

Diurnal and seasonal variation of surface sensible and latent heat fluxes in the city of São Paulo

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Resumo

Nesse trabalho é apresentada a variação diurna e sazonal dos fluxos verticais turbulentos de calor sensível e latente na superfície representativa de uma área suburbana da Região Metropolitana da Cidade de São Paulo (RMSP). Os valores horários médios mensais dos fluxos turbulentos de calor sensível e latente foram determinados pelo método empírico do balanço de energia utilizando como referência valores horários médios de temperatura e radiação líquida observados na plataforma micrometeorológica do IAG da USP durante 2009. Medidas simultâneas de turbulência realizadas em maio e junho de 2009 com um anemômetro sônico CSAT3 da Campbell e analisador de gás da LICOR permitiram estimar através do método da “eddy correlation” os fluxos de calor sensível e latente utilizados como referência na calibração do método do balanço de energia.

1. Introduction

There are observational evidences that the metropolitan region of São Paulo City is capable to induce a Urban Heat Island (UHI) with maximum intensity varying from 2 °C to 6 °C and occurring during daytime (Ferreira et al, 2011). The diurnal evolution of the anthropogenic energy flux in São Paulo indicated amplitude of about 20 W m⁻². Therefore, UHI in São Paulo is associated to the input of energy due to mainly solar radiation. To investigate the process that determines the UHI in São Paulo it is important to estimate the energy balance at the surface. Due to the heterogeneity of the urban canopy one of the most difficult terms of the energy balance are the turbulent fluxes of sensible and latent heat. Therefore, it is important to develop empirical methods that are capable to reproduce the observations. The most simple and

physically sound method is the energy balance method. In this work the energy balance method will be applied to estimate the turbulent fluxes of sensible and latent heat in the RMSF. Direct estimates of the surface turbulent vertical fluxes using eddy covariance method was used to validate the empirical method.

2. Methodology

In this work the vertical turbulent fluxes of sensible and latent heat are estimated using eddy correlation (Hammerle *et al.*, 2007) and the empirical method based on energy balance equation (de Bruin and Holtslag, 1983)

3. Results

In the Figures 1 and 2 are shown the diurnal evolutions of sensible and latent heat fluxes observed during the May and June 2009 obtained from the energy balance method considering the observed mean temperature and net radiation and estimating the energy storage from the objective hysteresis method with the coefficients from Ferreira (2010).

4. Acknowledgements

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5. Bibliography

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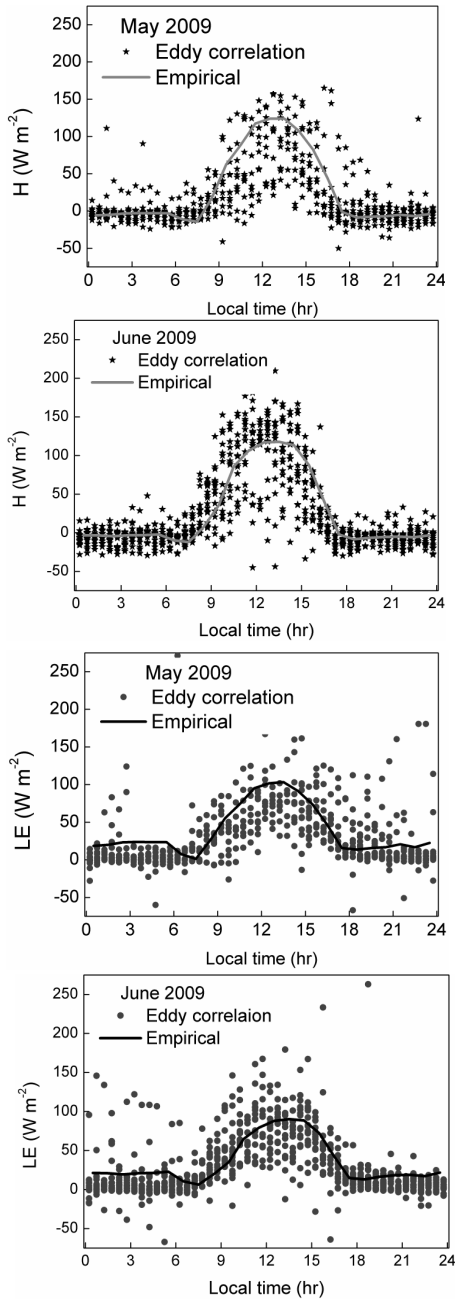


Figure 1. Diurnal evolution of sensible and latent heat fluxes observed (Eddy correlation) and modeled (Empirical) in the City of São Paulo. For $\alpha_{pt}=0.55$ (daytime), $\alpha_{pt}=1.0$ (nighttime) and $\beta=10\text{ W m}^{-2}$. (a–top left) May, (b–top right) June; (c–bottom left) May; (d–bottom right) June.

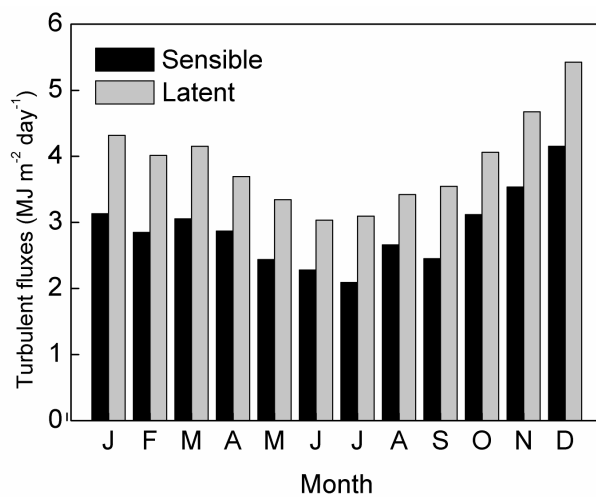


Figure 2. Seasonal variation H and LE for São Paulo City, corresponding to observations carried in 2009 (February-December) and 2007 (January).