Carbon Cycle Measurements at ARM Southern Great Plains Site: Scaling from Plots to Region

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- **Science Goals**
  - **CO_2/H_2O dynamics at regional scale**
  - **Surface influence on CO_2 in convective boundary layer**
- **Measurements to complement existing ARM strength in meteorology**
- **Modeling ecosystem-atmosphere exchange, footprints, and PBL mixing**

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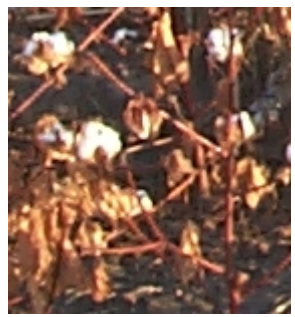
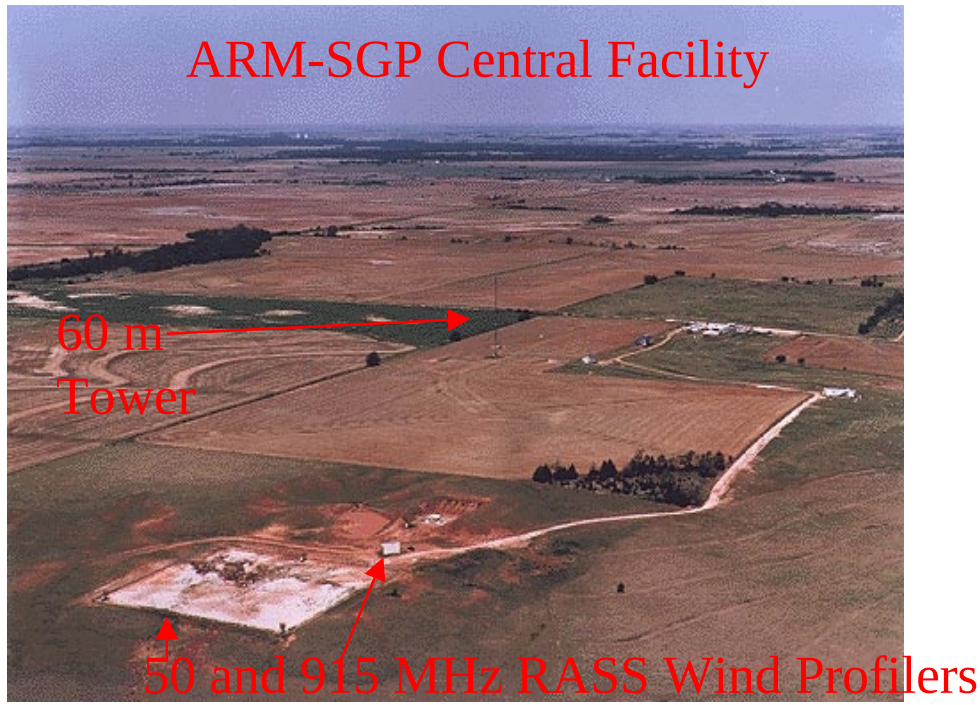
Steps toward regional C flux estimates

- **Plot Scale Characterizations:**
- **Portable C-cycle Systems**
  - Automated measurements of whole ecosystem CO_2 /H_2O and soil CO_2 fluxes
  - Automated stable isotope sampling of atmospheric/soil gas (analysis facilities at LBNL, UCB, Carnegie)
  - Sampling of biomass, and soil pools
- **Parameterization and testing of SiB2 model**



Landscape Scale C cycle estimates:

- **60m tower at central facility:**
  - **CO_2/H_2O fluxes**
  - **Precise CO2 mixing ratio profiles**
  - **CO_2/H_2O isotopes**
  - **CO, Rn, N_20**
- **PBL mixing heights from ARM profilers**
  - **"Virtual tall tower" CBL CO_2 mixing ratios**
- **Estimation of flux/concentration footprints for 60 m tower**
- **Prediction of CO_2/H_2O fluxes and concentrations at 60 m tower (SiB2 + RAMS (w/ Denning)**

