

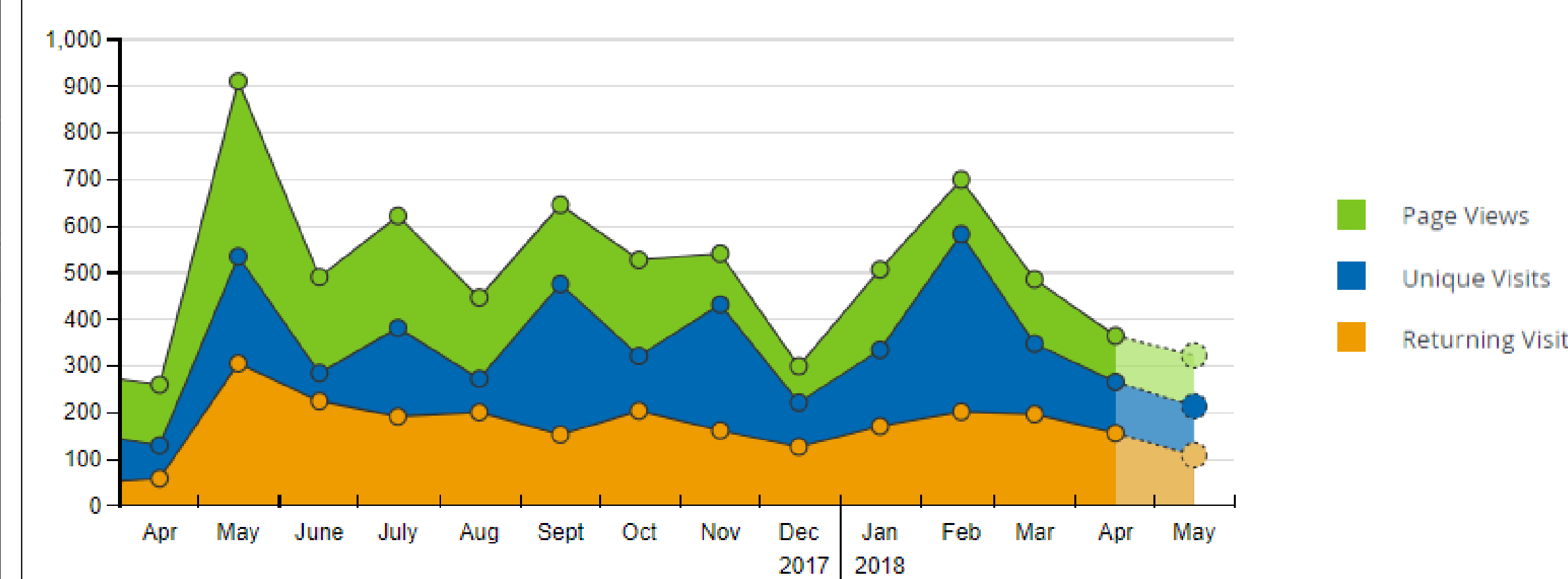
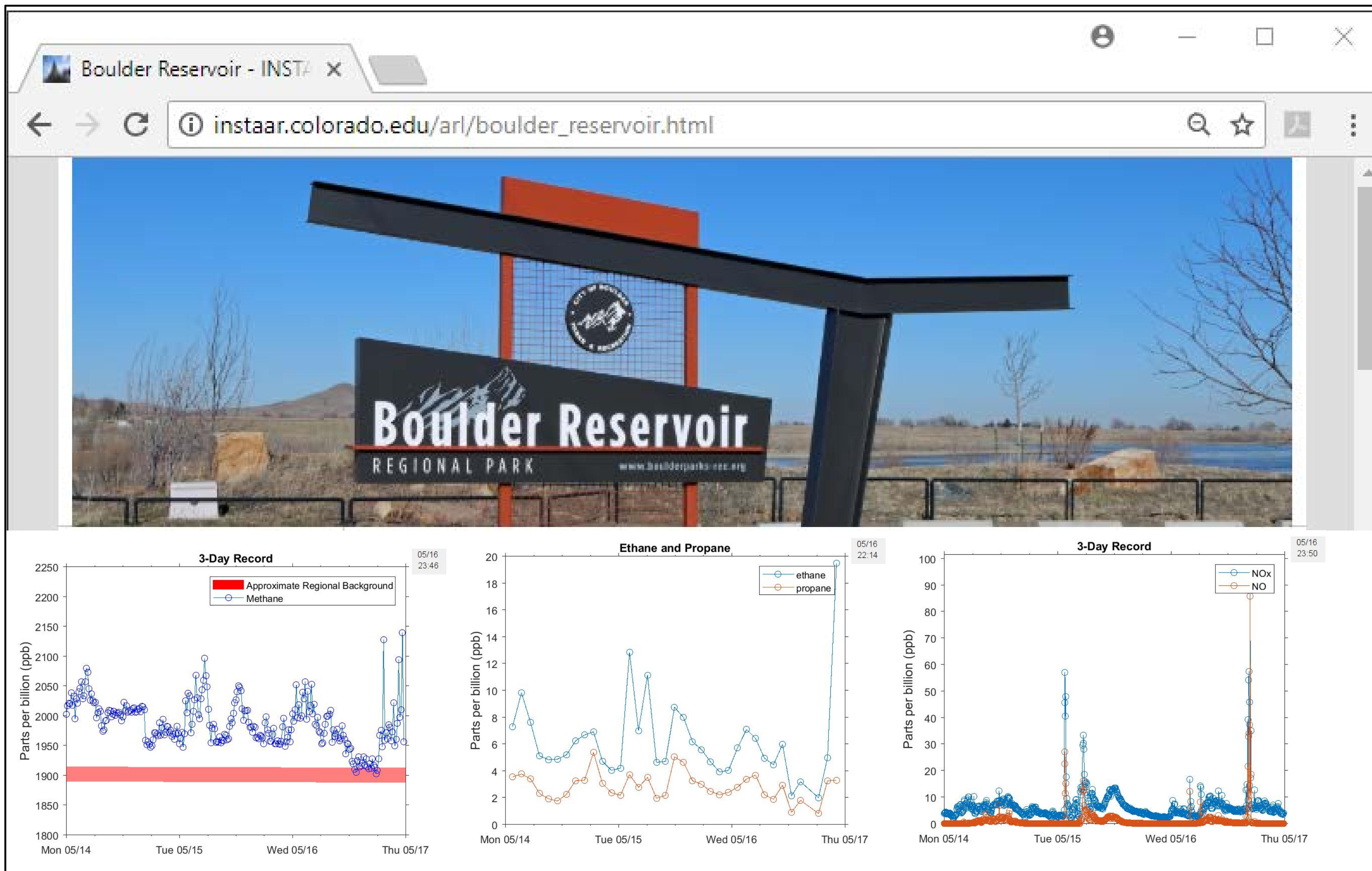
# Engaging Agencies and the Public in Atmospheric Monitoring Observations Through Real-time Data Posting

