



Biophysical drivers of the lake-air CO₂ flux at DPK, Lake Taihu

Wang Wei

March 22, 2013



Outline

- Motivation
- Method
- Preliminary results
- Next step



Notes

- Good fetch: wind direction 180-280 deg
- Study period: Aug.18, 2011 to Dec.31, 2012
- Nighttime: solar elevation ≤ 0
- Midday: 10am to 2:30pm

Yale 耶鲁大学-南京信息工程大学大气环境中心

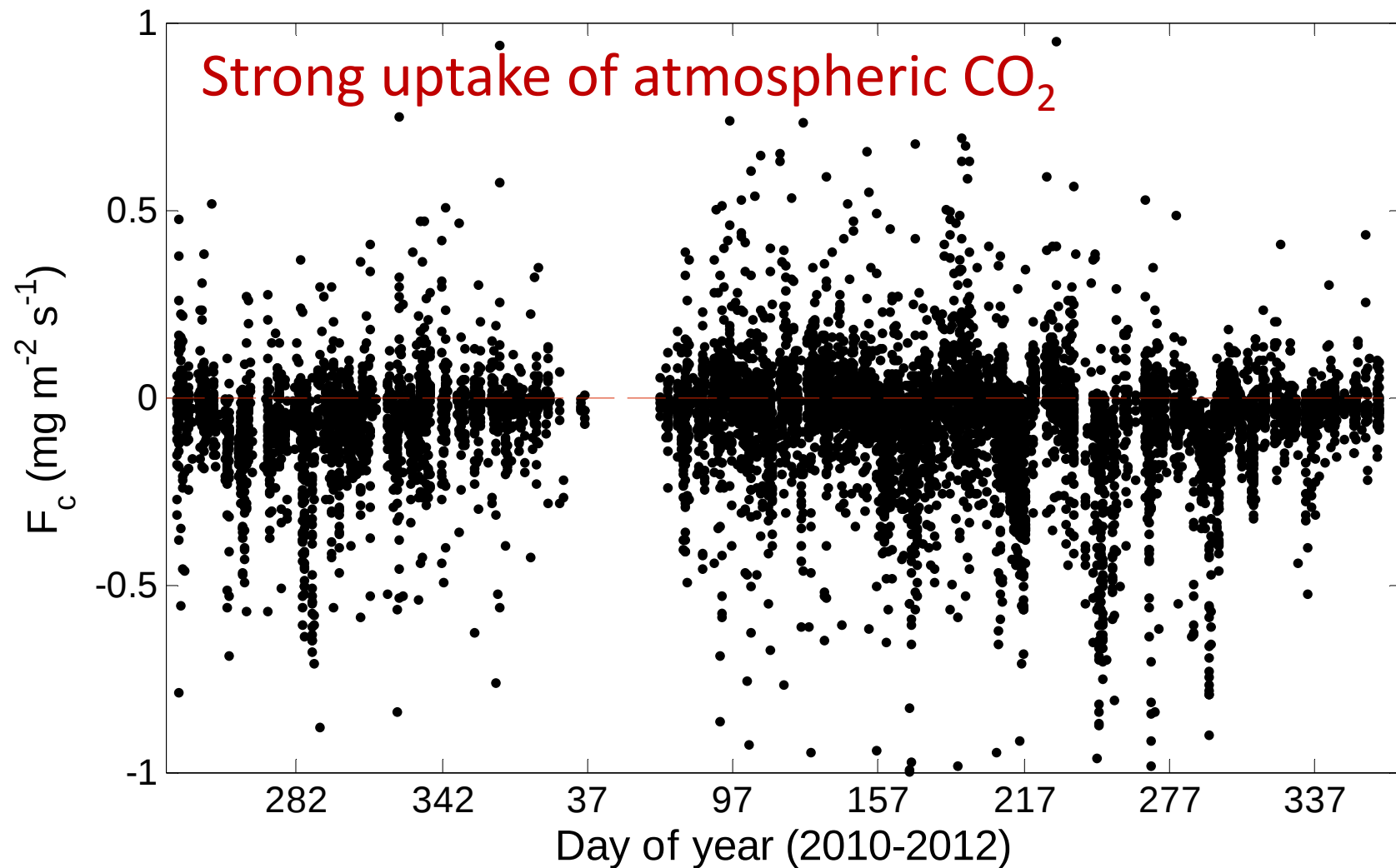


Yale-NUIST Center on Atmospheric Environment

1. Motivation



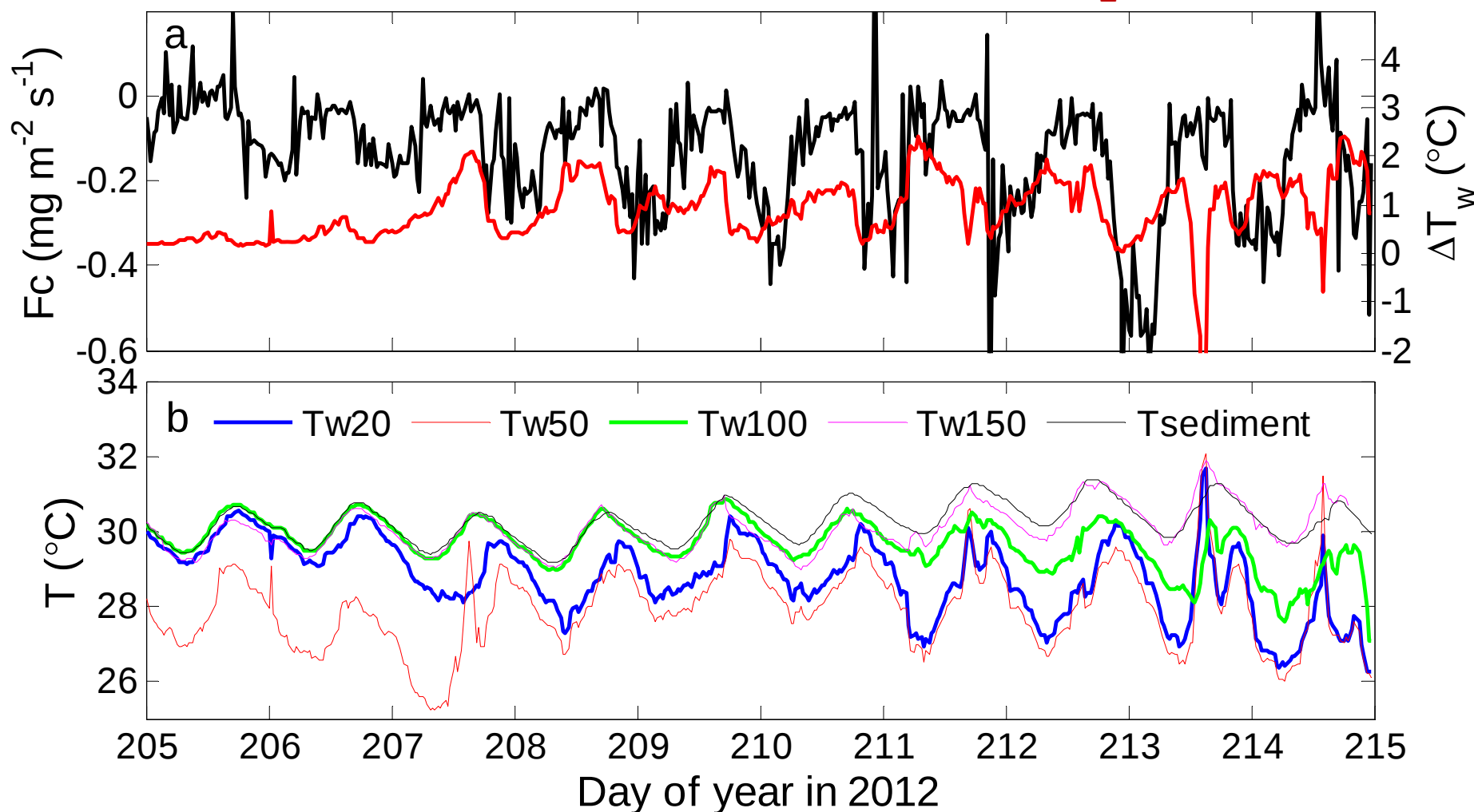
Seasonal variation in 30min CO_2 flux (F_c)





