



# Applied Geodata Science 1

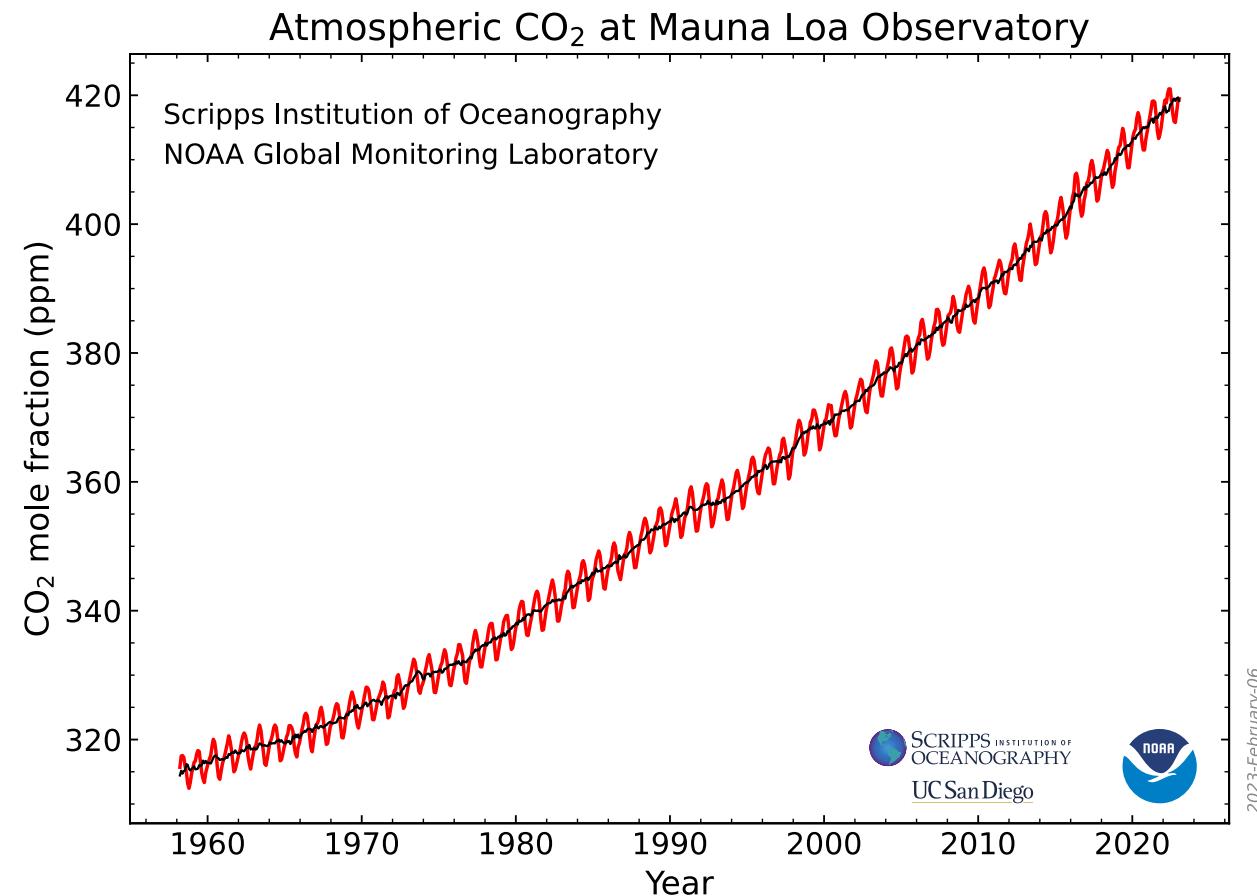
# Session 2

Prof. Dr. Benjamin Stocker  
Spring semester 2025



# Atmospheric CO<sub>2</sub> concentration

AGS  
GCD  
I



# Atmospheric CO<sub>2</sub> concentration

ACS  
I  
GD

Source: NASA (<https://www.youtube.com/watch?v=x1SgmFa0r04>)

