

# Flux 101

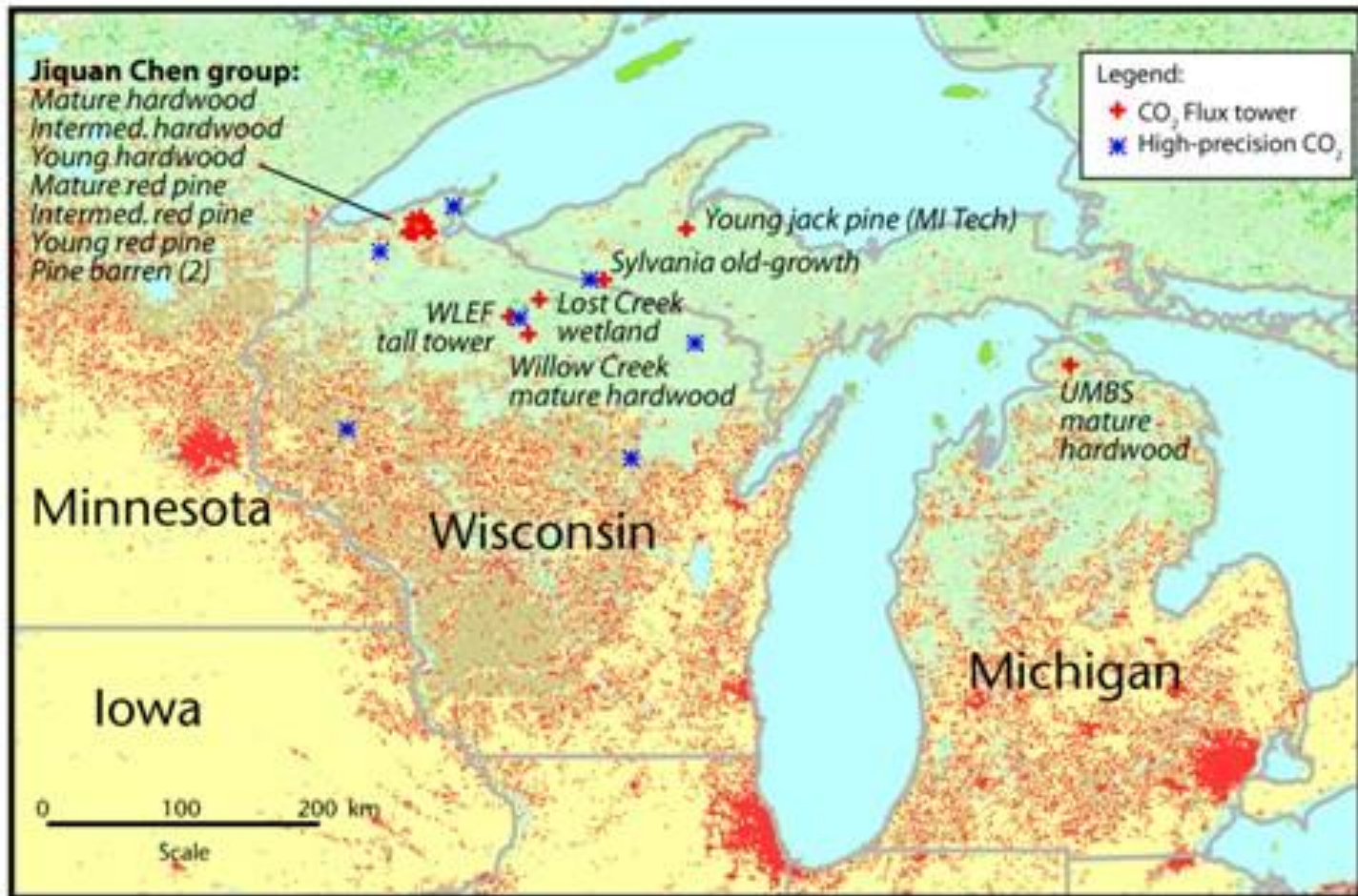


# Conceptual Overview

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- Flux theory
- What you can do with flux data
- Where you can find flux data
  
- In general flux sites measure
  - Carbon, water, energy fluxes
  - Meteorology/environmental conditions
- At one spatial location with high temporal frequency (30 minutes)

