NOAA
Global Monitoring Division

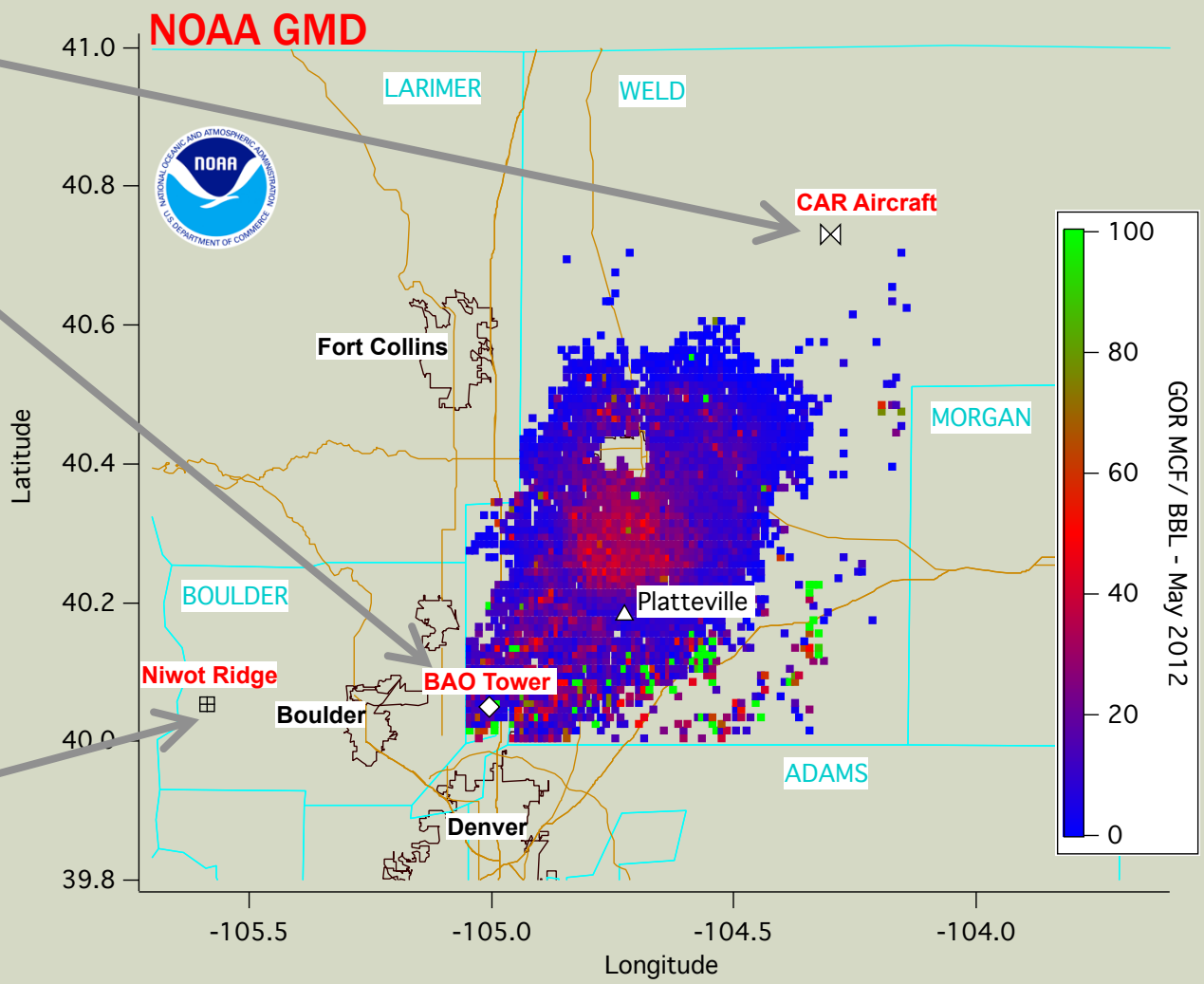
Overview of on-going and campaign-specific measurements in Colorado NE Front Range

Long-term measurement locations

CAR Aircraft Profile
- Flasks
- Every 2 weeks

BAO 300m tower
- In situ CO_2, CO at 3 levels (22, 100, 300 magl)
- In situ O_3 at 2 levels (surface and 300 magl)
- Daily flasks (300m)
- PSD Dan Wolfe manages met data