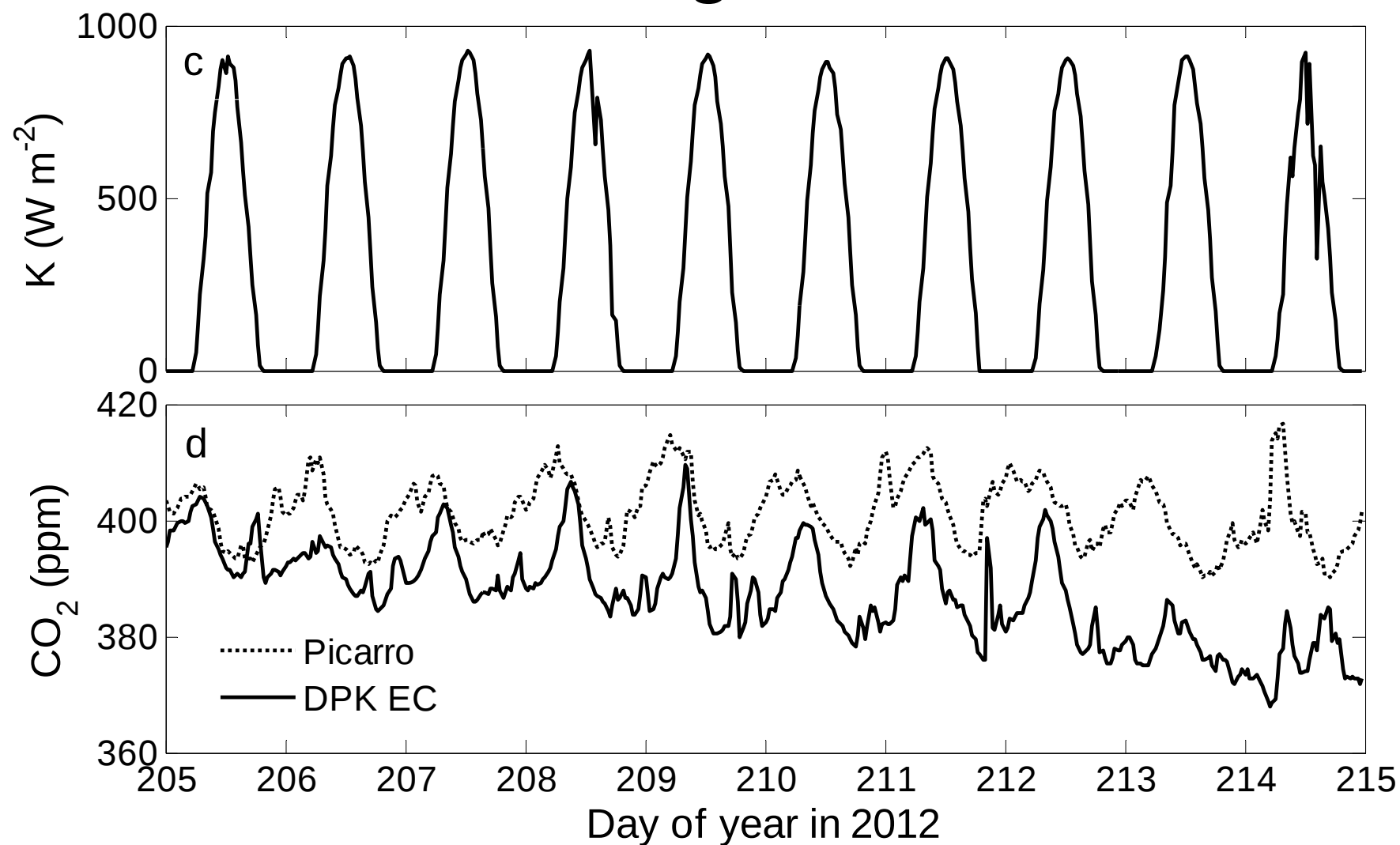
A 10-day case (Jul. 23-Aug.1, 2012)

