SEASONAL AND DIURNAL VARIATION IN CO FLUXES FROM AN AGRICULTURAL BIOENERGY CROP

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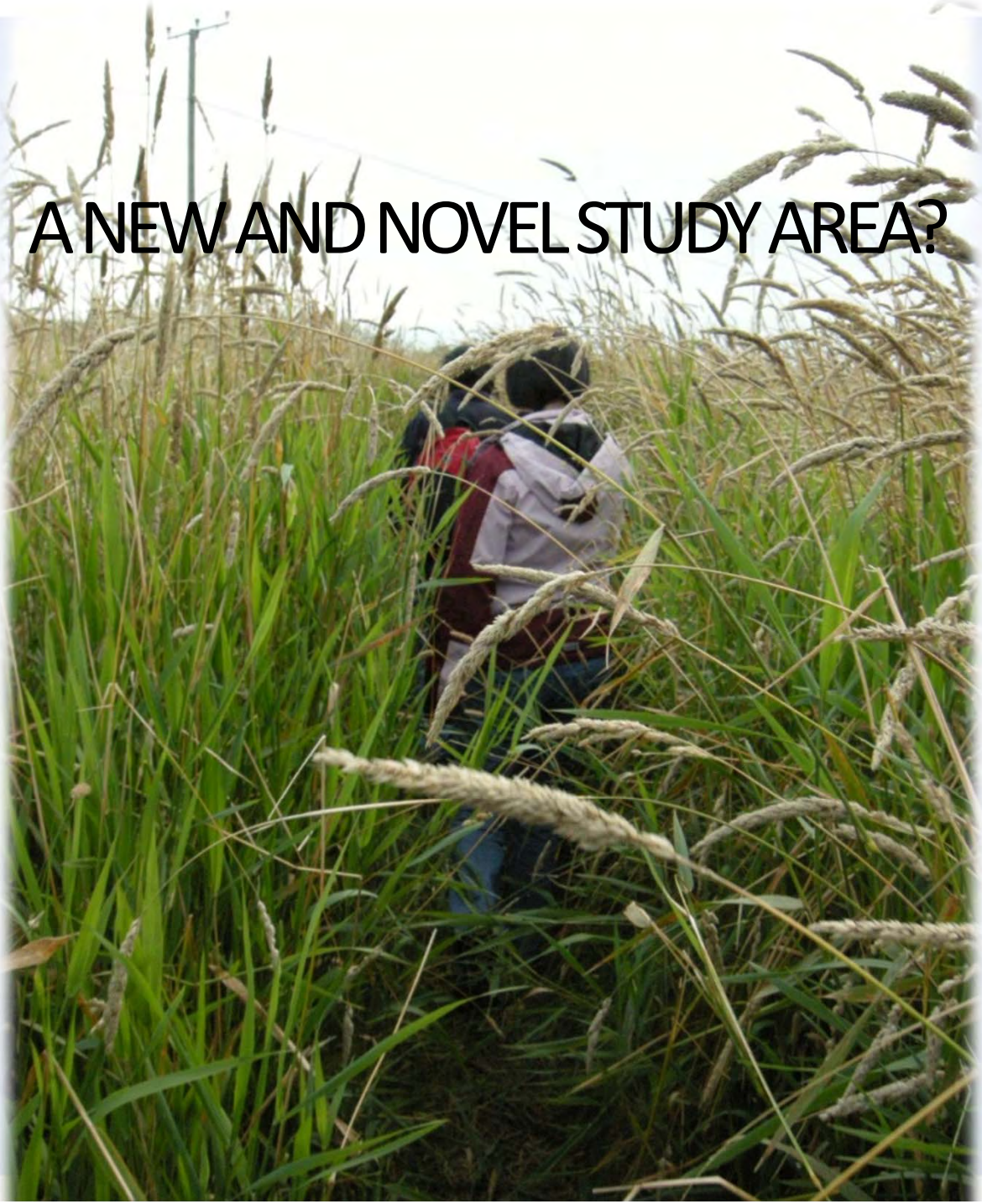
A NEW AND NOVEL STUDY AREA?



SOURCES AND SINKS OF CO

- CO participates in the tropospheric chemistry with O_3 and OH
- Main sources: burning of fossil fuel and biomass and photochemical oxidation of CH_4
- Soils globally considered as a sink for CO due to microbial oxidation processes
- CO exchange is a sum of CO consumption and production processes
- Production via abiotic photochemical and thermal degradation
- Biological CO production poorly understood

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FILLING THE GAPS IN THE KNOWLEDGE?