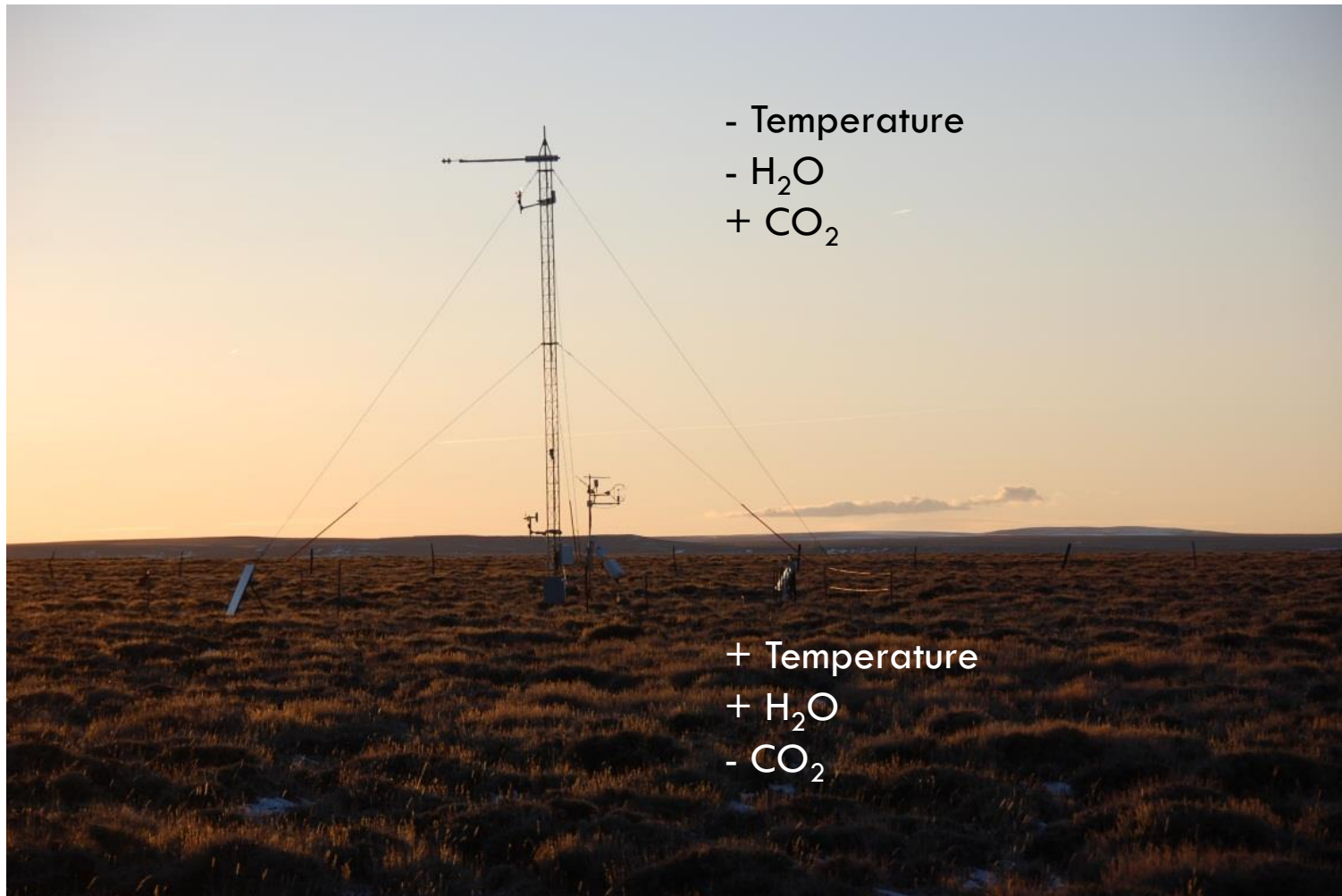
# Eddy Covariance Flux Theory



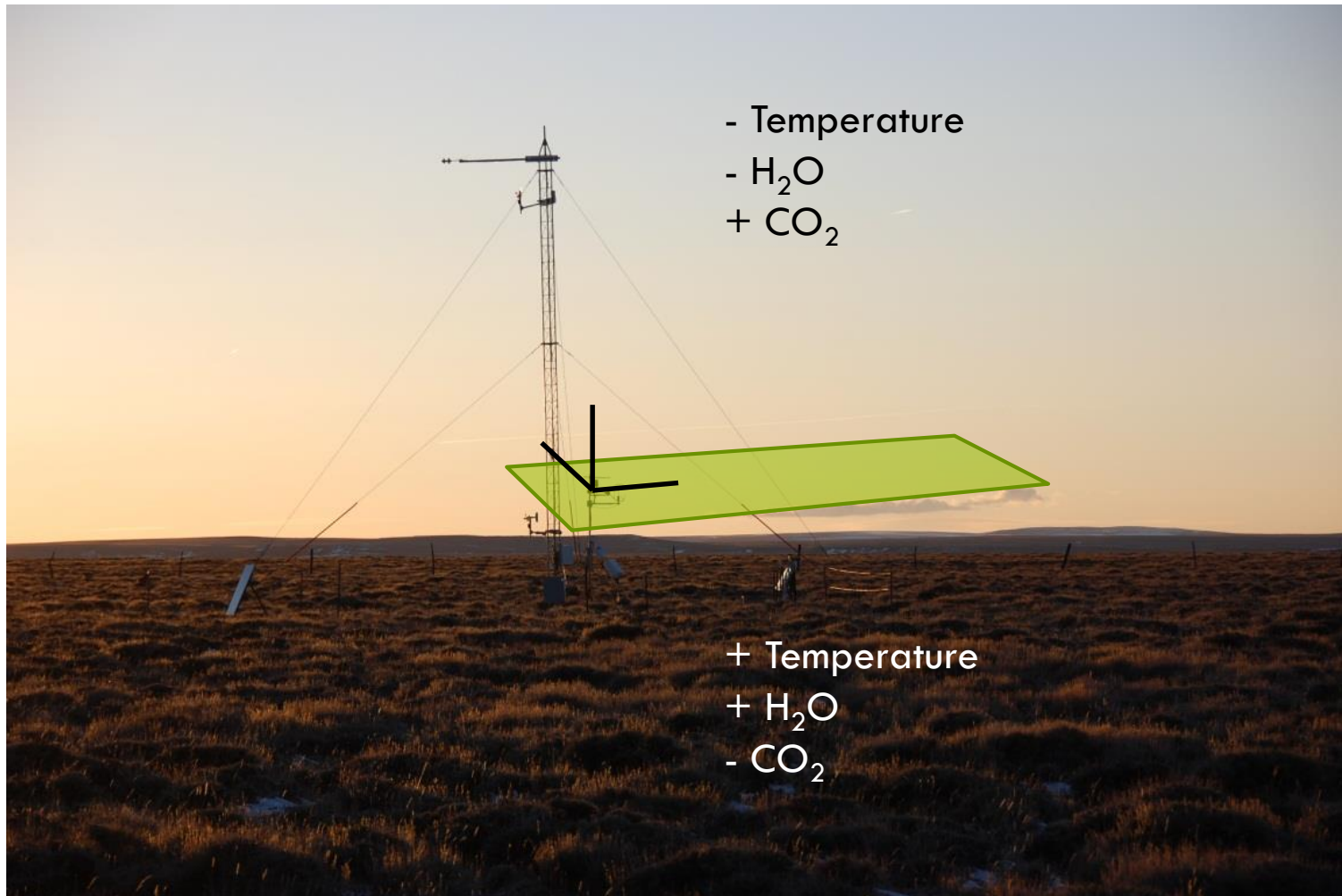
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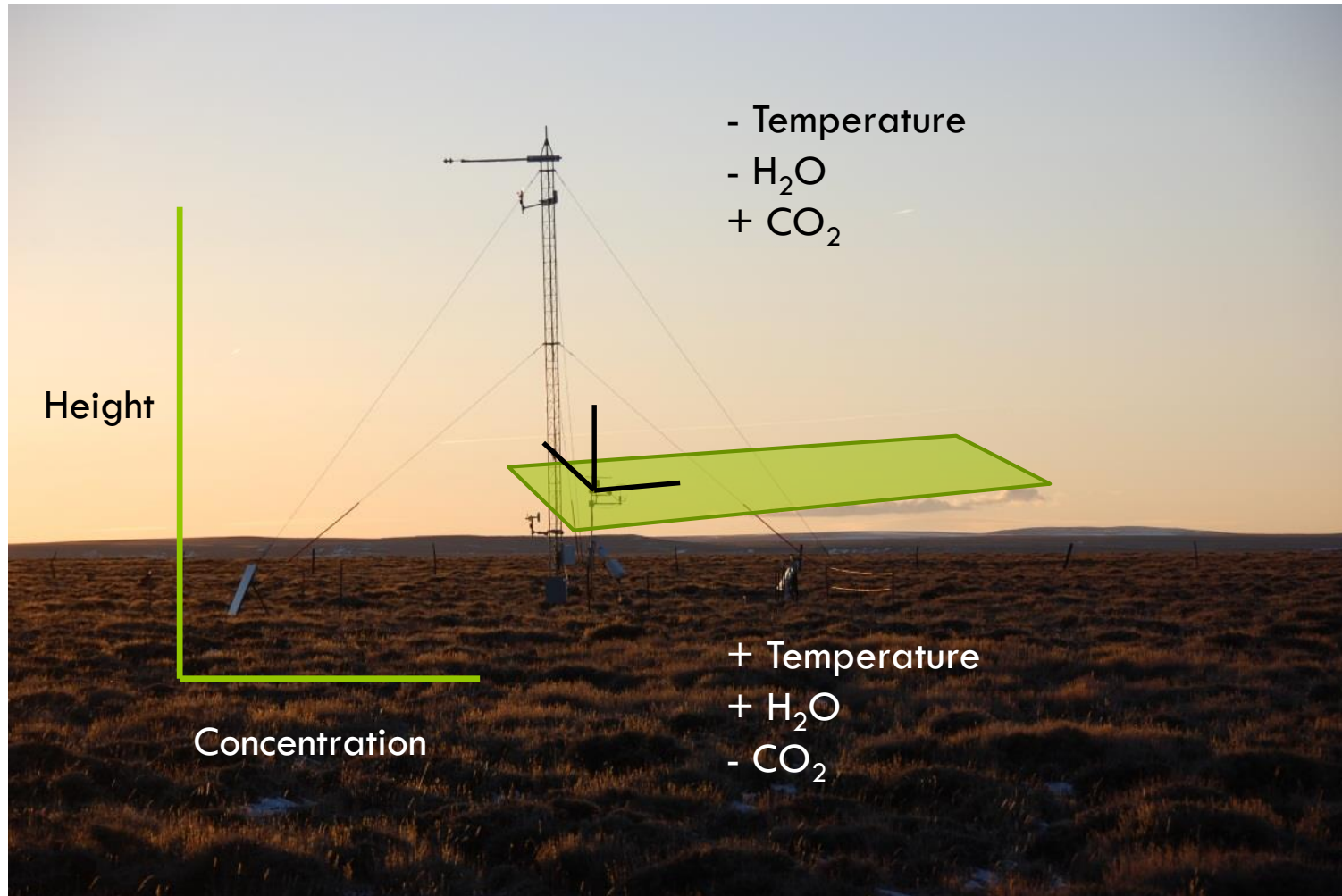
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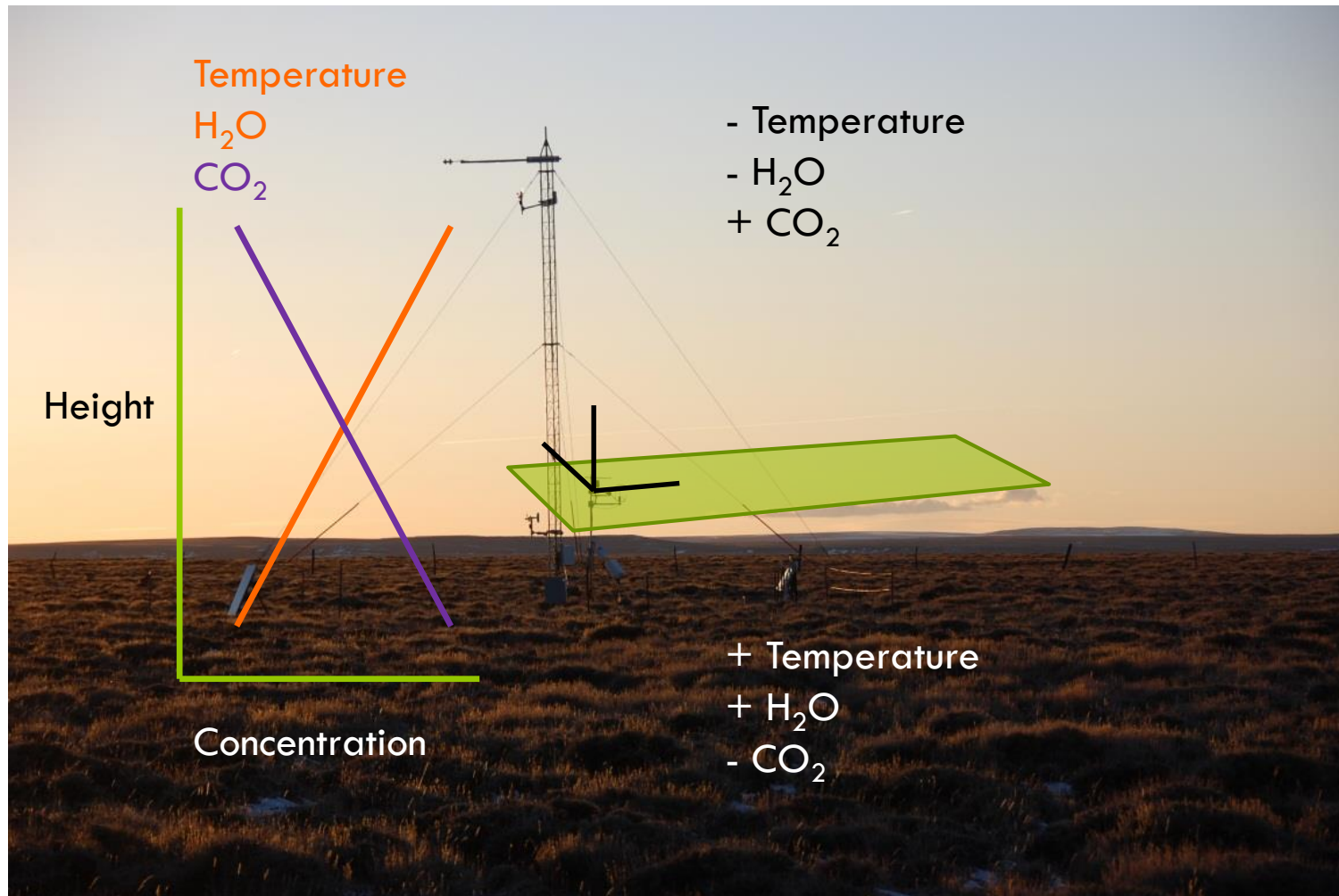
# Eddy Covariance Flux Theory