3

# Seasonality in gross primary production

AGS  
I  
GD

Stocker et al., 2020 *GMD*

$\text{gC m}^{-2} \text{ d}^{-1}$

# Breathing of the Earth

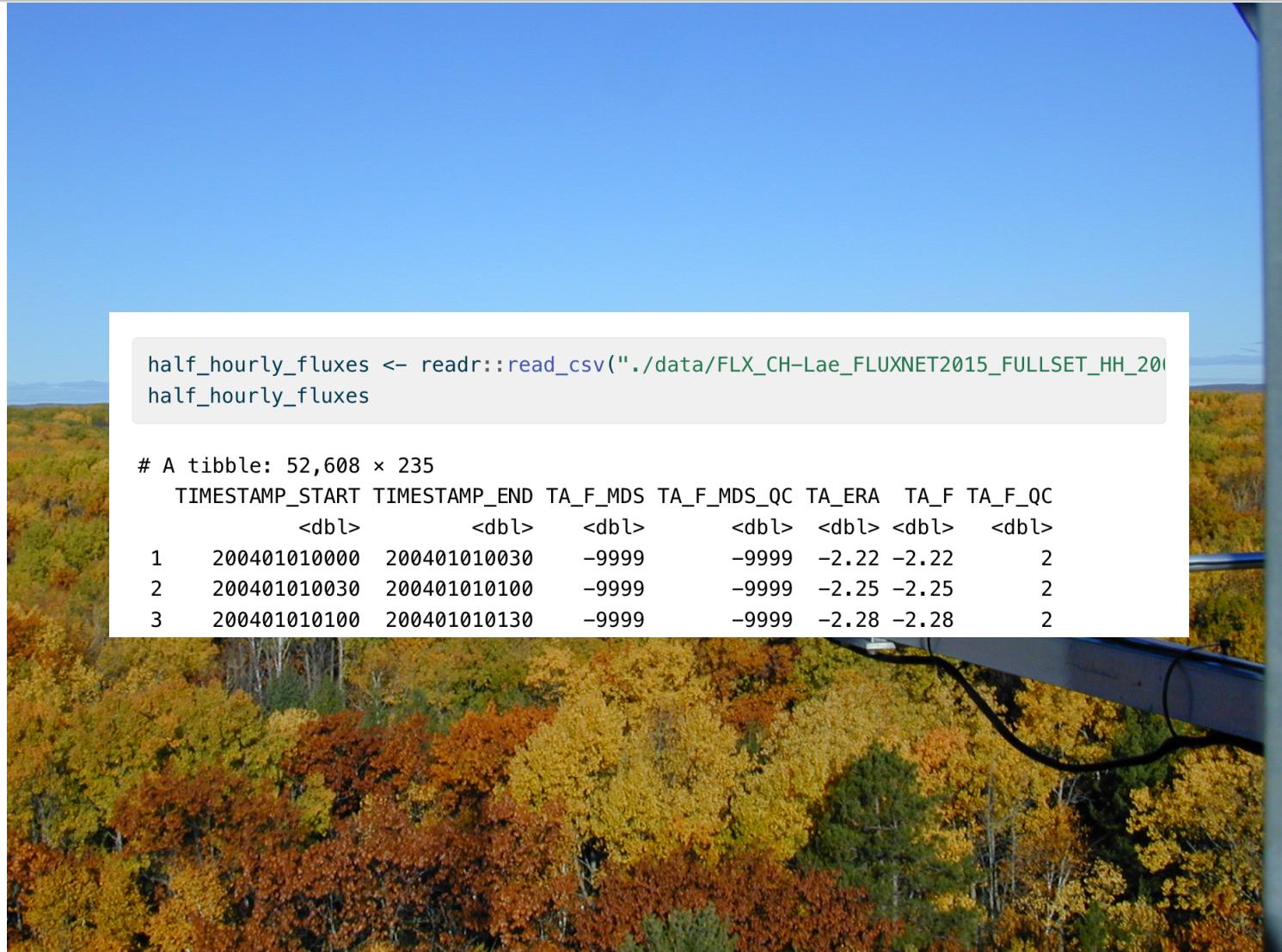
ACG  
I  
D

