux and Micrometeorological Trend

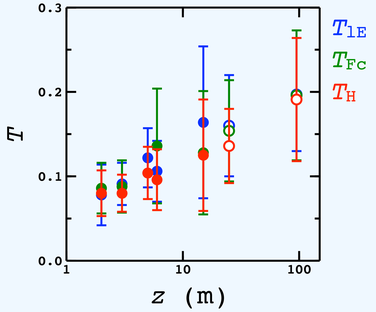


APPENDIX

Relative Error and Averaging Size



Tolerance and Measurement Height



DISCUSSION

Tolerance Estimated

Estimated weekly tolerances T of sensible heat flux H, latent heat flux lE, and carbon dioxide flux Fc were 11%, 23% and 15% respectively. The frequency distribution of ϵ_H had higher kurtosis and skewness than a Gaussian distribution without any relationship to the atmospheric stability $(z\text{-}d)/L$.

Flux and Micrometeorological Trend

Even though H, lE and Fc were estimated at the condition of lower friction velocity (stars: less than 0.15 ms^{-1}), some fluxes could be assured the reasonable quality based on Ts defined above. As a result, the reasonable flux of about 50% was captured for a week.

Relative Error and Averaging Size

Estimated relative random error ε drew like a convex curve according to increases in averaging size τ, and the result suggest that ε might be relevant to the land surface heterogeneity and the diurnal cycle of meteorological variables.

Tolerance and Measurement Height

The T values were nearly same among homogeneous sites (closed circles) but those increasing trend according to the measurement height z could not be negligible. Considering Ts measured at the other heterogeneous sites (opened circles), the trend may come from the land surface heterogeneity.

REFERENCES

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