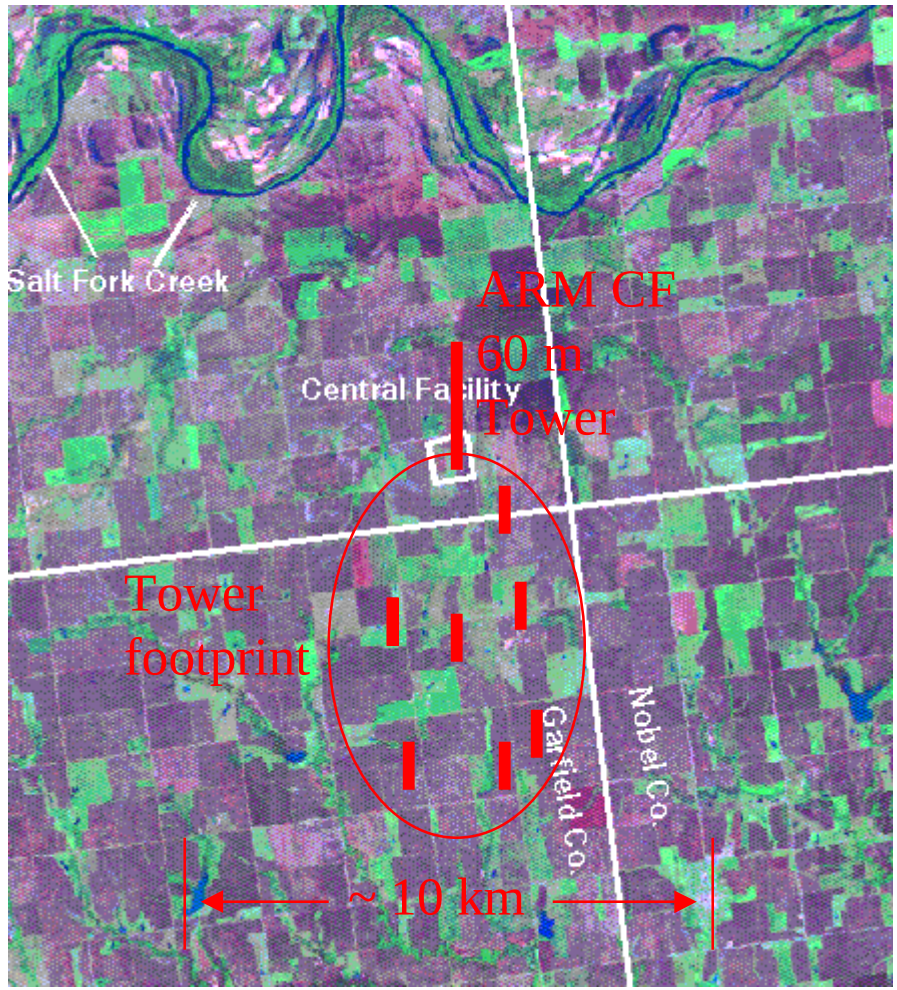


Portable Eddy Covariance Flux System

- **Gill Windmaster/LI7500 flux system + energy balance/met package**
- **Cross-calibrations at AmeriFlux Sites:**
  - **Tall-Grass Prairie (7/2000)**
  - **Wheat (10/2000) Sites**
  - **<u>Dave Billesbach's talk in pm</u>**

