

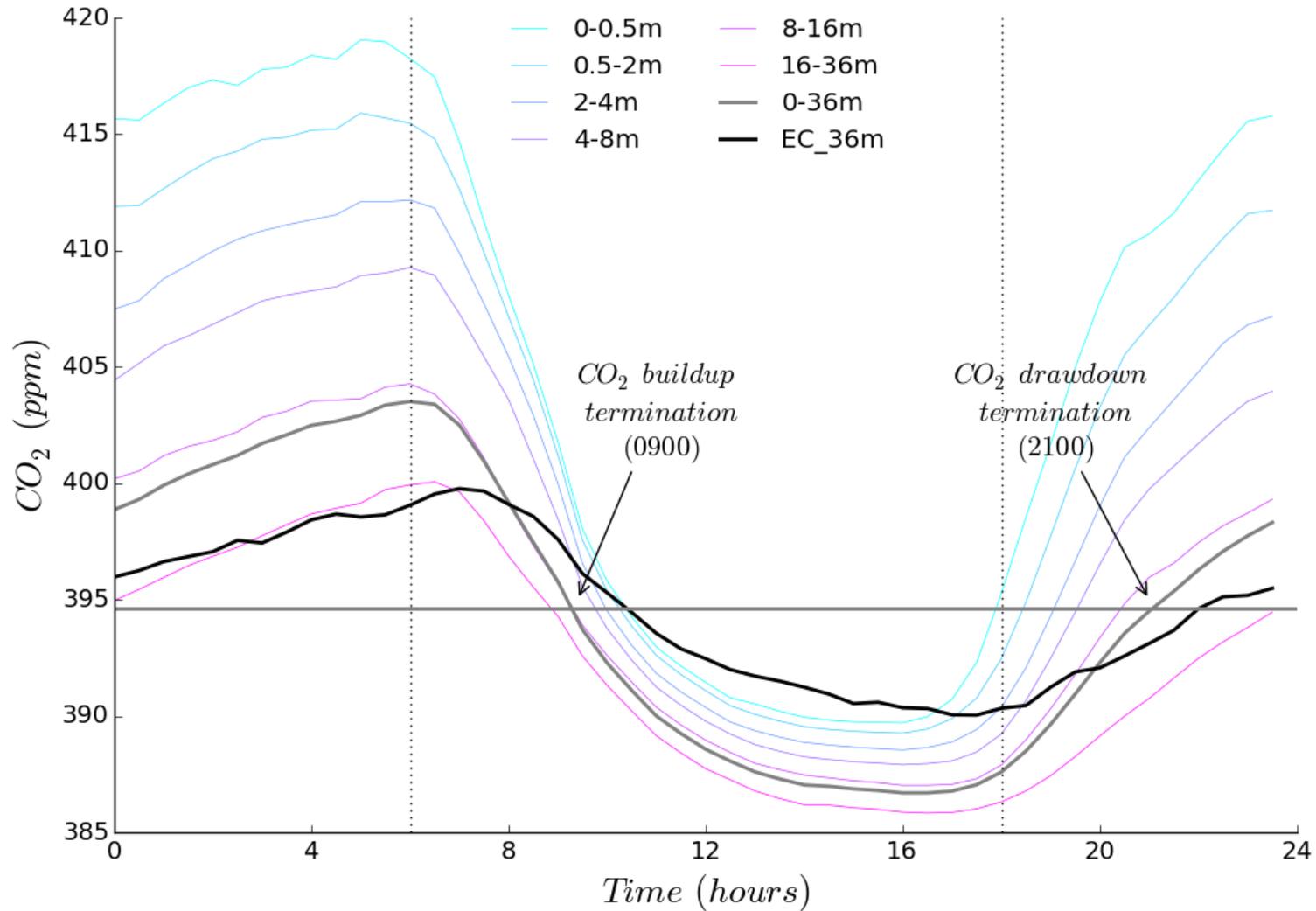


Oz *Flux*

General considerations on the importance of storage

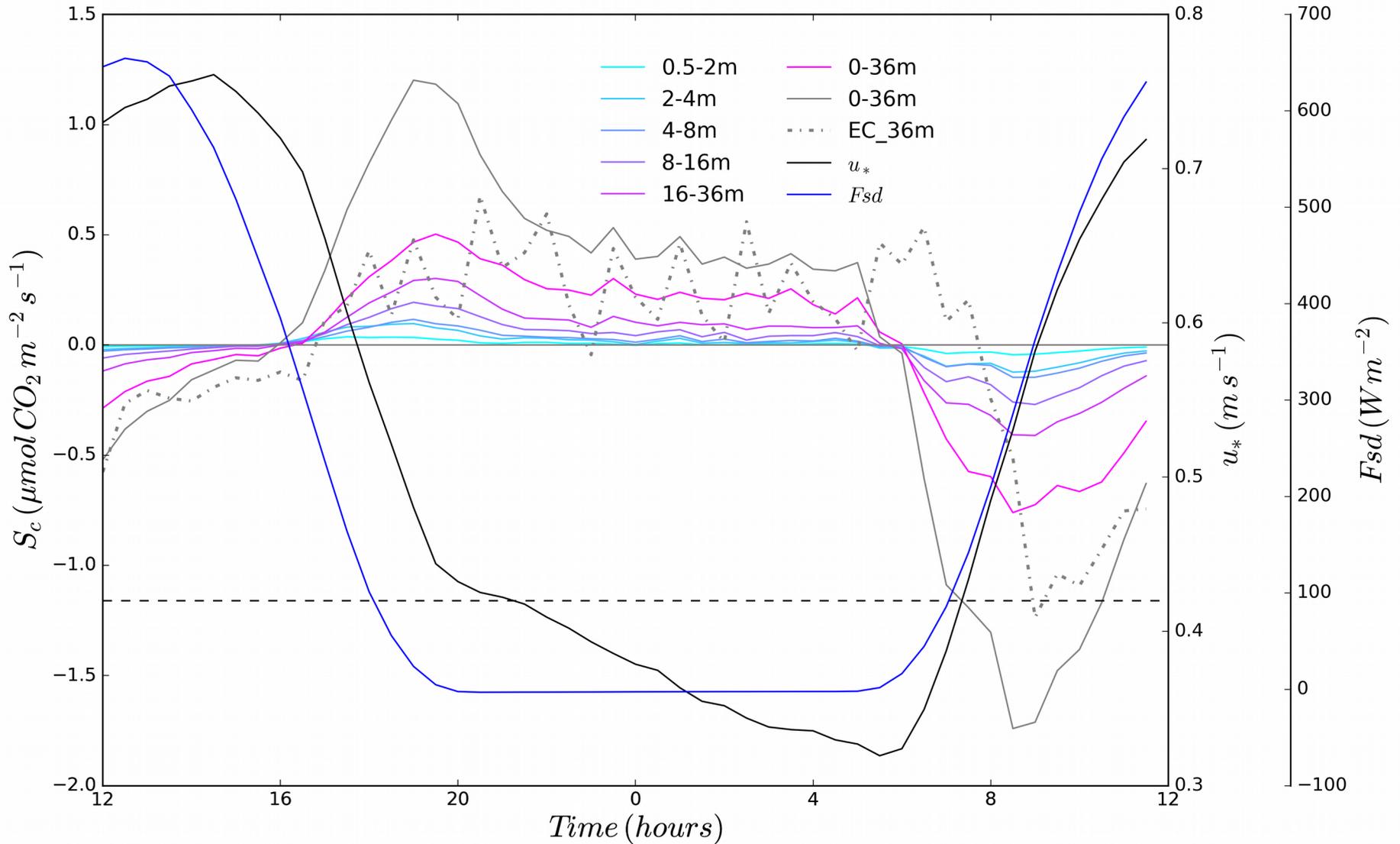
Ian McHugh, Jason Beringer, Shaun Cunningham,
Patrick Baker, Timothy Cavagnaro, Ralph MacNally,
Ross Thompson