CO<sub>2</sub> concentration at Mauna Loa

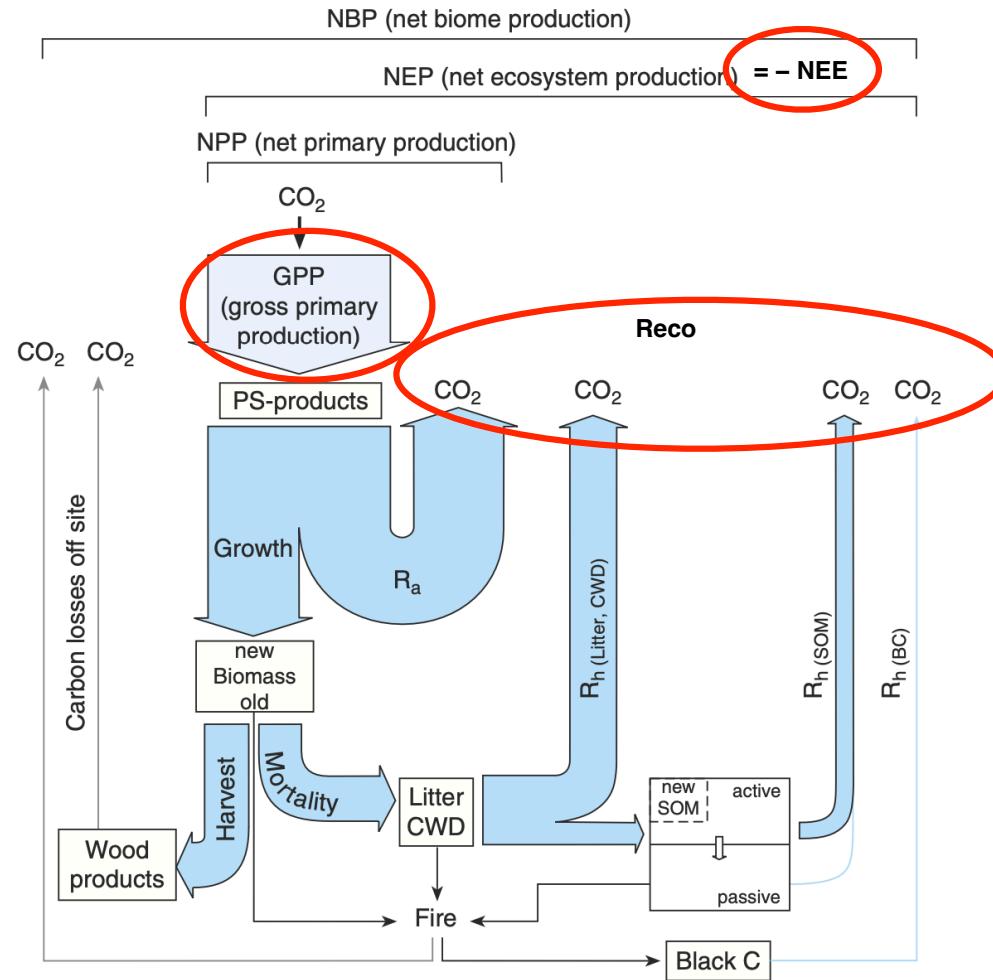


Keeling et al., 1976 *Tellus*  
Thoning et al., 1989 *JGR*

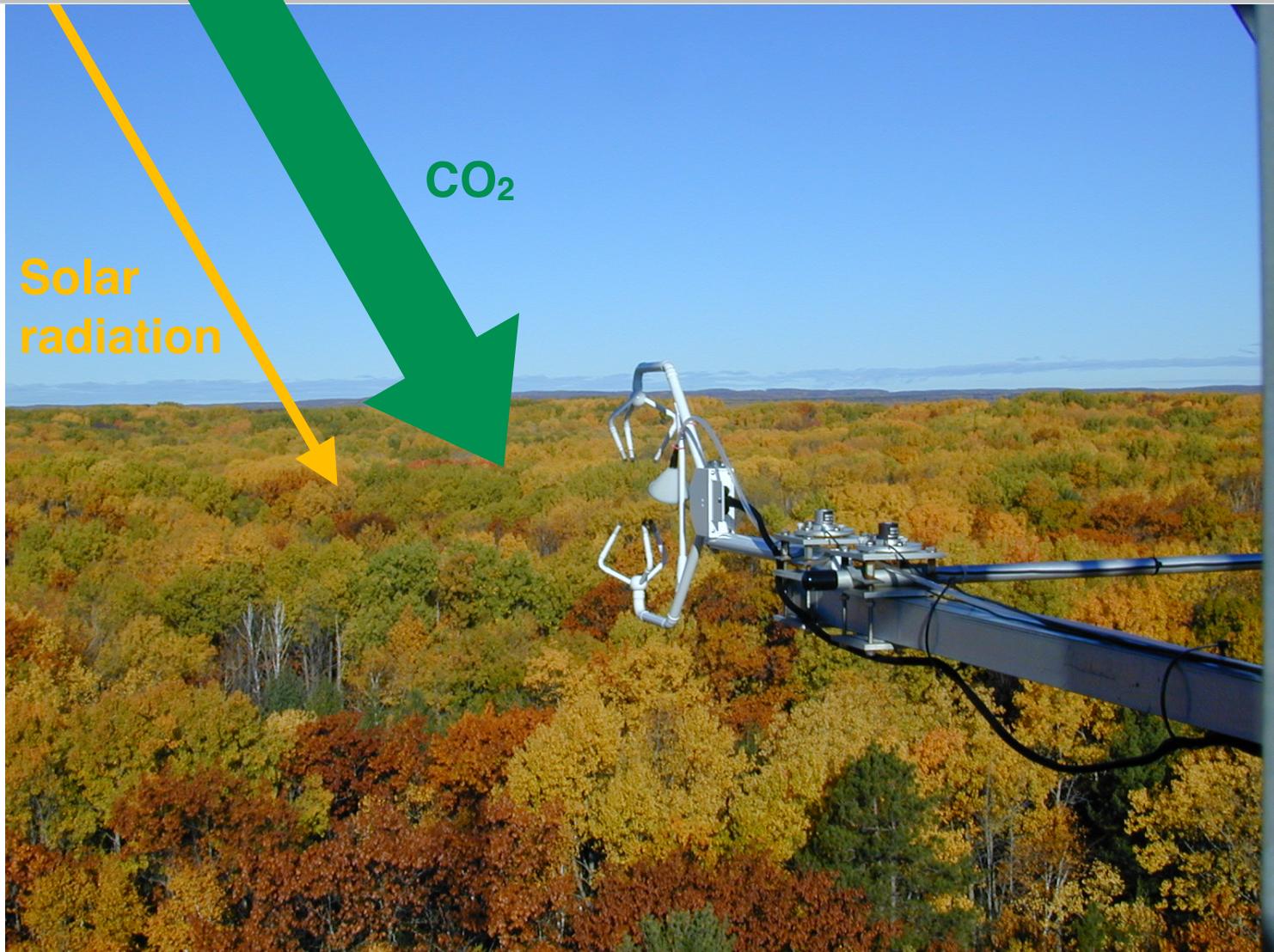
