



# Overview of Carbon Monoxide, Carbon Dioxide, and Methane Measurements during WINTER

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# Fast-Response In Situ Carbon Dioxide and Methane by Cavity Ringdown Absorbance Spectroscopy

**Picarro G2311 WS-CRDS**

**Fast-response CO<sub>2</sub> CH<sub>4</sub> and H<sub>2</sub>O analyzer**

**Precision (0.1-s averaging time):**

**250 ppbv CO<sub>2</sub>**

**3 ppbv CH<sub>4</sub>**

**10-Hz freq response**

**(vendor spec; likely limited to ~5 Hz by inlet configuration)**



## In Situ Carbon Monoxide by VUV Fluorescence

**Aero-Laser 5002 VUV resonance fluorescence**

**Source wavelength: 151 nm**

**CO emission wavelengths: 170-200nm**

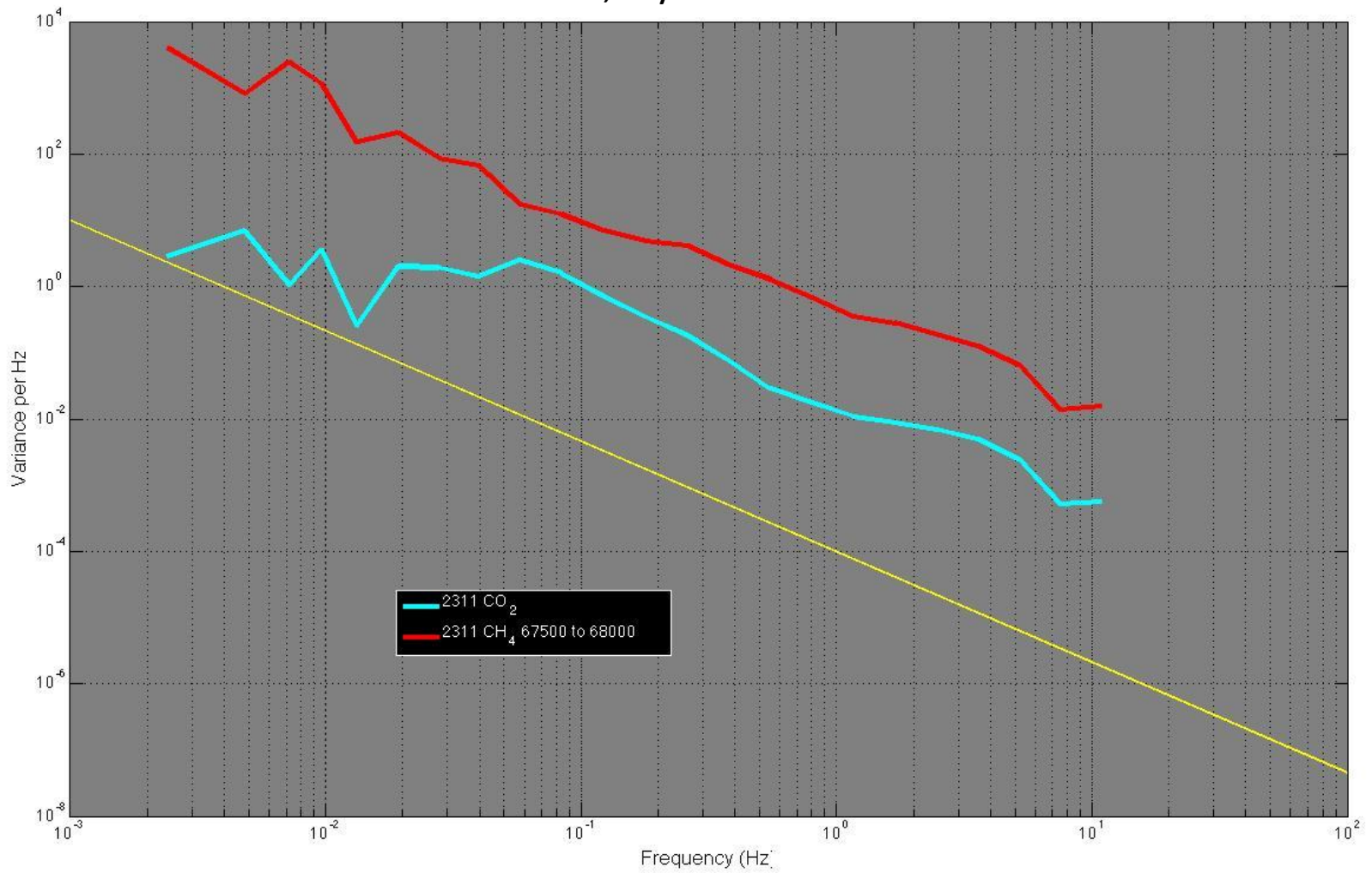
**2 ppbv precision (1-s averaging time)**

**.5-Hz freq response**

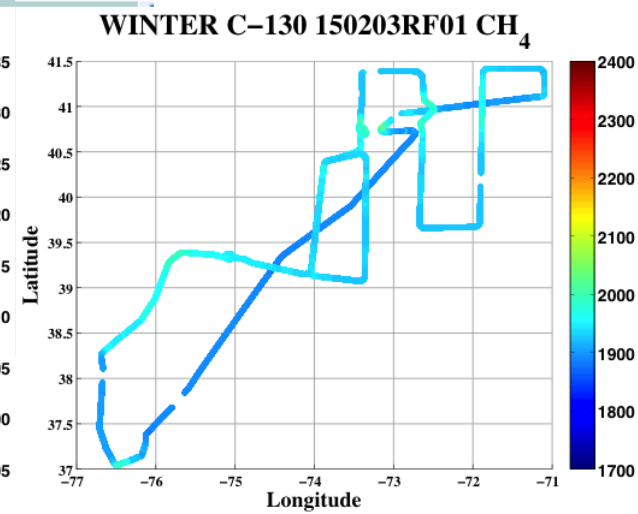
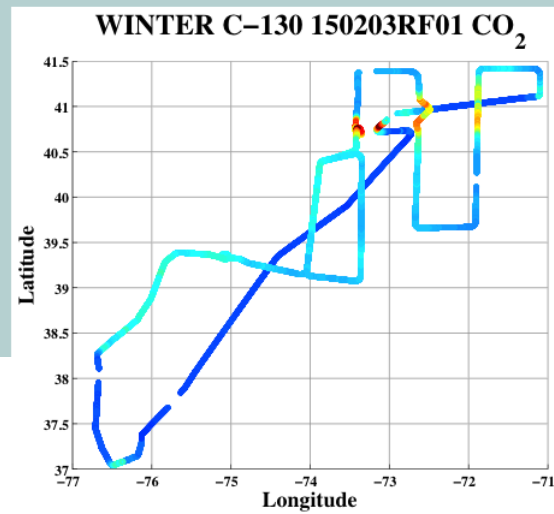
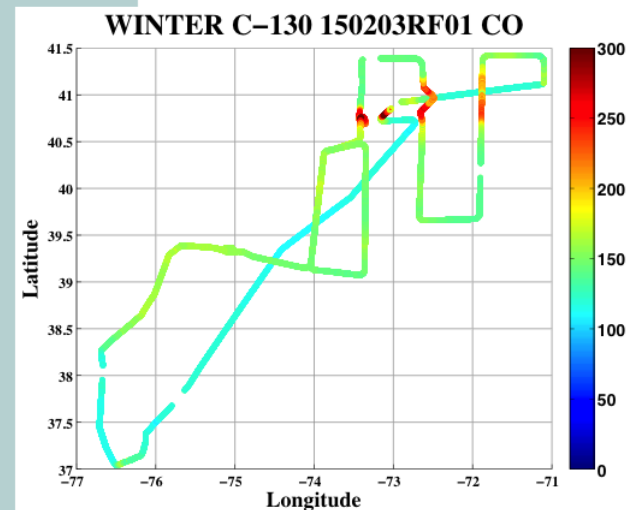
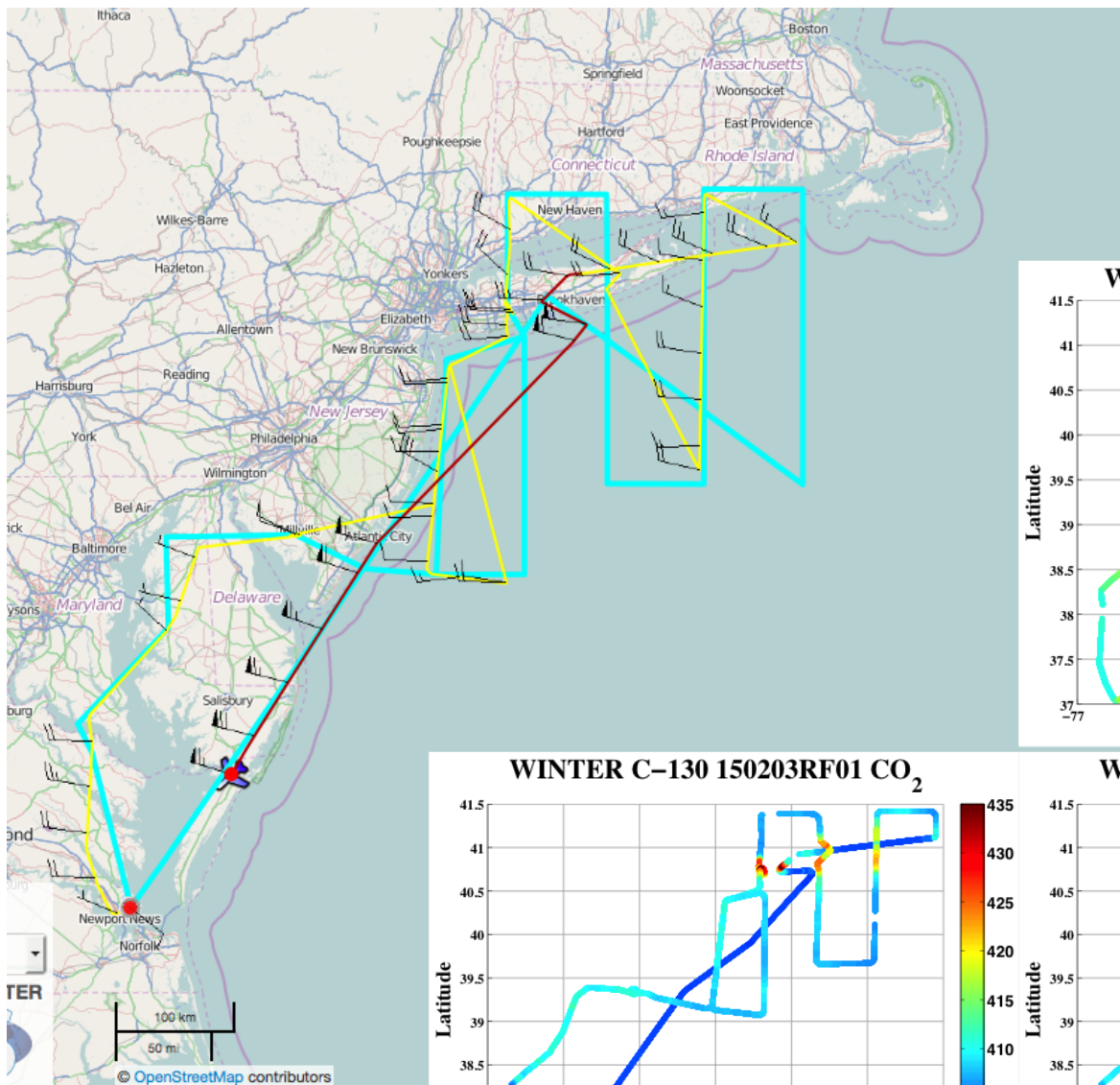
**2 ppbv ± 3% accuracy**