Nocturnal uptake of atmospheric CO₂



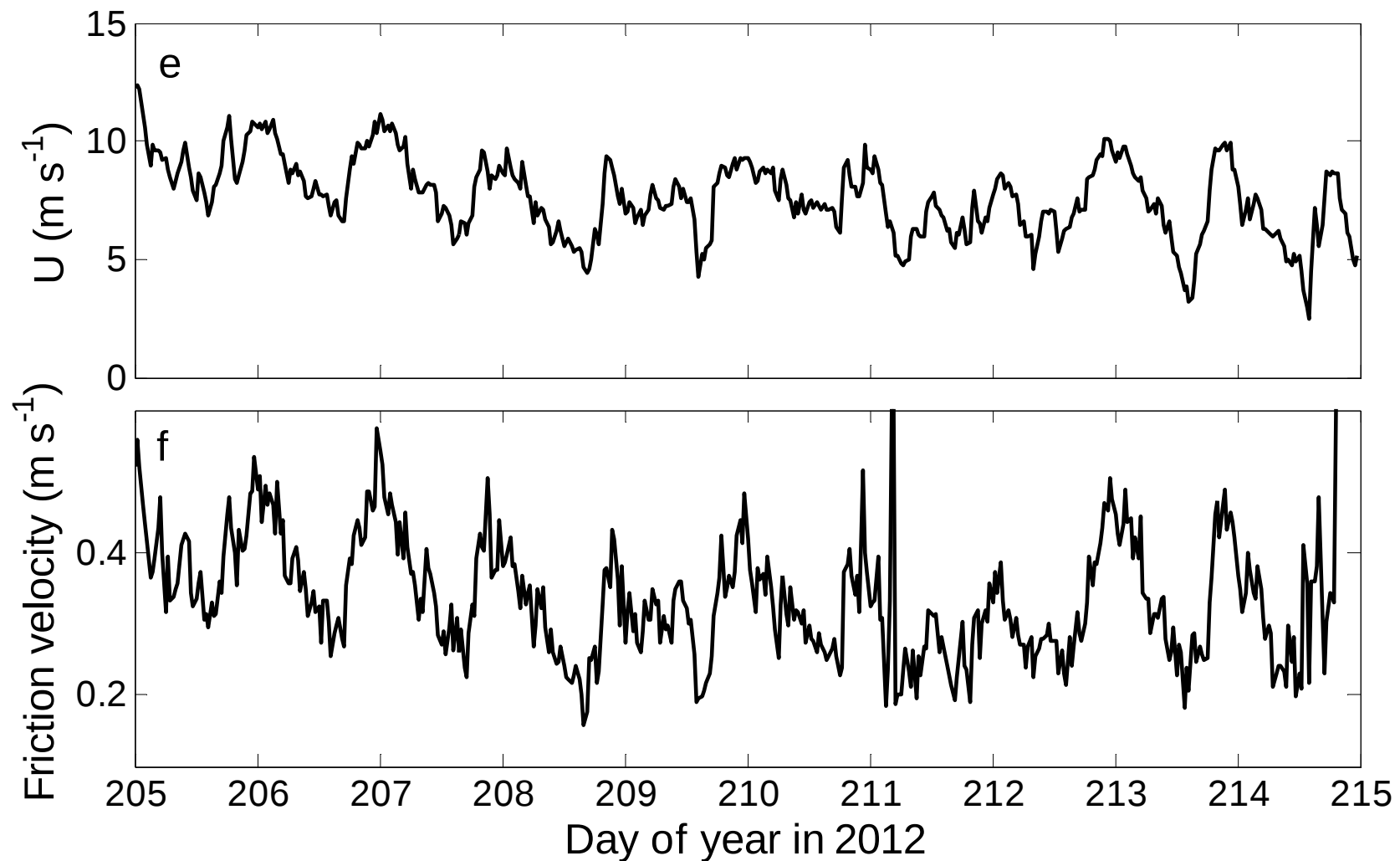


Incoming shortwave radiation (K) and CO₂ mixing ratio



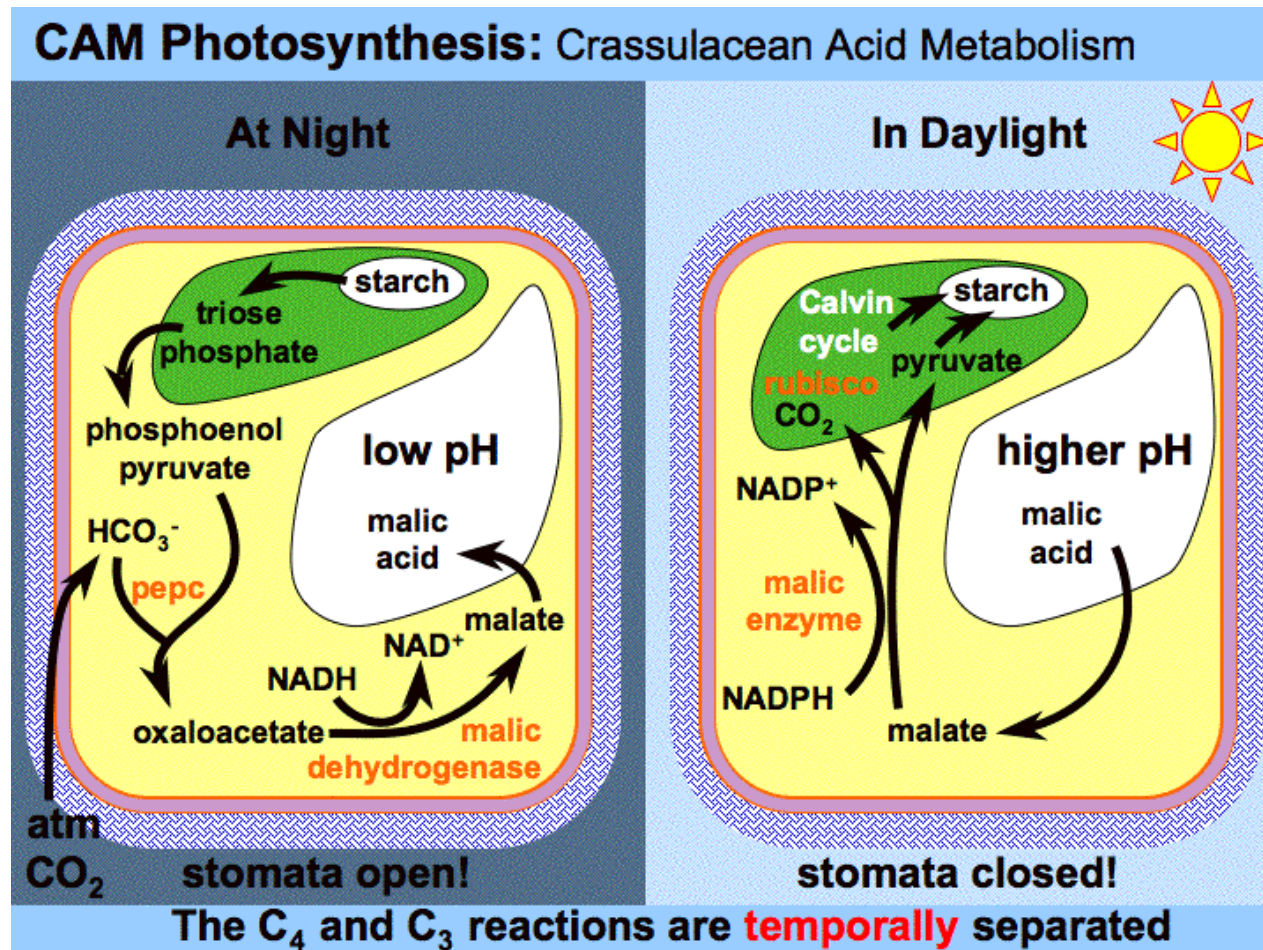


Wind speed (U) and friction velocity (u^*)





Crassulacean acid metabolism (CAM)



(Koning, Ross E. , 1994)



Logic

- Nocturnal CO_2 uptaking, indicative of the CAM of aquatic macrophytes or alga.
- CAM related to radiation and mass diffusion exchange.
- Nighttime F_c vs. daytime K , water convective instability (nighttime ΔT_w , U and u^*).