# Ecosystem flux measurement data



# Terminology of CO<sub>2</sub> fluxes



# Breathing of ecosystems: Day



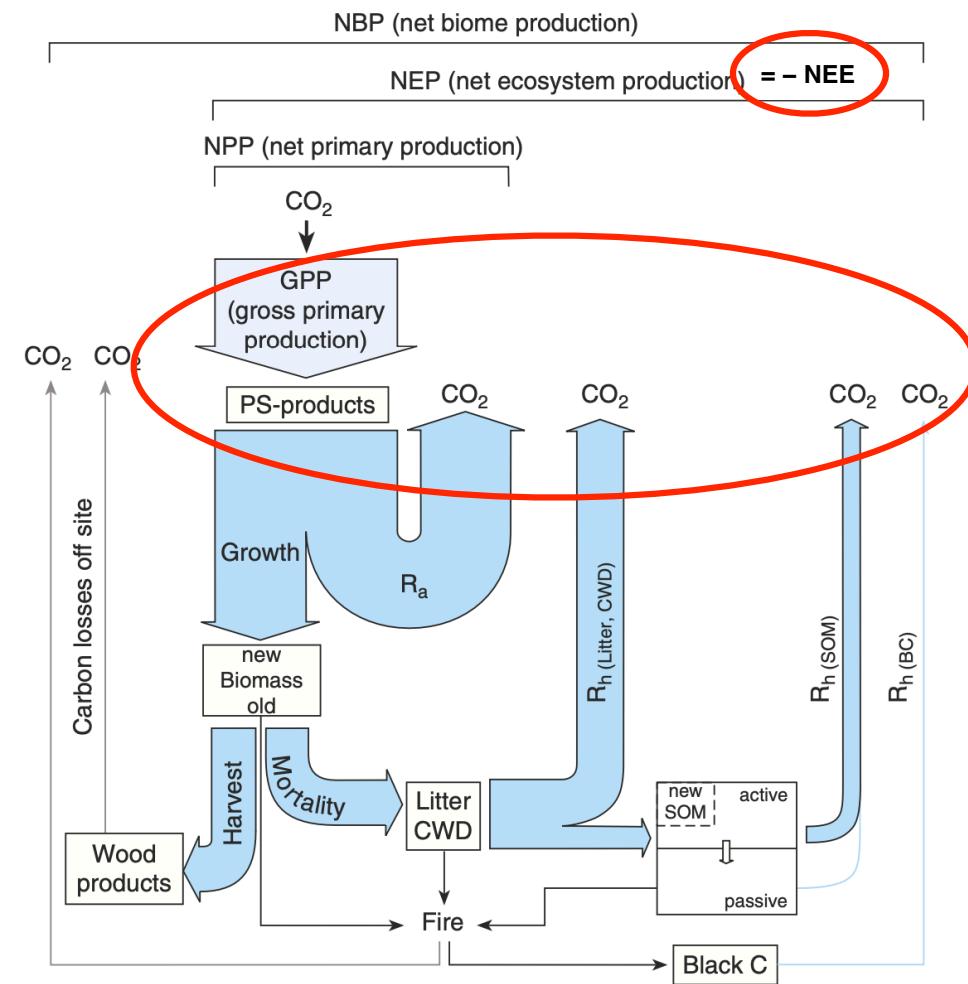
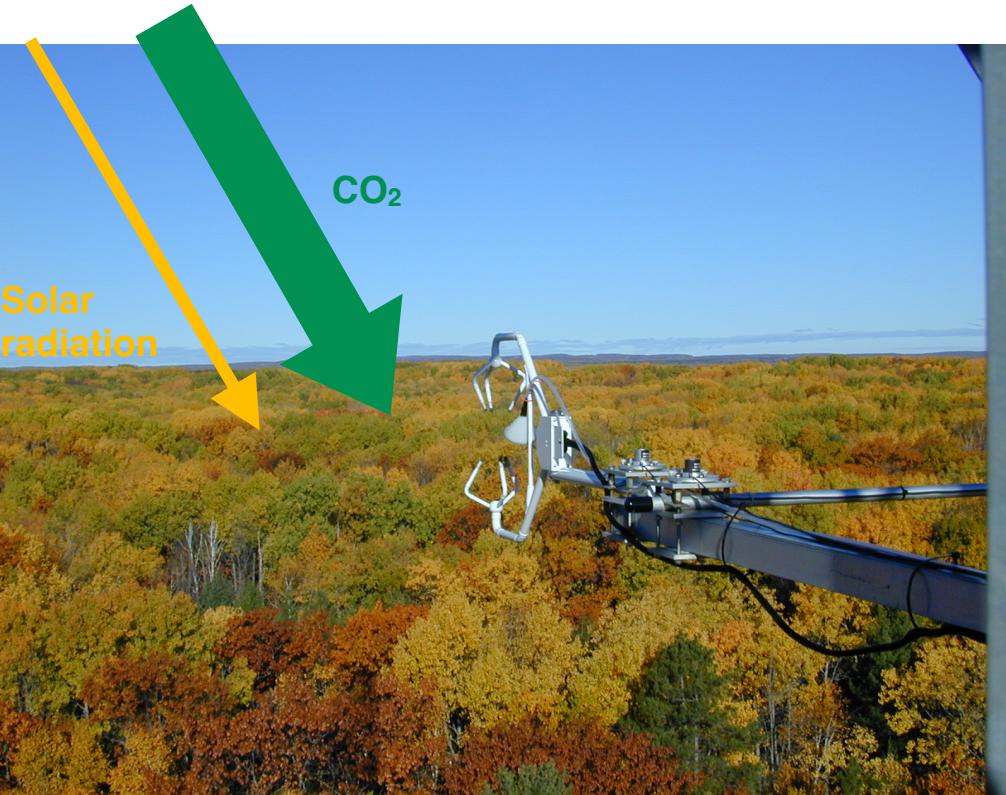
# Breathing of ecosystems: Night