NOMADSS RF05 June 14, 2013 Power Spectral Density of  
Plume-free SE US Boundary Layer Transect  
Red: Methane, Cyan: Carbon Dioxide

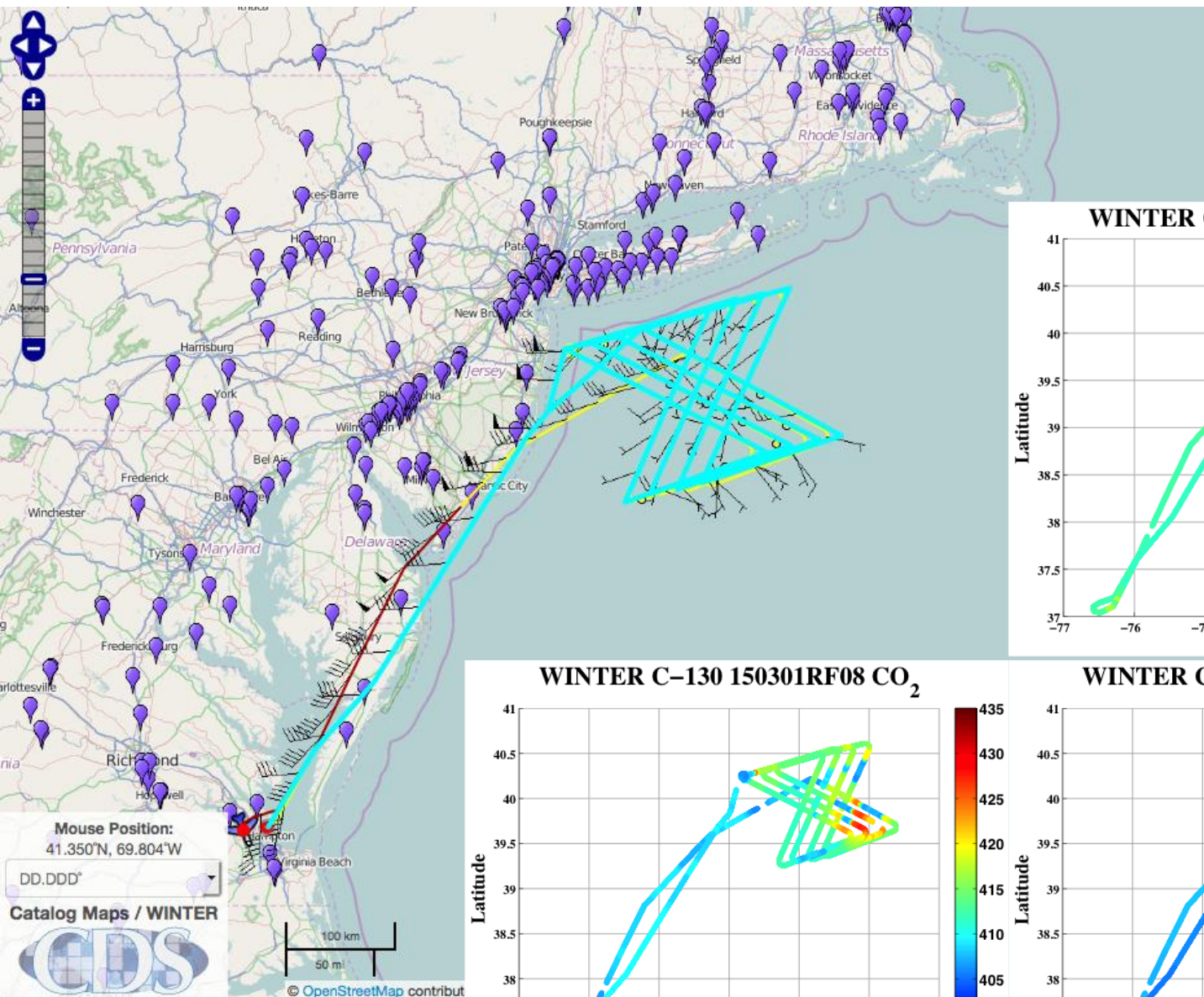


# RF01: Day into Night Transition - Eastern Seaboard

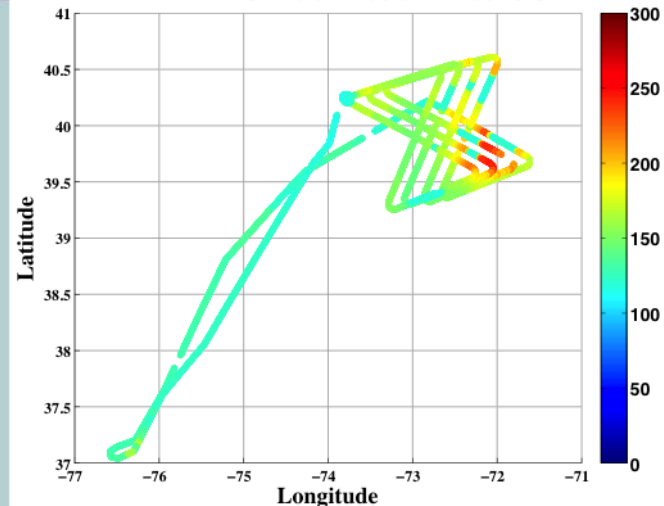




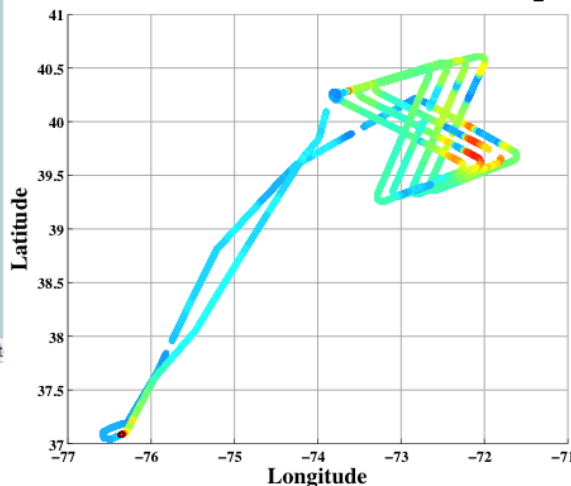
# RF08: Eastern Seaboard



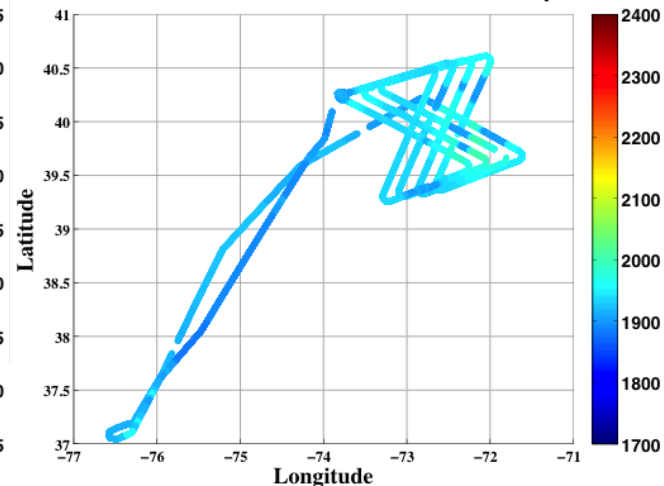