- Studies mainly focused in arid or semiarid environments, and tropical and subtropical areas
- Only little know of CO flux dynamics in boreal and arctic regions
- Long-term continuous data series do not exist, studies mainly conducted by soil enclosure methods or in the laboratory focusing on processes

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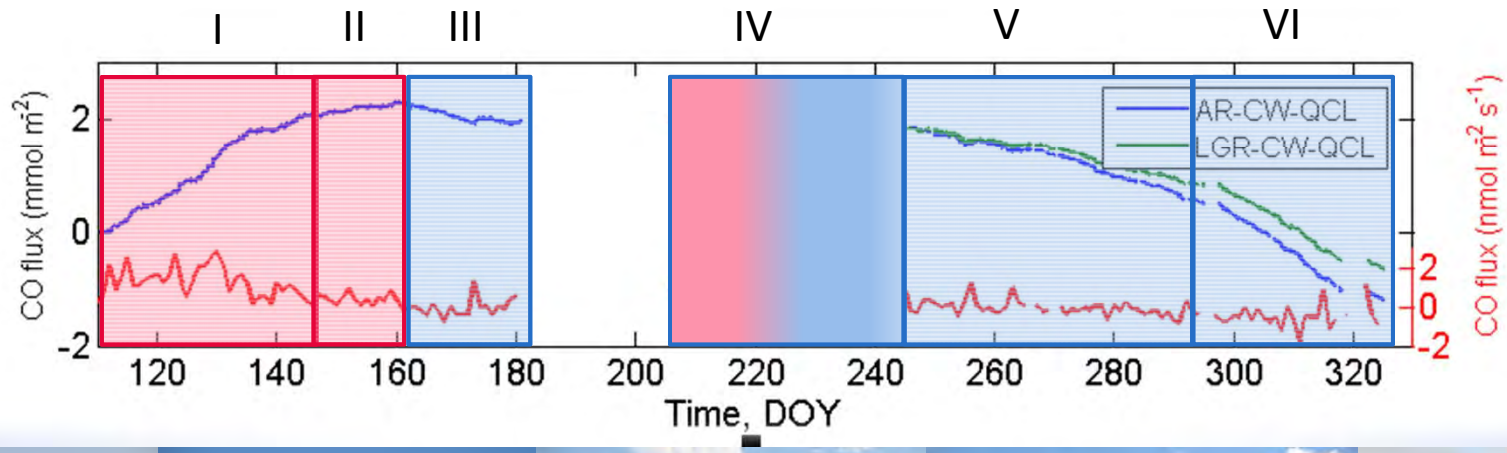
MEASUREMENTS: REED CANARY GRASS CULTIVATION FOR BIOENERGY USE

- RCG 6.3 ha
- Eddy covariance tower for CO_2, N_2O, CO and energy exchange
- Two QCL analyzers (AR-CW-QCL, LGR-CW-QCL)
- Measurements during 4-11/2011

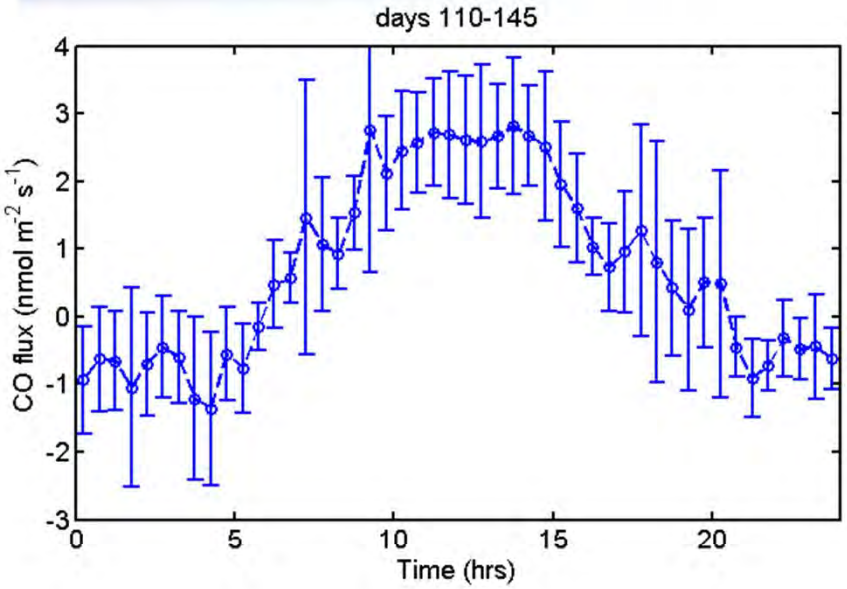
Intercomparison of fast response N_2O gas analyzers, see Rannik et al., 2015, BG