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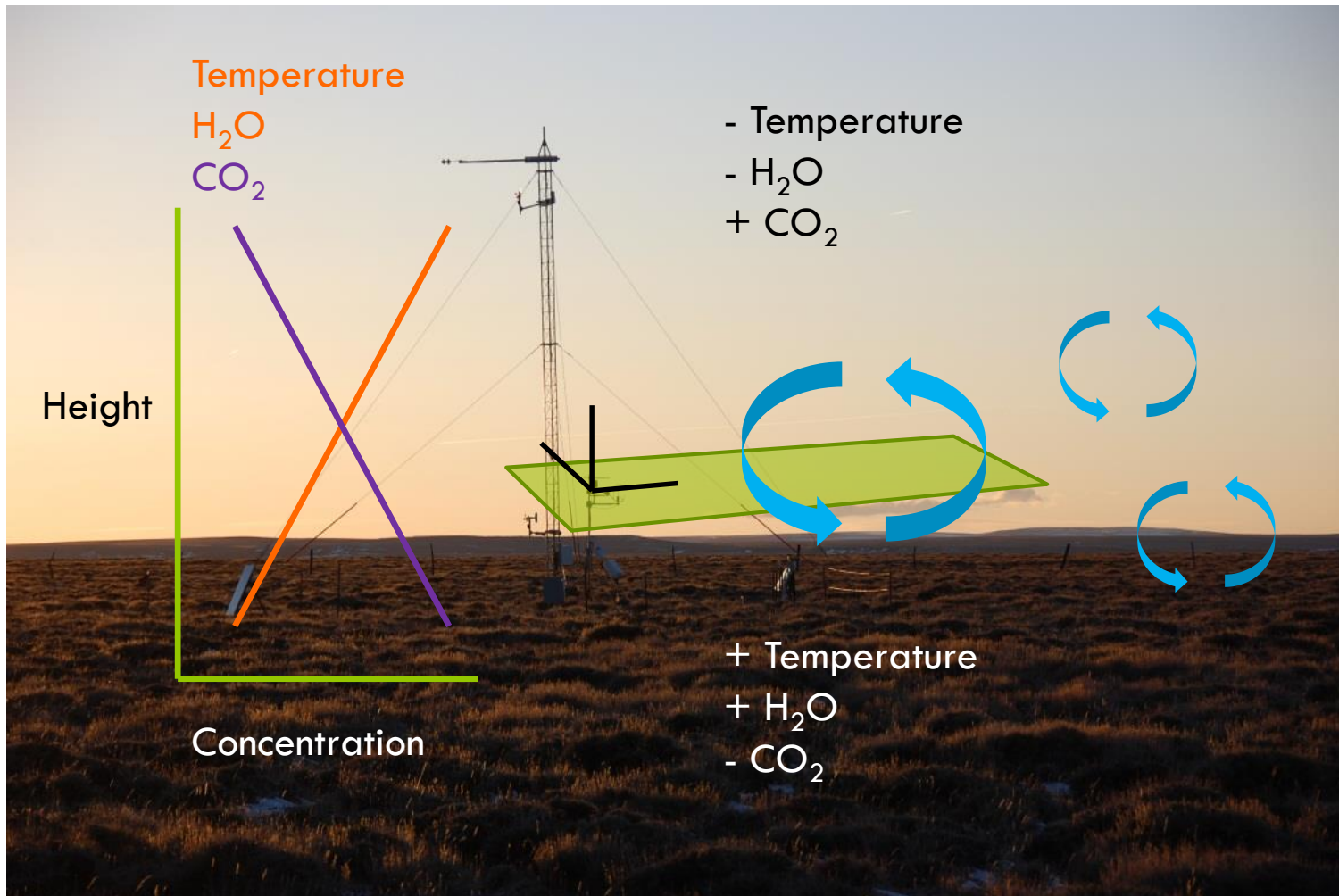


# Eddy Covariance Flux Theory

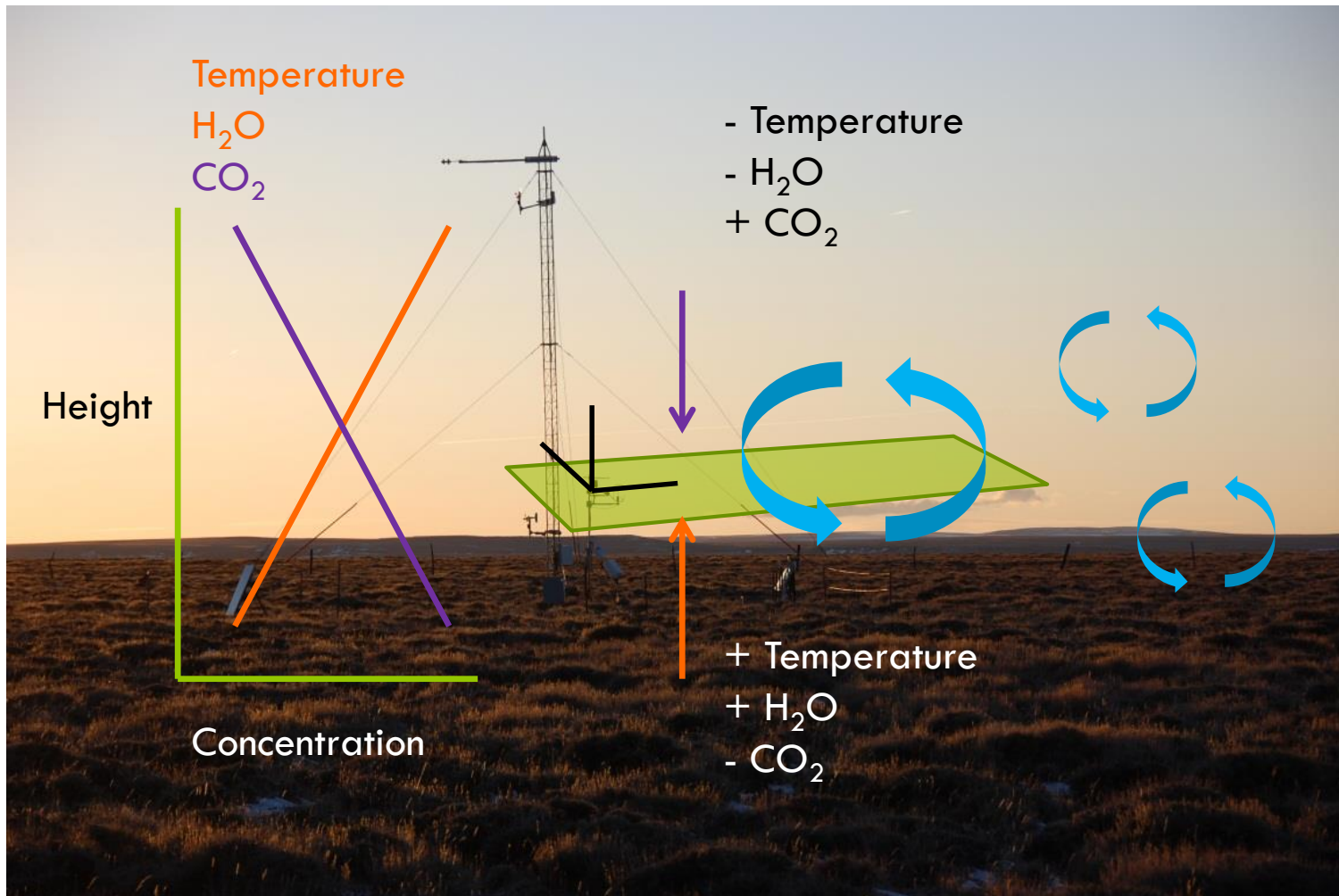




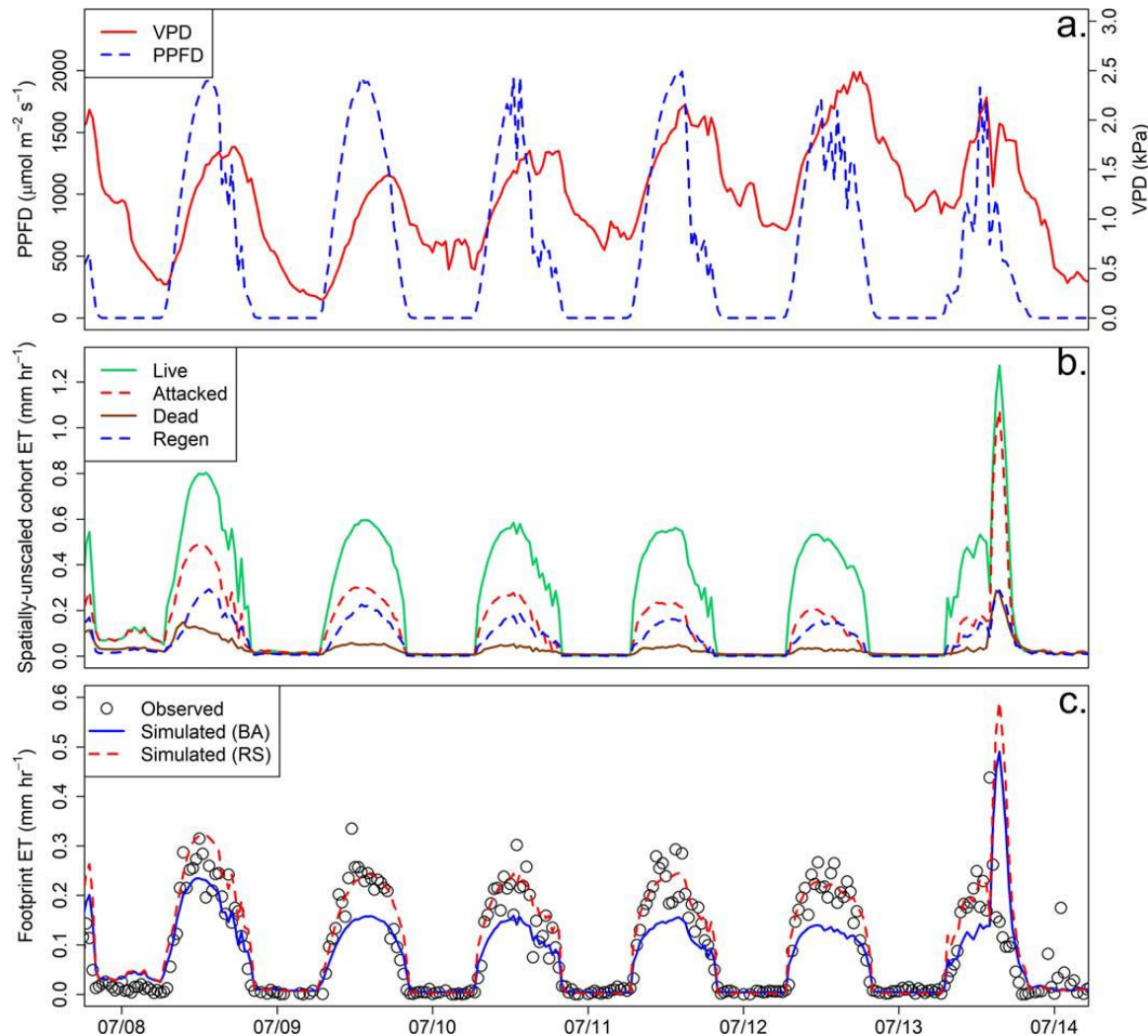
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# Eddy Covariance Flux Theory