### WINTER C-130 150301RF08 CO



### WINTER C-130 150301RF08 CO<sub>2</sub>



### WINTER C-130 150301RF08 CH<sub>4</sub>



Mouse Position:  
41.350°N, 69.804°W

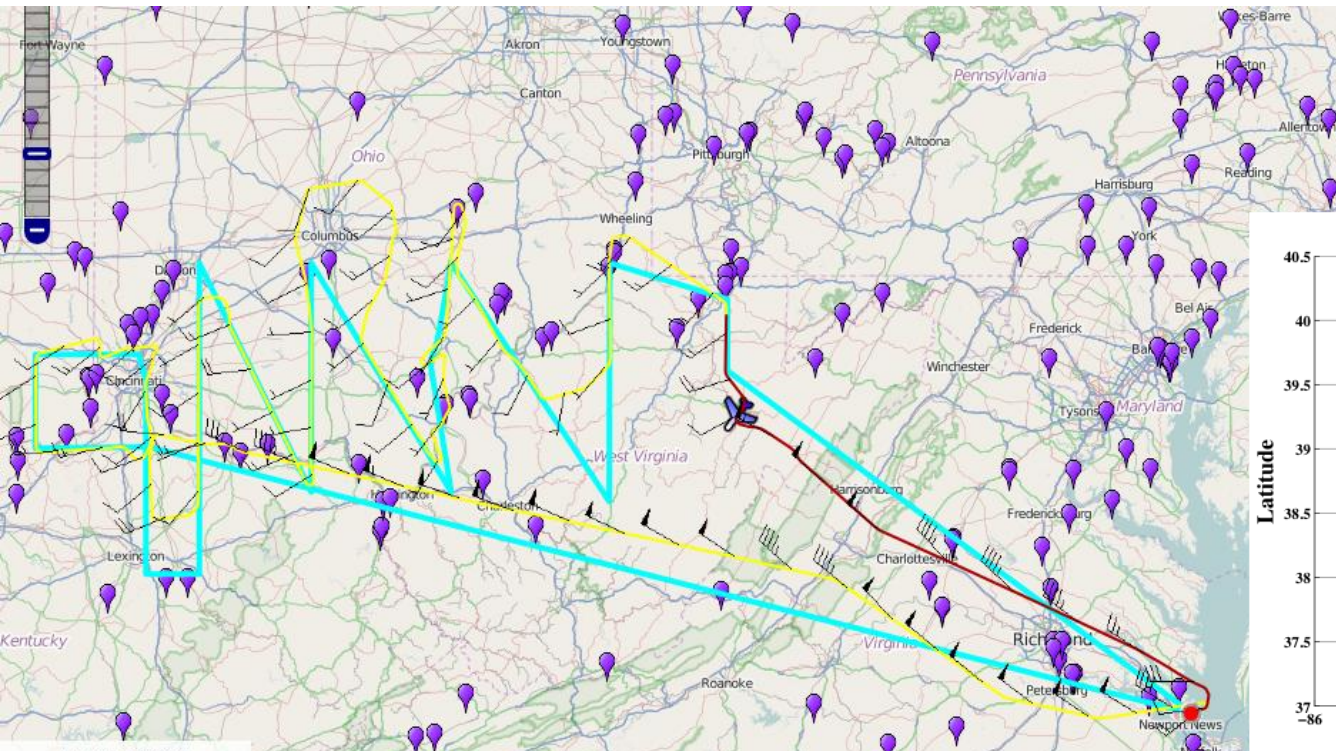
DD.DDD°

Catalog Maps / WINTER



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# RF02: Daytime Ohio Valley



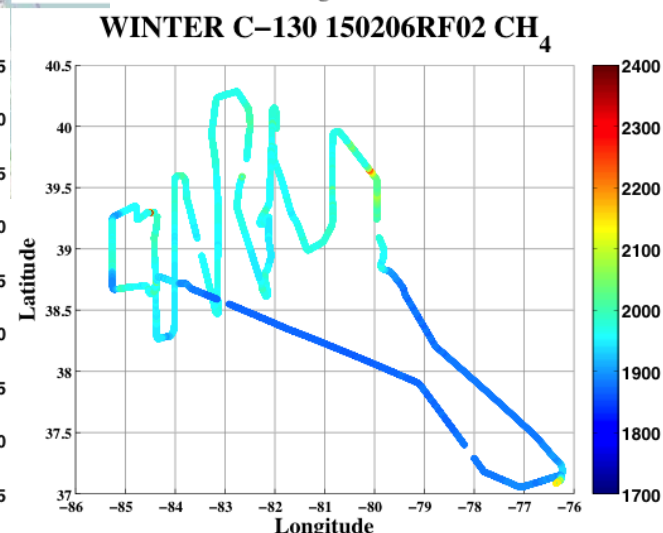
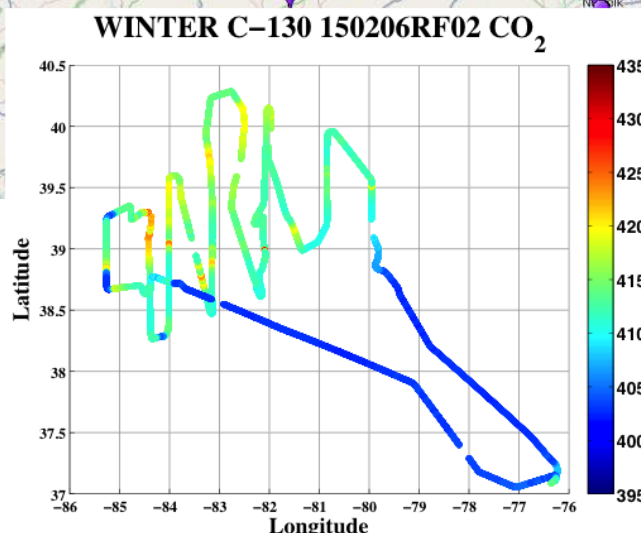
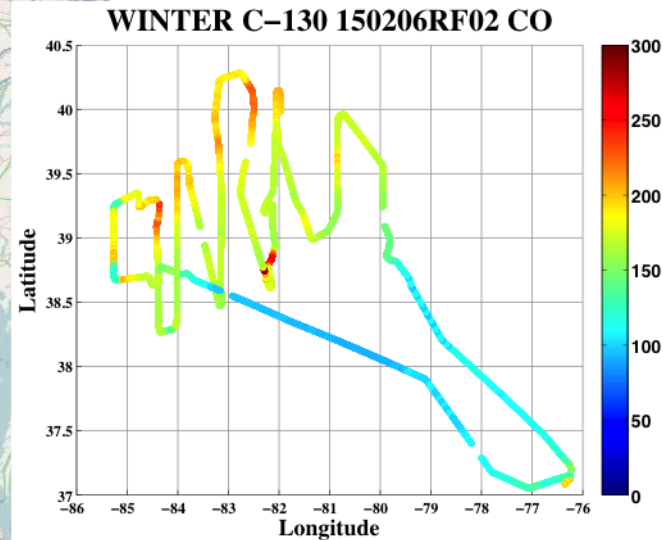
Mouse Position:  
37.123°N, 77.873°W