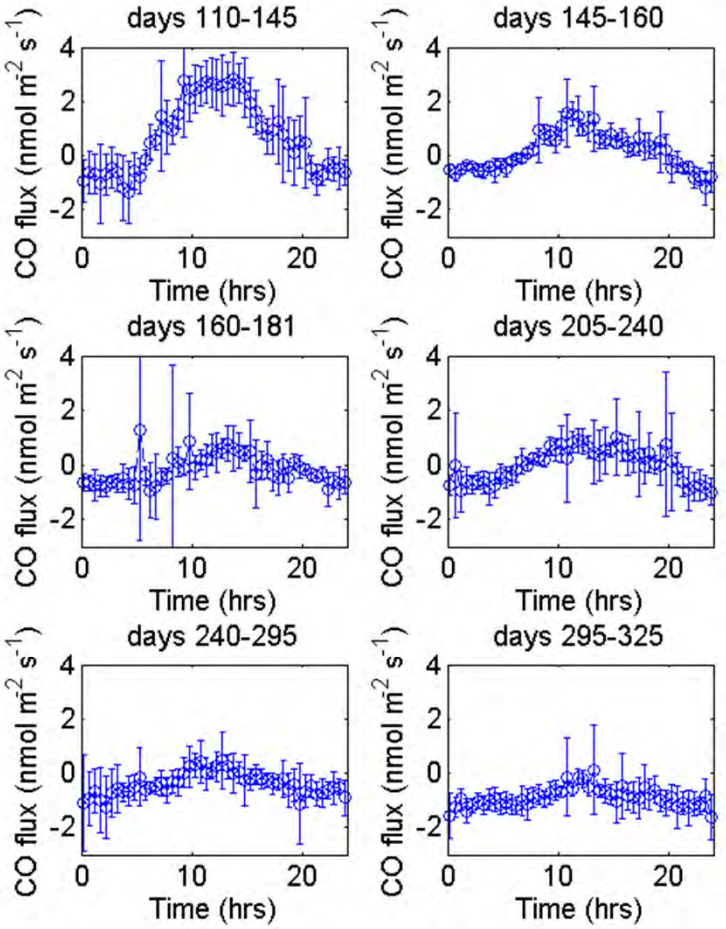
SEASONAL CO FLUXES

	daytime (h_{sun}>0)		nighttime (h_{sun}<0)		day & night	
Period	mean	median	mean	median	mean	median
days 110-145	1.26	0.87	-0.62	-0.54	0.69	0.25