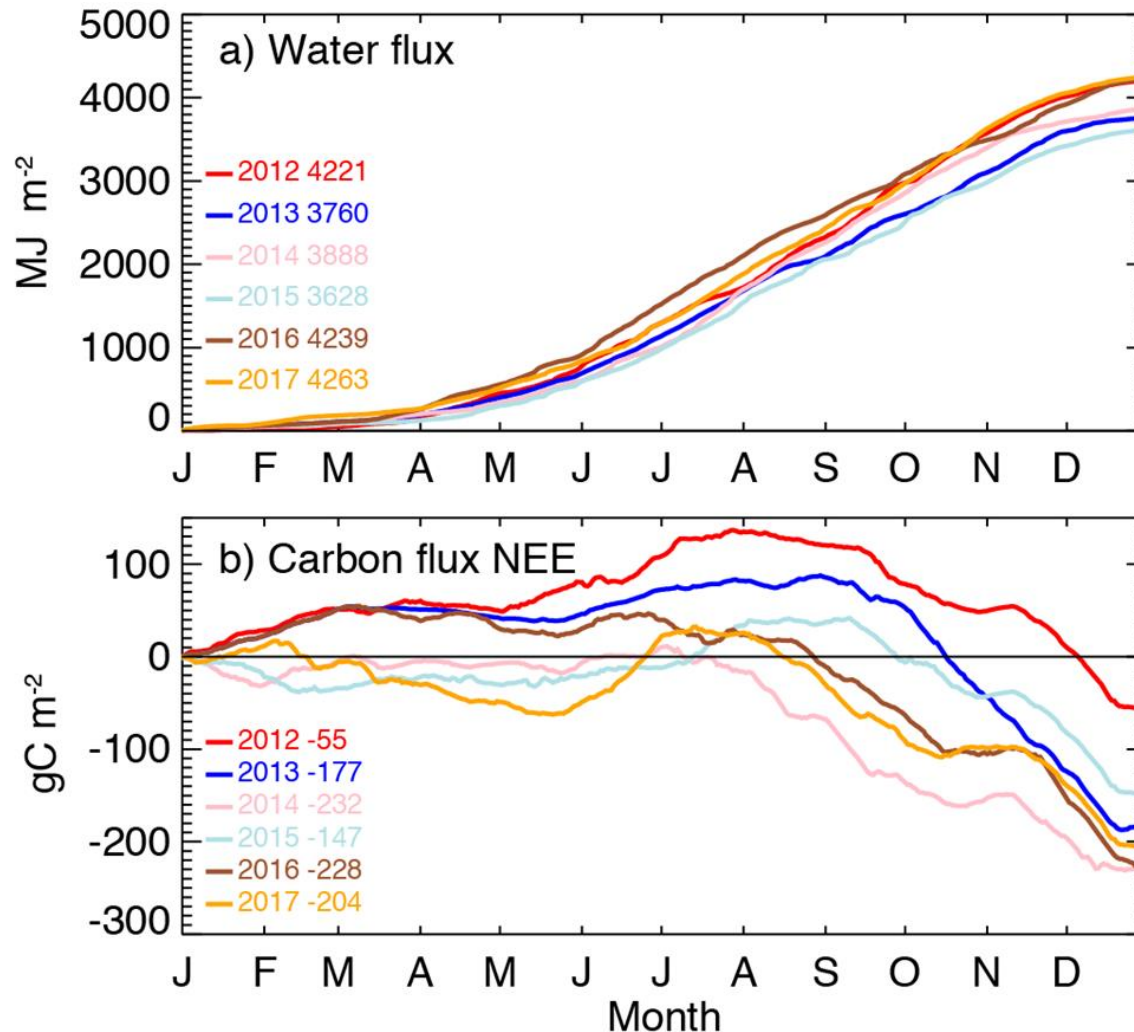


# Using Flux Date



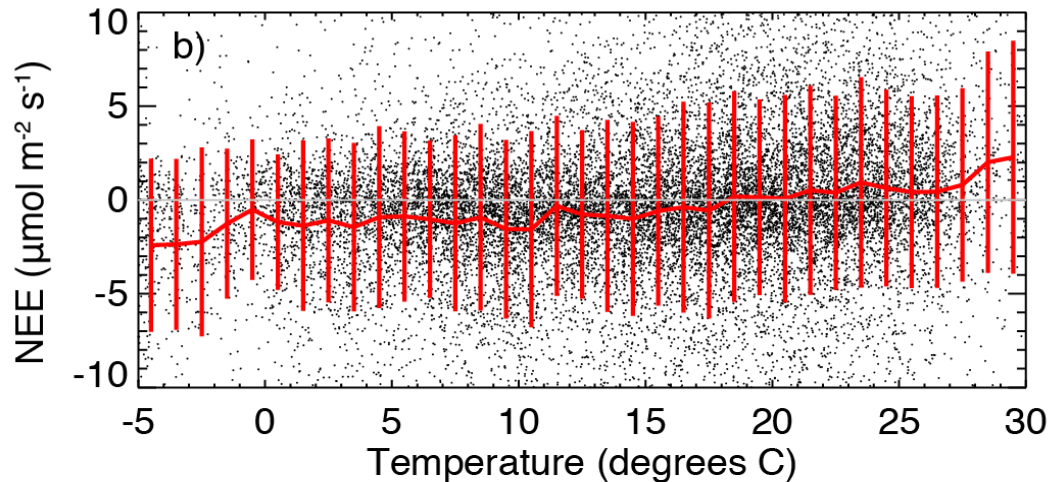
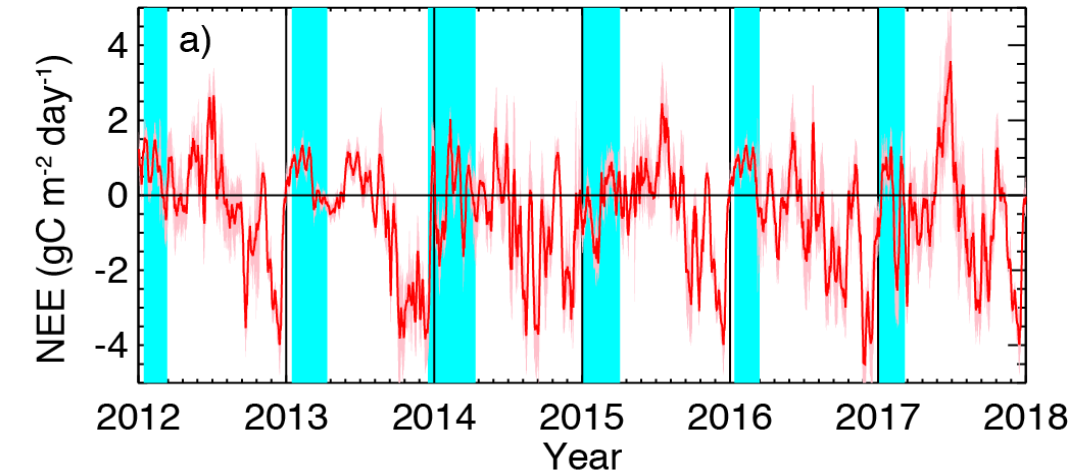
Example time series data set from the 2009 study period, including (a) photosynthetically photon flux density (PPFD) and vapor pressure deficit (VPD), (b) spatially unscaled cohort ET flux estimates, and c) simulated ET using both spatial scaling methods with observed eddy covariance estimates.