DD.DDD°

Catalog Maps / WINTER

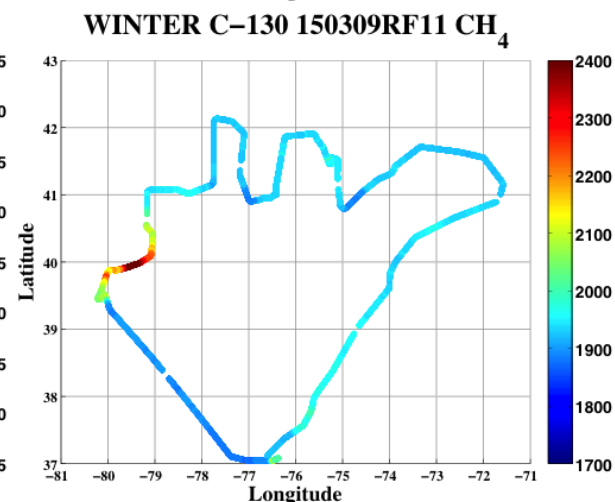
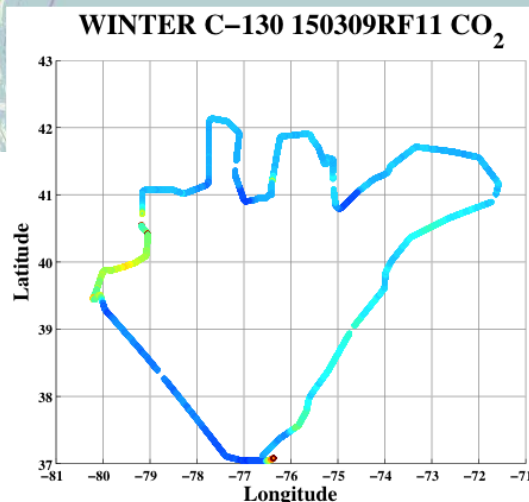
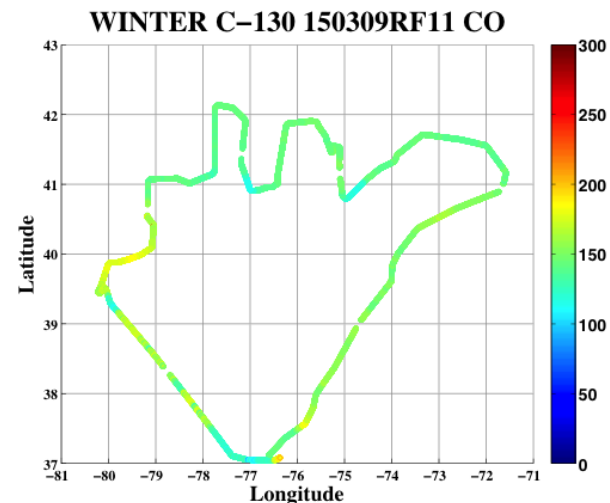
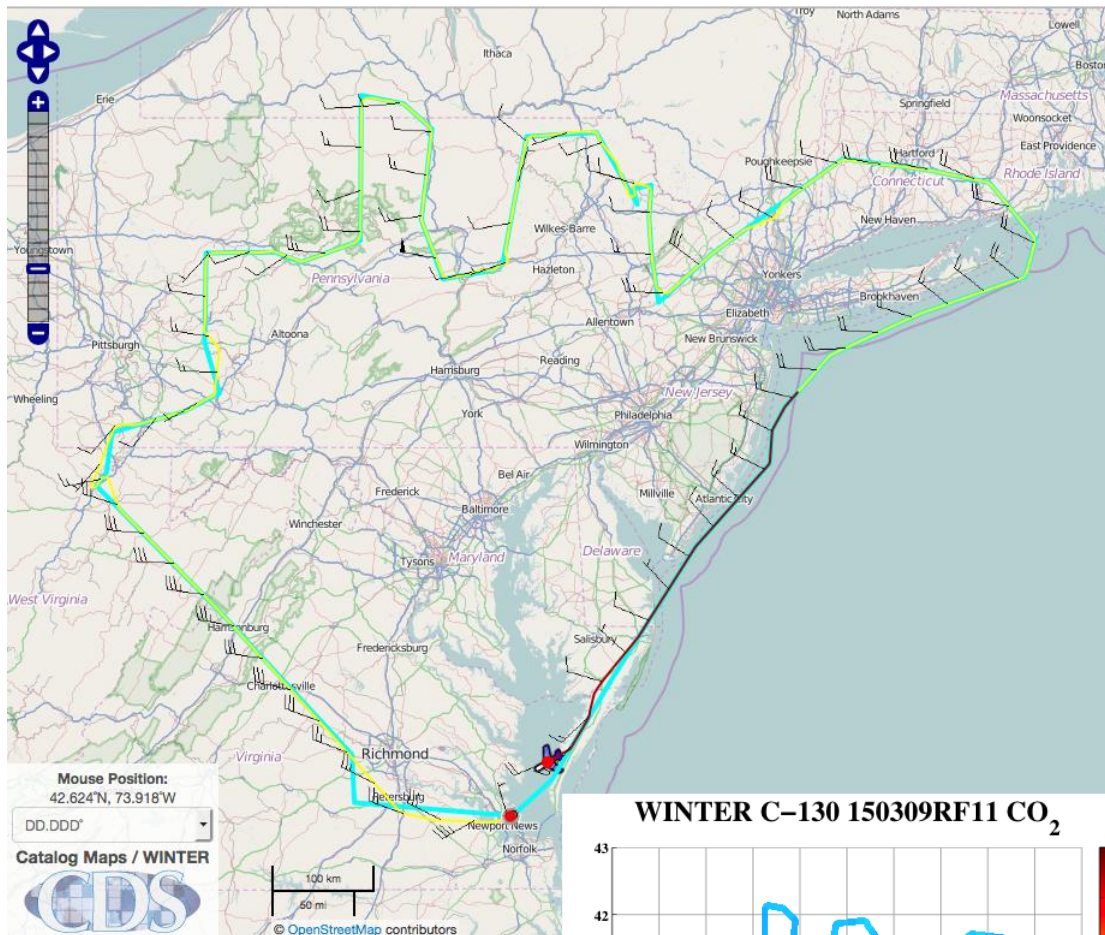
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100 km  
50 mi

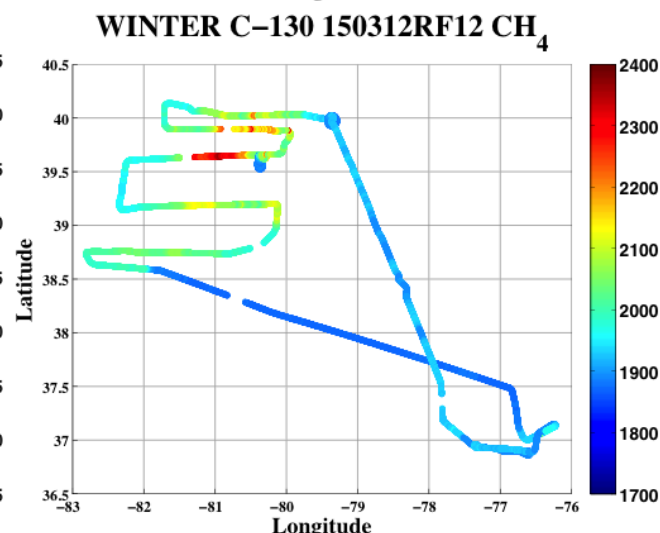
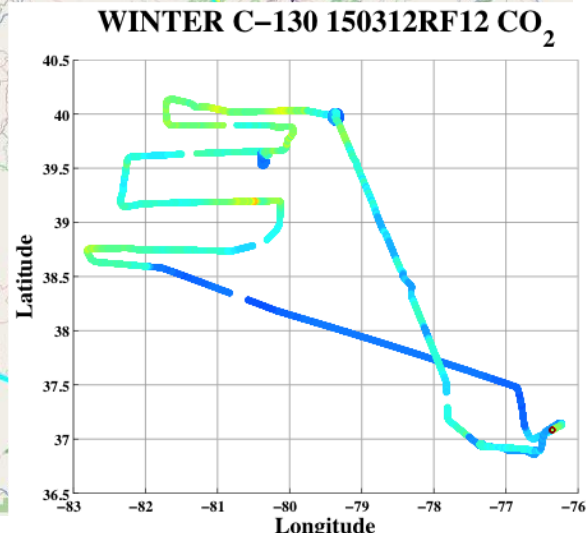
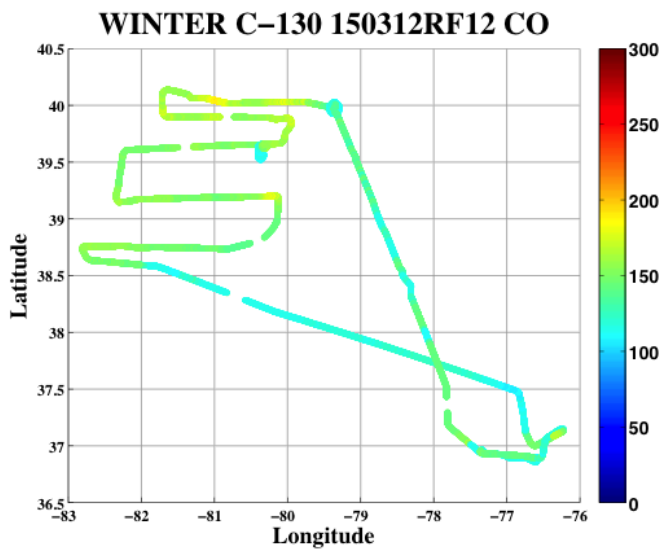
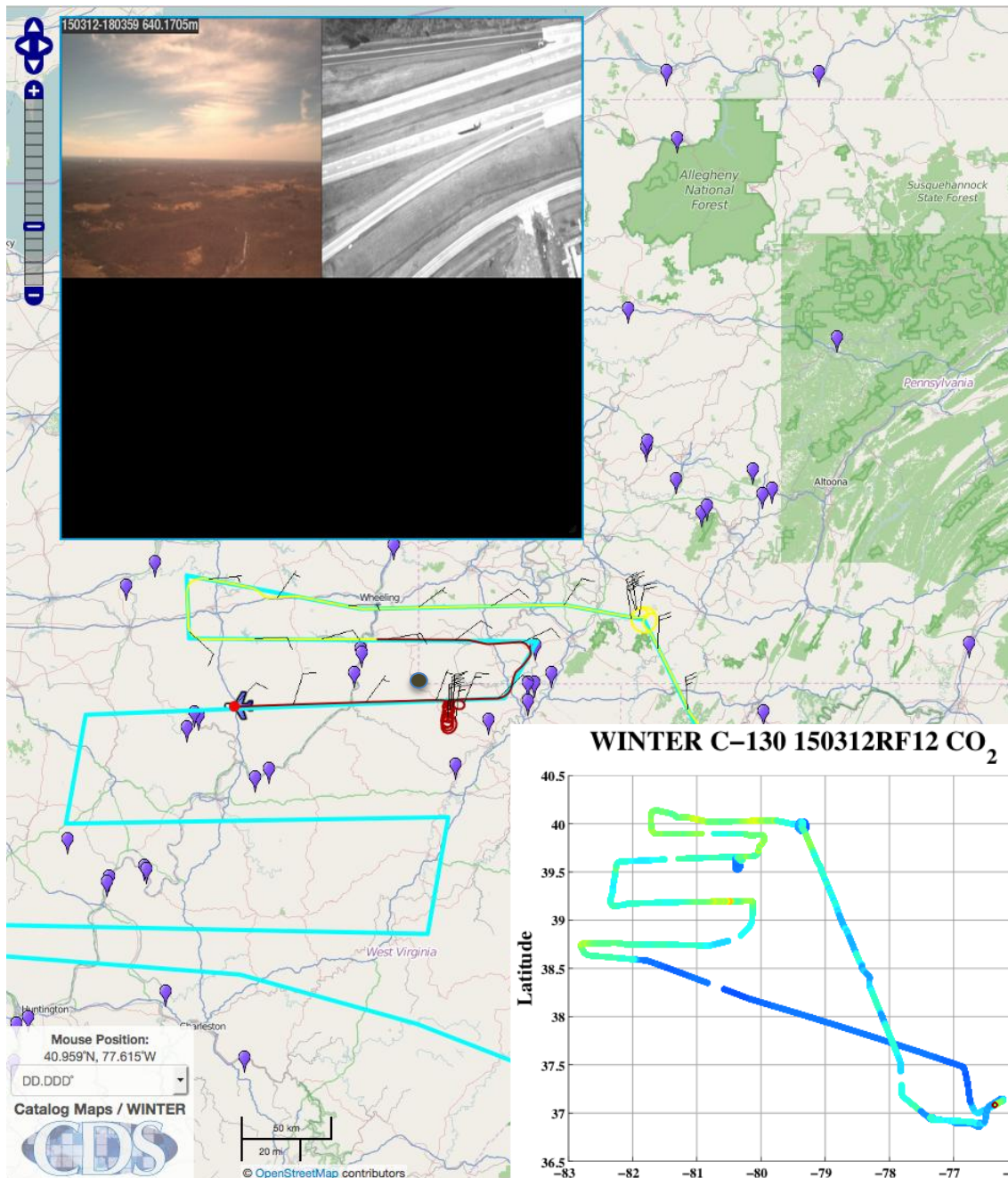