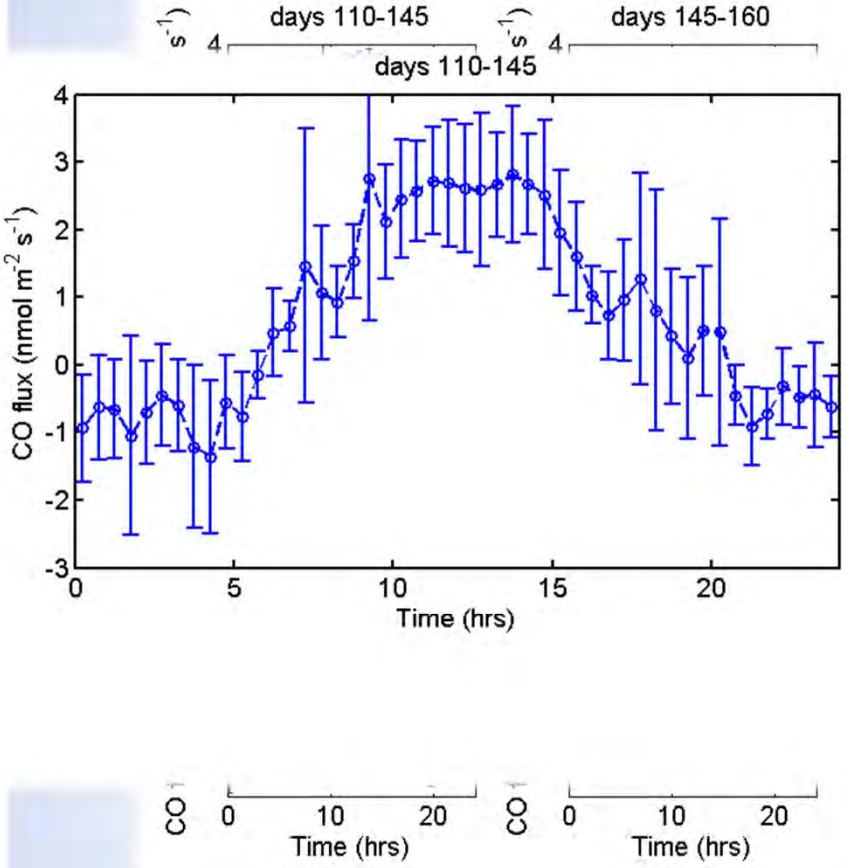
DIURNAL CO FLUXES

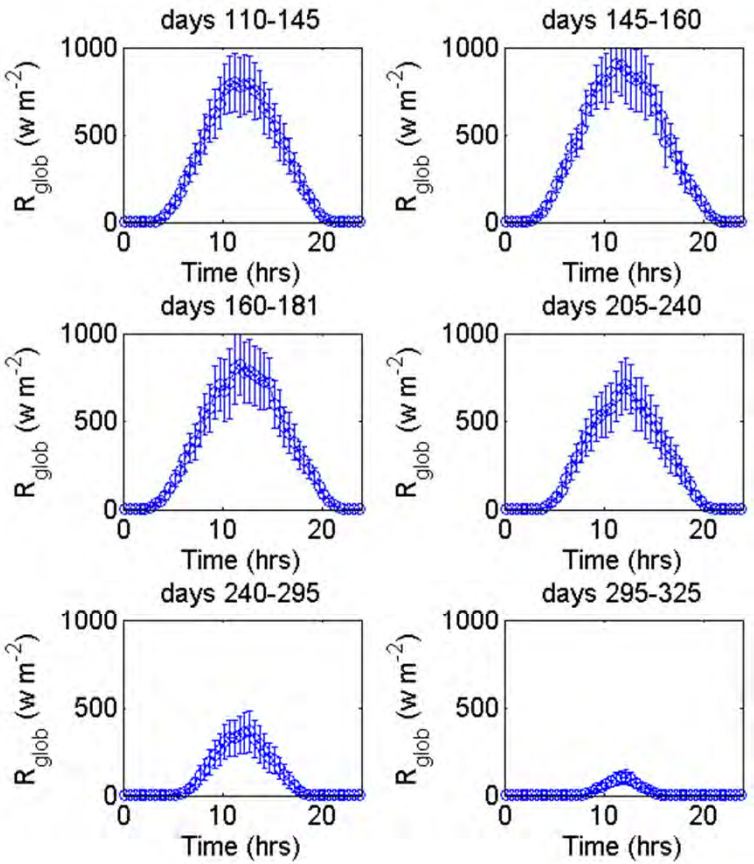


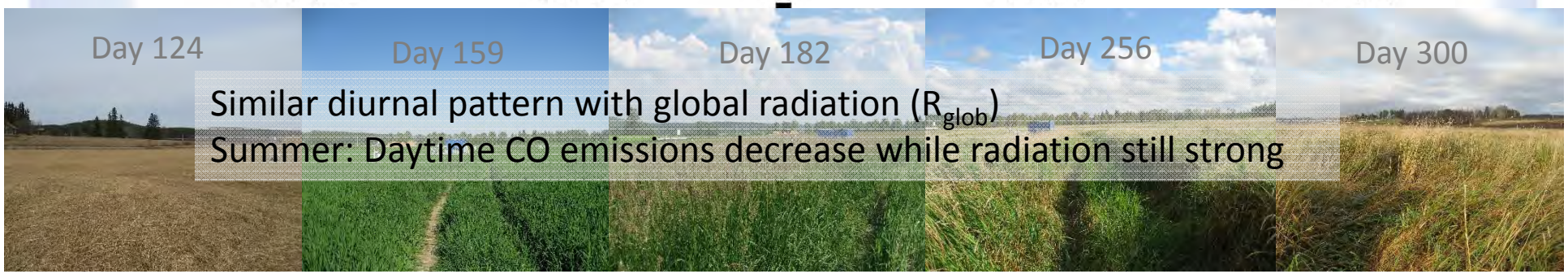


Highest emissions in the spring during a time when crop has not developed.