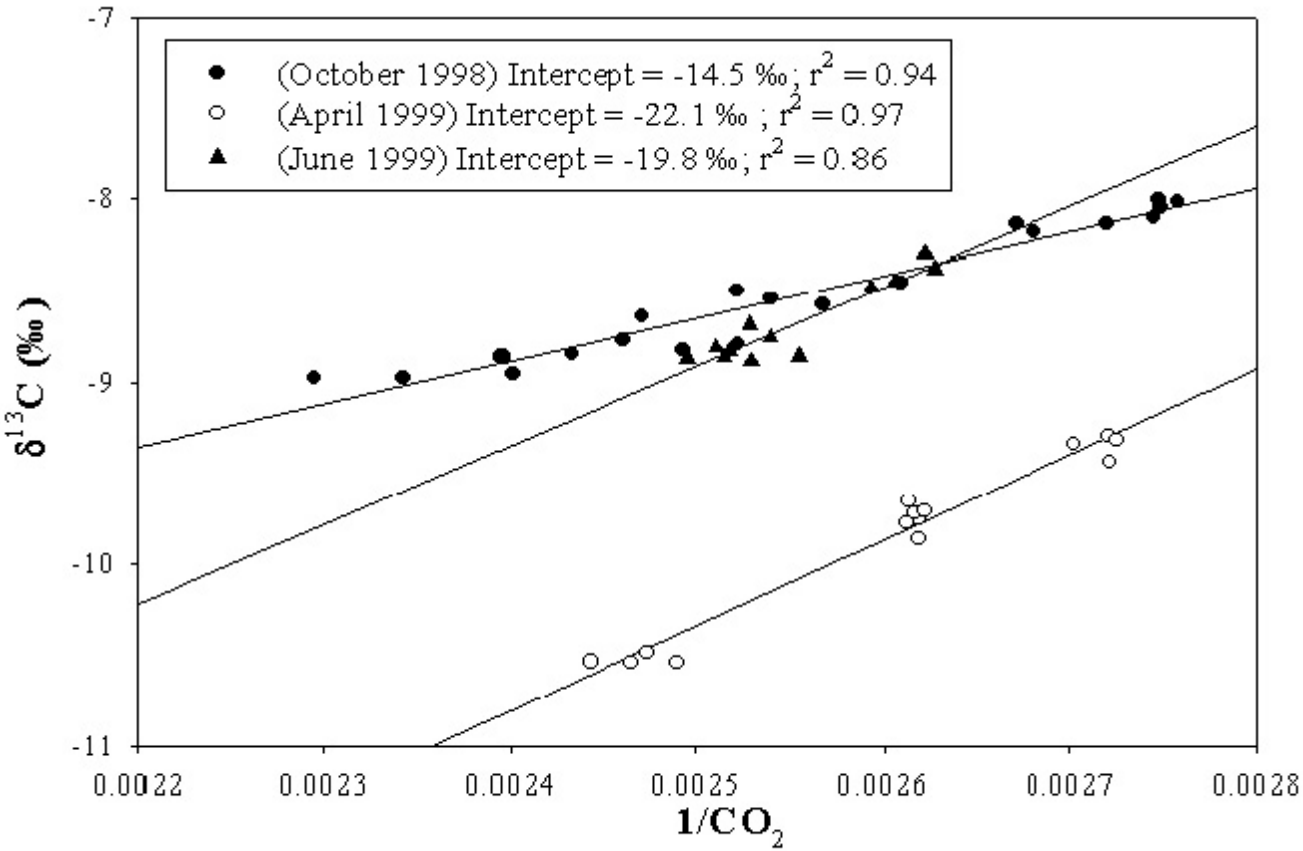
Field campaigns w/ portable towers

- **Field campaigns (2001):**
  - **Walnut Creek Watershed**
  - **Measurements in footprint of ARM 60 m tower**
    - **Wheat**
    - **Prairie**
    - **other crops (e.g. Cotton)**
    - **Riparian habitat**



Stable Isotope Sampling

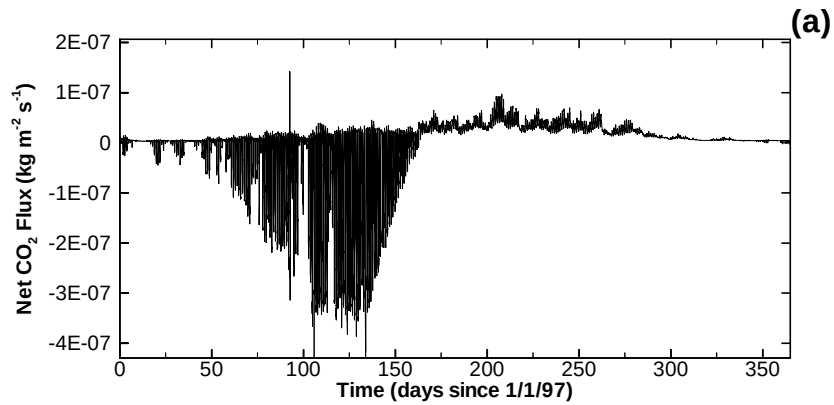
- **Multi-flask automated sampling system tested at OK prairie site**
- **Seasonal shift in soil respired $^{13}\delta C$ due to shifts from C3 to C4 native prairie species (Still, Berry, Ribas-Carbo, Helliker, and Verma, in prep.)**