# RF11: Pittsburgh and NYC urban and power plant emissions; survey PA Marcellus shale region

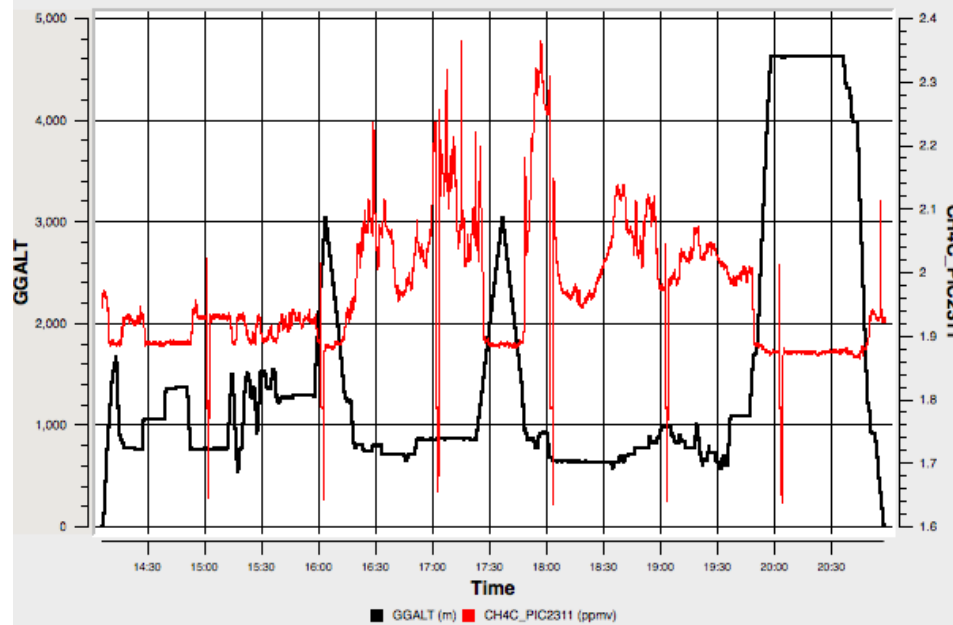


# RF12: Ohio Valley

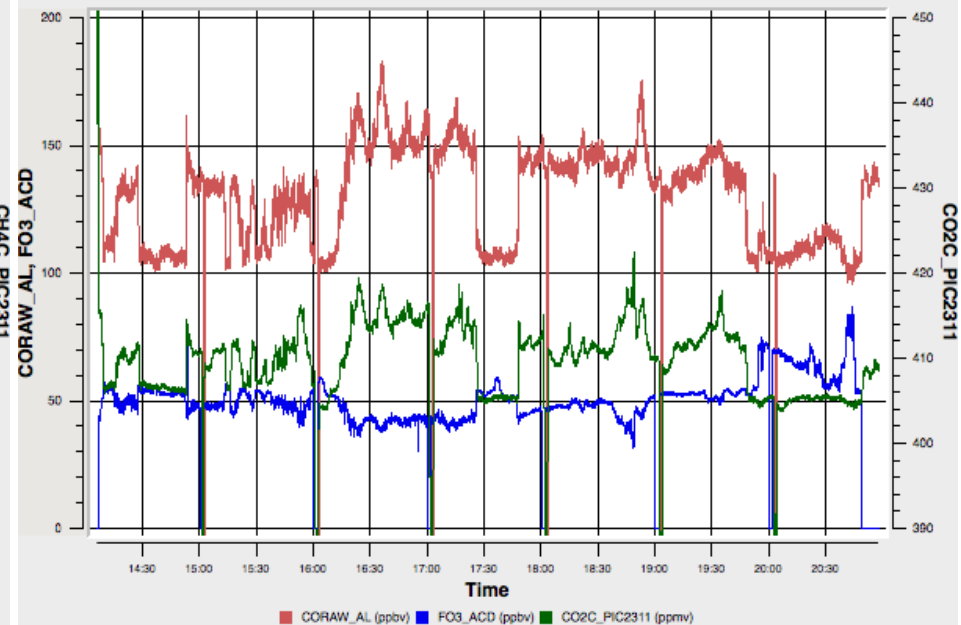




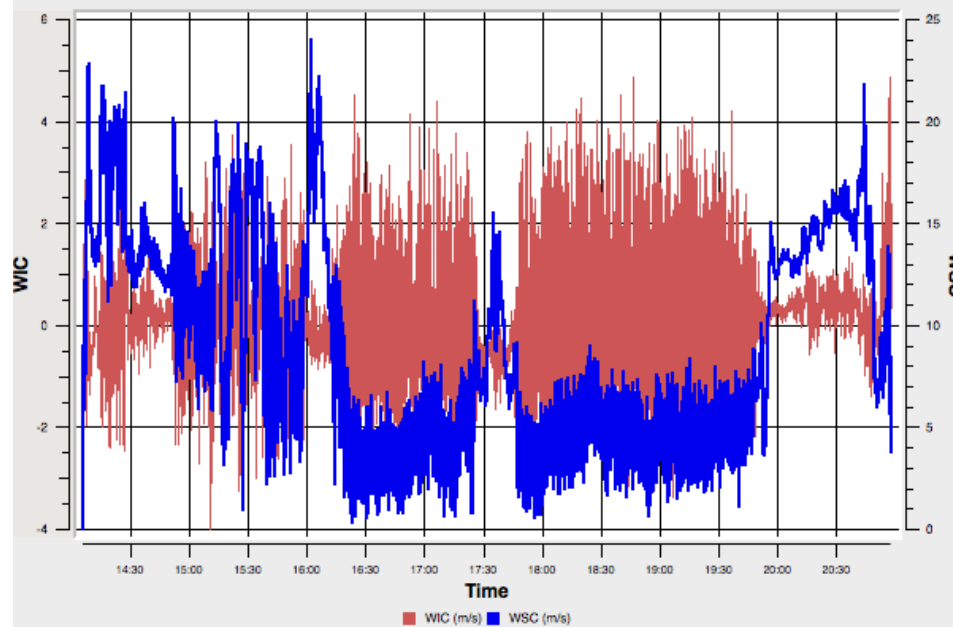
2015-Mar-12 14:06:00 - 20:58:00



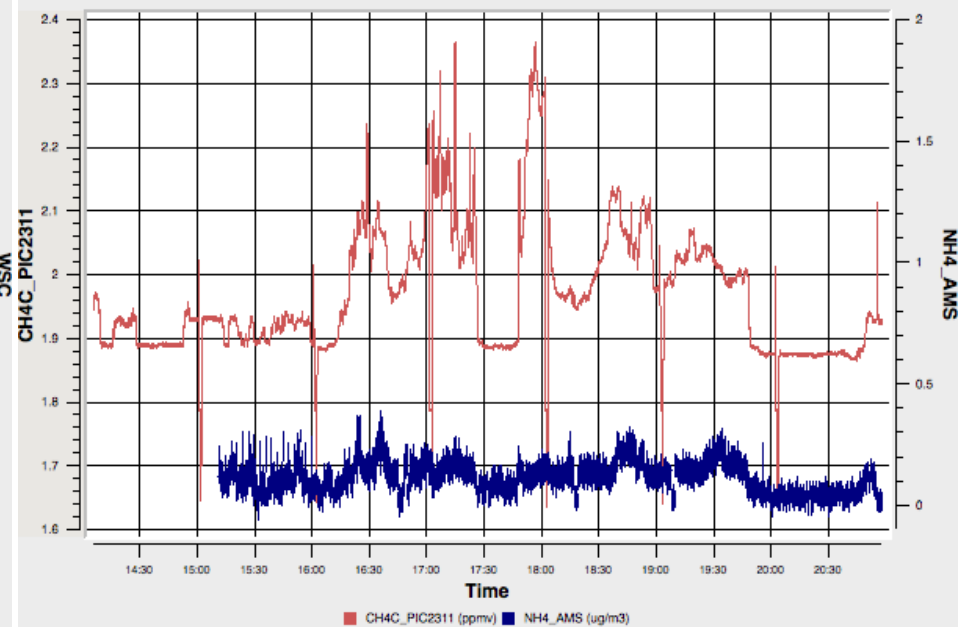