RELATIONSHIP WITH RADIATION



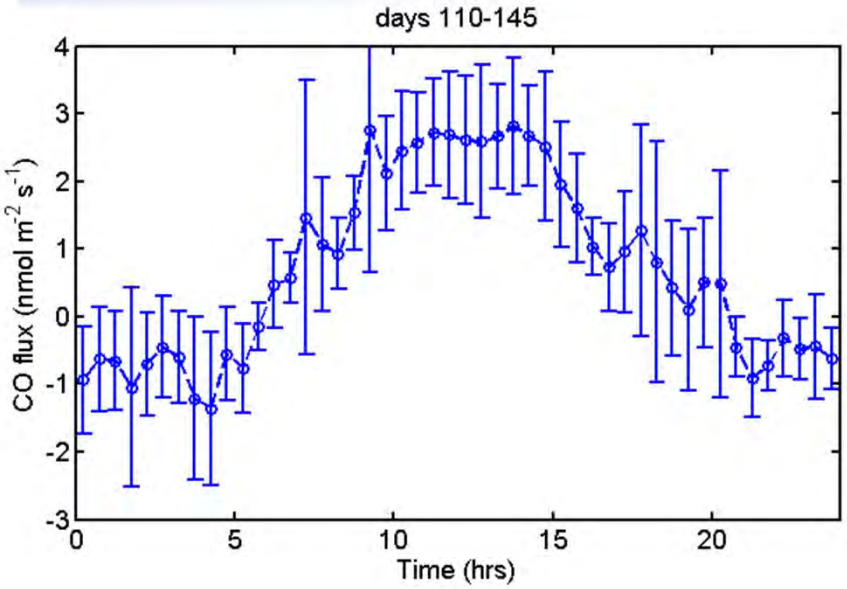


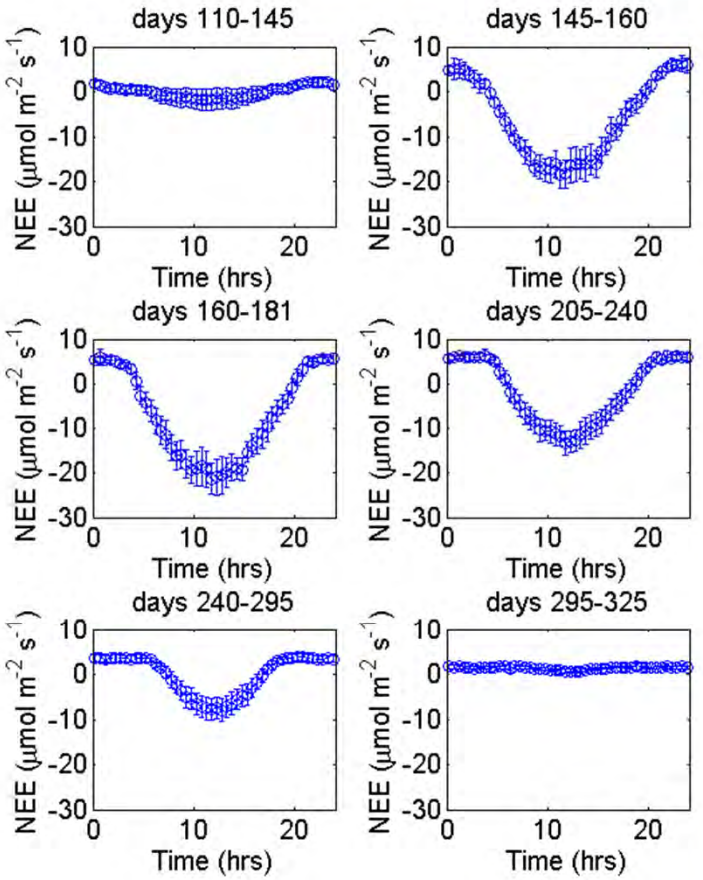


Similar diurnal pattern with global radiation (R_{glob})