Yale 耶鲁大学-南京信息工程大学大气环境中心

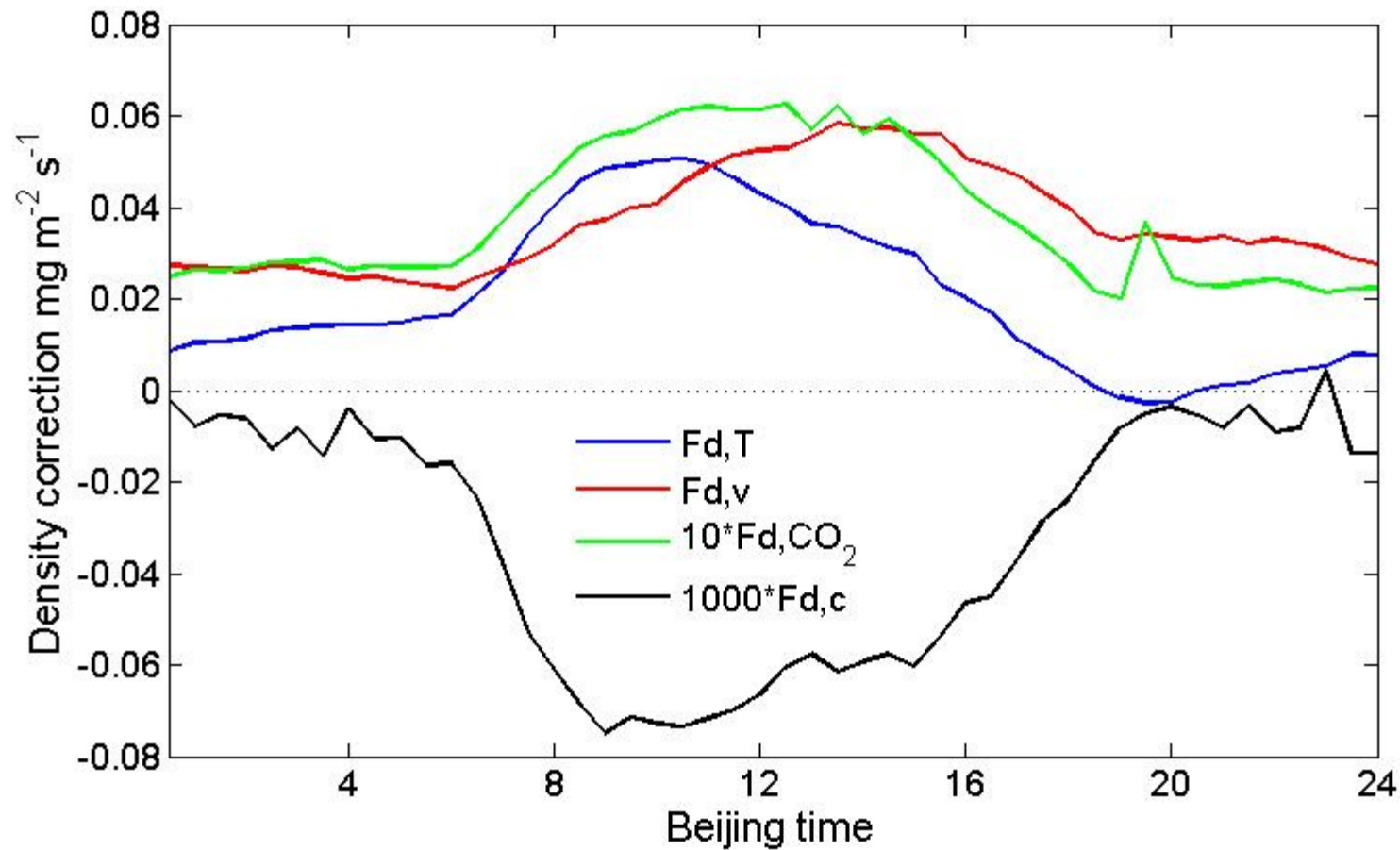


Yale-NUIST Center on Atmospheric Environment

2. Method



Diurnal composite of density correction



- The annual cumulative density correction for CO_2 underestimate is roughly **16%** of the annual NEE.



Additional WPL correction

$$Fc_M = Fc_{raw} + WPL_M$$

$$Fc_T = Fc_{raw} + WPL_T$$

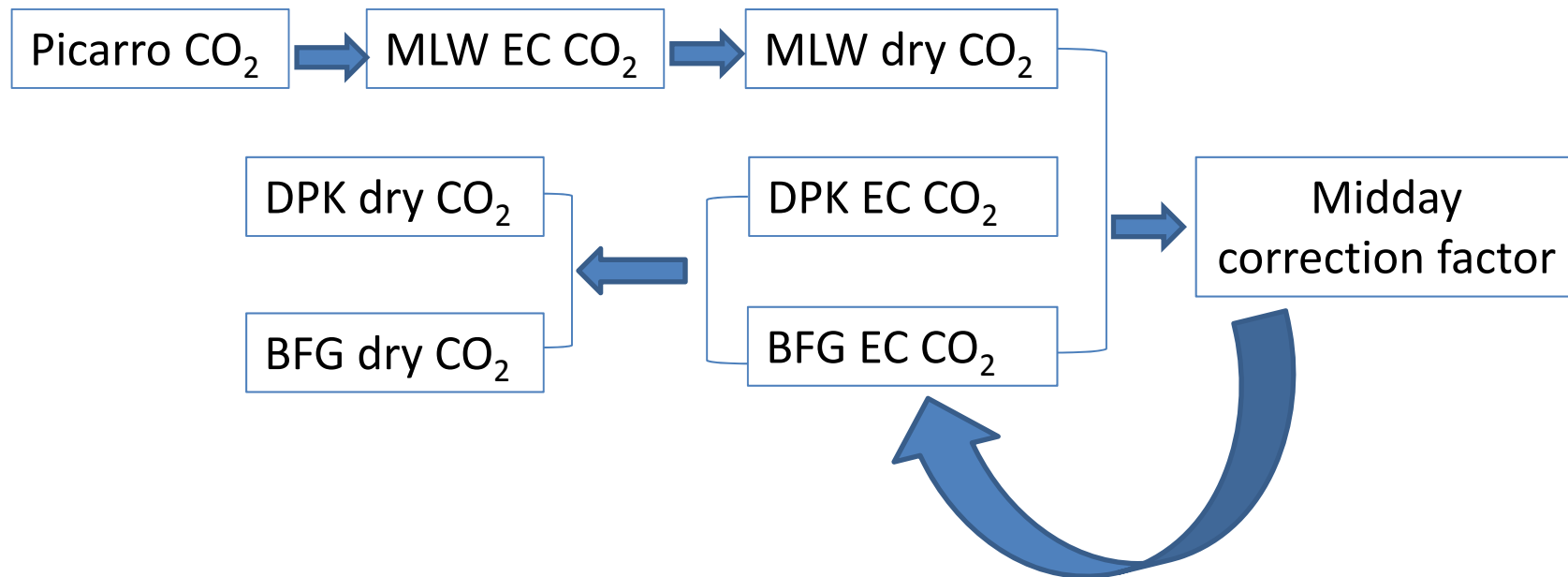
$$WPL_T = WPL_M \times \frac{\chi_T}{\chi_{M.moist}}$$

$$Fc_T = Fc_{raw} + WPL_M \times \frac{\chi_T}{\chi_{M.moist}} = Fc_M + WPL_M \times \left(\frac{\chi_T}{\chi_{M.moist}} - 1 \right)$$