- Nocturnal accumulation due to respiratory source and collapse of turbulence
- Daytime drawdown due to photosynthetic sink and reinitiation of turbulence



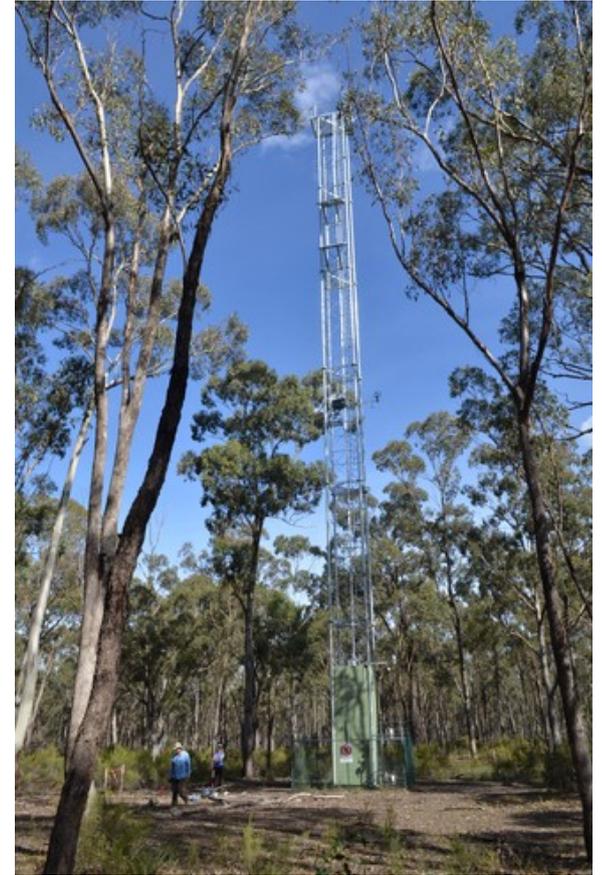
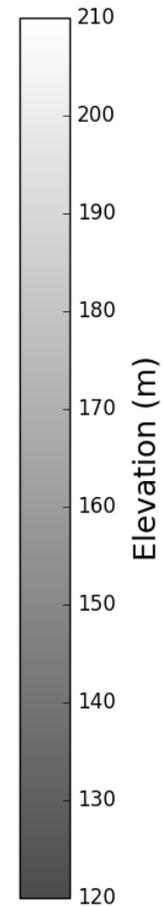
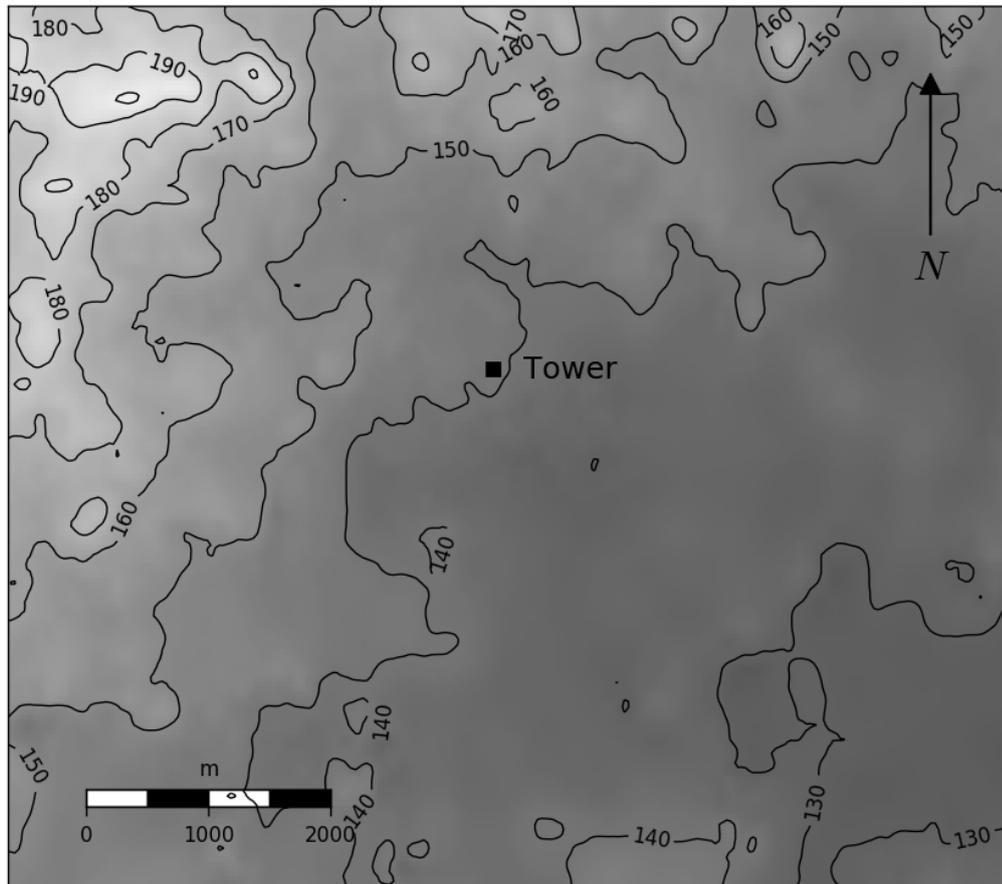
Storage is negligible over 24 hours