Summer: Daytime CO emissions decrease while radiation still strong

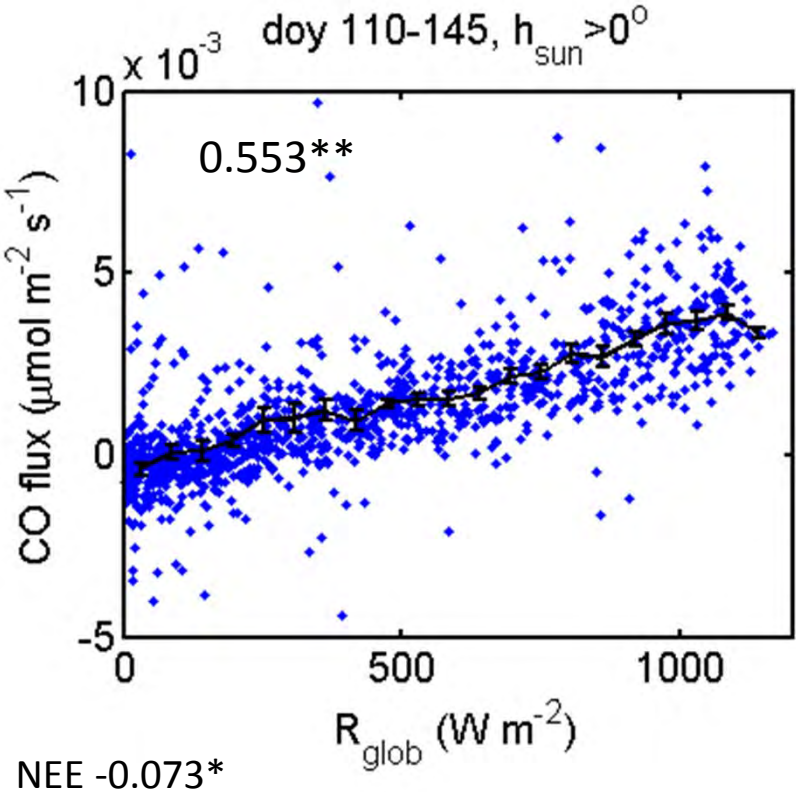
RELATIONSHIP WITH NEE



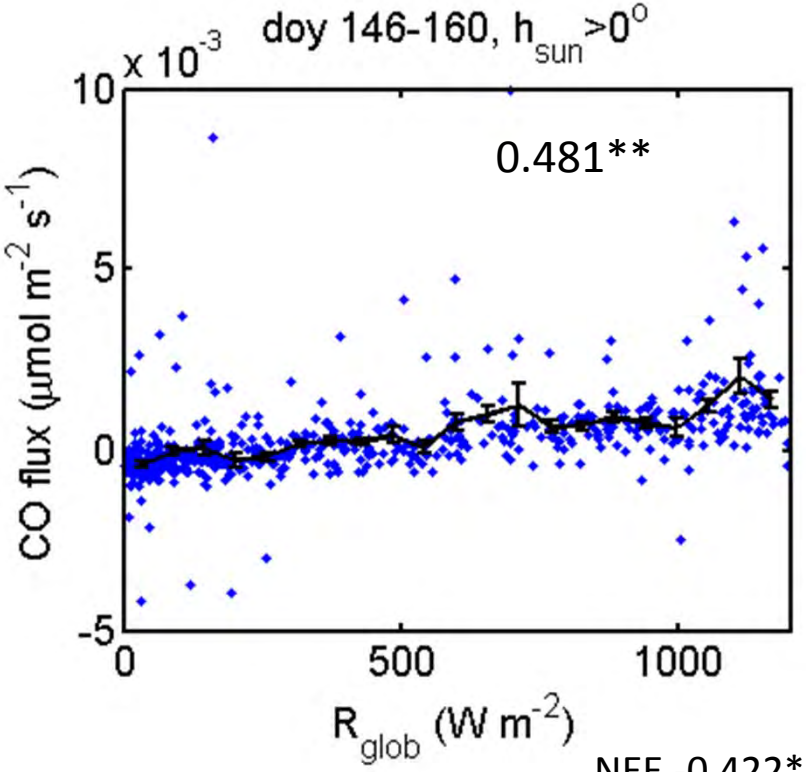


Spring daytime CO emissions high while NEE still negligible

DAYTIME CO FLUXES DRIVEN BY RADIATION