(Lee, 2012)



Moist CO_2 correction



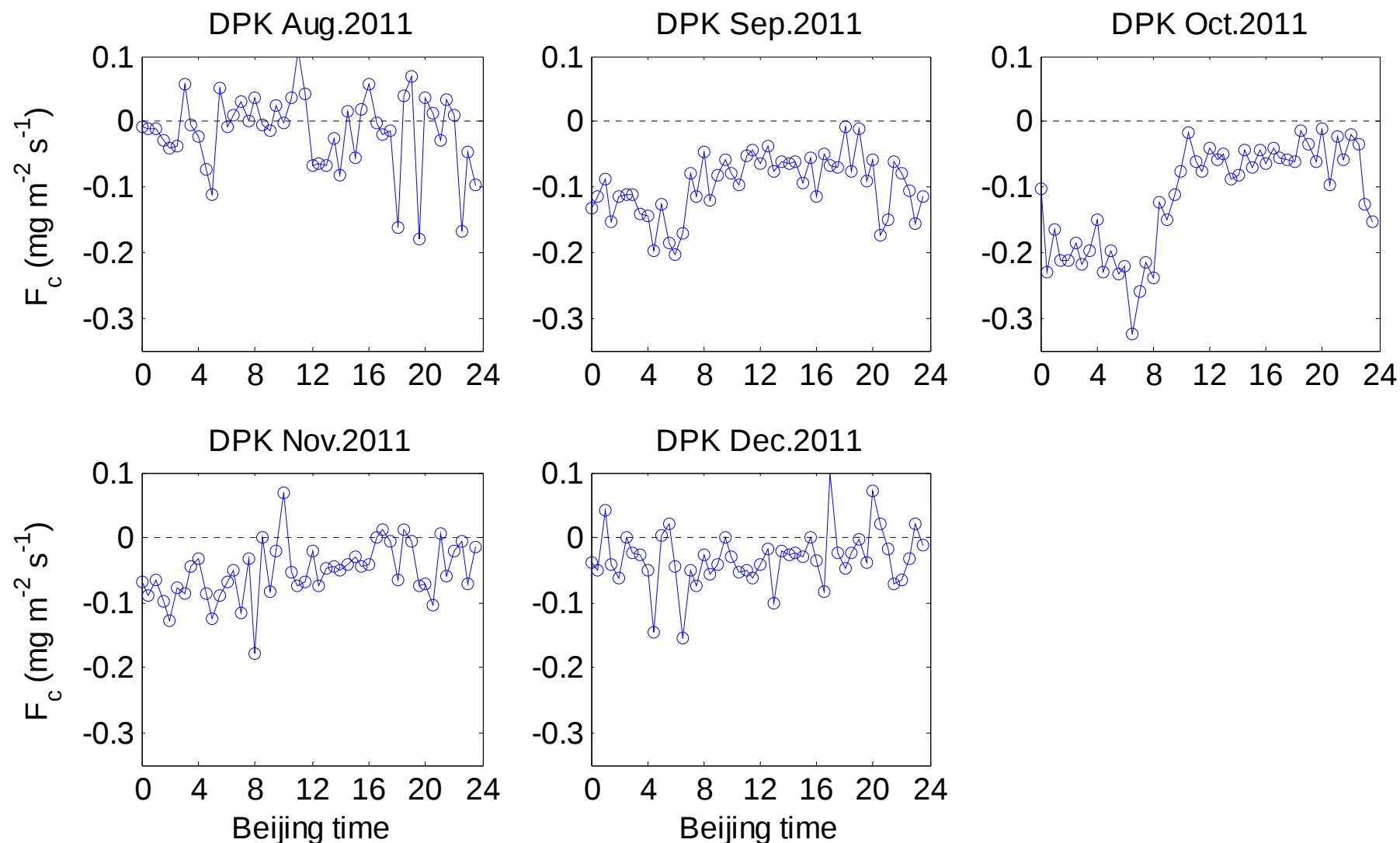
(Lee, 2012)