# Using Flux Date



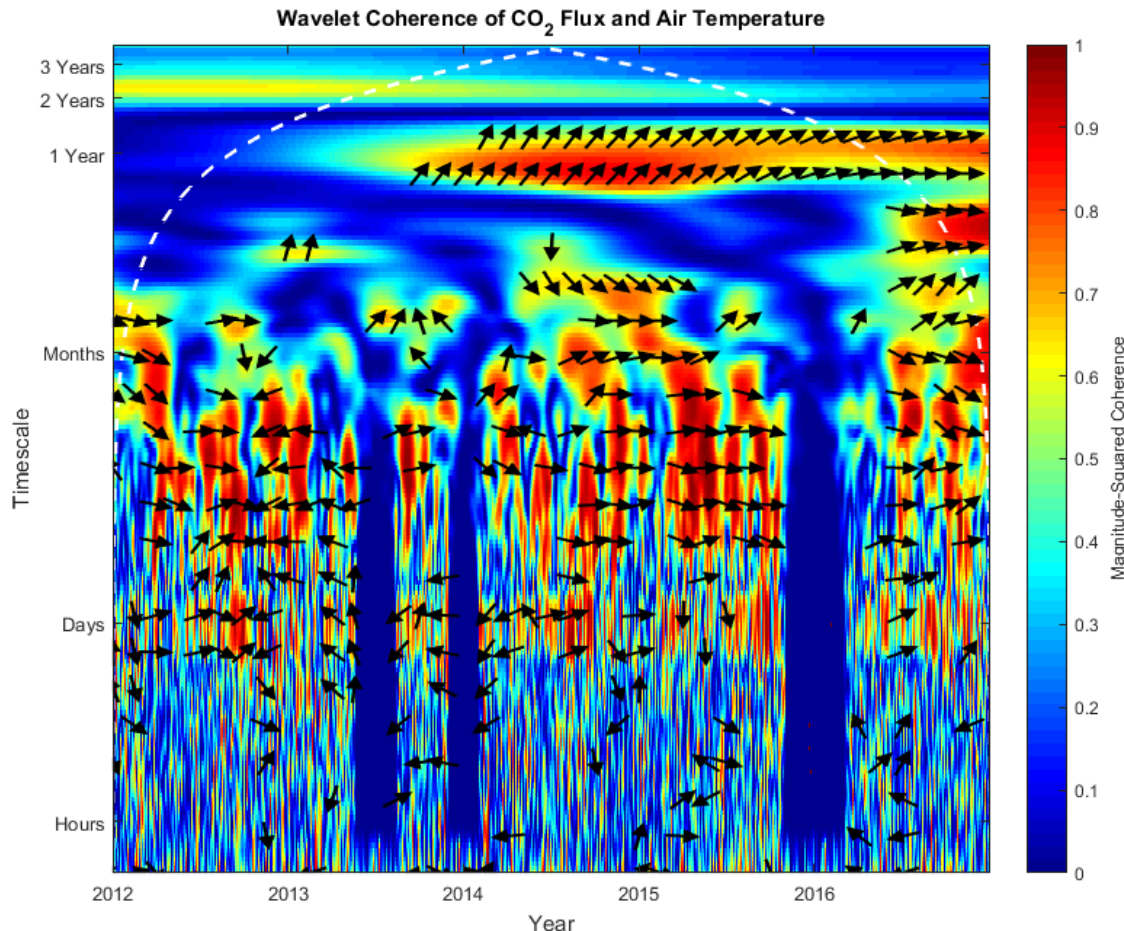
Cumulative annual Lake Mendota sums of water (a) and  $\text{CO}_2$  (b) flux for 2012-2017 with annual sums noted.

# Using Flux Date



a) Daily gap-filled NEE of carbon dioxide from 2012-2017, blue periods indicating periods of ice overage, with the average non-missing day 71% gap-filled. Positive NEE indicated carbon flux from the lake to the atmosphere. b) Red shows one degree bin averaged NEE and standard deviation

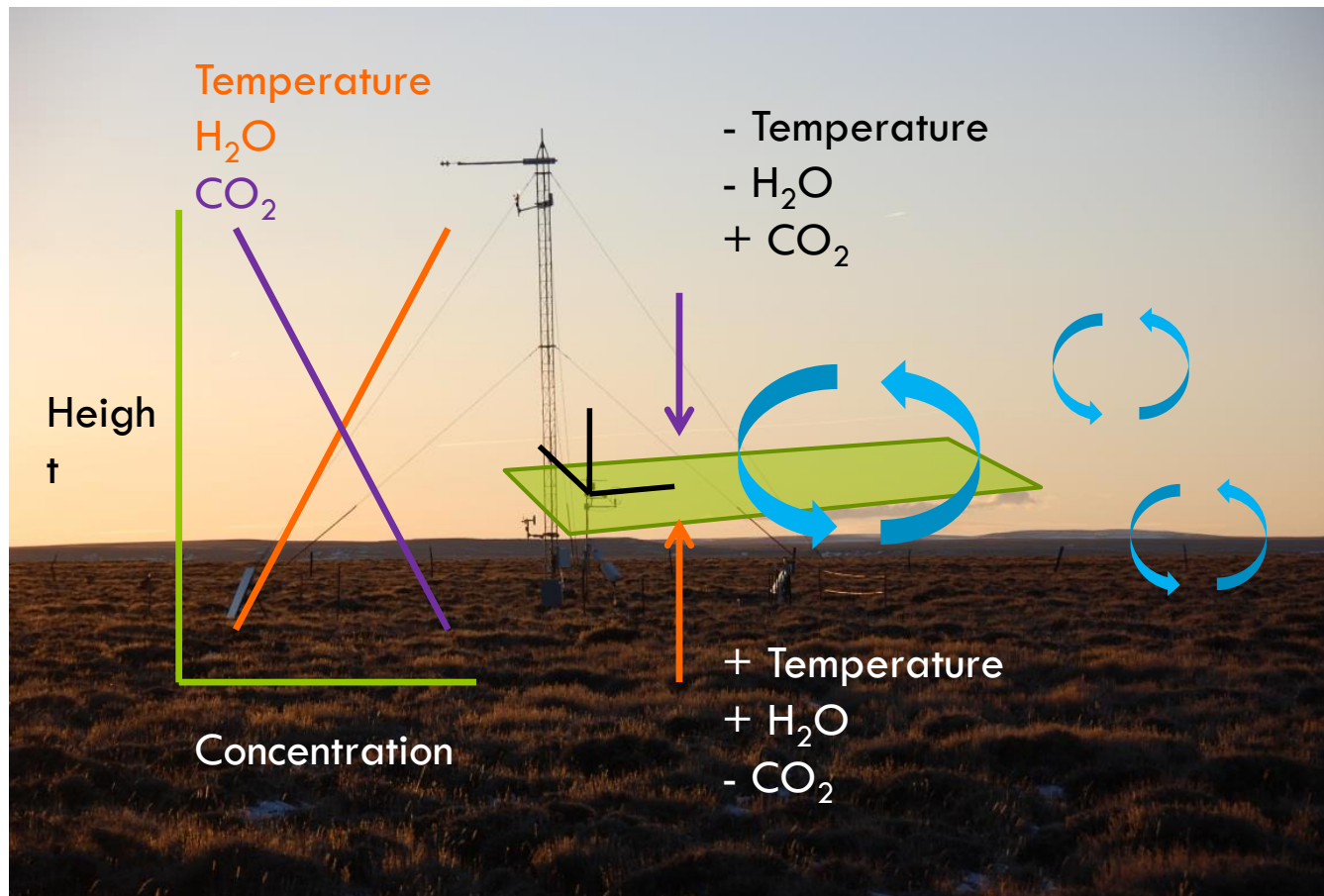
# Using Flux Date



Morlet wavelet coherence plot of net CO<sub>2</sub> flux and air temperature for 2012-2016 with Jan 1<sup>st</sup> of each year labeled. Phase arrows in black represent the time lag between CO<sub>2</sub> flux and air temperature with right facing arrows showing in-phase time series, left facing arrows anti-phase time series, upward facing arrows shows temperature leading flux while a downward facing arrow shows flux leading temperature. Arrows only shown where the coherence is greater than or equal to 0.7. Cone of influence shown in white.