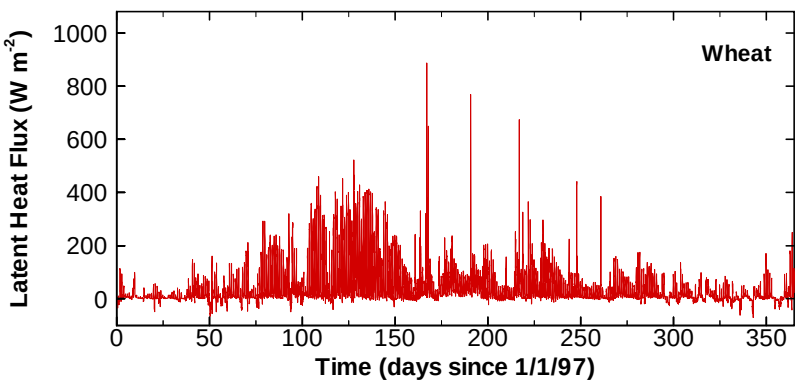


SiB2 Predictions of CO_2 and LE fluxes
(work of Bill Riley)

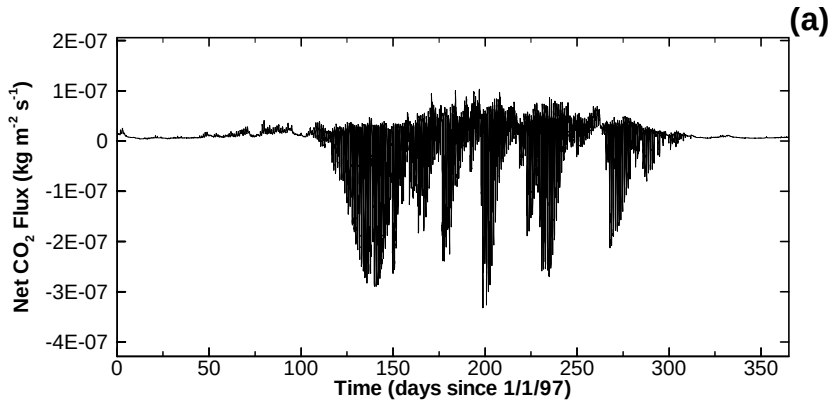
- Different in plant phenology -> Different timing of CO_2/ H_20 cycles