3. Preliminary Results

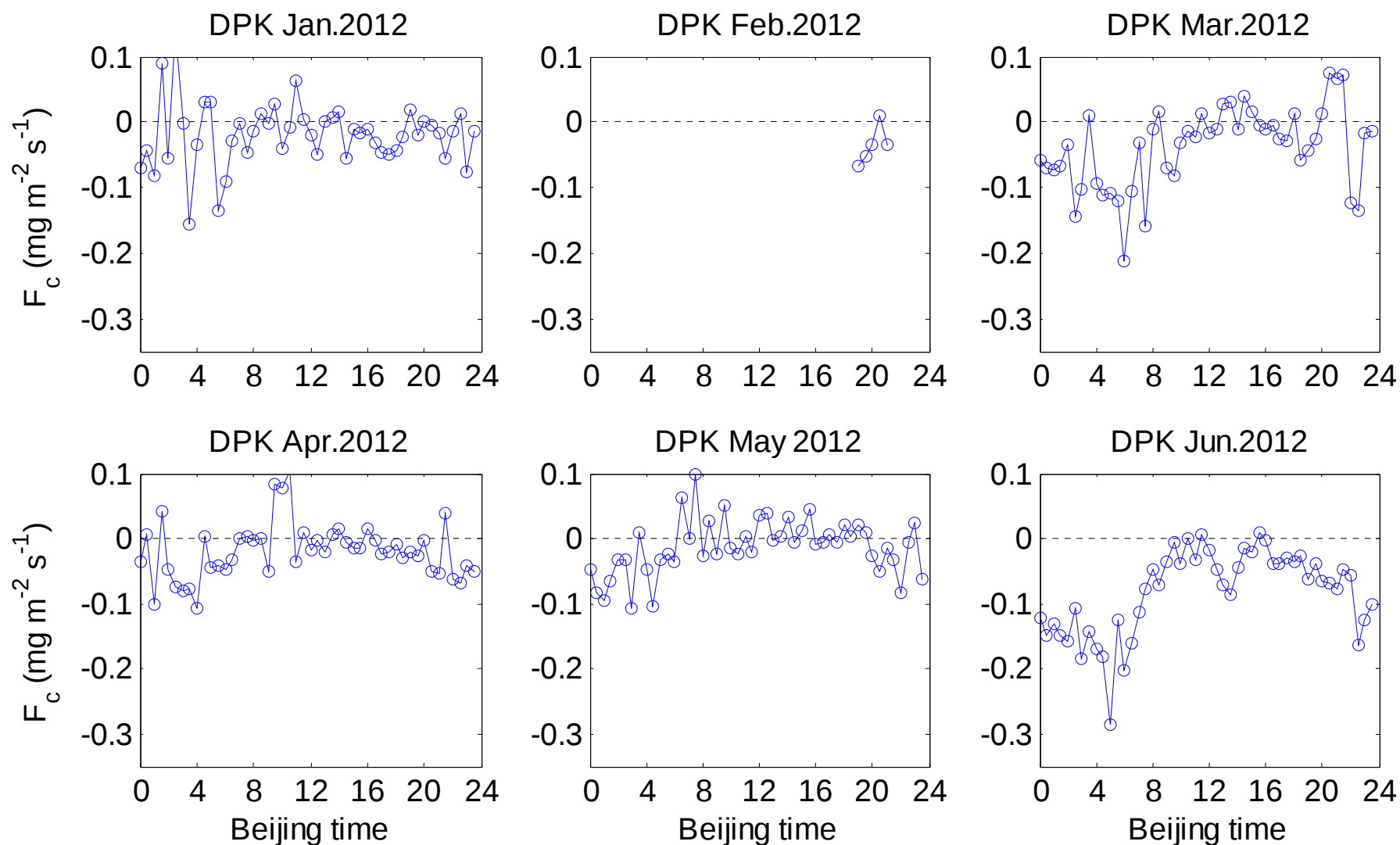


Monthly diurnal composite (Aug.-Dec., 2011)



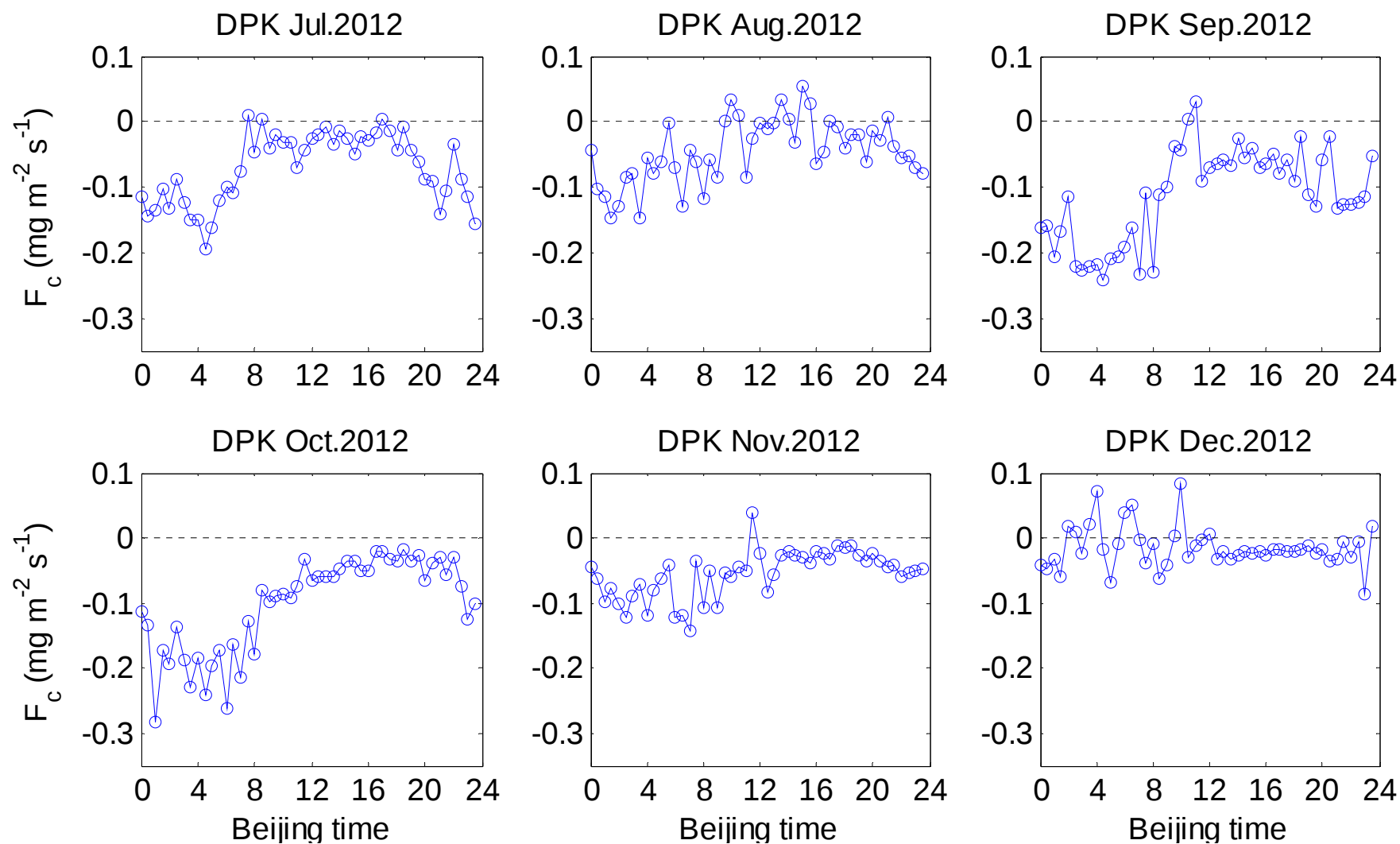


Monthly diurnal composite (Jan.-Jun., 2012)