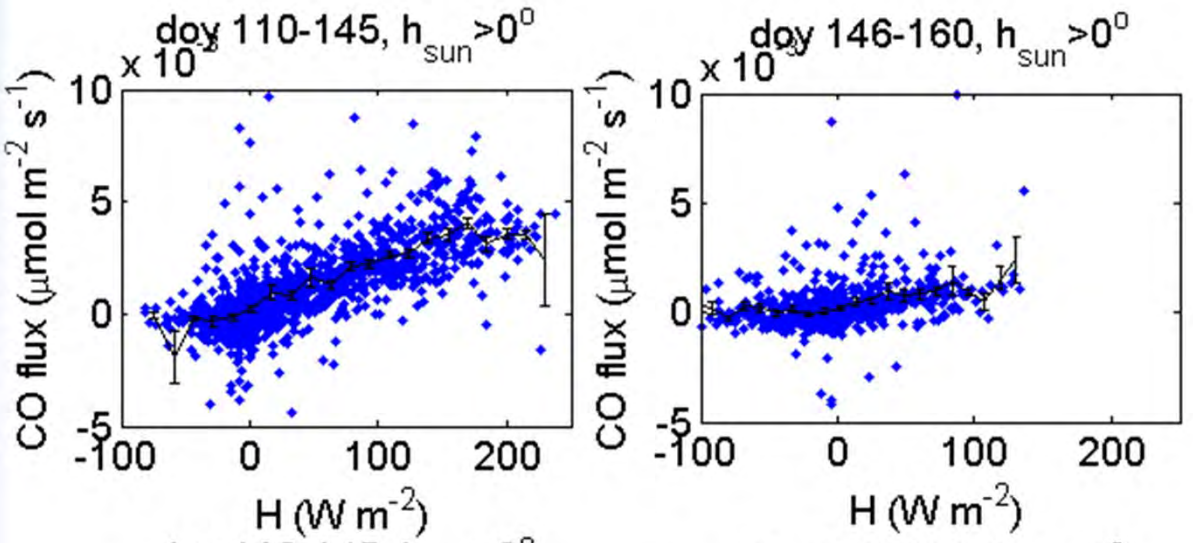
NEE -0.073*
H 0.550**
LE 0.246**
G 0.429**
T_{air} 0.280**



NEE -0.422**
RESP 0.246**
H 0.314**
LE 0.377**
G 0.422**
T_{air} 0.322**

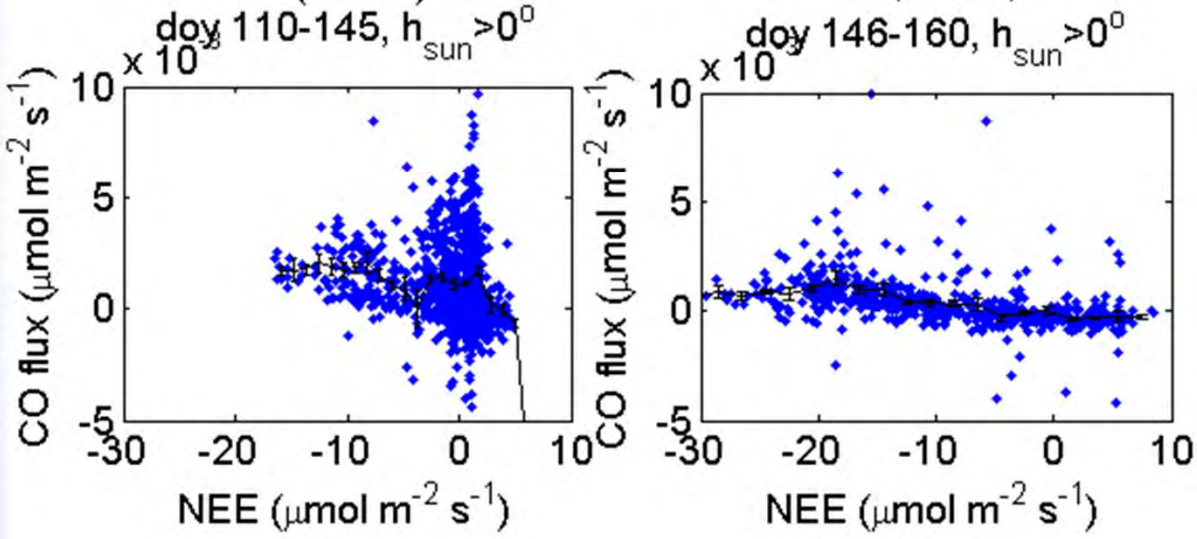
DAYTIME CO FLUXES: CONNECTED TO NEE?