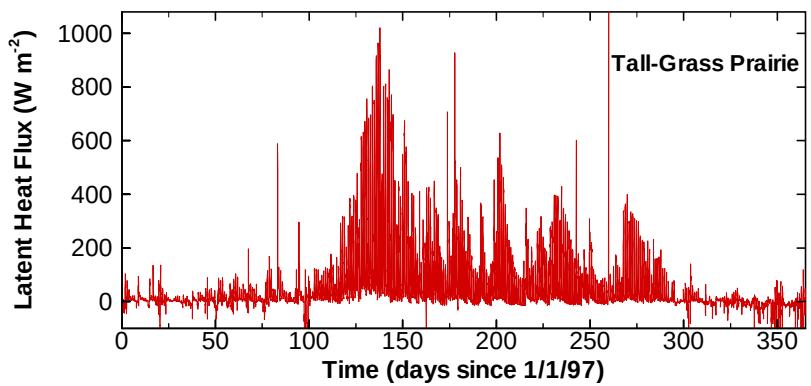
Wheat



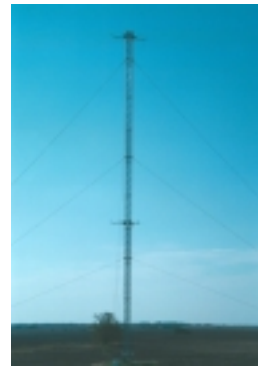


Tall-grass





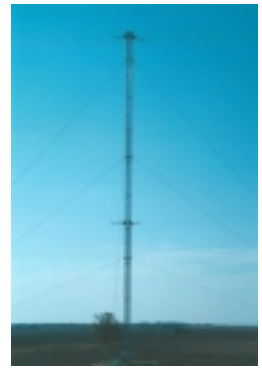
Eddy Covariance System for 60m Tower

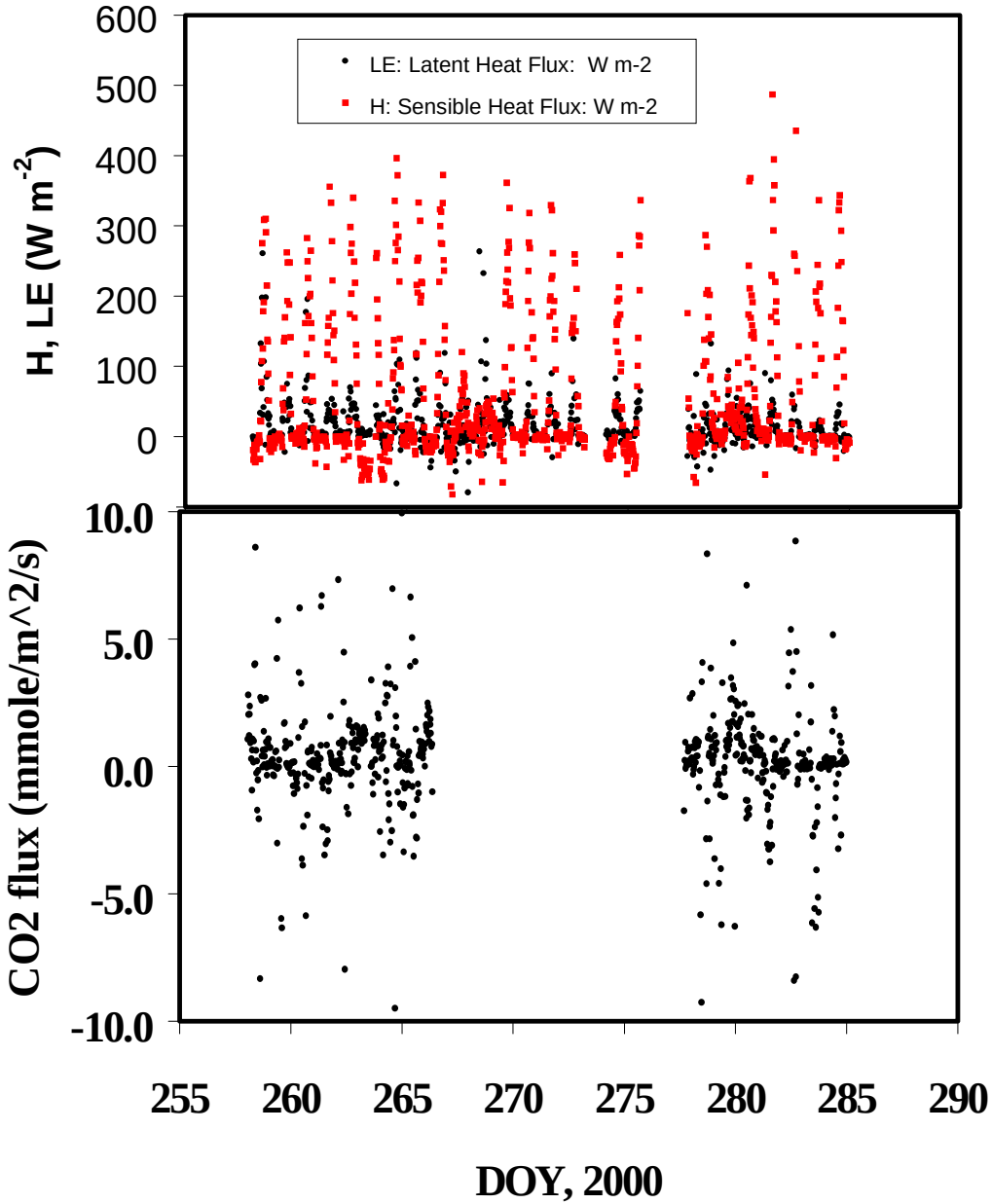


- Gill Windmaster/LI-7500
- PC based data acquisition and file transfer system
- Installed at ARM-CF 9/2000