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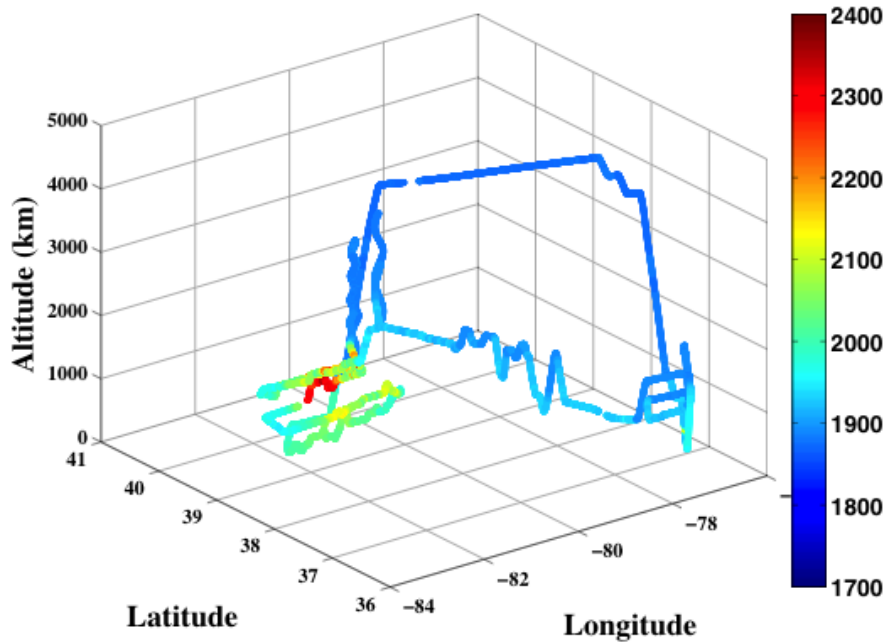
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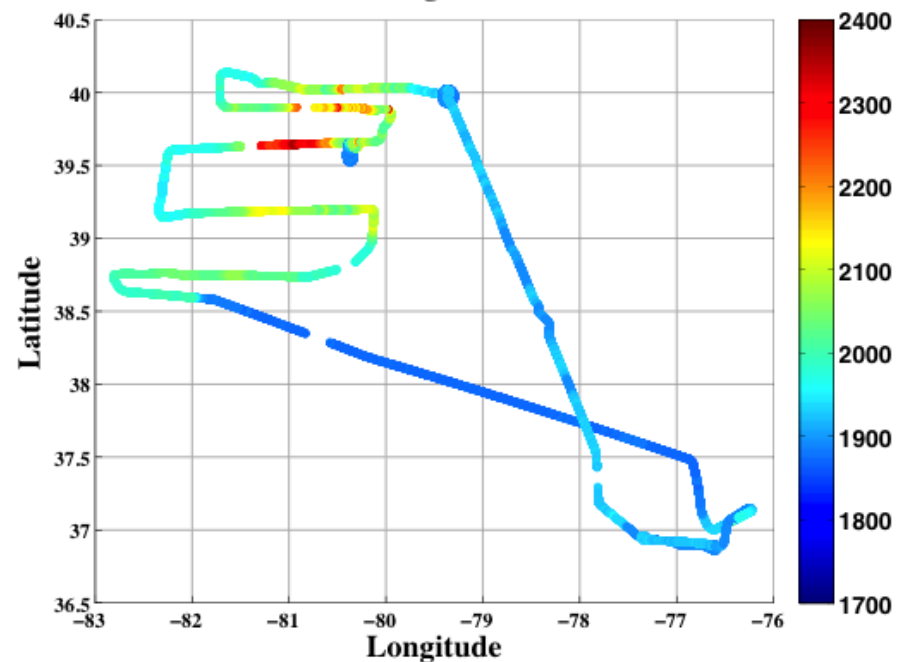
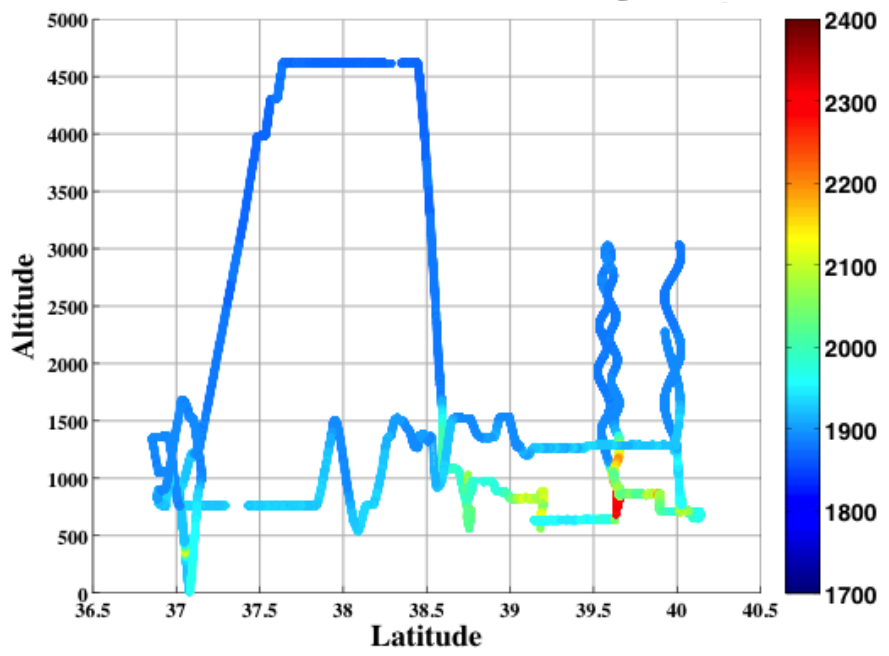
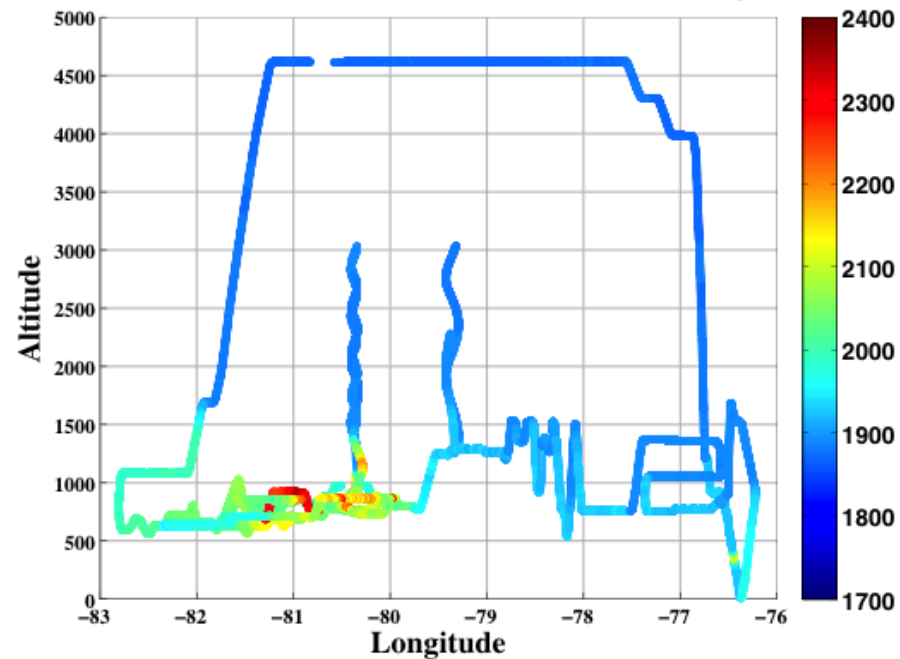
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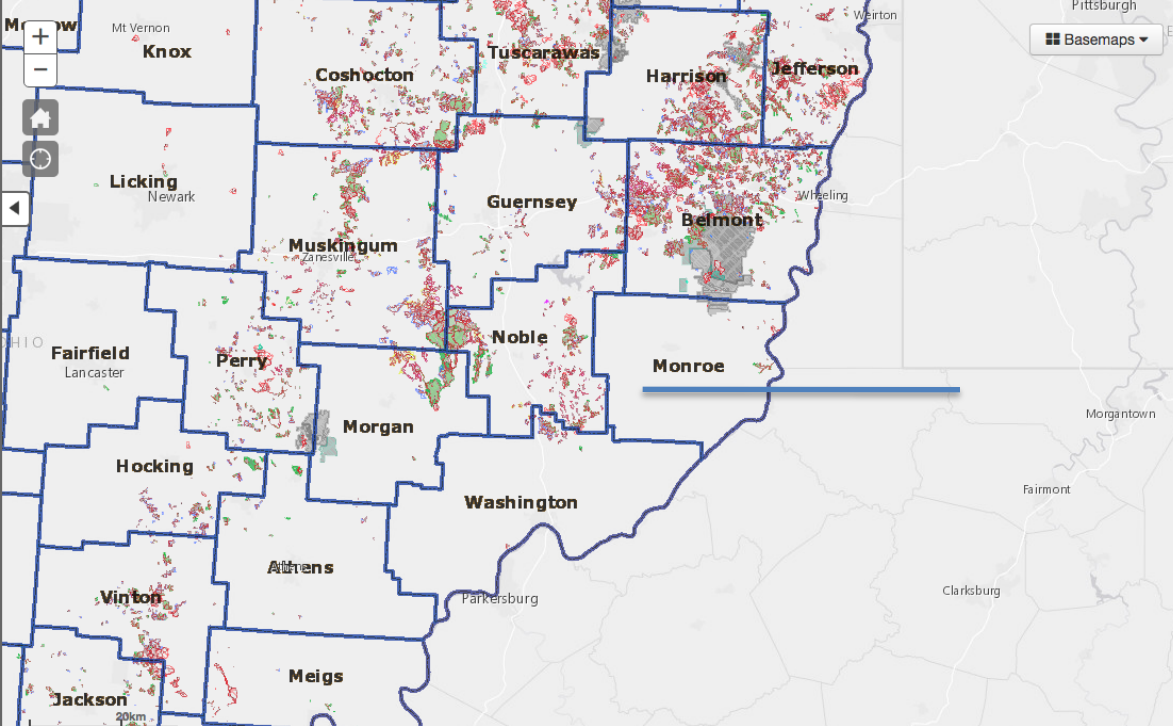