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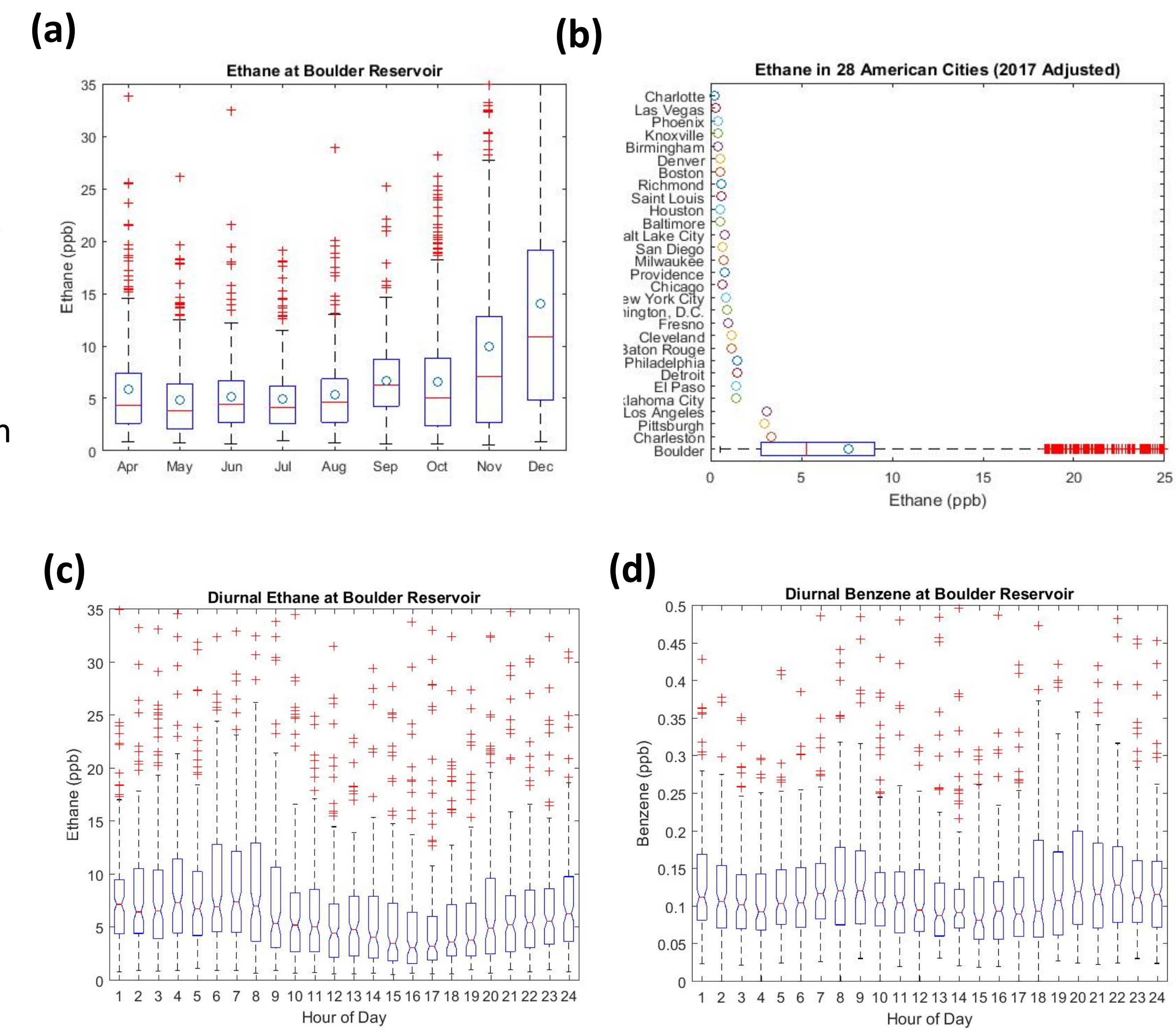