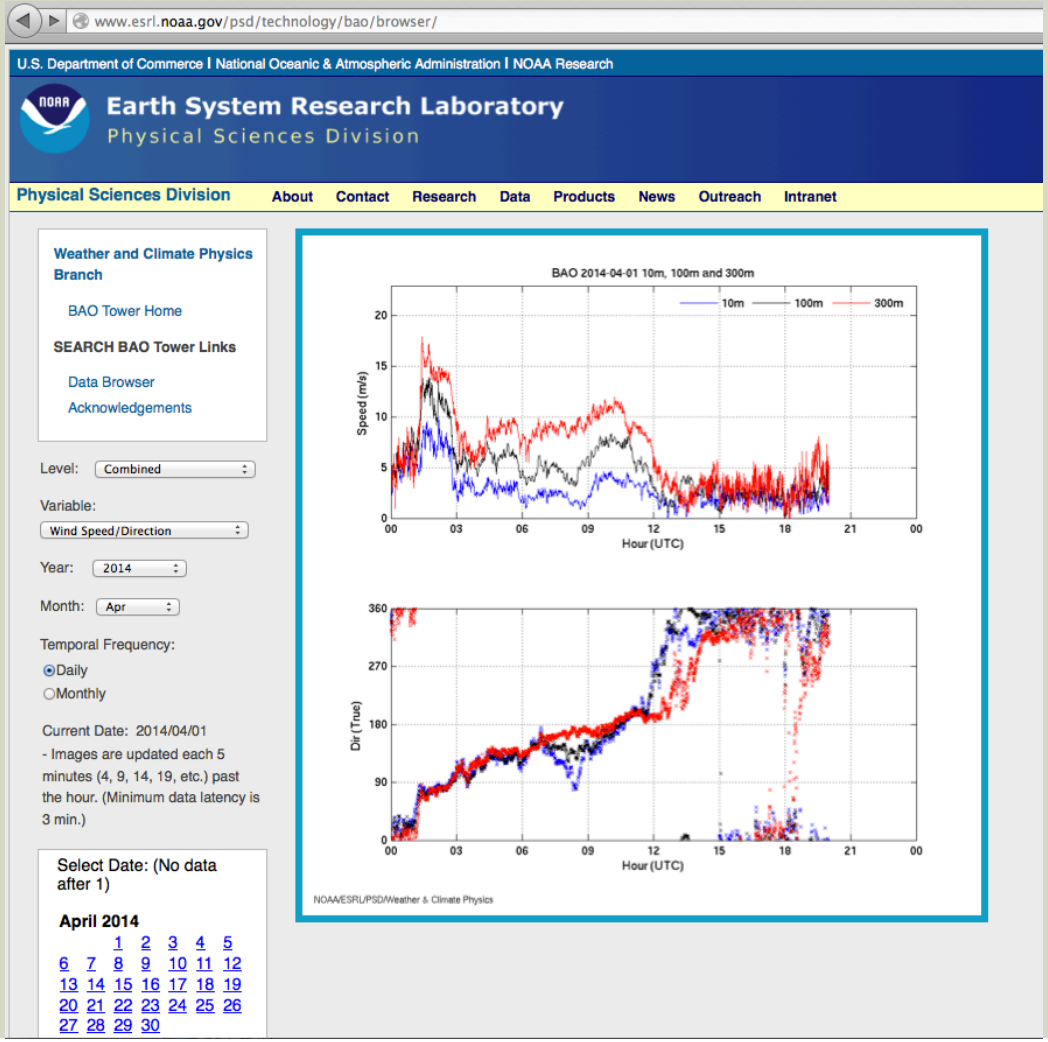
Niwot Ridge
- In situ O_3 (2 locations)
- Daily flasks



Background plot: gas to oil production ratio based on COGCC well production statistics