WINTER C-130 12 CH<sub>4</sub>



WINTER C-130 150312RF12 CH<sub>4</sub>





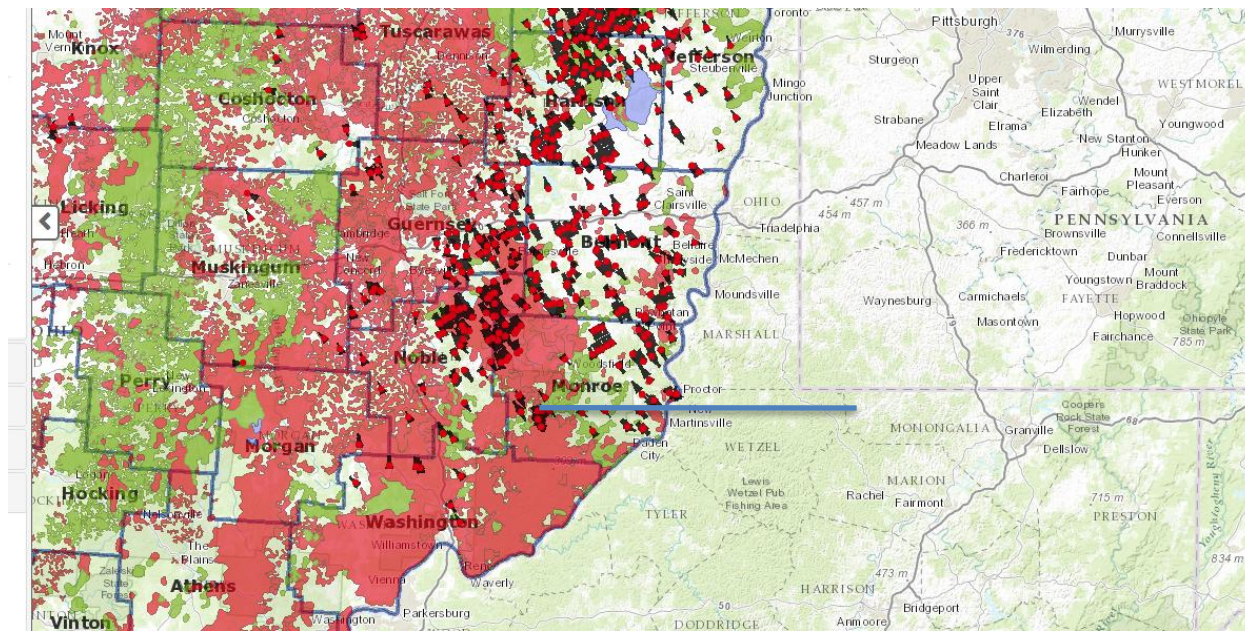
## Ohio Department of Natural Resources Maps

Coal Mines:  
Active and Proposed

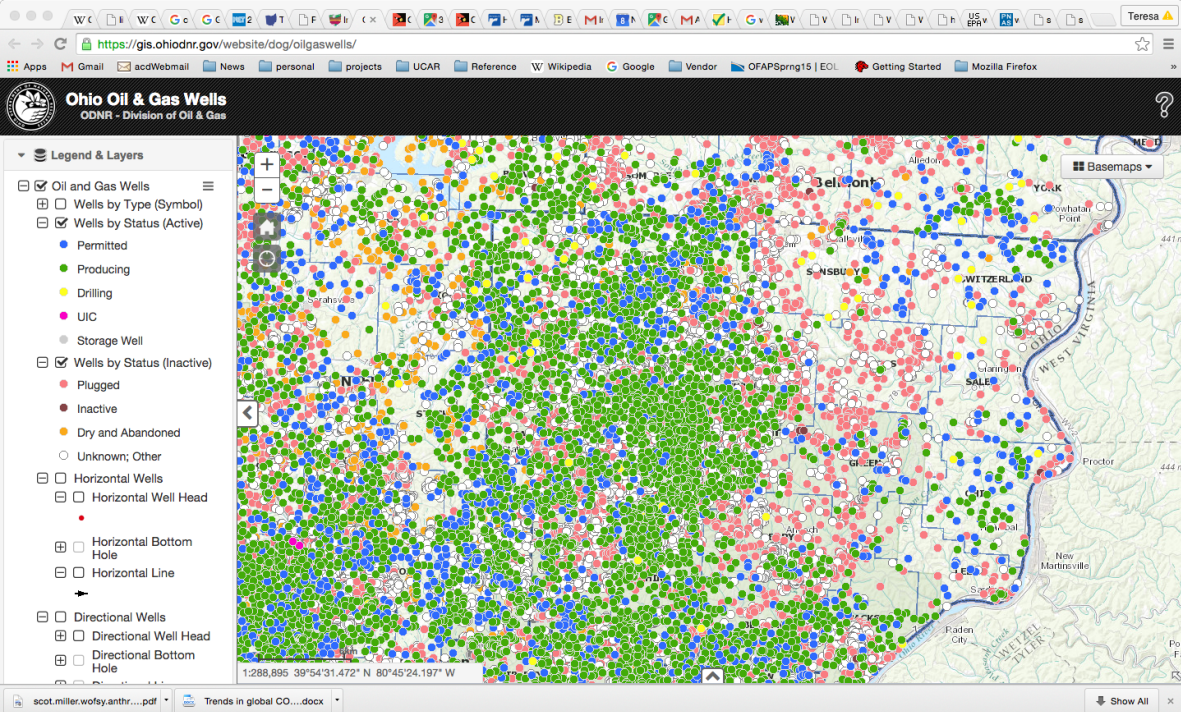
<https://gis.ohiodnr.gov/website/mrm/OhioMines/>