**COLORADO**  
Department of Public Health & Environment



**Figure 1:** Since the beginning of the project, the website has been visited over 10,000 times, with steady new and return visitors.

**Figure 2 (Right):** (a) Ethane shows a strong seasonal cycle and regular outliers far above median values. (b) Median values match or exceed ethane reported from most urban environments in the United States (1999-2004 data from Baker et al., 2008, projected to 2017 using the LA trend from Warnecke et al., 2012). (c) The ethane diurnal cycle is mostly determined by boundary layer dynamics, resulting in nighttime to early-morning peak values. (d) The benzene diurnal cycle peaks during commuting times, suggesting that vehicle emissions exhibit a major influence on benzene emissions. A likely explanation is the sites proximity to Highway 119, one of the major N-S thoroughways in Boulder.



## Summary

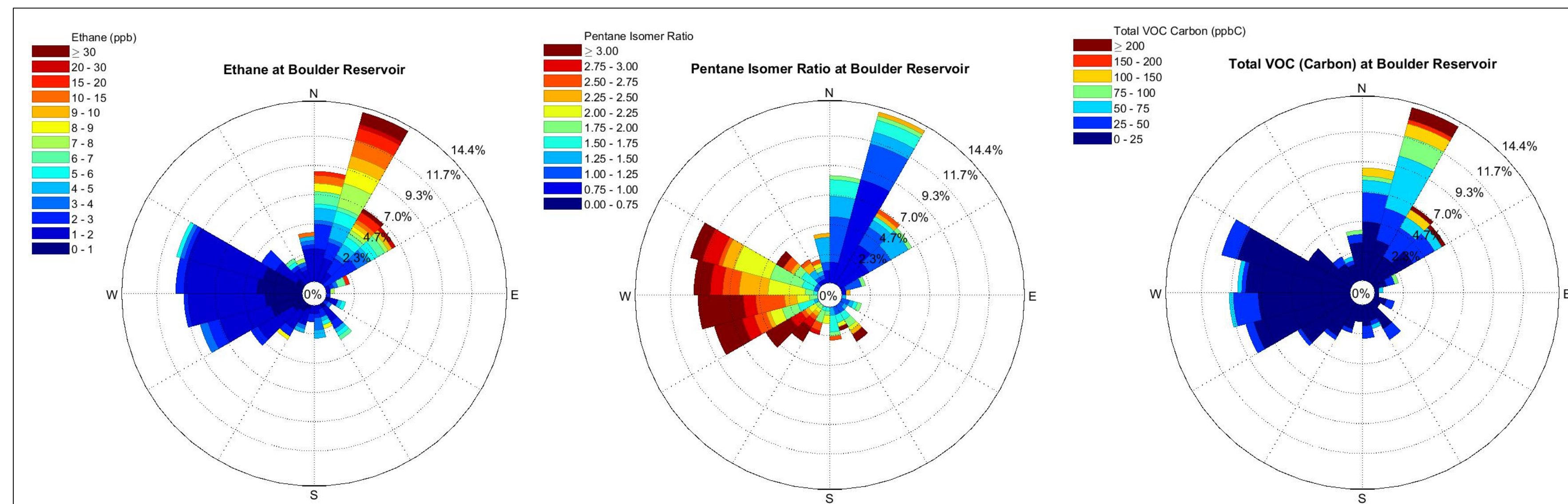
Sponsored by Boulder County Public Health, and in partnership with the Colorado Department of Public Health and Environment (CDPHE), the Atmospheric Research Lab at INSTAAR has developed a fully automated monitoring system that has been providing near real-time measurements of trace gases including methane ( $\text{CH}_4$ ), nitrogen oxides ( $\text{NO}_x$ ), and volatile organic compounds (VOC) at the Boulder Reservoir since April, 2017. Live-posting of data and educational outreach material at the public website [http://instaar.colorado.edu/arl/boulder\\_reservoir.html#monitoring](http://instaar.colorado.edu/arl/boulder_reservoir.html#monitoring) is providing monitoring results and takeaways to Boulder County citizens, and has resulted in engagement of the public into air quality discussions.

**VOC** samples are collected and analyzed every two hours. Over 4,500 samples have been taken since April 2017, resulting in an uptime of over 98%.