0.550**



0.314**

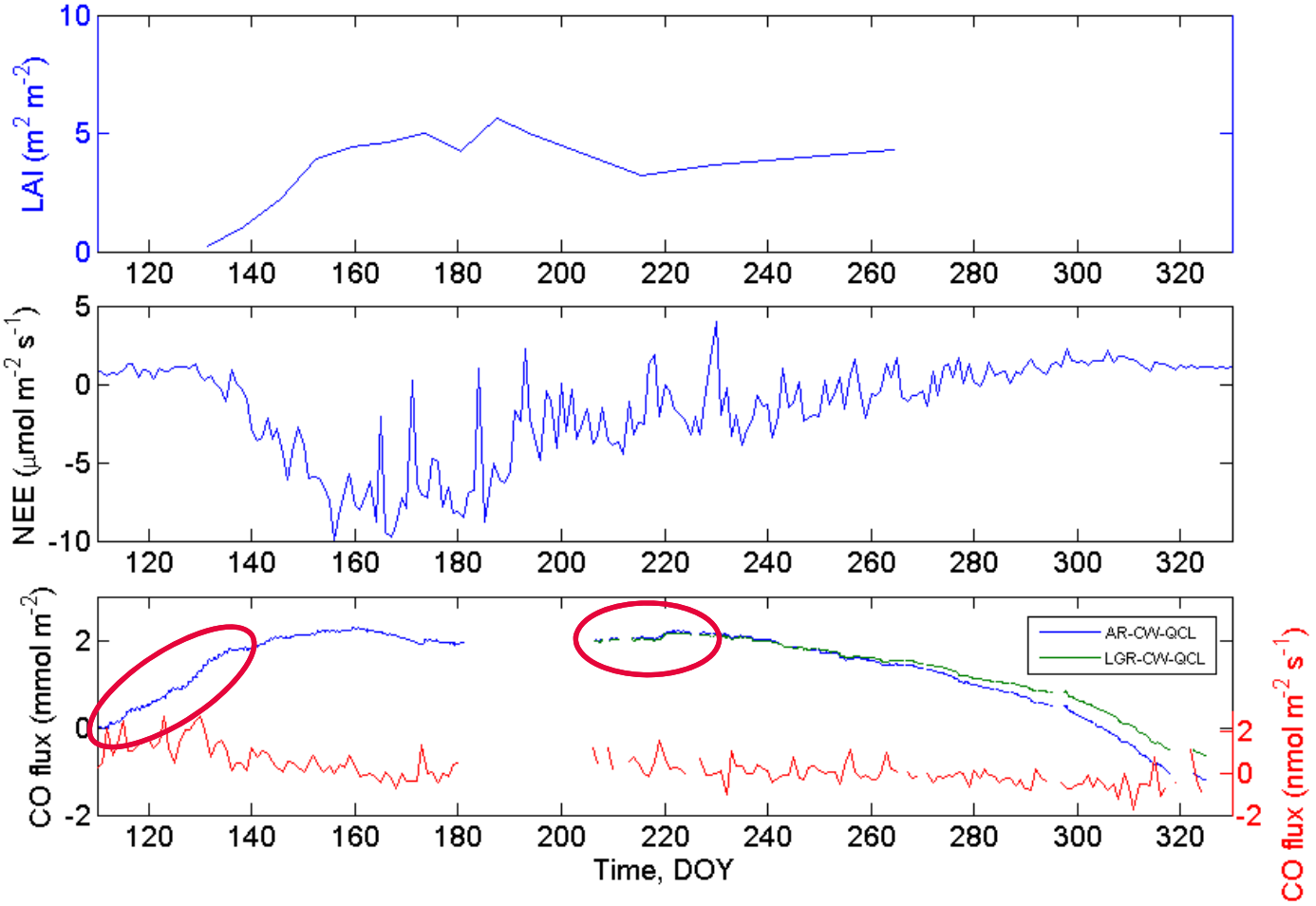
-0.073*



-0.422**

ARE CO FLUXES FULLY DRIVEN BY ABIOTIC PROCESSES?

Careful analysis of specific emission events outside spring



TO CONCLUDE

- More long-term flux data series are needed!
- Diurnal CO fluxes are dominated by daytime emissions
- Emissions decrease with the growing crop
- Near-constant background CO uptake
- Emissions driven by radiation and hence most probably abiotic

THANKS FOR YOUR ATTENTION!

Luke
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ICOS
INTEGRATED CARBON OBSERVATION SYSTEM

InGOS
Integrated non-CO_2 Greenhouse gas Observing System