Real-Time Data Browser at BAO

- http://www.esrl.noaa.gov/psd/technology/bao/browser/



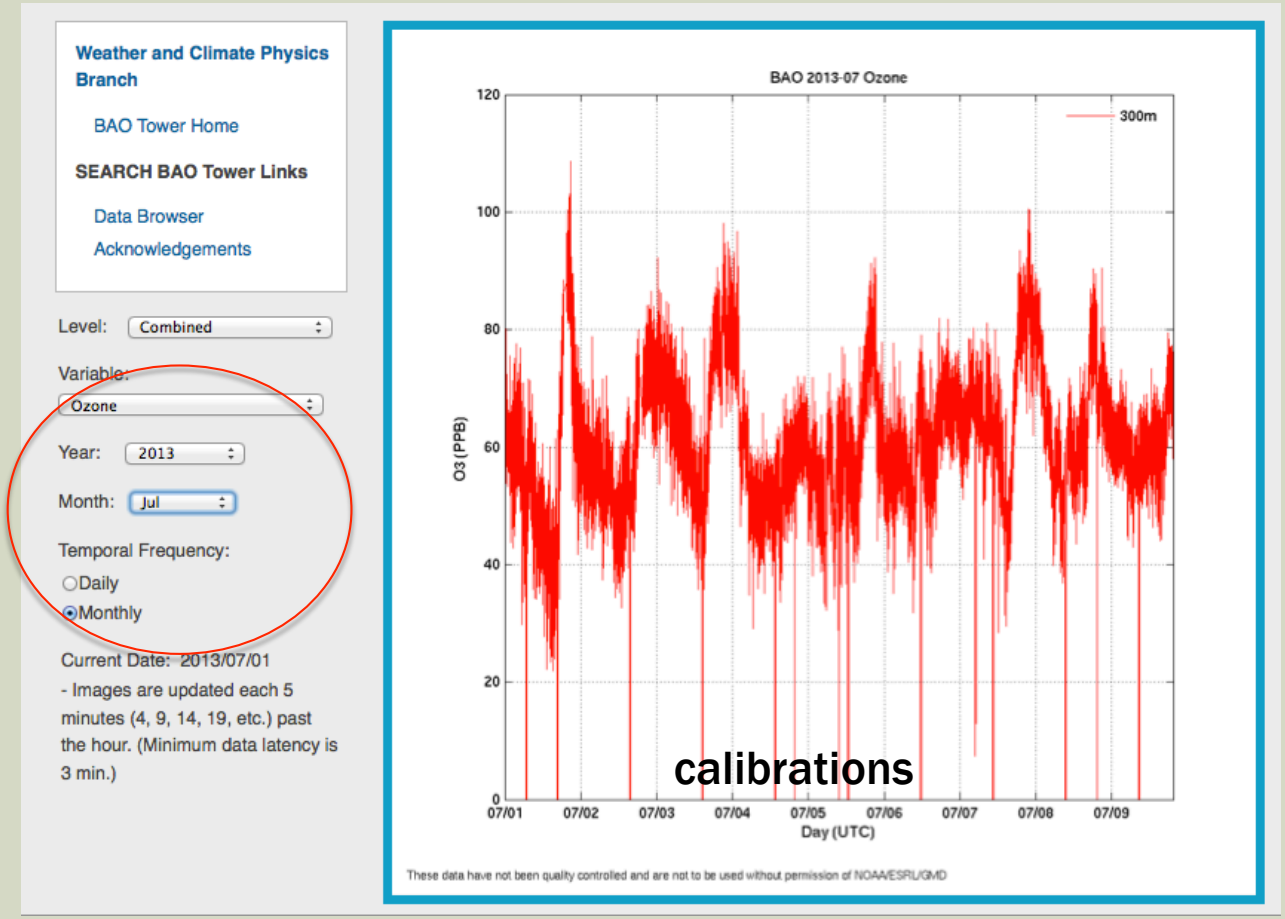
40.05 °N ; 105.01 °W

BAO Tower
PI & Contact:

Dan Wolfe
daniel.wolfe@noaa.gov

BAO 300m Ozone data

Real-time O3 data from BAO 300magl level
http://www.esrl.noaa.gov/psd/technology/bao/browser/



July 2013
BAO 300m
GMD 1min Ozone data

1min, 5min and hourly averages are available at

ftp://ftp.cmdl.noaa.gov/ozwv/SurfaceOzone/

BAO Tower OZONE Contact:
Audra McClure
audra.mcclure@noaa.gov

BAO (continued)