$$\rightarrow S_{c_day} \approx -S_{c_night}$$



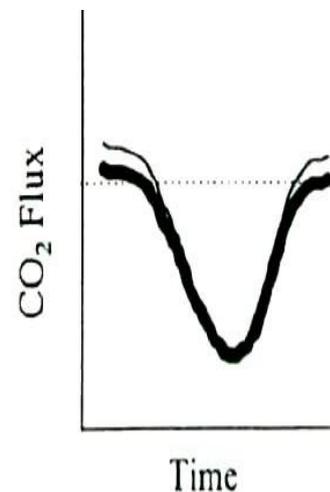
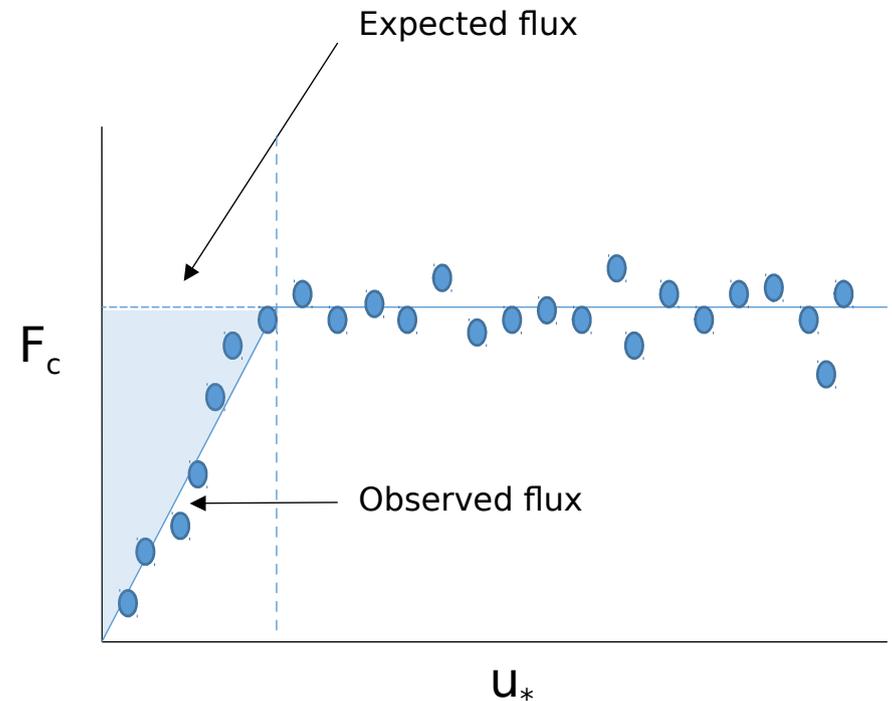
Whroo as a case study

- Very flat for a flux site
- Has a consistent southeasterly aspect, sloping up to a ridge approximately 3-4km



Nocturnal turbulent flux underestimation

- Occurs primarily under stable conditions
- Manifests as low- u_* dependency of F_c
- Since insolation is driver of turbulent activity, occurs primarily nocturnally
- Since insolation is also a driver of photosynthesis, nocturnal NEE is respiratory flux only
- Hence risk of bias at diurnal and longer time scales
- Underestimation due to advection and storage below EC measurement height
- If we measure S_c and estimate ER at low u_* , we can estimate A_c (and relative contributions of S_c and A_c to flux underestimation)

