1.4 Carbon Gases CSI: Mobile Lab, Methane, & More

Engage

Scientist Snapshot

(5:00) Fracking's Methane Trail: A Detective Story

As a class, listen to the story and meet Gaby Pétron, an atmospheric scientist at CIRES/NOAA.

Engage

Scientist Snapshot

[NPR radio interview](#) (5:00) Fracking's Methane Trail: A Detective Story

As a class, listen to the story and meet Gaby Pétron, an atmospheric scientist at CIRES/NOAA.

Discussion:

- Why do we call carbon monoxide, carbon dioxide, and methane "carbon gases"?

- Why do you think scientists are interested in knowing the levels of carbon gases in the air?

- What is "Picarro"? What does it measure?

- What is does the term "spike" mean in regards to measuring gases in the atmosphere?

Engage

NOAA Mobile Laboratory Introduction:

Explore

Researching Carbon Gases

Carbon gases "fast facts" (one per student, based on their assigned carbon gas):

CO: http://www.epa.gov/airquality/carbonmonoxide/

CO2: http://www.epa.gov/climatechange/ghgemissions/gases/co2.html

CH4: http://epa.gov/climatechange/ghgemissions/gases/ch4.html

1. Circle the carbon gas that your team is researching:
    Carbon monoxide   Carbon Dioxide   Methane

2. Write the chemical symbol of your carbon gas.

3. Is this carbon gas naturally occurring in Earth's atmosphere? If so, give an example(s) of where this carbon gas is found in nature.

4. Do human activities (sources) emit (release) this carbon gas into the atmosphere? If so, give an example(s) of human activities that emit this carbon gas.

5. Can this carbon gas affect human health and/or the environment? If so, give one example of human health and/or environmental effects caused by this carbon gas.