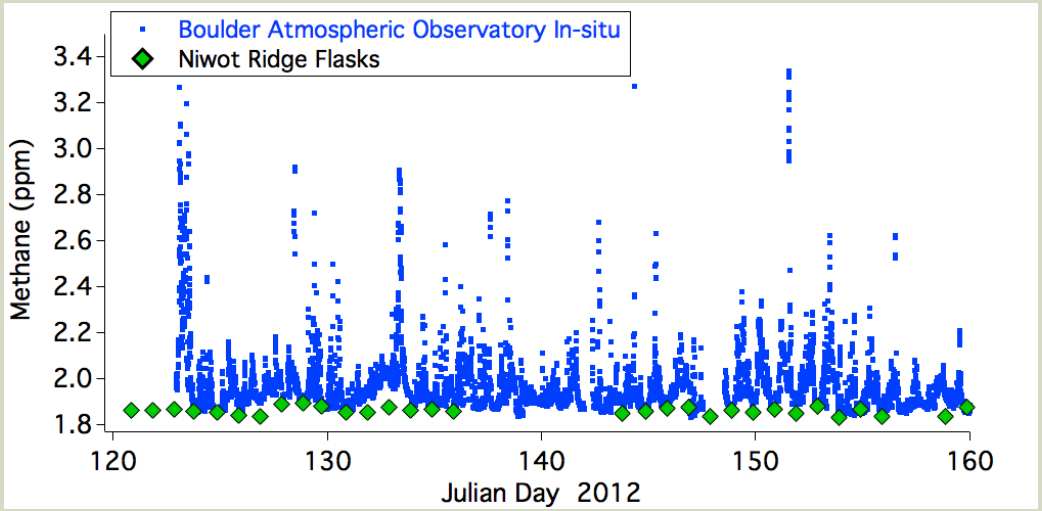
BAO is part of GMD's US Tall Tower Network
Contact: Arlyn E. Andrews (arlyn.andrews@noaa.gov)

- In situ CO_2 and CO rotating: 22, 100 and 300m
- Middle of the day discrete air sampling in glass flasks from 300 m level and analyzed at
  - GMD CCG MAGICC: CO2, CH4, N2O, SF6, CO, H2,
  - GMD HATS: halocarbons, hydrocarbons, etc

We will try to have a Picarro at BAO during the campaign to measure continuous CH_4, cycling between 3 levels.

See example of in situ CH_4 in May 2012 to the right.

BAO May 2012, Methane time series



Niwot Ridge

- Continuous Ozone

3035 masl (NWR c1)

3523 masl (Tundra lab)

- Daily flask
- O_3 Contact:

Audra McClure

audra.mcclure@noaa.gov

CAR Aircraft

- 12 flasks
- In-situ Ozone, T, RH
- collected along vertical profile up to ~ 8,000 masl
- Biweekly
- Contact:

Colm Sweeney

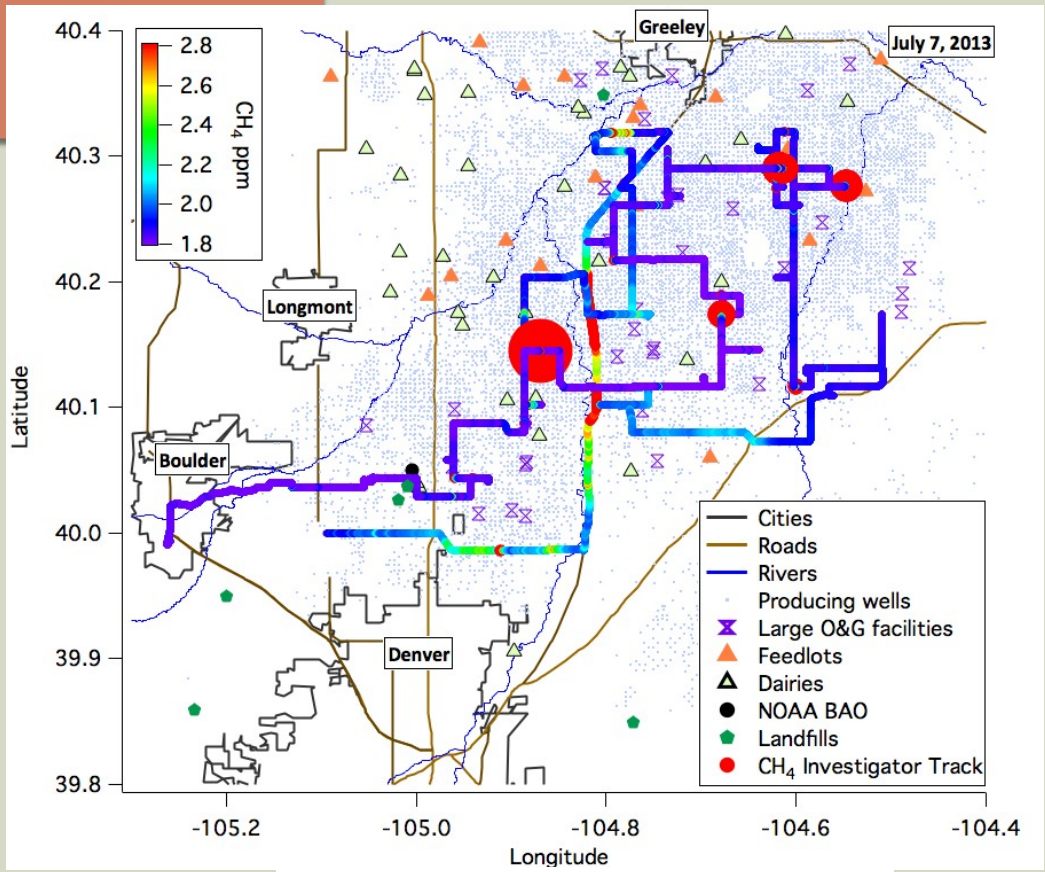
colm.sweeney@noaa.gov

GMD Mobile Laboratory

GMD Mobile Lab
- In situ CO_2, CH_4, CO, H_2O (Picarro)
- In situ Ozone (2B)
- GMD Flasks
- Met 2D sonic

- Daytime and nighttime drives
- CH_4 ($^{13}CH_4$) gradients and CH_4 hotspots
- O_3 gradients
- Repeated dense surveys in small region to map CH_4 leaks
- Compare different leak detection tools (FLIR,...)
- NSF support (AirWaterGas project)
- Contact: Gabrielle.Petron@noaa.gov

Example of in situ CH_4 during a ML survey (day and nighttime data)



AirWaterGas

Sustainability Research Network

NOAA Tethered Ozone and Met Profiles in FRAPPE

Russ Schnell for NOAA Tethersonde Group

russell.c.schnell@noaa.gov

- NOAA will operate a profiling ozone/met tethersonde at one site.
- Profiles from the surface to 1,000/2,000 ft. depending on FAA clearance and wind speed.
- Winds> 10mph: free flying ozonesonde balloons that cut away at low altitudes
- A profile can be completed every 30 minutes.
- Ozone and met available in real time.
- Surface ozone will be measured continuously at the tethersonde site and at Niwot Ridge.
- The tethersonde will operate on 10 selected days, 16 profiles/day.

Tethersonde specifications:

Ozone Absolute accuracy:	± 2ppbv
Temperature accuracy:	± 0.2 C
Humidity accuracy	± 3%
Pressure accuracy	± 0.5 mb
GPS Altitude	± 5 m
Data Frequency:	± 1 hz

Supporting Regional Assessments of CH_4 Emissions with Ground-Based Isotopic Measurements and FLIR (Forward Looking InfraRed) Imaging

Bruce H. Vaughn & Owen Sherwood, Andrea Sack

INSTAAR, University of Colorado Stable Isotope Lab

Contact: Bruce.Vaughn@colorado.edu

Combining Real-Time Mobile CH_4 Measurements with Infrared Imaging Leak Verification and Isotopic Fingerprinting