Oil and Gas Wells

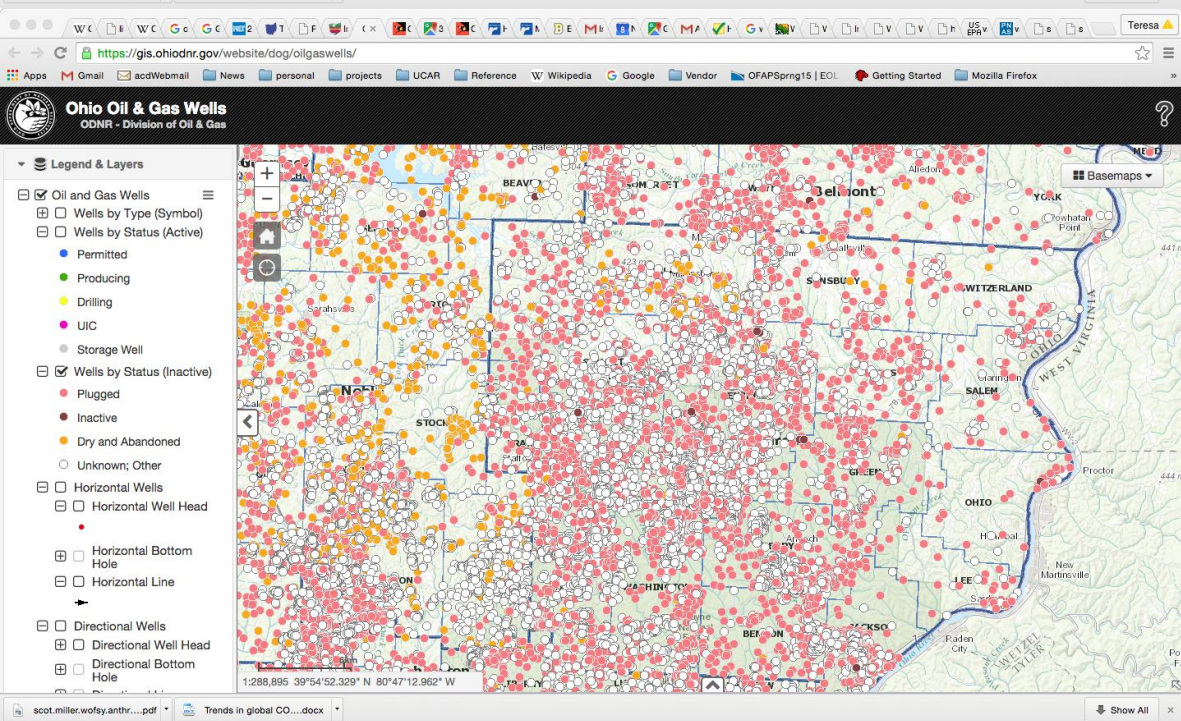
<https://gis.ohiodnr.gov/website/dog/oilgaswells/>







Blue and Green: Active Wells

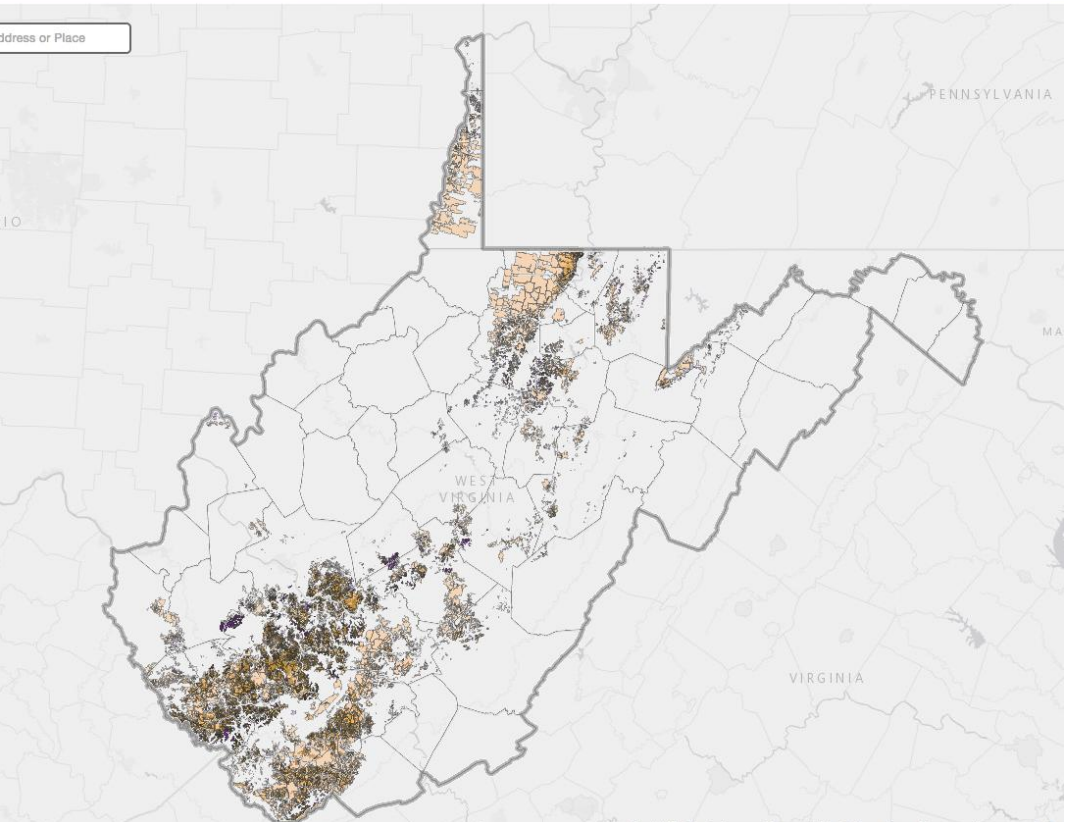


Pink and Orange: Inactive Wells



# Underground and Surface Coal Mines

Zoom in and click on mine outline to get further information.



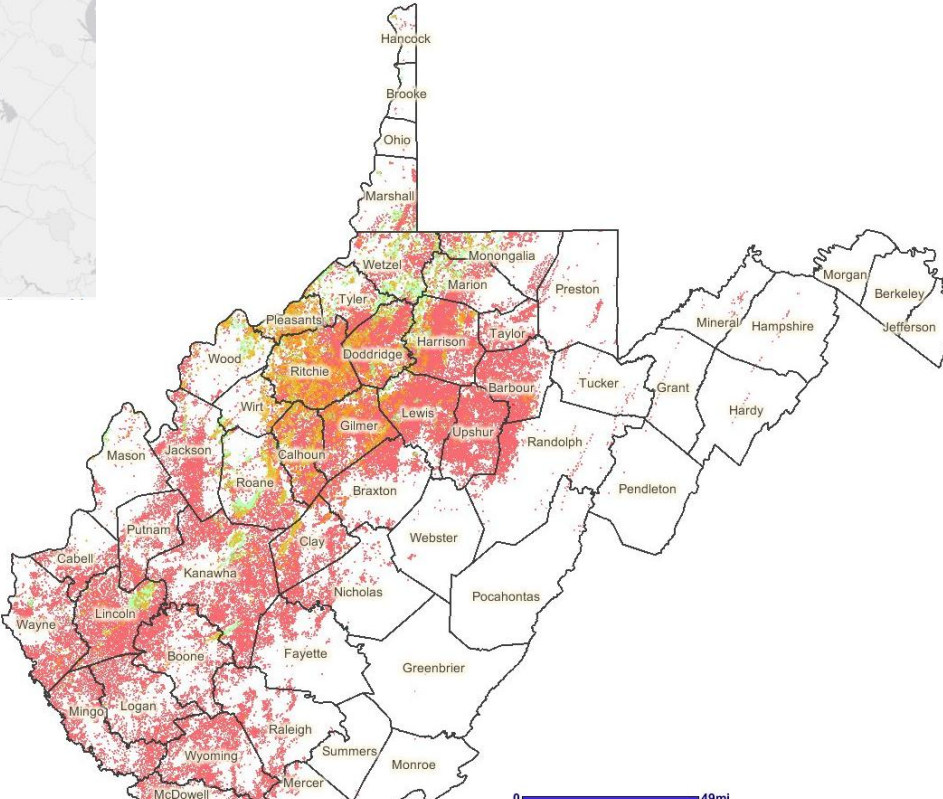
## West Virginia Geological and Economic Survey Maps

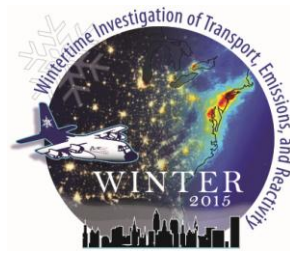
### Coal Mines

[http://www.wvgs.wvnet.edu/GIS/CBM/P/all\\_mining.html](http://www.wvgs.wvnet.edu/GIS/CBM/P/all_mining.html)

### Oil and Gas Wells

<http://ims.wvgs.wvnet.edu/WVOG/viewer.htm>





RF03: NYC Urban plume - near field daytime and downwind nighttime

RF04: Urban plume pushed southward over Virginia and the Carolinas

RF05: Urban plumes along east coast up to NYC , shortened mission

RF06: Urban plumes along the east coast being swept offshore by a front

RF07: Urban and power plant plumes from PA to VA

RF09: Power plants in Western PA and urban chemistry downwind of Pittsburgh

RF10: Atlanta and vicinity

RF13: Aged outflow from NYC and the NE corridor, both short and long range; in MBL, transport ranged from hours to days