Explain

Carbon Gas Data Plot Analysis

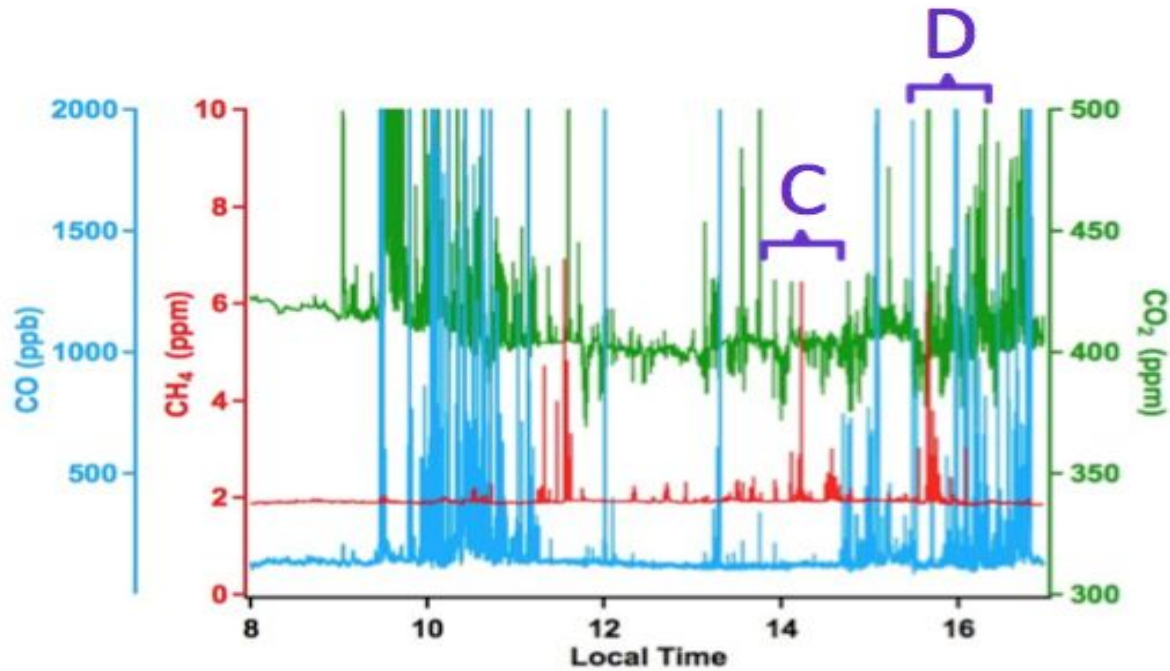

Carbon Gas Levels Recorded by Picarro – July 21st (Day 1)
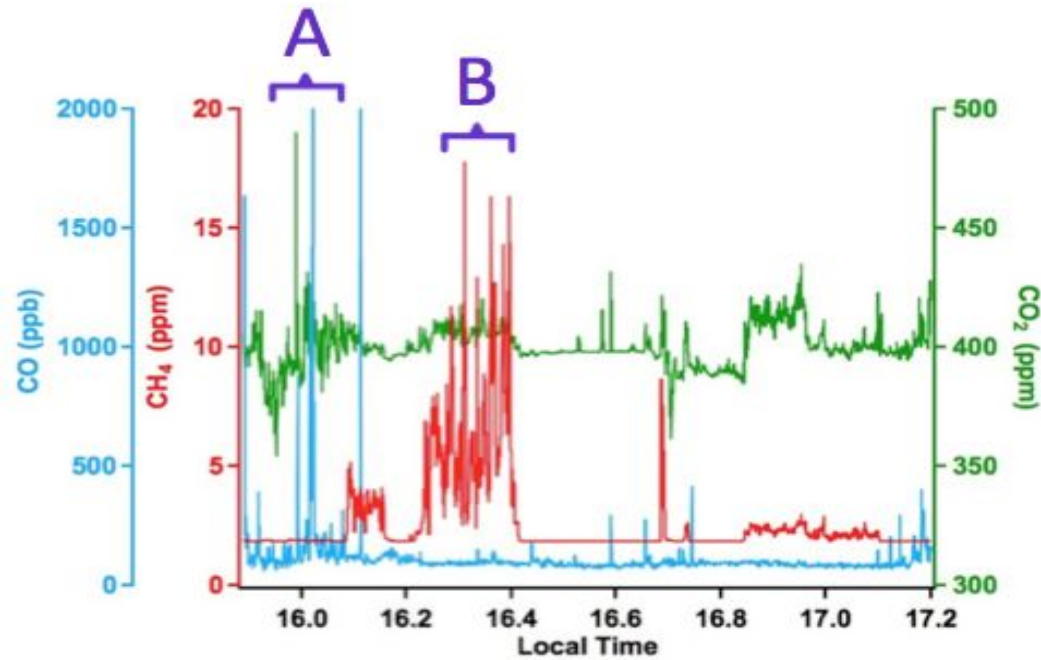
Key:
A = Mobile Lab Measurement Data Plot
___ = Carbon Dioxide (CO₂) Levels
___ = Carbon Monoxide (CO) Levels
___ = Methane (CH₄) Levels

Explain

Carbon Gas Data Plot Analysis

Carbon Gas Levels Recorded by Picarro – July 22nd (Day 2)

Key:
A = Mobile Lab Measurement Data Plot
___ = Carbon Dioxide (CO₂) Levels
___ = Carbon Monoxide (CO) Levels
___ = Methane (CH₄) Levels

Explain

Picarro Carbon Gas Spike Maximum Levels			
Data Plot	CO2 (ppm)	CO (ppb)	CH4 (ppm)
A			
B			
C			
D			

| NOAA Mobile Lab Air Quality Monitoring			
Monitoring Locations	Main Carbon Gas Source (e.g. Landfill)	Predicted Data Plot Match (A - D)	Actual Data Plot Match (A - D)
1			
2			
3			
4			

2: Landfill Conditions: This is a very large, active landfill and on this day there was limited road traffic.