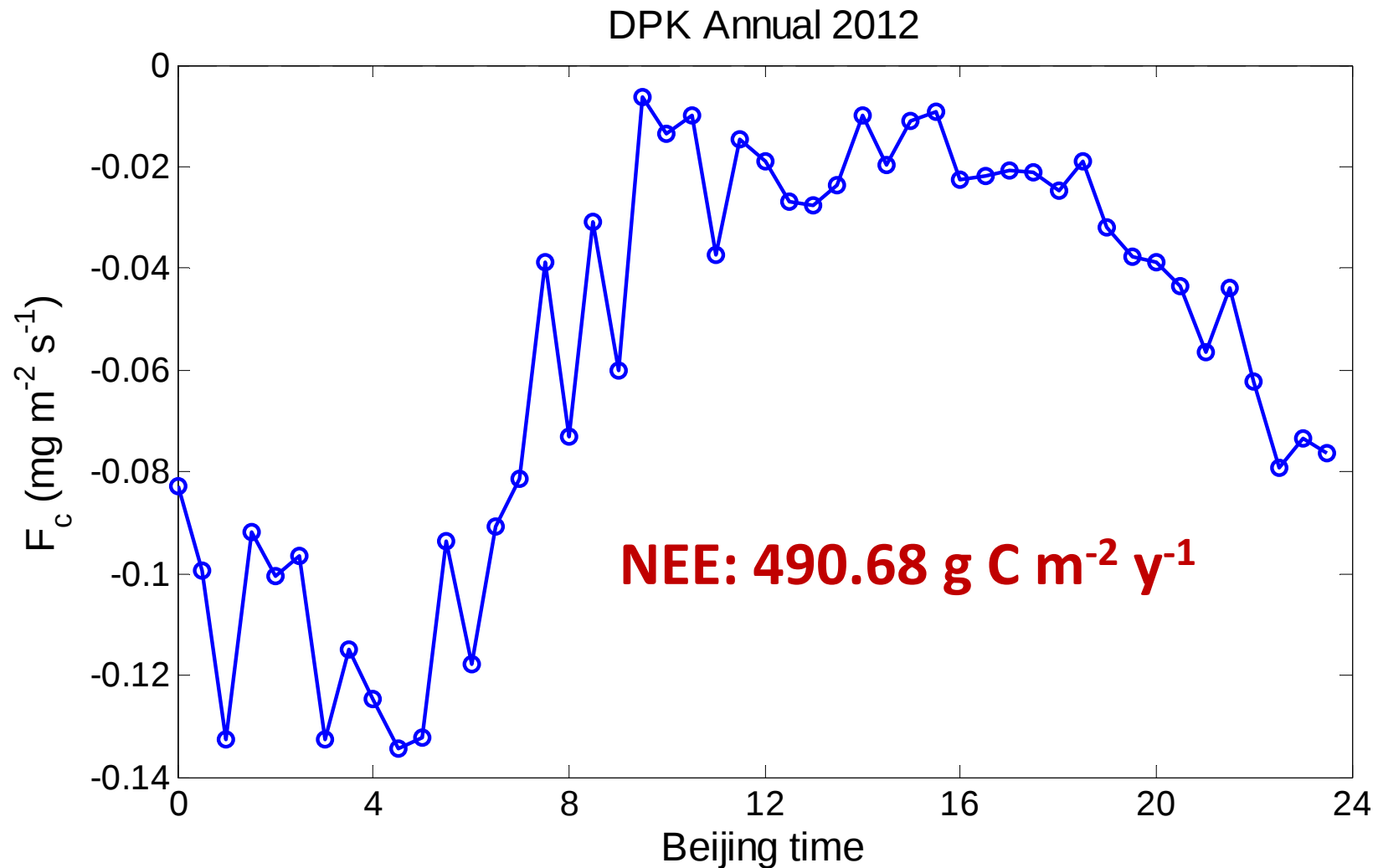


Monthly diurnal composite (Jul.-Dec., 2012)