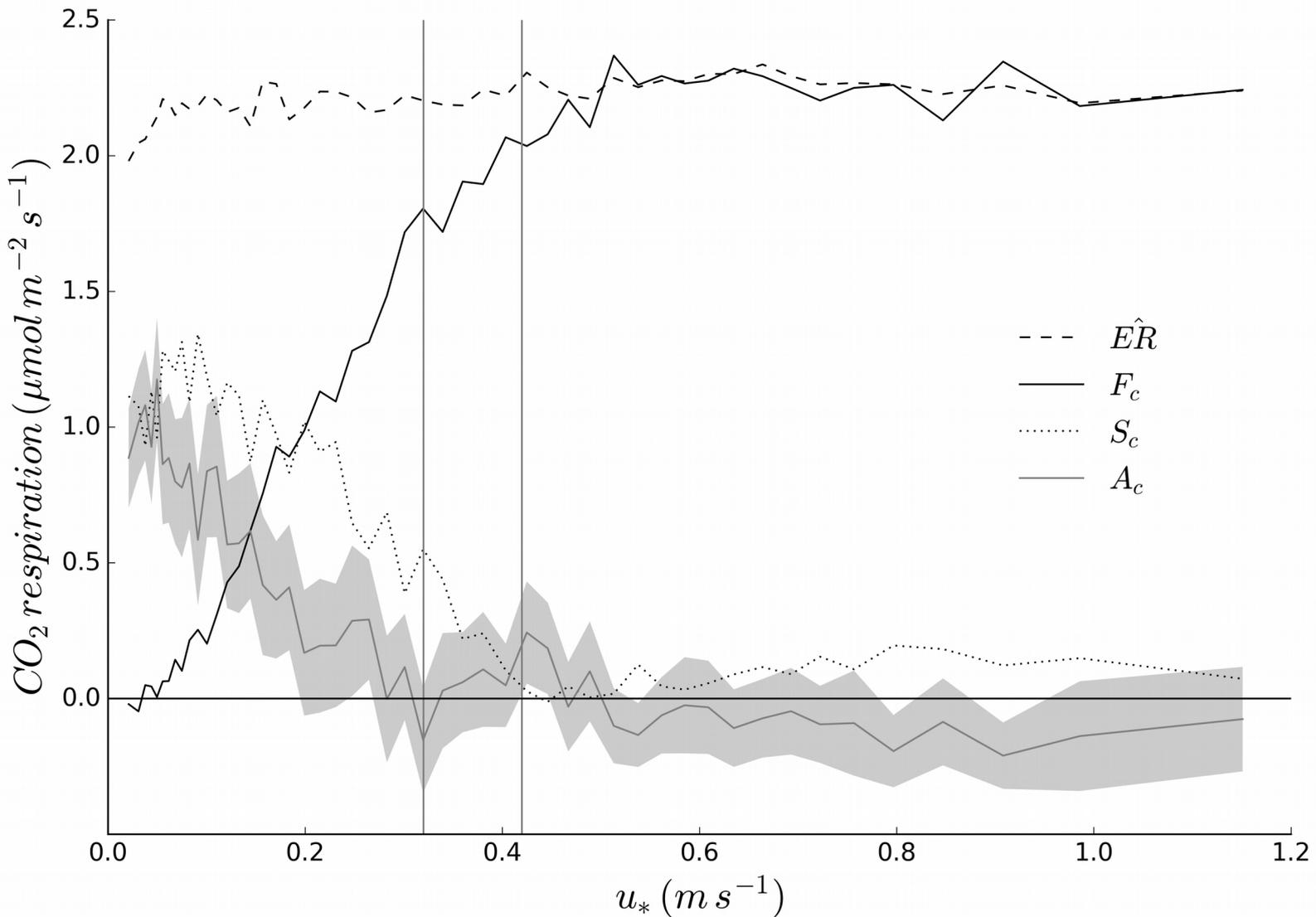


Selective-Systematic

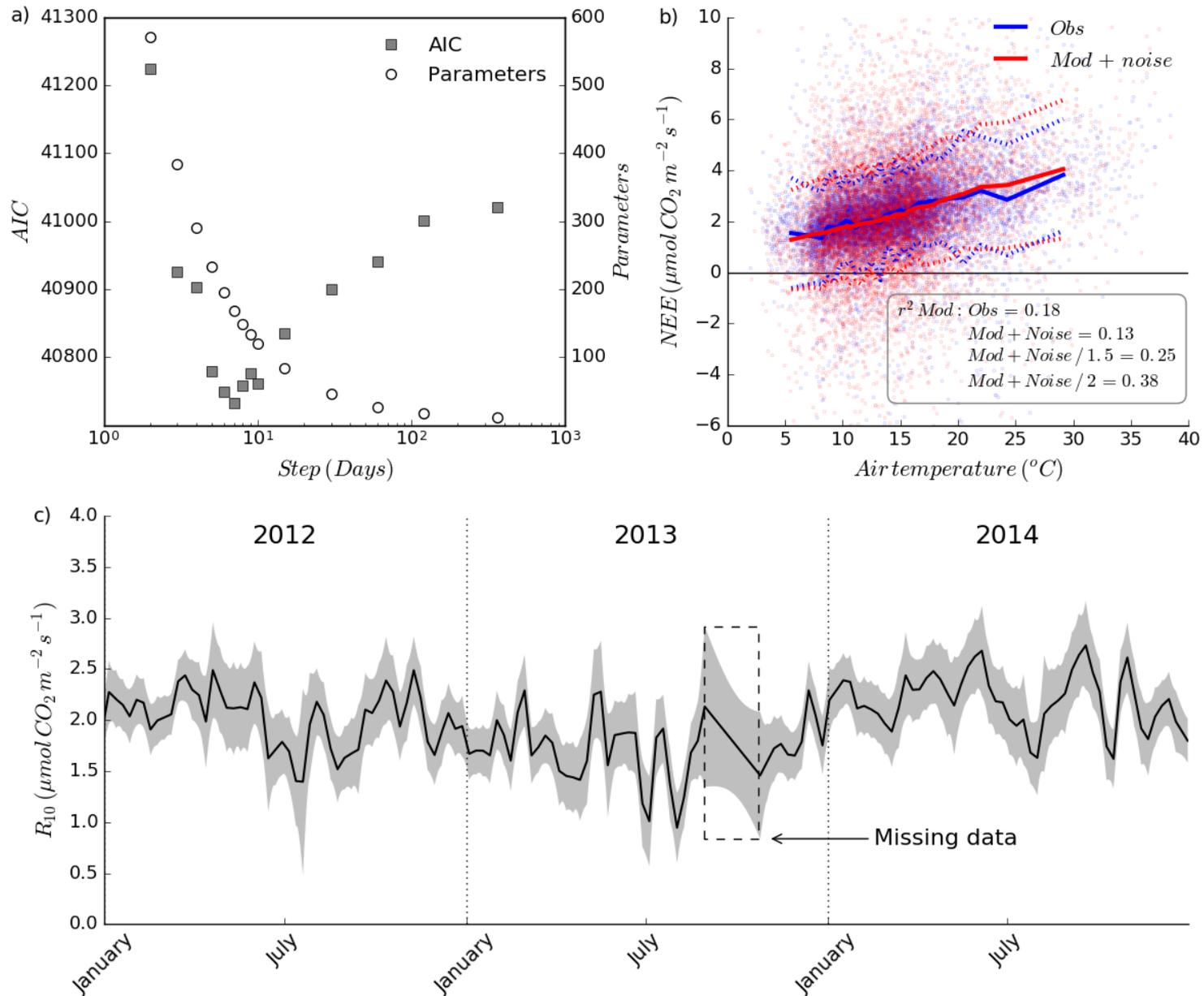
e.g. under-reading of night-time fluxes because of drainage flows, different turbulence spectra