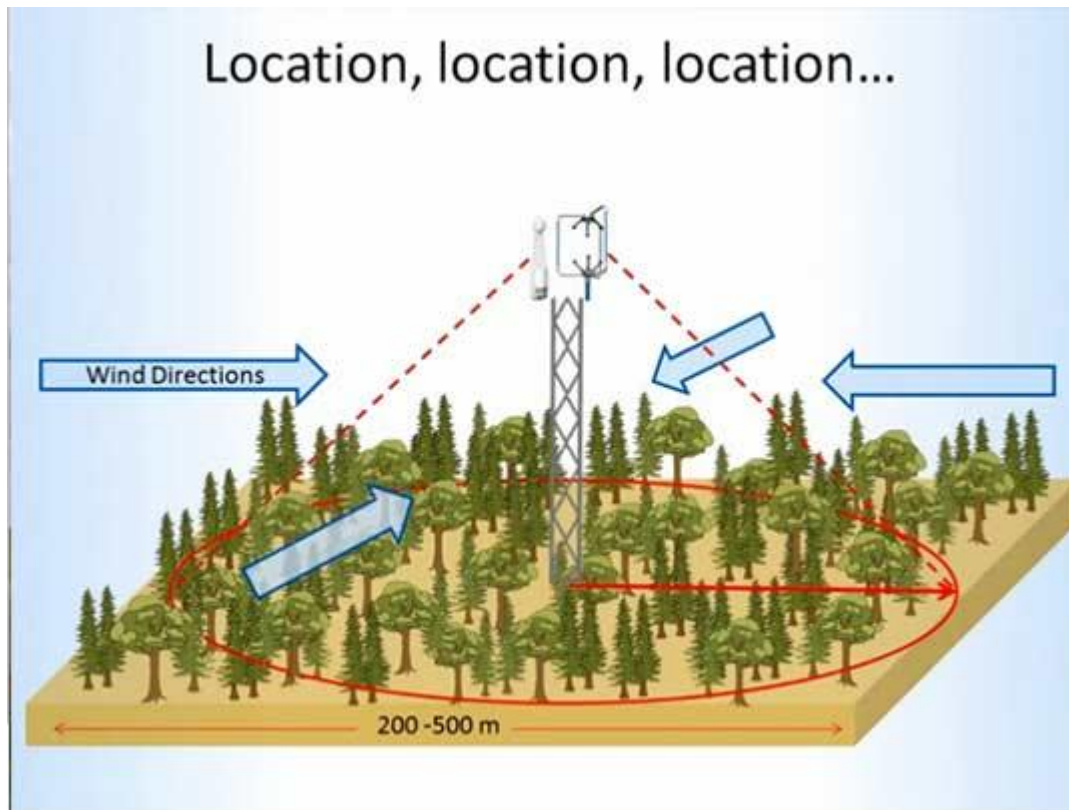
# Flux Date, Things To Keep In Mind

## Assumption 1: Turbulent Atmosphere



# Flux Date, Things To Keep In Mind

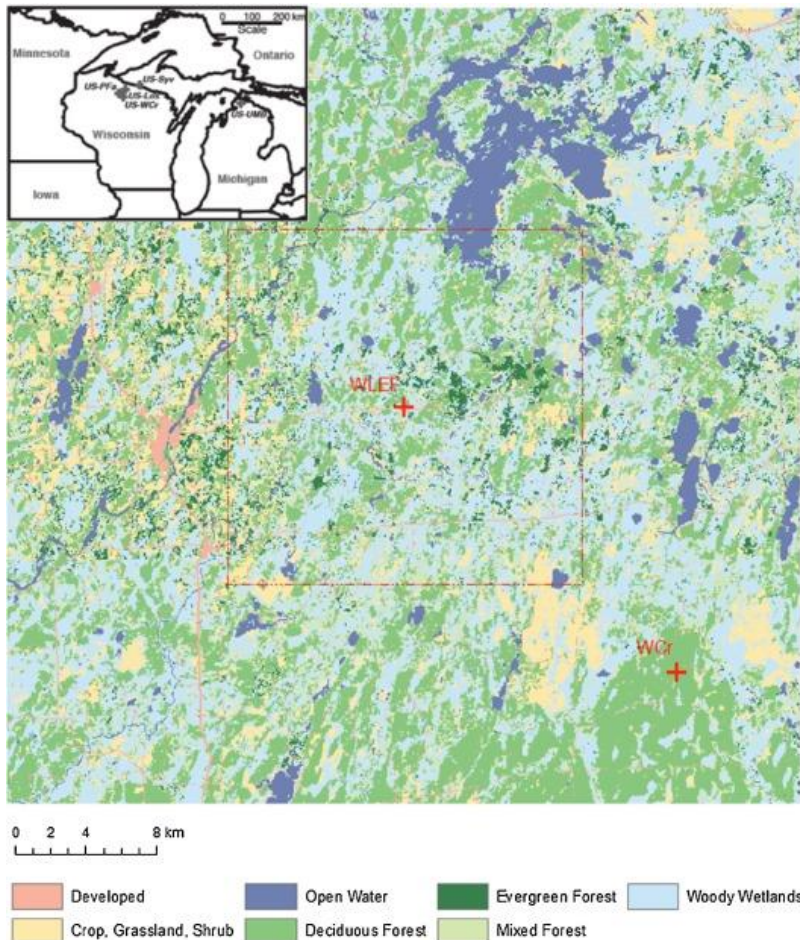
## Assumption 2: Footprint





# Flux Date, Things To Keep In Mind

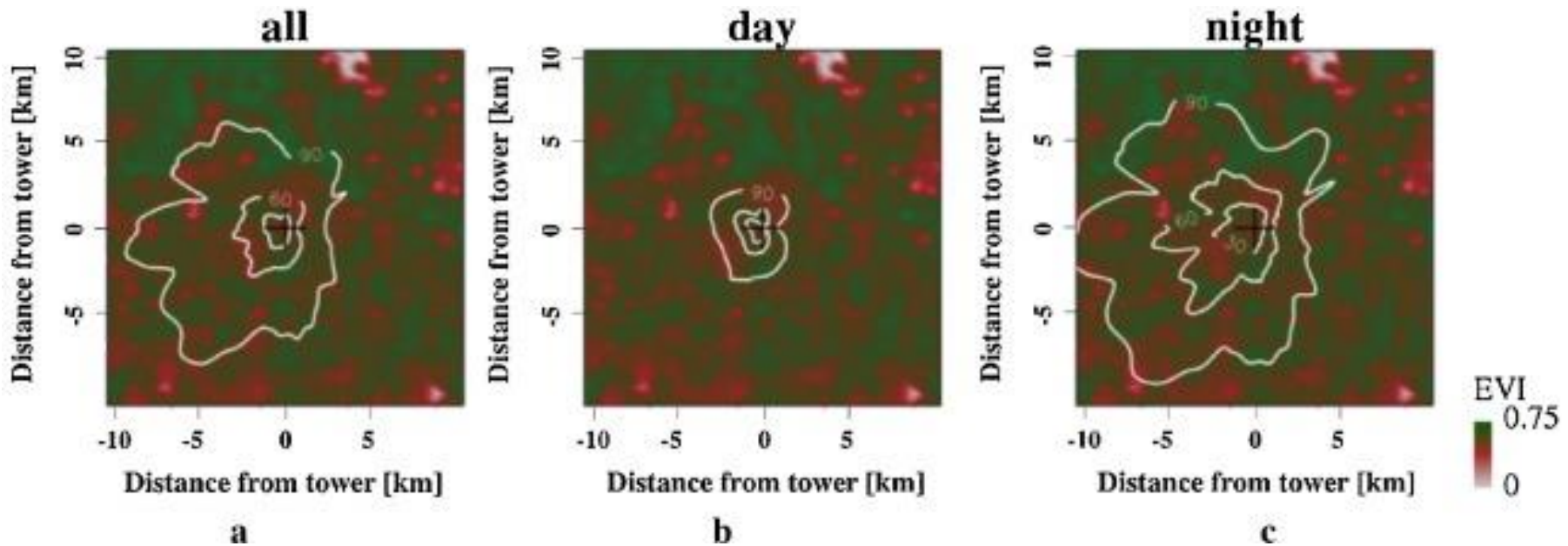
## Assumption 2: Footprint



Ke Xu, Stefan Metzger, Ankur R. Desai,  
Upscaling tower-observed turbulent  
exchange at fine spatio-temporal resolution  
using environmental response functions,  
Agricultural and Forest Meteorology

# Flux Date, Things To Keep In Mind

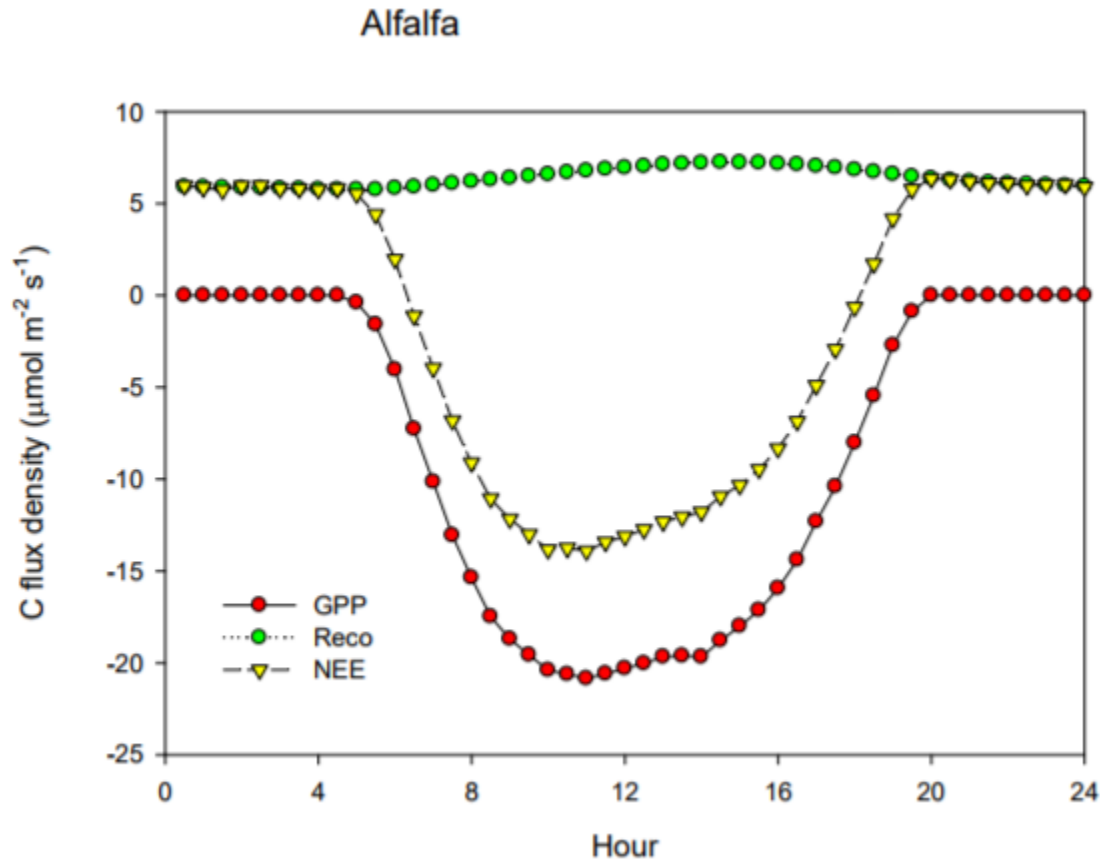
## Assumption 2: Footprint



Ke Xu, Stefan Metzger, Ankur R. Desai, Upscaling tower-observed turbulent exchange at fine spatio-temporal resolution using environmental response functions, *Agricultural and Forest Meteorology*