3. Oil and Gas Wells Conditions: These wells are located in a rural area in Weld County. Road traffic is limited at this location.
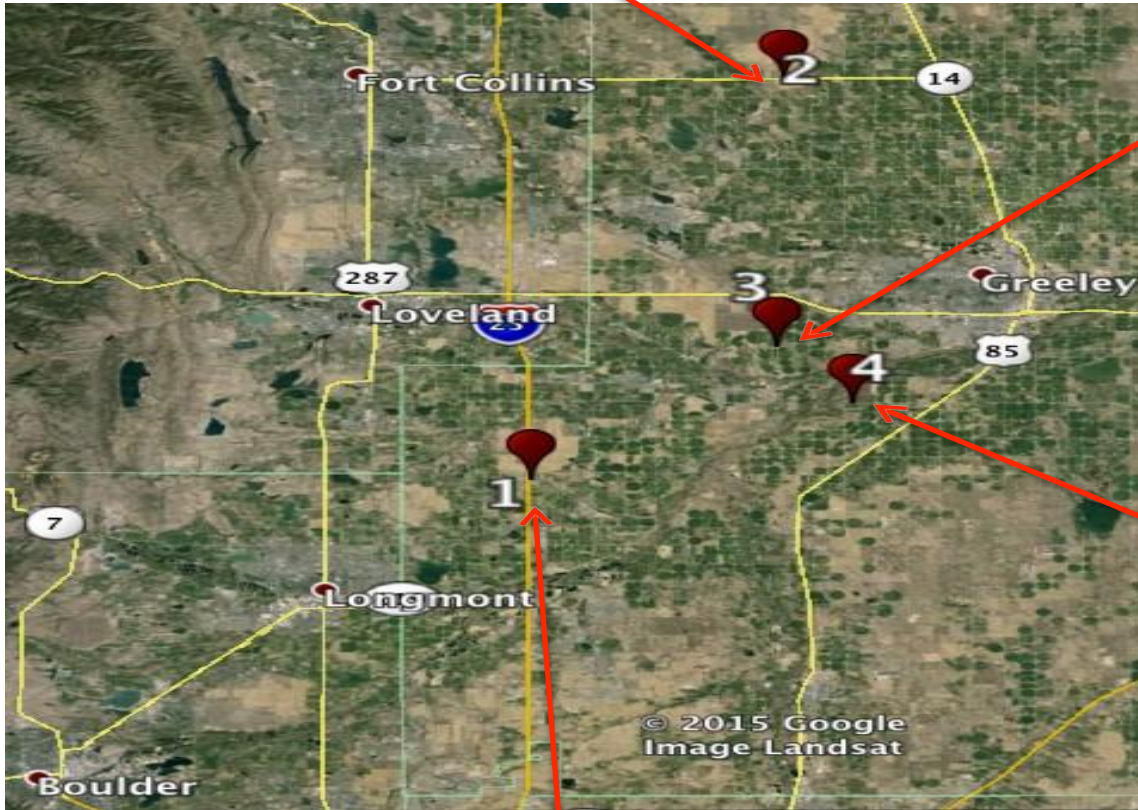