Inferred mass balance components

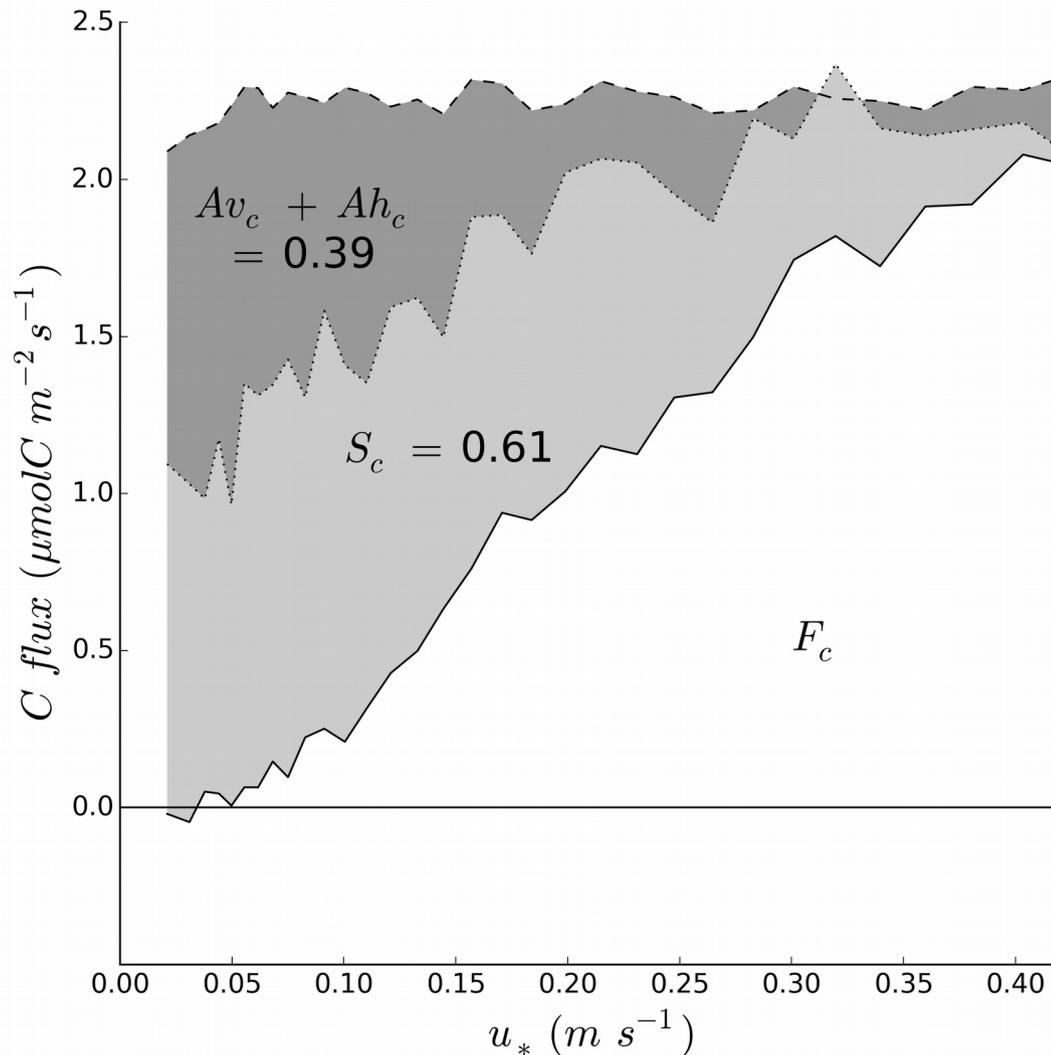
$$\widehat{ER} = \underbrace{R_{10} e^{E_o \left(\frac{1}{T_{ref} - T_0} - \frac{1}{T - T_0} \right)}}_1 \times \underbrace{\frac{1}{1 + e^{(\theta_1 - \theta_2 VWC)}}}_2$$