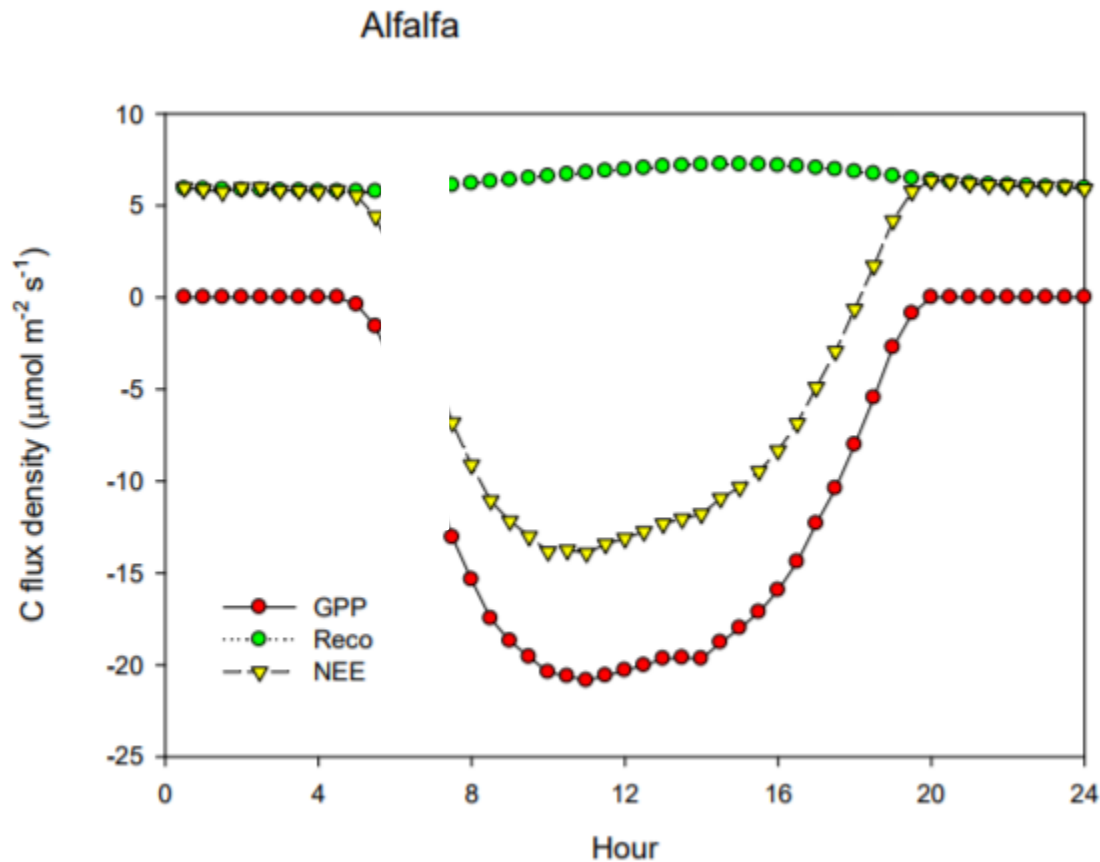
# Flux Date, Things To Keep In Mind

## Assumption 3: Flux Partitioning



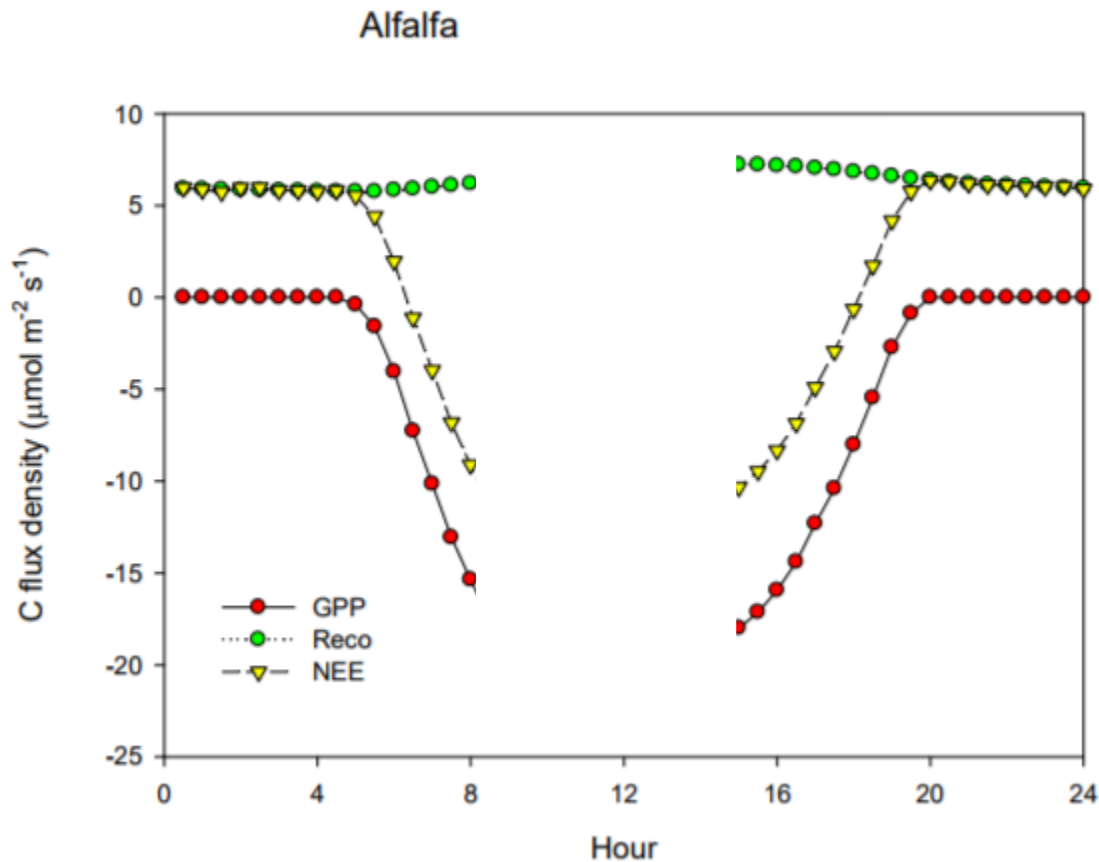
# Flux Date, Things To Keep In Mind

## Assumption 4: Gap Filling



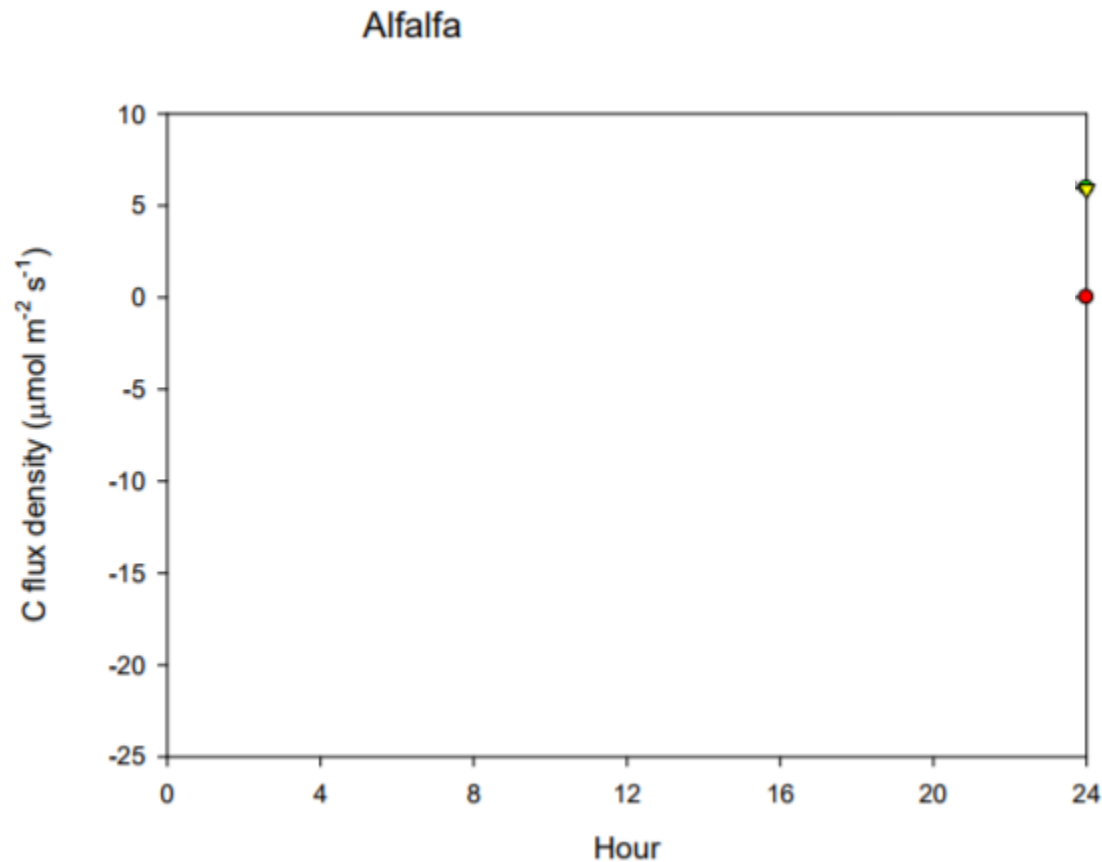
# Flux Date, Things To Keep In Mind

## Assumption 4: Gap Filling



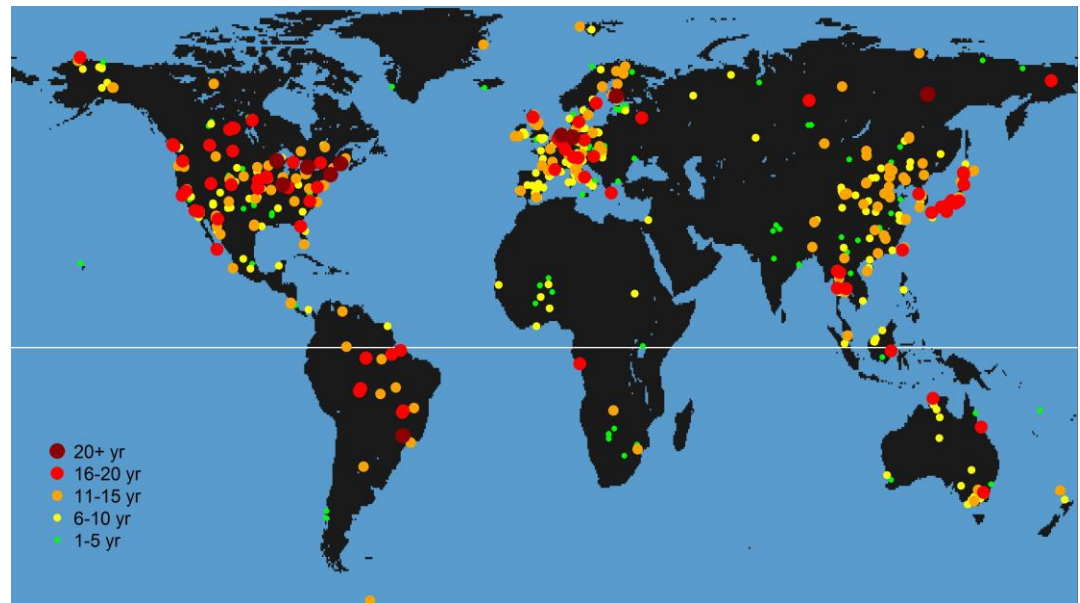
# Flux Date, Things To Keep In Mind

## Assumption 4: Gap Filling



# Finding Flux Date

- Fluxnet 2015
  - 1991-2015
- Global data from multiple flux networks








# Finding Flux Date

[Return to fluxnet.fluxdata.org](http://fluxnet.fluxdata.org)