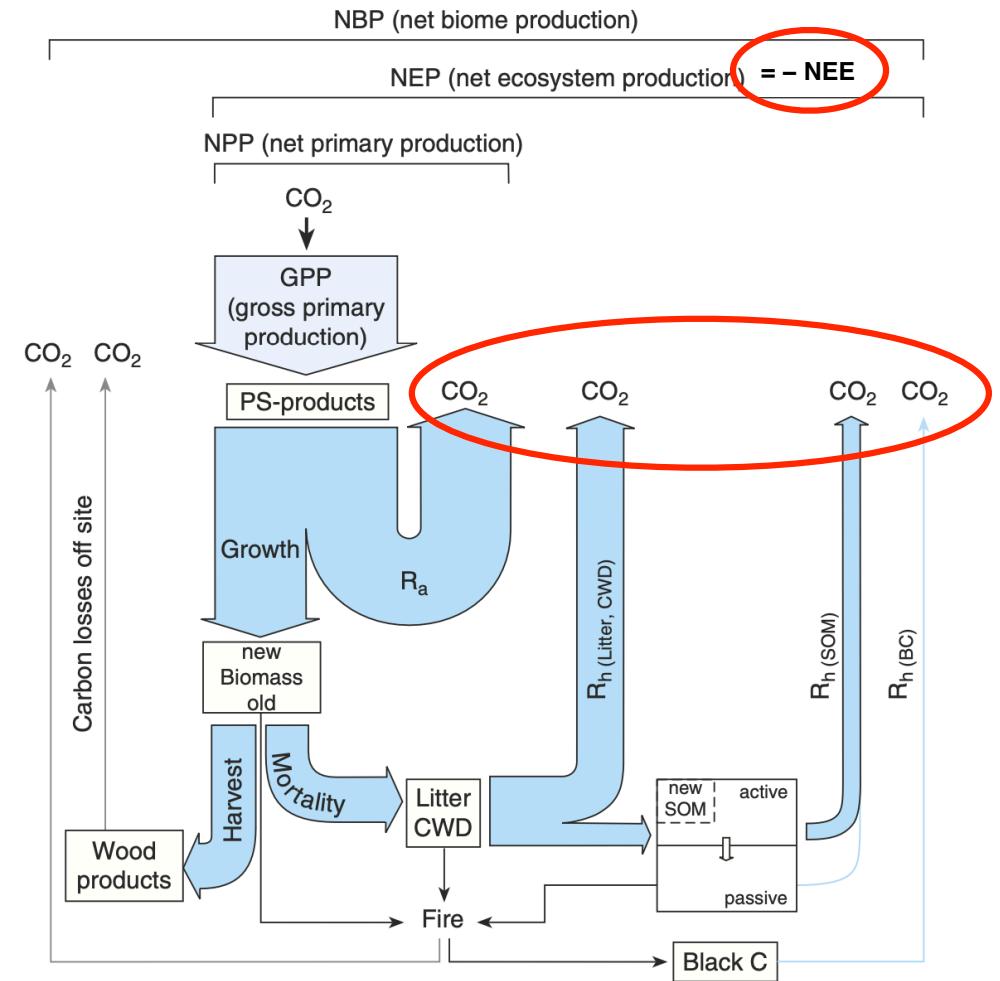
<https://andrewsforest.oregonstate.edu/research/programs>