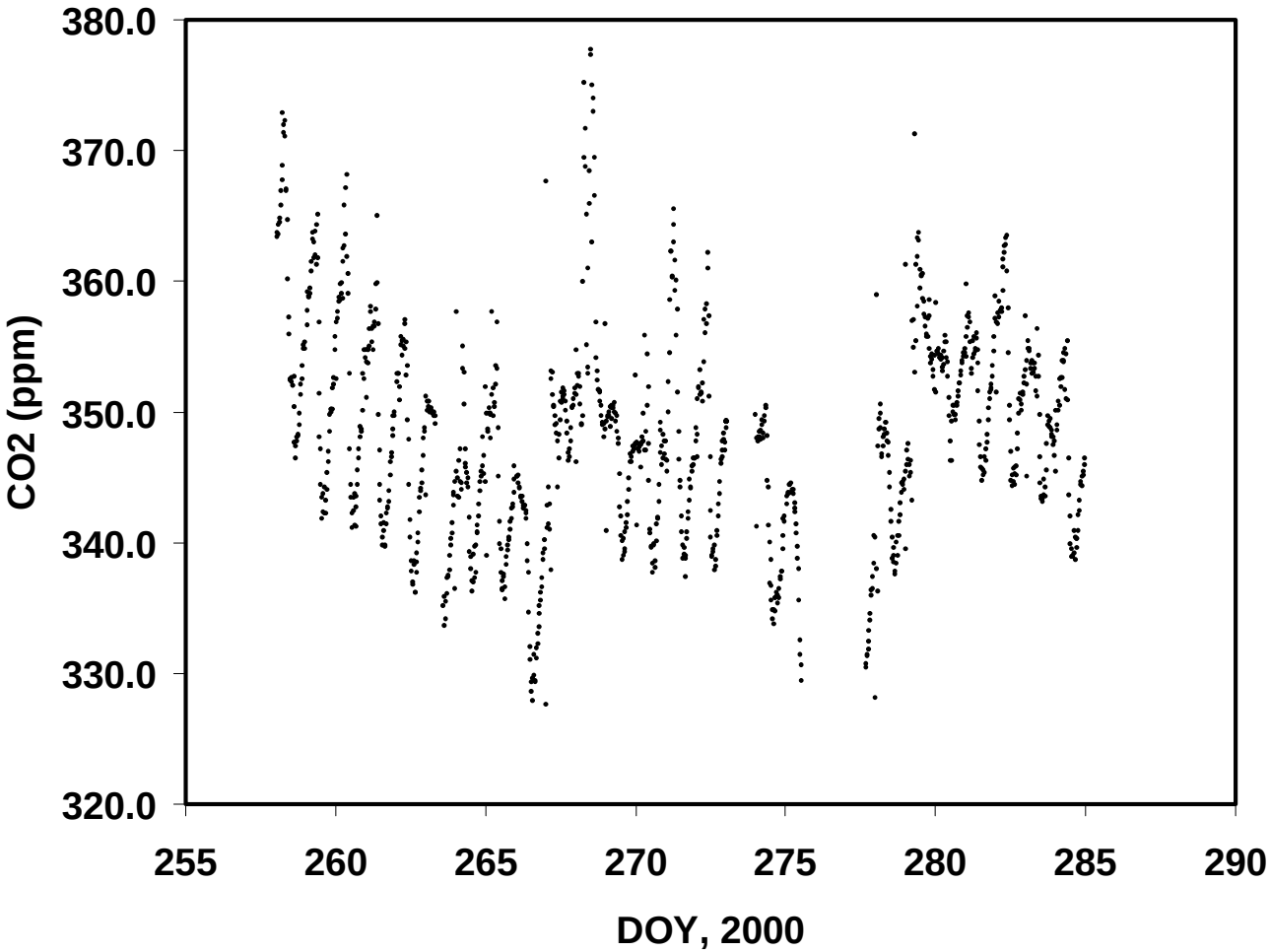
Oklahoma, where the wind goes whistlin cross the (40º C) plains

Initial Flux Data from 60m

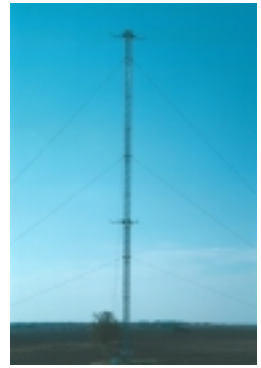




Initial CO_2 Mixing Ratio Data from 60 m Tower



Precise CO_2 Mixing Ratio System for 60 m CF Tower



- **Based on NOAA-CMDL design (~ 0.2-0.5 ppm accuracy)**
  - Temperature and pressure stabilized IR Gas Analyzer
  - Automated calibration with 4 NOAA-CMDL Standards
  - Air sampling at 2, 4, 25, and 60 m on CF tower
  - Software control of conditional isotope sampling system