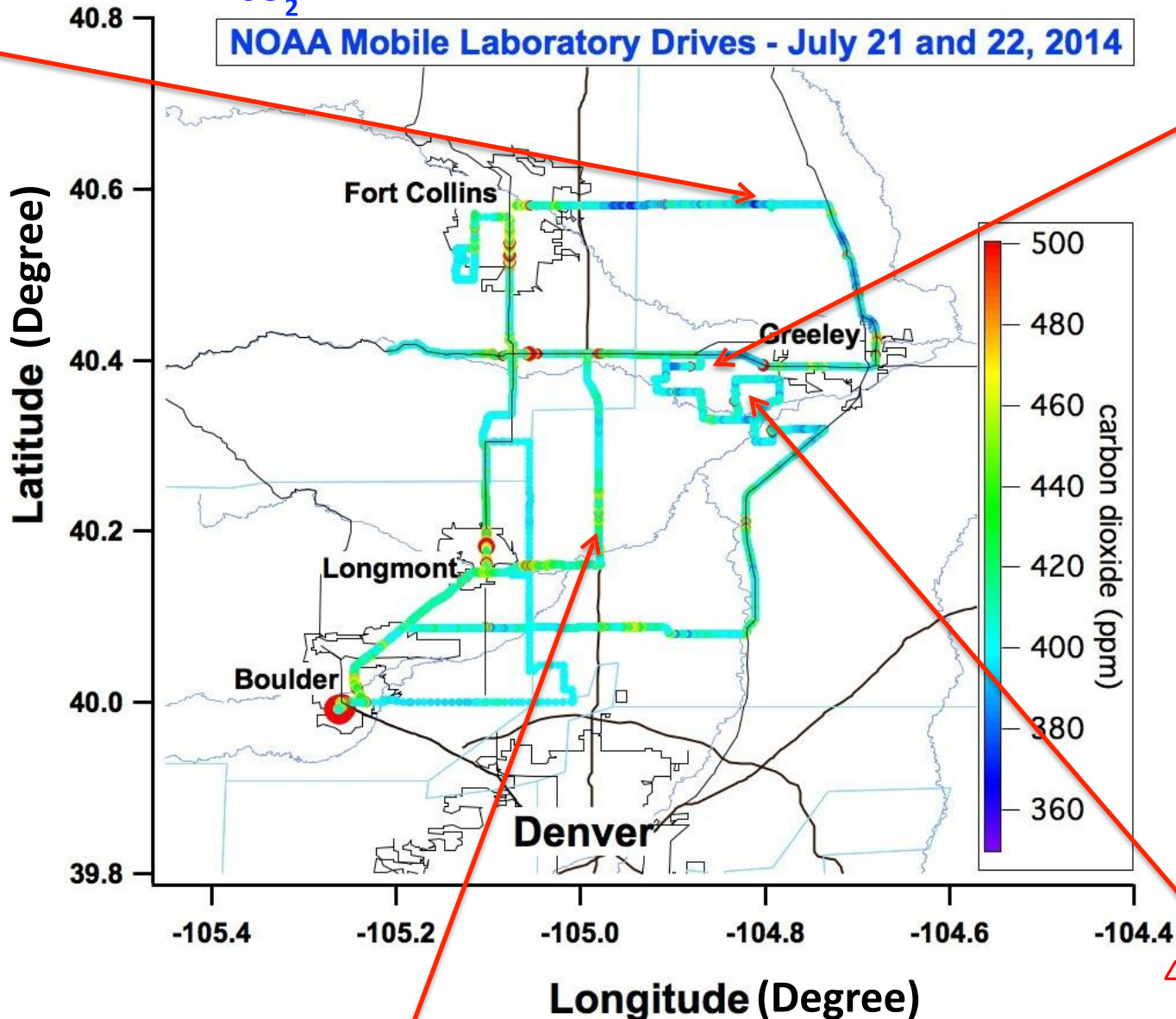
4: Cow CAFO (controlled animal feeding opera.on) Conditions: This cow feedlot is located near a major road. There was high traffic on this day.