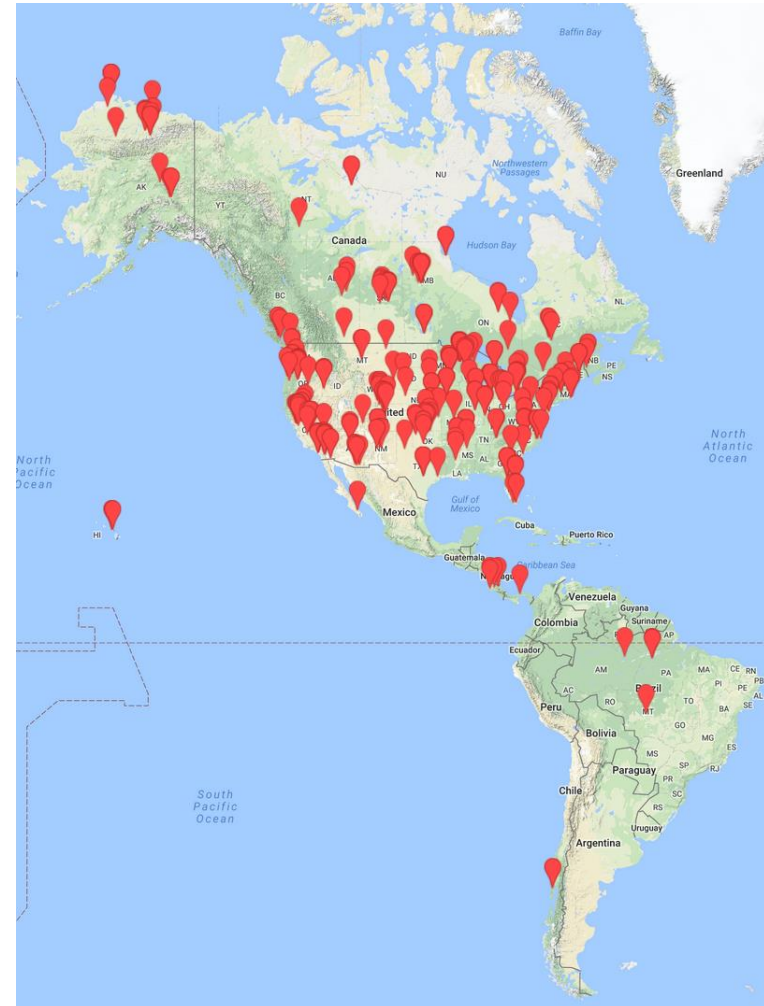
General Site Information	
Site ID:	US-Sta
Site Name:	Saratoga
Tower Team:	PI: Brent Ewers <BEEwers@uwyo.edu> - University of Wyoming PI: Elise Pendall <ependall@westernsydney.edu.au> - University of Wyoming Data Manager: David Reed <david.edwin.reed@gmail.com> - University of Wyoming
Latitude:	41.3966
Longitude:	-106.8024
Elevation (m):	2089
Network:	AmeriFlux
IGBP:	OSH (Open Shrublands)
Mean Annual Temperature (degrees C):	5.1
Data Products:	FLUXNET2015 Dataset
Data Availability:	FLUXNET2015: 5 years (Duration: 2005 - 2009)
Data Downloads to Date:	FLUXNET2015: 333 unique downloads
Description:	Sagebrush steppe ecosystem
Site image(s):	No images



These pages show the current information available at <http://fluxnet.fluxdata.org> about this tower.  
If any of this information is wrong or missing, please submit corrections and updates via <http://fluxnet.fluxdata.org>

# Finding Flux Date

- Ameriflux
  - 1991-2017
- As name implies, focuses on American sites



# Finding Flux Date

## Site Search

**Filters**

Clear All

Return sites with: "all of the following"

**Return sites with**

all of the following

any of the following

**Vegetation & Climate**

**IGBP Class (vegetation)**

All IGBP Classes

- DBF - Deciduous Broadleaf For
- DNF - Deciduous Needleleaf Fc
- EBF - Evergreen Broadleaf Fore

**Koepfen Climate Class**

All Climate Classes

- Tropical rain forest Af
- Tropical monsoon Am
- Tropical savanna Aw

**Precipitation (annual cumulative)**

eg: 100 to 200, or >200 mm

**Air Temp. (average annual)**

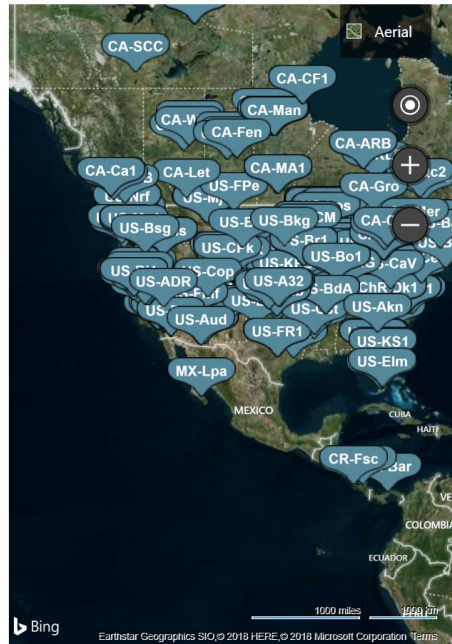
eg: 0 to 10, or >10 c

General

Geography

Submit

### AmeriFlux Network: 298 sites



Copy sites to clipboard

Sign in to Use the Found Sites in a Site Set

View and Edit Site Sets

▶ US-Snd	GRA	Csa	358mm	15.6°C	-5m	2007	🔍
▶ US-Sne	GRA	Csa	311mm	16.09°C	-5m	2016	🔍
▶ US-SO2	CSH	Csa	553mm	13.63°C	1394m	1997	🔍
▶ US-SO3	CSH	Csa	576mm	13.29°C	1429m	1997	🔍
▶ US-SO4	CSH	Csa			1429m	2004	🔍
▶ US-SP1	ENF	Cfa	1310mm	20.06°C	50m	2000	🔍
▶ US-SP2	ENF	Cfa	1314mm	20.07°C	50m	1999	🔍
▶ US-SP3	ENF	Cfa	1312mm	20.25°C	50m	1999	🔍
▶ US-SP4	ENF	Cfa	1320mm	20°C	47m	1998	🔍
▶ US-SRC	OSH				991m	2008	🔍
▶ US-SRG	GRA	Bsk	420mm	17°C	1291m	2008	🔍
▶ US-SRM	WSA	Bsk	380mm	17.92°C	1120m	2004	🔍
▶ US-Srr	WET	Csa	326mm	15.1°C	8m	2014	🔍
▶ US-SSH	DBF	Dfb	1050mm	9.5°C	310m		🔍
▶ US-Sta	OSH	Bsh		5.1°C	2069m	2005	🔍
▶ US-StJ	WET	Cfa	1121mm	13.5°C	6.7m		🔍
▶ US-StS	WET	Cfa	1300mm	18.1°C	0m		🔍

# Finding Flux Date

Home / Sites / Siteinfo / US-Sta

## US-Sta: Saratoga

Overview	Windroses	DOI	Data Use Log	Image Gallery	MODIS	Publications	BADM
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**Tower\_team:**

**PI:** Brent Ewers BEEwers@uwyo.edu - University of Wyoming  
**PI:** Elise Pendall e.pendall@westernsydney.edu.au - University of Wyoming  
**DataManager:** David Reed david.edwin.reed@gmail.com - University of Wyoming

**Lat, Long:** 41.3966, -106.8024

**Elevation(m):** 2069

**Network Affiliations:** AmeriFlux

**Vegetation IGBP:** OSH (Open Shrublands)

**Climate Koeppen:** Bsh (Steppe: very cold winter)

**Mean Annual Temp (°C):** 5.1

**Mean Annual Precip. (mm):** —

**Flux Species Measured:** CO2, H2O

**Years Data Collected:** AmeriFlux: 2006 - 2009

**Description:** Sagebrush steppe ecosystem

**URL:** —

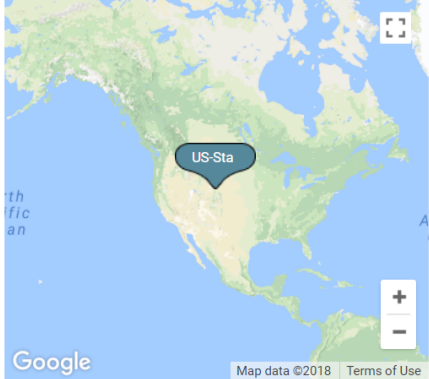
**Research Topics:** Sagebrush water relations

**Acknowledgment:** —


**Site Tasks**

[Add Image](#) [Add Publication](#) [Download Data](#) [Add to Site Set](#)

[Data Processing Status](#)



Site Photo [More Site Images](#)



Site Publication [More Site Publications](#)

