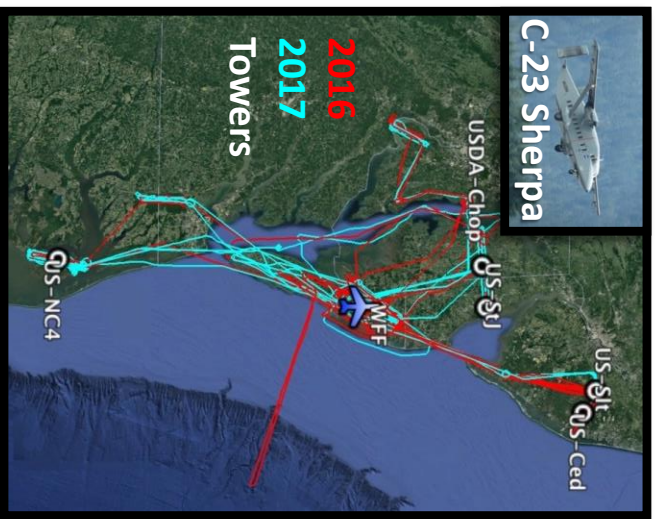# The Carbon Airborne Flux Experiment (CARAFE)
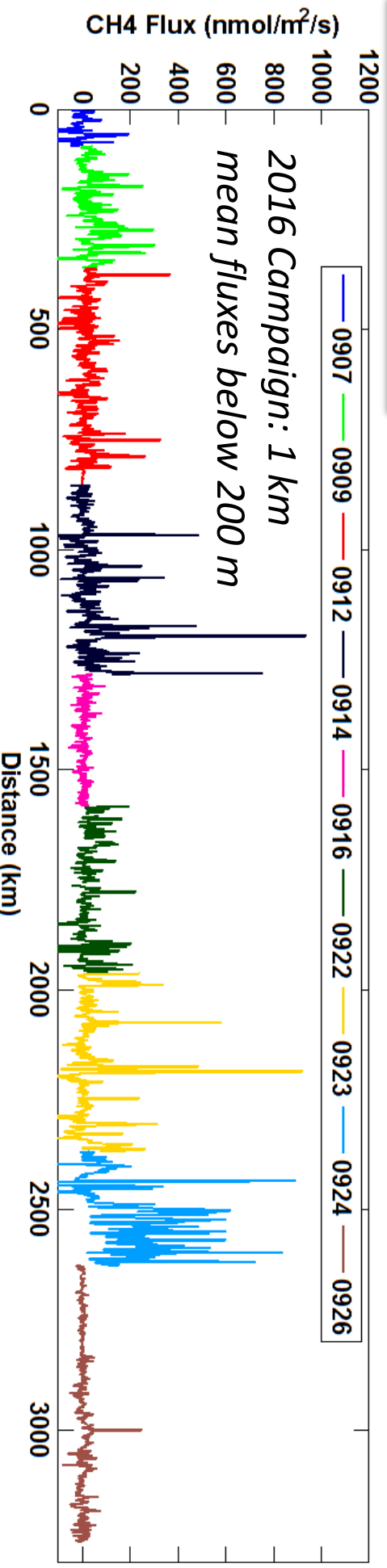
CARAFE directly quantifies surface fluxes via airborne eddy covariance. Key components include 3D winds/met (LaRC/Thornhill & Barrick), H_2O (LaRC/Diskin), greenhouse gases (GSFC/Hanisco & Kawa), and data acquisition (ARC/Sorenson).
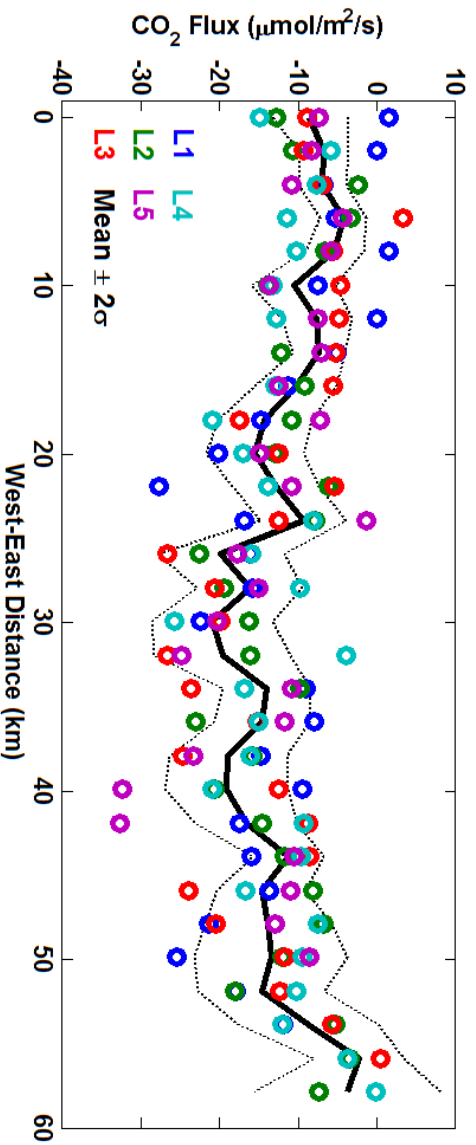