Signal: noise and parameter uncertainty

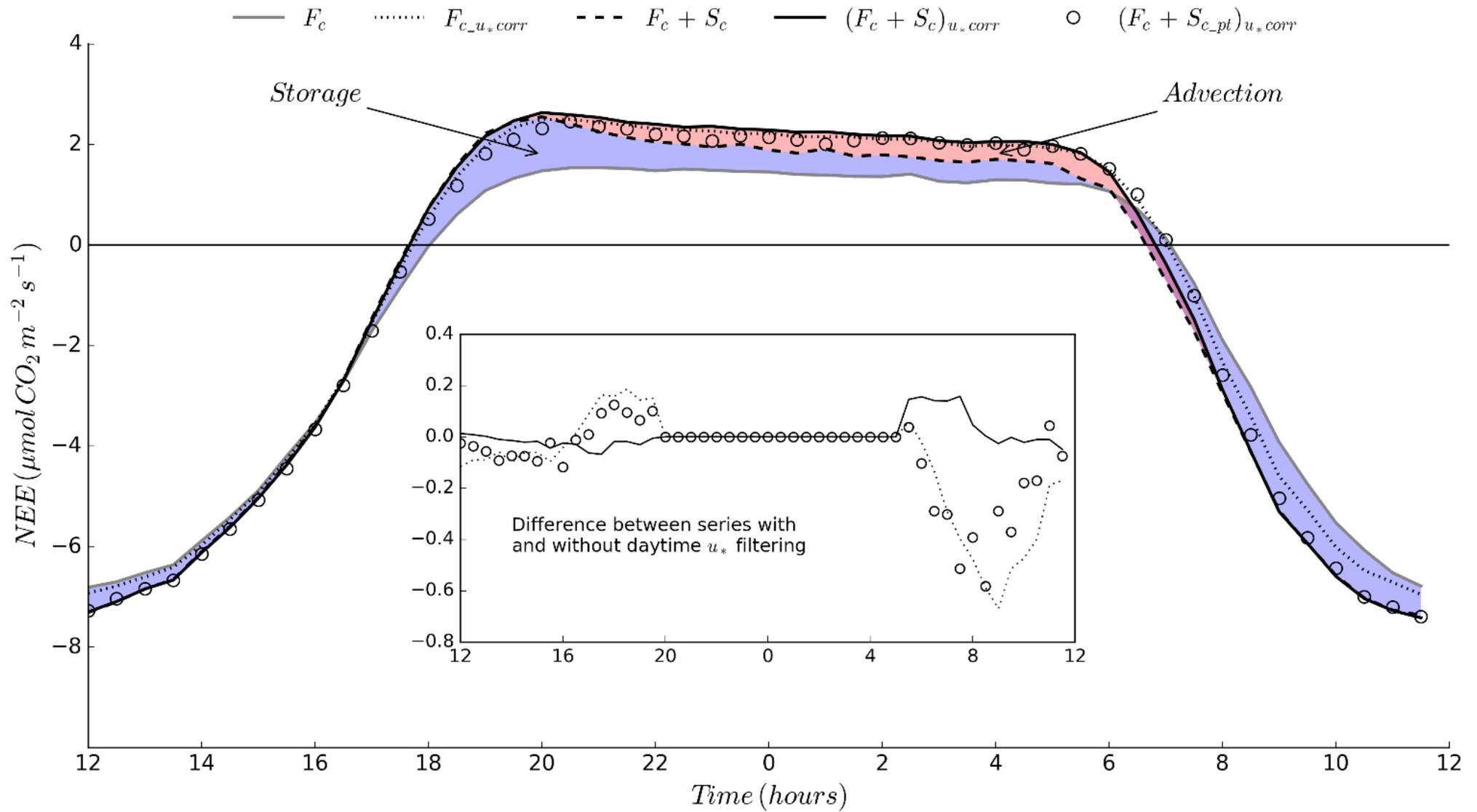


Relative contributions of advection and storage



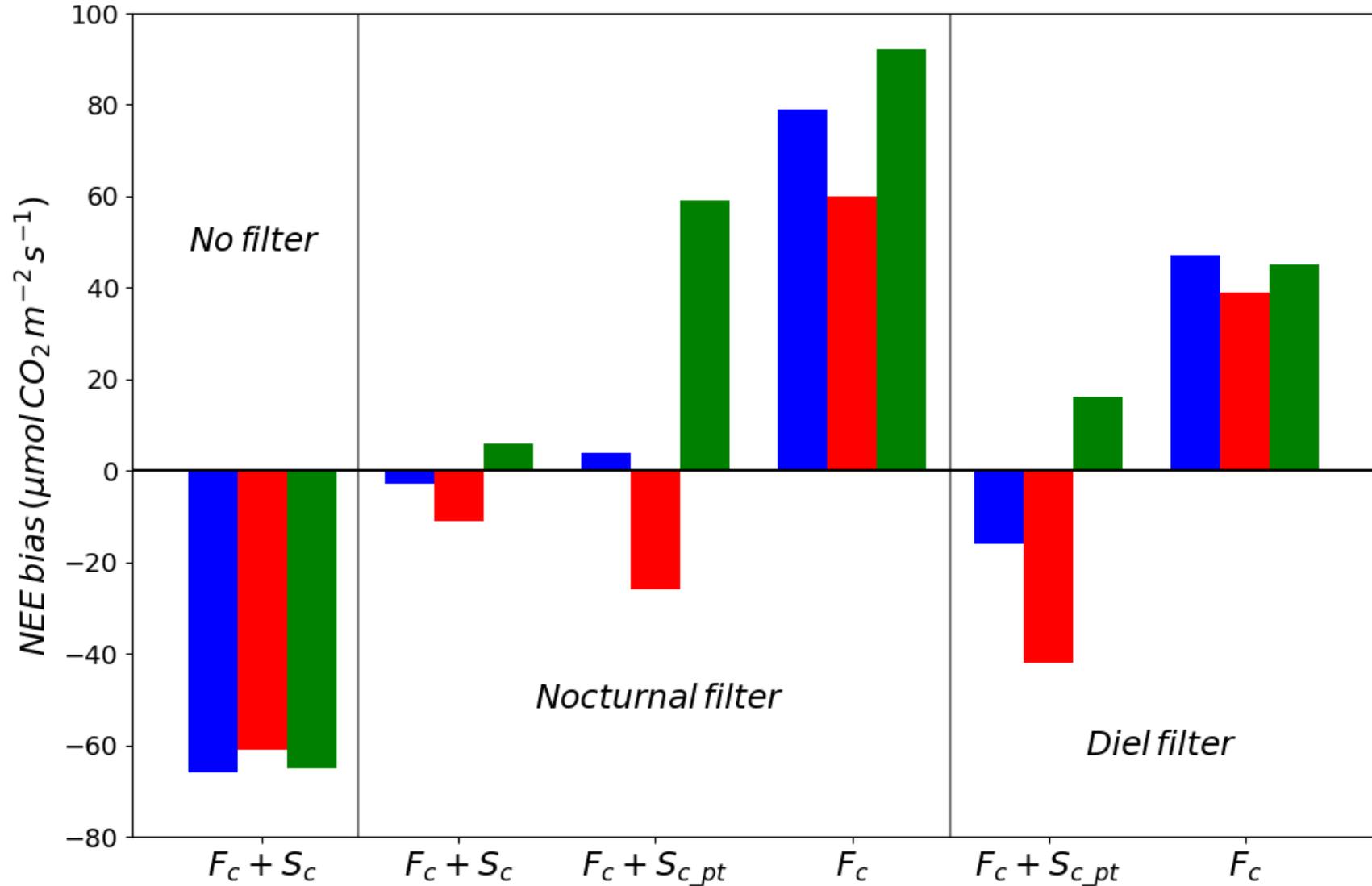
- Nocturnal u_* correction (filtering + gap-filling) is dumb: assuming it works as advertised (!), it corrects for all sources of turbulent flux underestimation
- $S_{c_night} \approx -S_{c_day}$, but S_{c_day} missed, therefore efflux bias inserted
- If $S_c > A_c$, nocturnal u_* correction inevitably increases bias relative to no correction
- Profile system required to estimate contributions – without it, you're doomed!