1: I-25 Corridor Conditions: Consistent traffic, including passenger cars and 18-wheeler semi-trailer trucks.

CO$_2$

NOAA Mobile Laboratory Drives - July 21 and 22, 2014

2: Landfill

3: Oil and Gas Wells

Latitude (Degree)

40.8
40.6
40.4
40.2
40.0
39.8

Fort Collins

Greeley

Longmont

Boulder

Denver

carbon dioxide (ppm)

500
480
460
440
420
400
380
360

4: Cow Feedlot

1: I--25

-105.4   -105.2   -105.0   -104.8   -104.6   -104.4

Longitude (Degree)

CO

NOAA Mobile Laboratory Drives - July 21 and 22, 2014
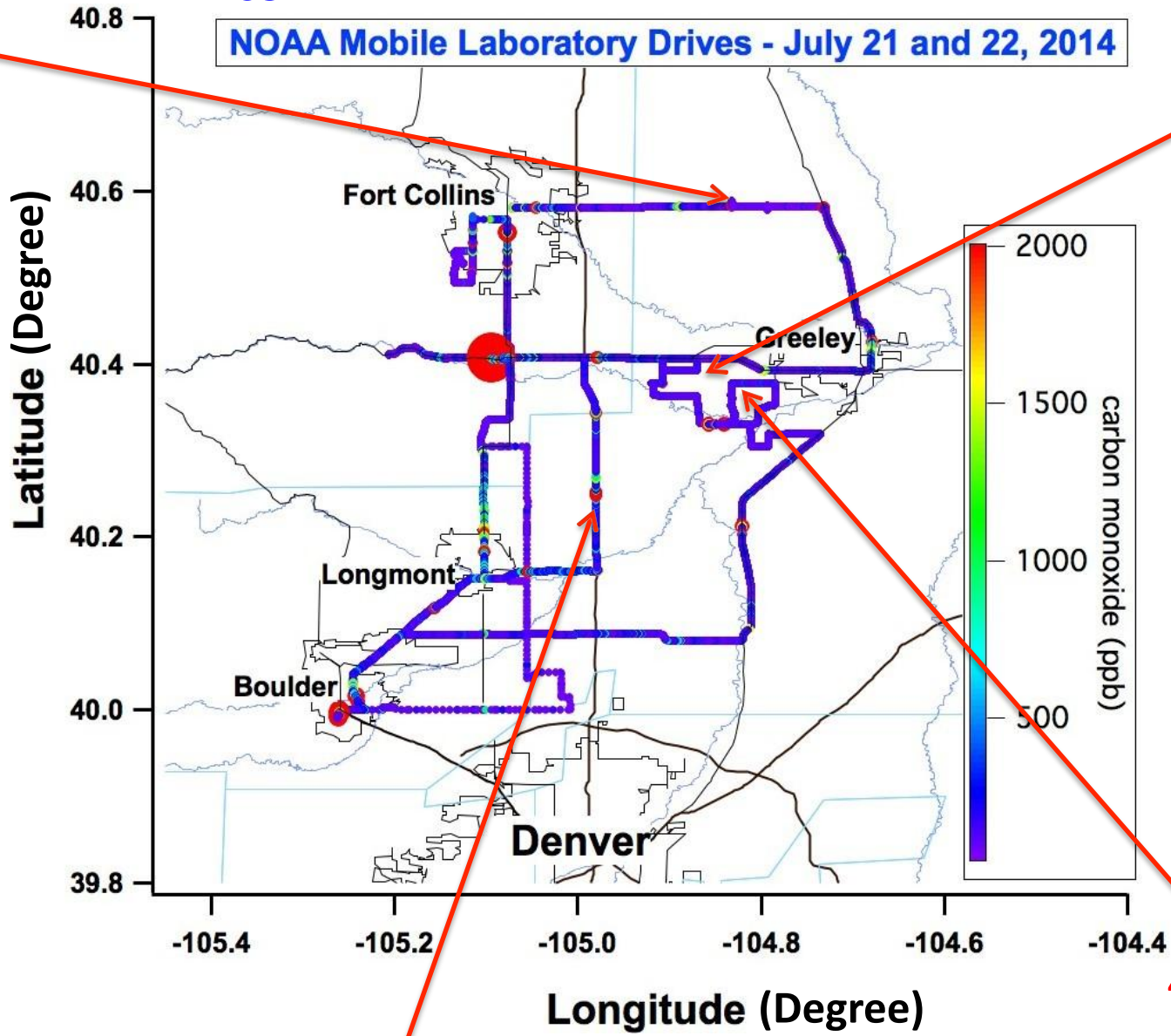
2: Landfill

3: Oil and Gas Wells

4: Cow Feedlot

1: I--25

carbon monoxide (ppb)

2000

1500

1000

500

Fort Collins

Greeley

Longmont

Boulder

Denver

Latitude (Degree)

Longitude (Degree)

CH$_4$

NOAA Mobile Laboratory Drives - July 21 and 22, 2014

2: Landfill

3: Oil and Gas Wells

Fort Collins

Greeley

methane (ppm)

3.0
2.8
2.6
2.4
2.2
2.0
1.8

Longmont

Boulder

Denver

40.8
40.6
40.4
40.2
40.0
39.8

Latitude (Degree)

-105.4   -105.2   -105.0   -104.8   -104.6   -104.4

Longitude (Degree)

1:
I--25

4: Cow Feedlot

Evaluate

Carbon Gases & Me Think-Pair-Share

1. How do the sources of carbon gases (energy production, landfills, animal feedlots, and roadways) relate directly or indirectly to your daily life (think about your needs and uses of electricity, garbage collection, food sources, transportation, etc.)? Explain.

2. What are ways that you can help reduce the contribution of anthropogenic (human made) carbon gases (CO, CO2, and CH4) in the atmosphere (think about saving energy in your home, recycling, food choices, walk/bike/bus/carpool, etc.)? Explain.