# Terminology of CO<sub>2</sub> fluxes

AGS  
CD  
I



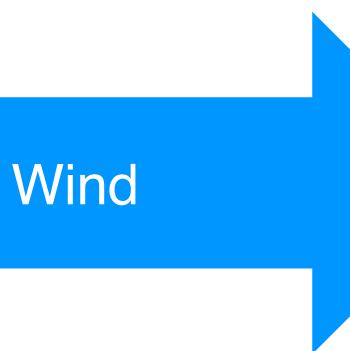
# Terminology of CO<sub>2</sub> fluxes



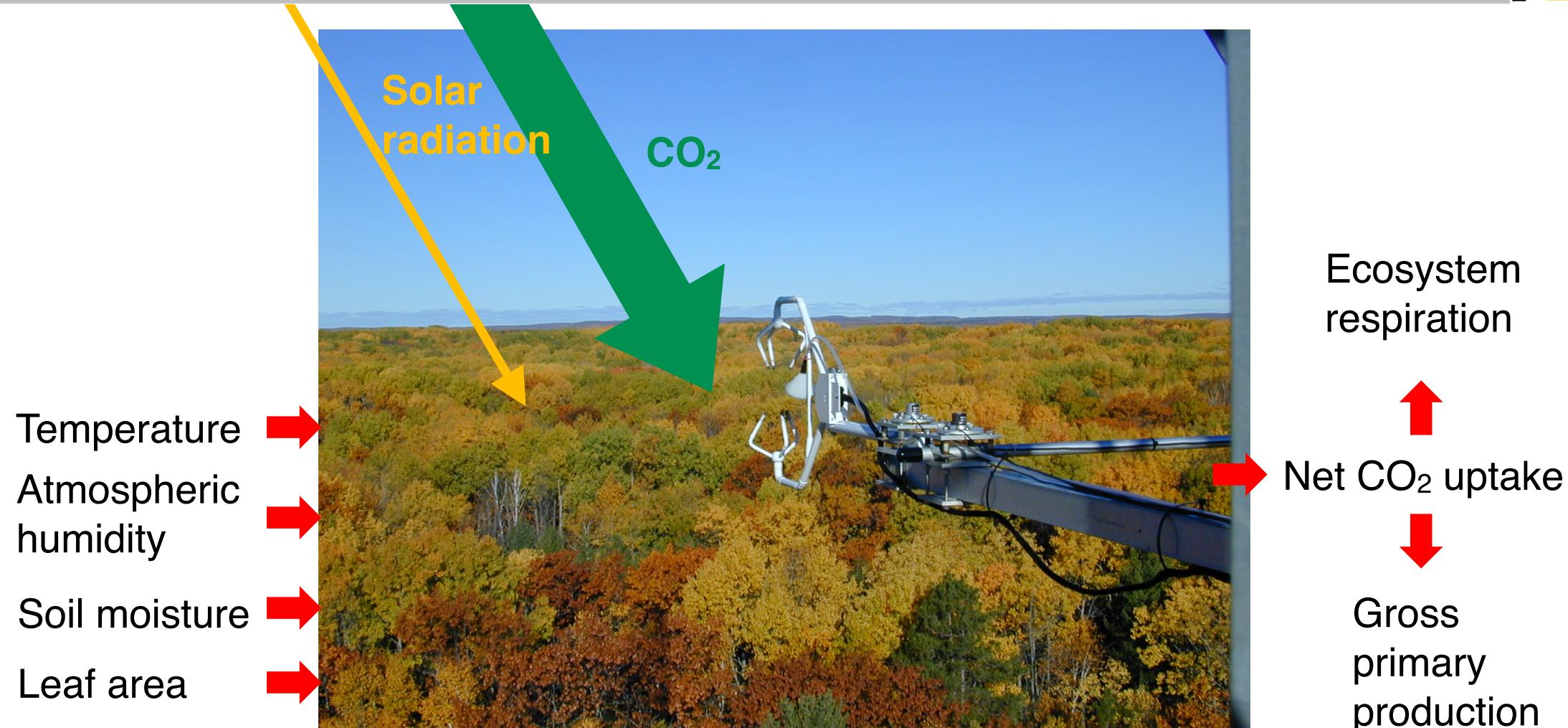
# Land-atmosphere gas exchange through eddies