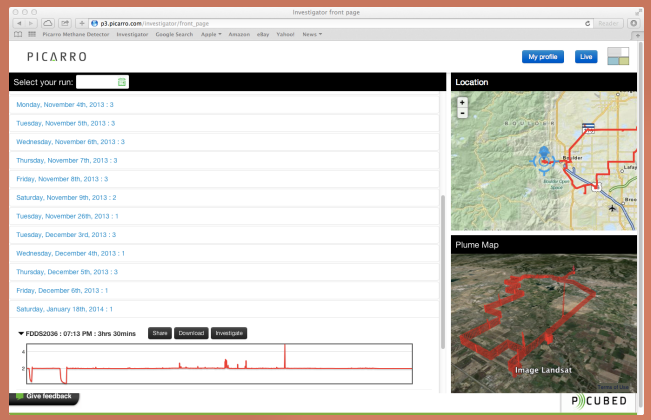
Mobile Picarro $\delta^{13}C$ of CH_4 Analyzer

- 4-wheel drive platform
- GPS
- Sonic Anemometer
- Wireless package
- Cloud Computing
- Real-time air and Mega-Core measurements

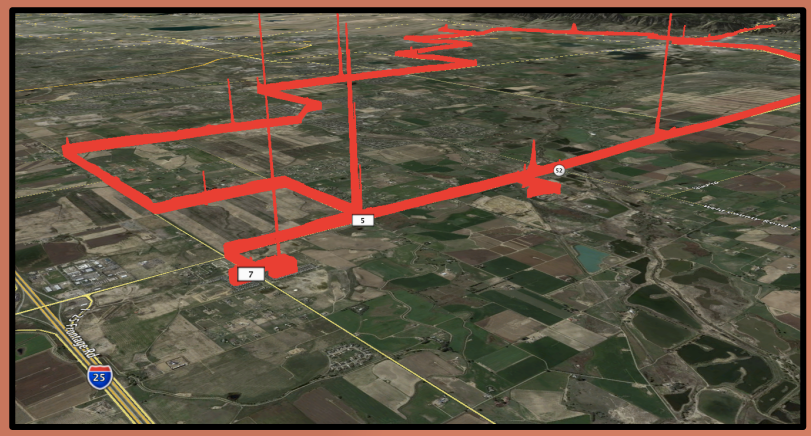
FLIR Camera

Thermal Infrared gas leak detection using the Regional Air Quality Council Optical Gas Imaging (OGI) Camera Loan Program (as available)

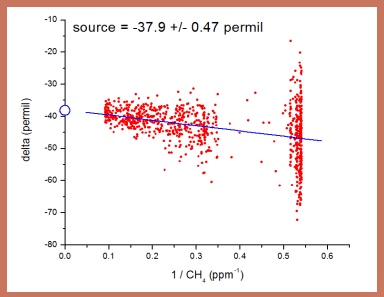
Examples of Outputs



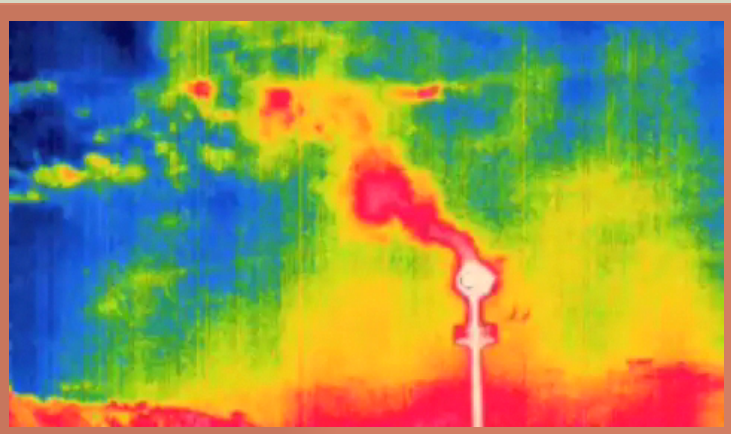
Real-Time analysis of ambient air and collection of 'Mega-Core', samples of transects that can be analyzed in detail for $\delta^{13}C$ of CH_4 in post processing.



Generate maps with measured CH_4 concentration over study area along accessible roads. All data are archived and KML files aid visualization.



Use 'Keeling-plot' identification of isotopic source signatures to distinguish methane from natural gas and oil from landfills, feedlots, wetlands, etc. and use mass spectrometer analysis for air flask samples for $\delta^{13}C$ and δD of CH_4



Use RAQC FLIR Camera to detect and verify point sources as found with infrared imagery.