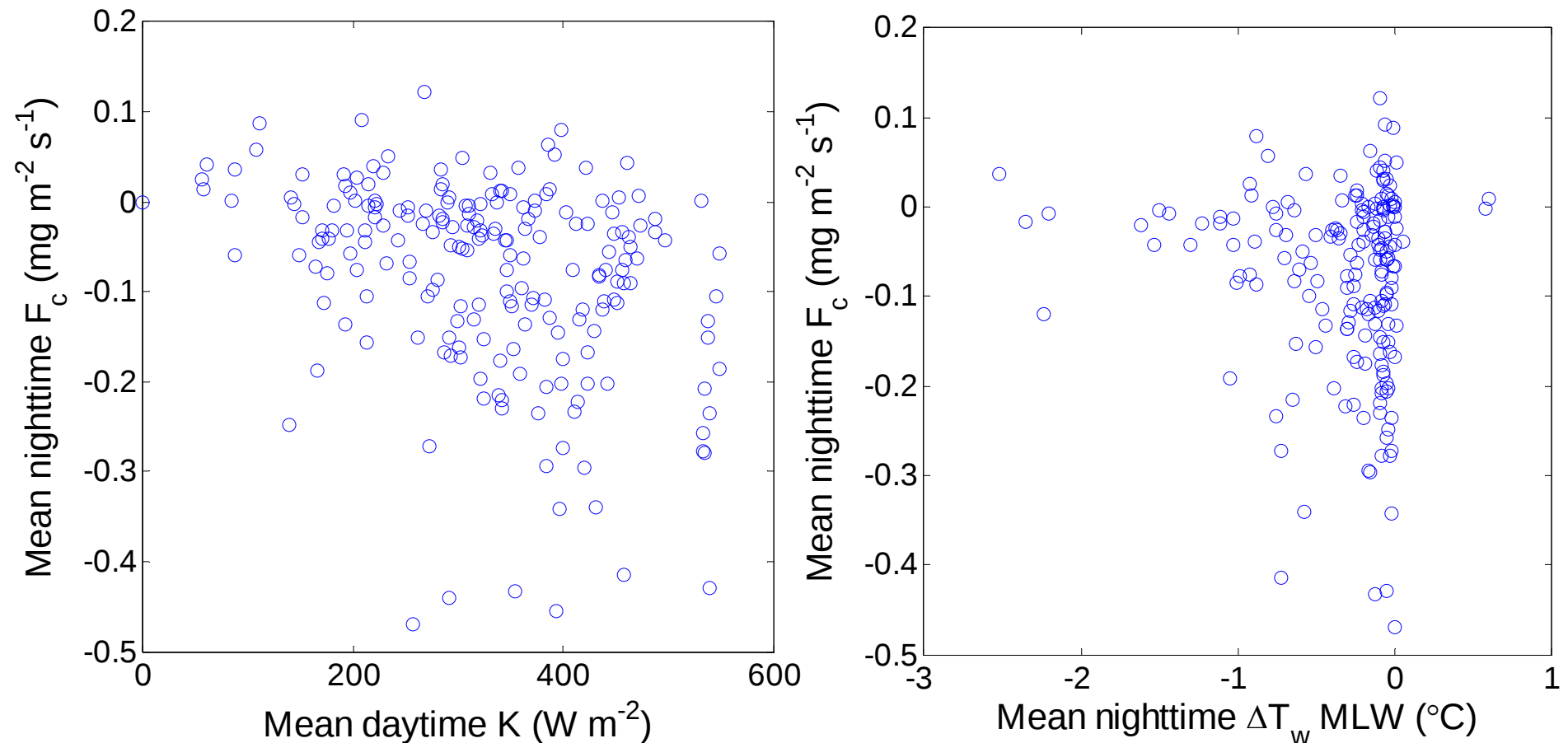


Annual diurnal composite of 2012



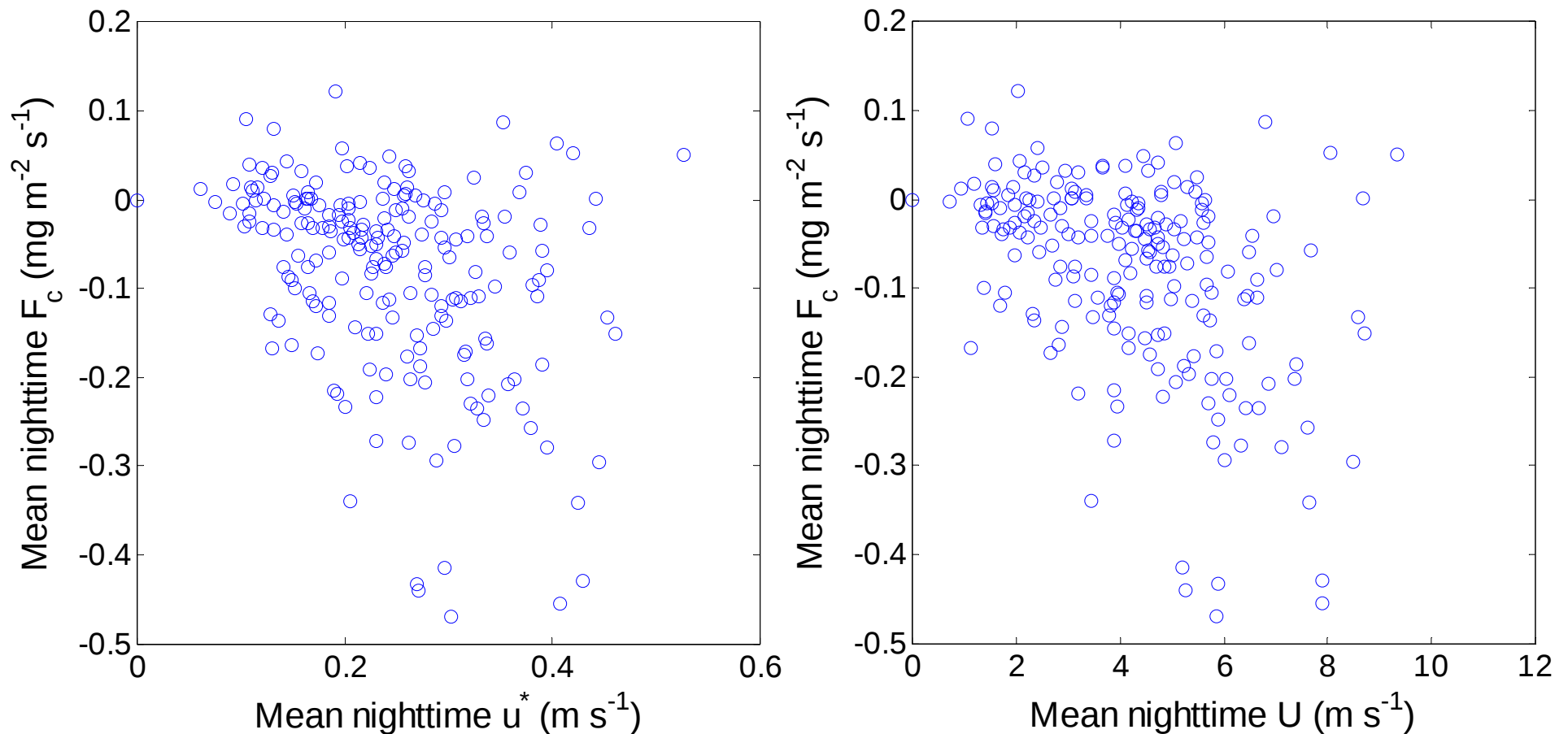


Mean nighttime F_c vs. mean daytime K and nighttime ΔT_w (100cm minus 20cm)





Mean nighttime F_c vs. mean nighttime u^* and U



Yale 耶鲁大学-南京信息工程大学大气环境中心

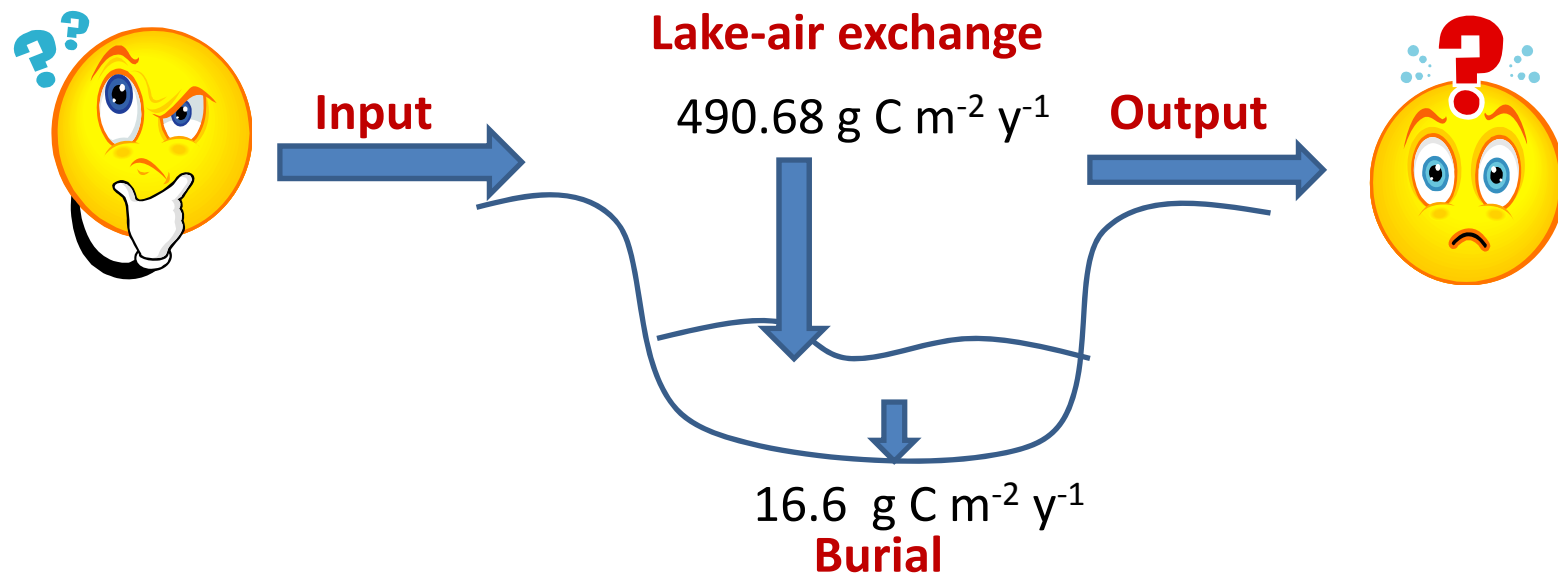


Yale-NUIST Center on Atmospheric Environment

4. Next step



Carbon cycle of Lake Taihu



- Experiment 1: Taihu fluvial carbon
- Experiment 2: Species survey of macrophytes and alga around DPK

(Hu et al., 2011; Gui et al., 2012)