C-23 Sherpa

2016
2017
Towers

USDA-Chop
US-StJ
WFF
US-NC4
US-Slt
US-Ced

- Two 40 h missions in September 2016, May 2017
- ~7000 km^2 of surface fluxes for CO_2, CH_4, H_2O, heat
- Forests, wetlands, crops, water
- 5 flux towers, 50+ overpasses
- Data archived at LaRC:

https://www-air.larc.nasa.gov/missions/carafe/index.html

CH4 Flux (nmol/m²/s)

2016 Campaign: 1 km
mean fluxes below 200 m

Distance (km)

— 0907
— 0909
— 0912
— 0914
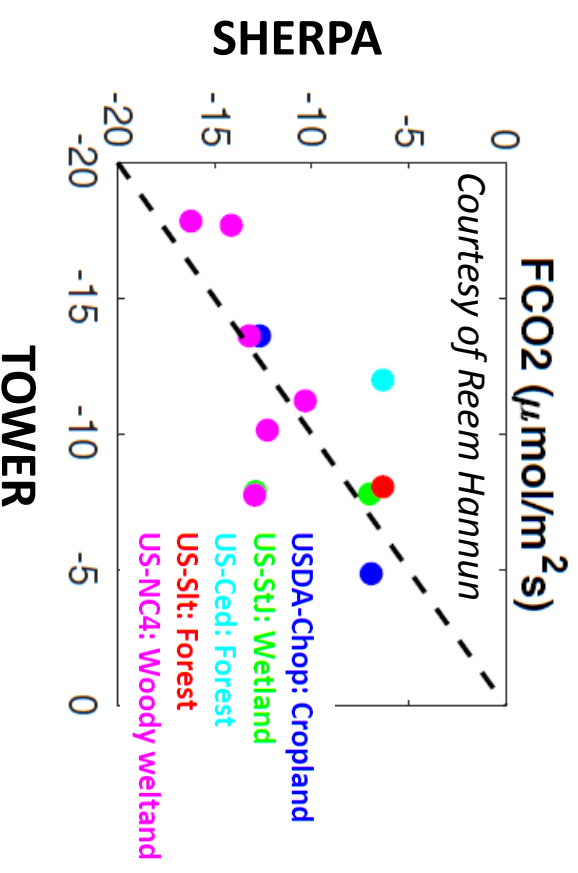— 0916
— 0922
— 0923
— 0924
— 0926

Methods Paper and Ongoing Work

Wolfe et al. (2018) describes the CARAFE payload, flux calculations, and uncertainty analysis. This CMS-funded dataset is novel, as is our effort to make it accessible to the community in a user-friendly format with rigorous uncertainty estimates.

Wavelet transforms resolve fluxes at ~km scales with reasonable precision and reproducibility

Ongoing work includes tower comparisons and evaluation of model products related to wetland CH_4 (collaborator B. Poulter) and forest CO_2 (collaborator G. Hurtt)

Wolfe, G. M., Kawa, S. R., Hanisco, T. F., Hannun, R. A., Newman, P. A., Swanson, A., Bailey, S., Barrick, J., Thornhill, K. L., Diskin, G., DiGangi, J., Nowak, J. B., Sorenson, C., Bland, G., Yungel, J. K., Swenson, C. A., 2018: The NASA Carbon Airborne Flux Experiment (CARAFE): instrumentation and methodology, Atmos. Meas. Tech., 11, 1757-1776, doi: 10.5194/amt-11-1757-2018.

CO$_2$ Flux (µmol/m²/s)

West-East Distance (km)

L1 L4
L2 L5
L3 Mean ± 2σ

SHERPA

TOWER

FCO2 (µmol/m²s)

Courtesy of Reem Hannun

USDA-Chop: Cropland
US-StJ: Wetland
US-Ced: Forest
US-Slt: Forest
US-NC4: Woody wetland