Implications



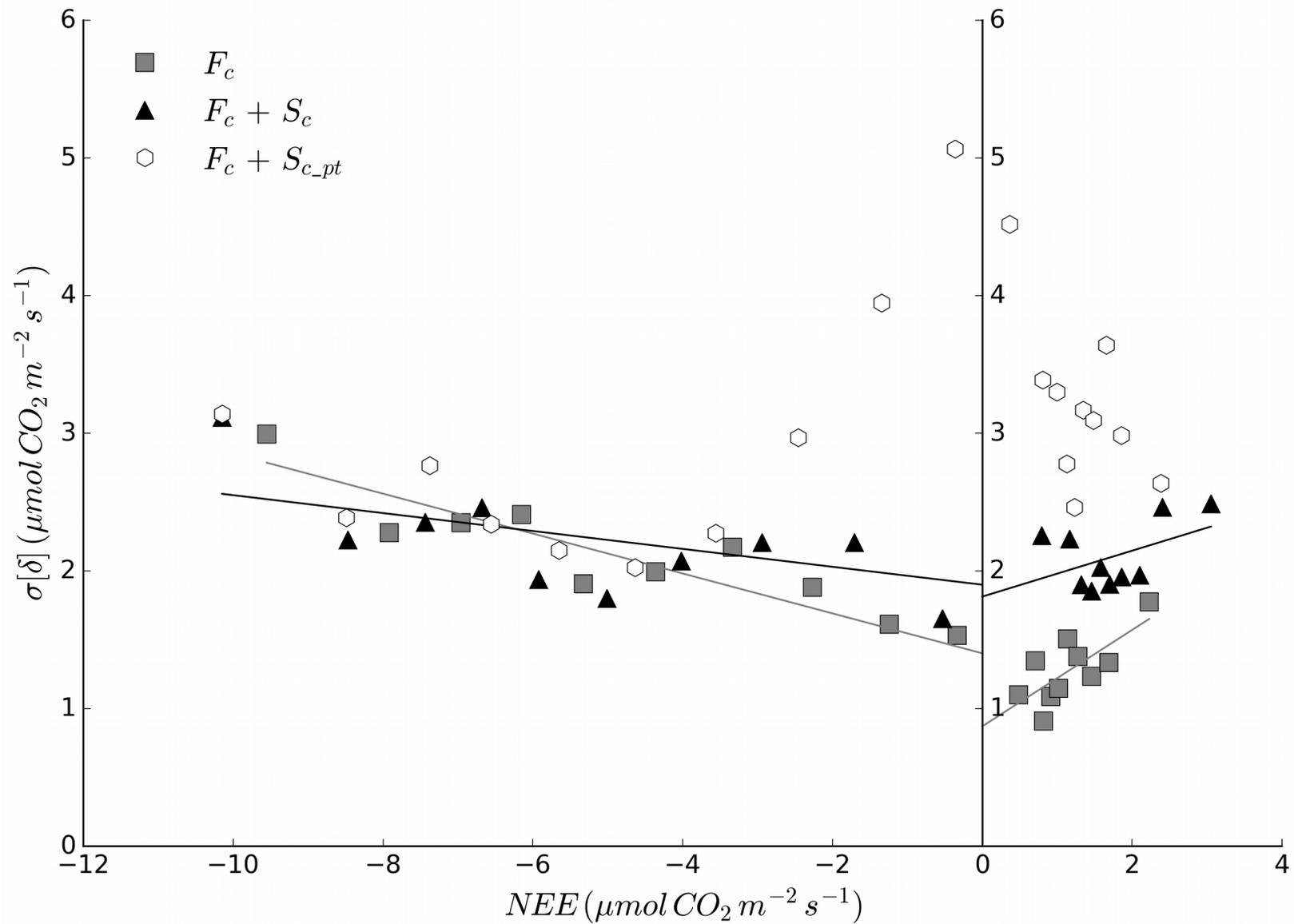
Annual NEE Biases

2012 2013 2014

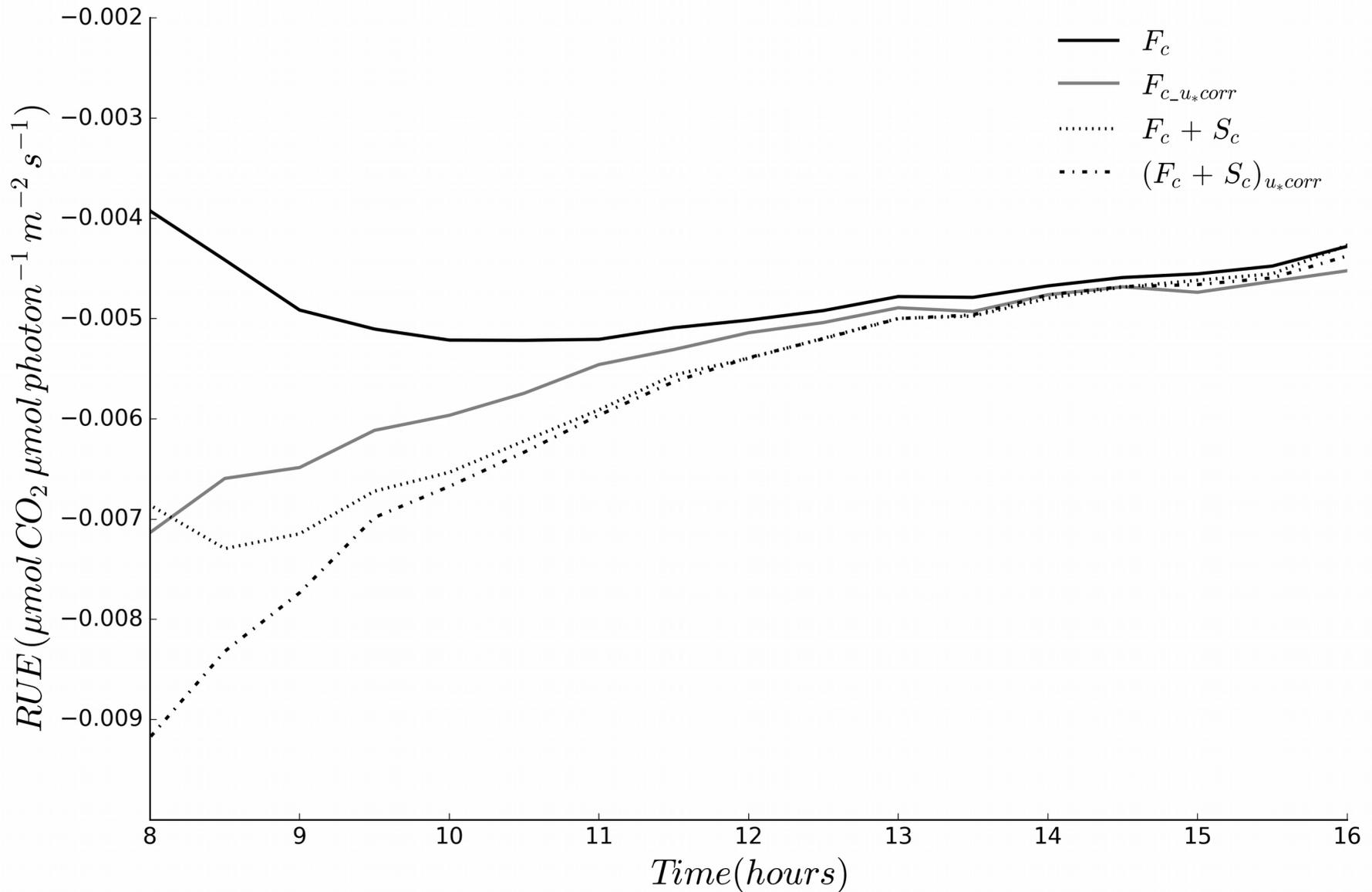


Noise issues

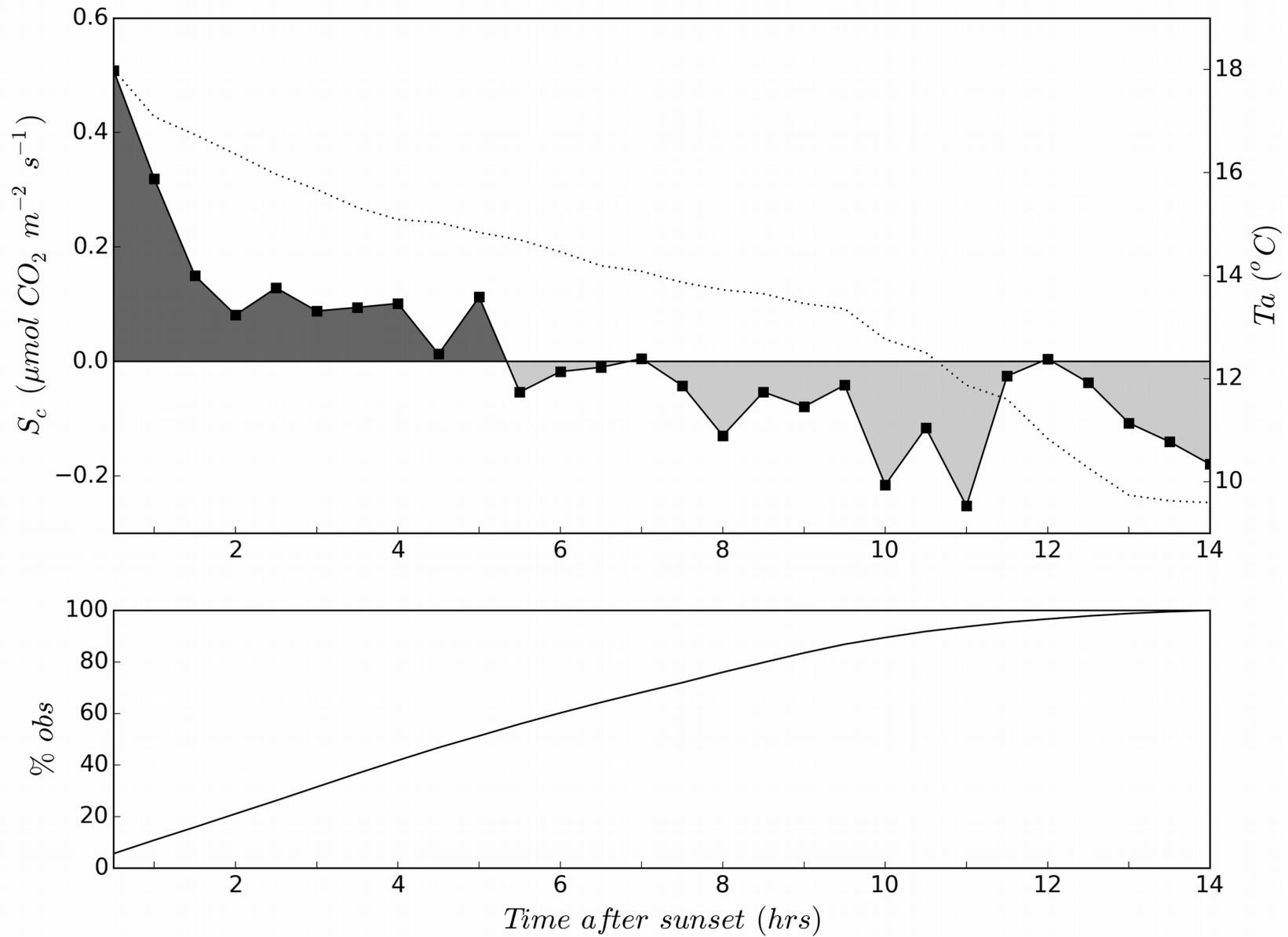
$$\sigma(\delta)_i = \sqrt{2} \frac{1}{n_i} \sum_{j=1}^{n_i} |\delta_{i,j} - \bar{\delta}_i|$$



Ecological interpretation issues I



Ecological interpretation issues II



Intersite comparison