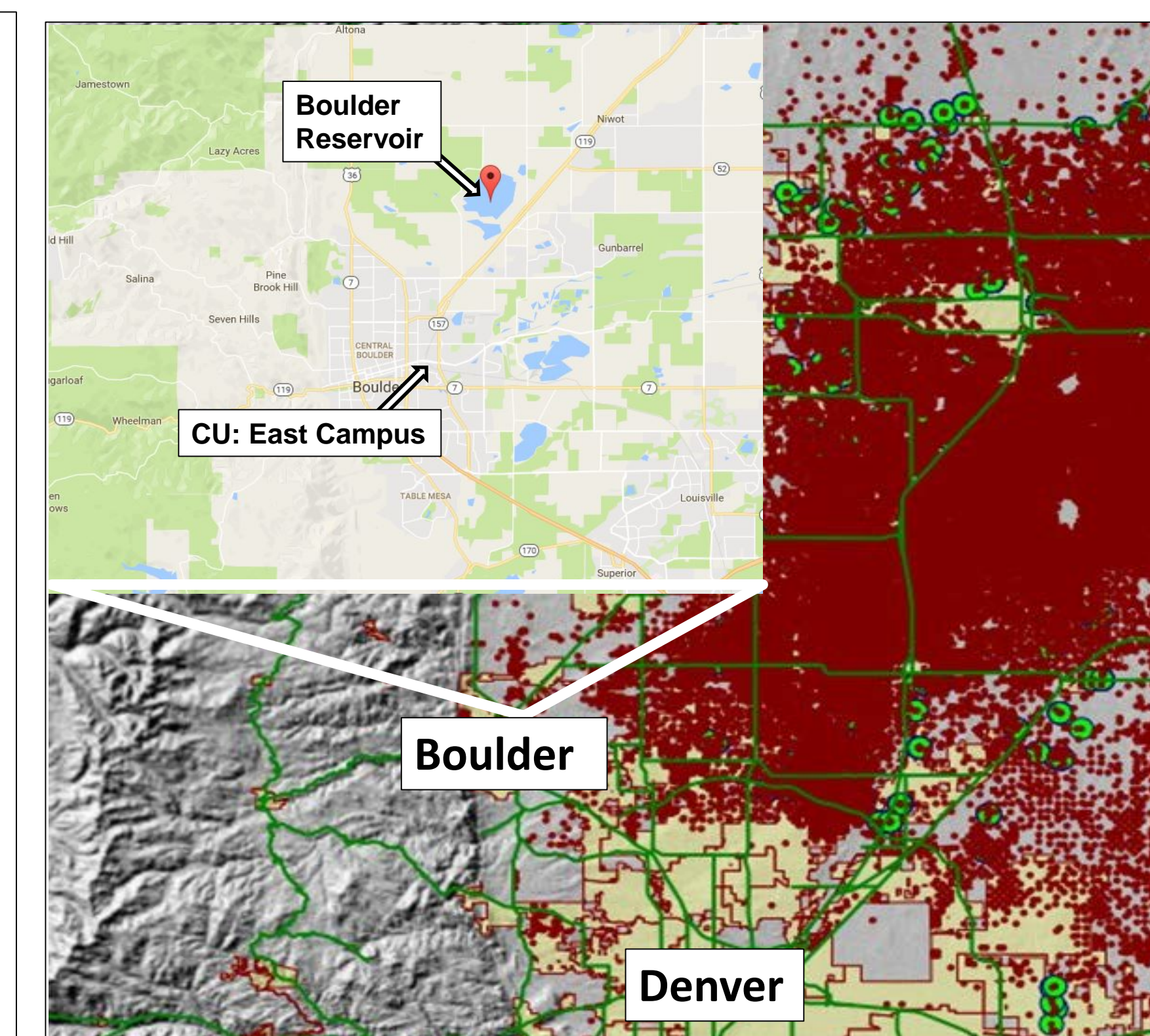
**Methane** samples are taken every fifteen minutes. Close to 40,000 samples have been taken since Feb, 2017. Methane has the lowest uptime of all measurements at the Reservoir, coming in at over 96%.

**NO and  $\text{NO}_x$**  are analyzed continuously, and recorded every 5 minutes. Over 120,000 measurements have been collected since Feb, 2017, resulting in an uptime of over 98%.

**Wind Speed and Direction** are analyzed continuously and recorded every minute. Close to 500,000 recordings have been taken since June, 2017, with data coverage of over 98%.



**Figure 3:** Concentration wind roses (filtered to winds above 3m/s) show clear transport patterns for individual compounds, as well as isomeric-ratio tracers and total VOCs. Transport is dominated from from the west and northeast sectors. Western winds show are associated with the lowest VOC concentrations across most compounds. High methane, ethane, and propane combined with a low (0.9-1.0) pentane ratio is a clear signature for oil and natural gas emissions and primarily associated with northeasterly winds.

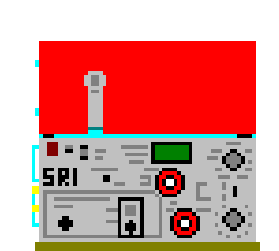


**Figure 4:** Location of Boulder Reservoir, with all oil and gas wells shown (red dots) and proposed wells (green circles). Photo: COGCC GIS Tool 2016.

## Data Flow

Once data have been integrated and saved on the two computers running at the Boulder Reservoir, they are sent via a scheduled WinSCP connection to a lab computer at INSTAAR. Minutes later, a series of scripts are run to process the  $\text{CH}_4$ , VOC, and  $\text{NO}_x$ .

SRI Peaksimple



WinSCP



Website



## Data Processing Scripts

The series of scripts that runs each hour to process the data began as simple scripts that loaded in and plotted data, but have since been designed to detect and correct systematic integration issues, check log values for anomalies, and report issues or the complete absence of new data. Notifications are sent to project personnel when instrument variables deviate from pre-set values, allowing instrument problems and errors in data collection and processing to be corrected within minutes to hours, and all without constant human supervision or intervention.