# Eddies and CO<sub>2</sub> transport



# Breathing of ecosystems



# The FLUXNET network

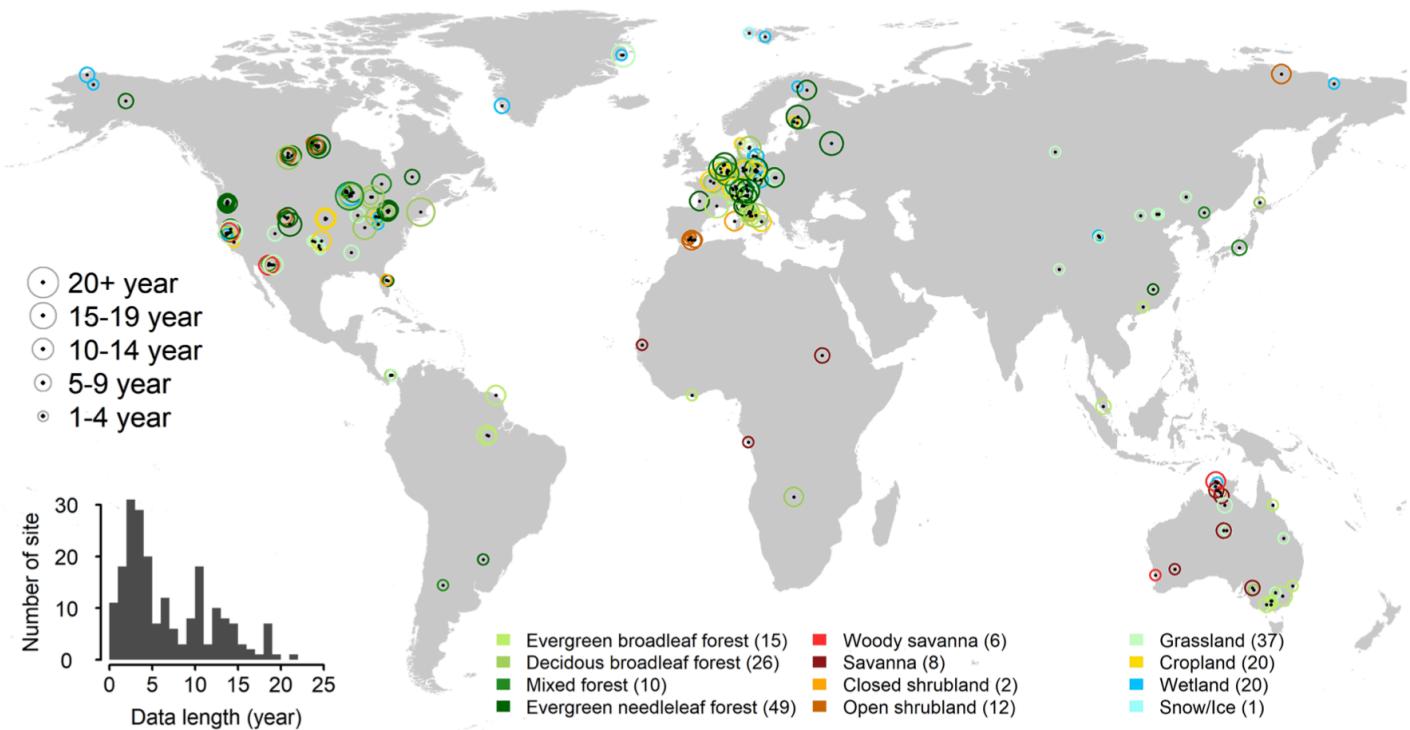




Image Markus Staudinger

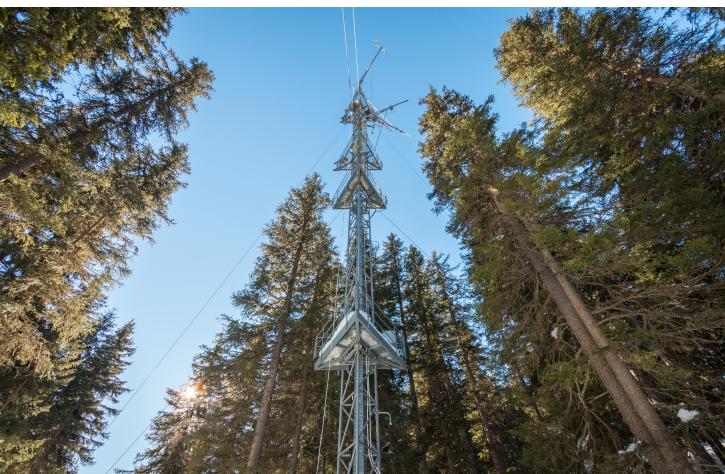
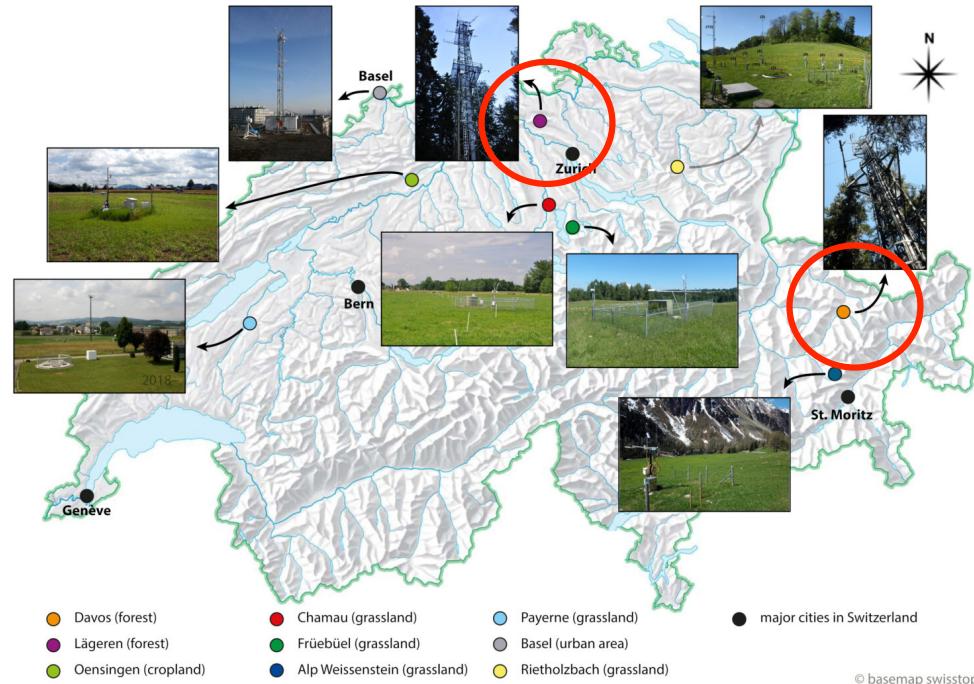


Image Lukas Hörtnagl

## Lägern CH-Lae

## Davos CH-Dav



# Variables in a FLUXNET-standard dataset

[www.nature.com/scientificdata/](http://www.nature.com/scientificdata/)

## SCIENTIFIC DATA

OPEN

DATA DESCRIPTOR

### The FLUXNET2015 dataset and the ONEFlux processing pipeline for eddy covariance data

Gilberto Pastorello et al.\*

- `TIMESTAMP_START` : Hour and day of the start of the measurement period for which the respective row's data are representative. Provided in a format of “YYYYMMDDhhmm”.
- `TIMESTAMP_END` : Hour and day of the end of the measurement period for which the respective row's data are representative. Provided in a format of “YYYYMMDDhhmm”.
- `TA_*` ( $^{\circ}\text{C}$ ): Air temperature.
- `SW_IN_*` ( $\text{W m}^{-2}$ ): Shortwave incoming radiation
- `LW_IN_*` ( $\text{W m}^{-2}$ ): Longwave incoming radiation
- `VPD_*` (hPa): Vapor pressure deficit (the difference between actual and saturation water vapor pressure)
- `PA_*` (kPa): Atmospheric pressure
- `P_*` (mm): Precipitation
- `WS_*` ( $\text{m s}^{-1}$ ): Wind speed
- `SWC_*` (%): Volumetric soil water content
- `GPP_*` ( $\mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$ ): Gross primary production (the ecosystem-level gross  $\text{CO}_2$  uptake flux driven by photosynthesis)
- `*_QC` : Quality control information for the variable `*`. Important for us: `NEE_*_QC` is the quality control information for the net ecosystem  $\text{CO}_2$  exchange flux (`NEE_*`) and for GPP derived from the corresponding NEE estimate (`GPP_*`). 0 = measured, 1 = good quality gap-filled, 2 = medium, 3 = poor.