



# Compendium of Airborne Trace Gas Measurements Collected in and around California Fire Plumes by the AJAX Project



Authors: Laura T. Iraci, Emma L. Yates, Josette E. Marrero, Caroline L. Parworth, Ju-Mee Ryoo, Tomoaki Tanaka

NASA Ames Research Center, Atmospheric Science Branch, Moffett Field, CA 94035  
Point of Contact: Laura.T.Iraci@NASA.gov

doi: 10.5067/ASDC/AJAX/wildfire

<https://asdc.larc.nasa.gov/documents/ajax/AJAX-WildfireMeasurementsCompendiumR2.pdf>

*Cite as:* Iraci, L. T., E.L. Yates, J. E. Marrero, C. L. Parworth, J.-M. Ryoo, T. Tanaka (2021) *Compendium of Airborne Trace Gas Measurements Collected in and around California Fire Plumes by the AJAX Project*, Atmospheric Science Data Center, initial release, doi: 10.5067/ASDC/AJAX/wildfire

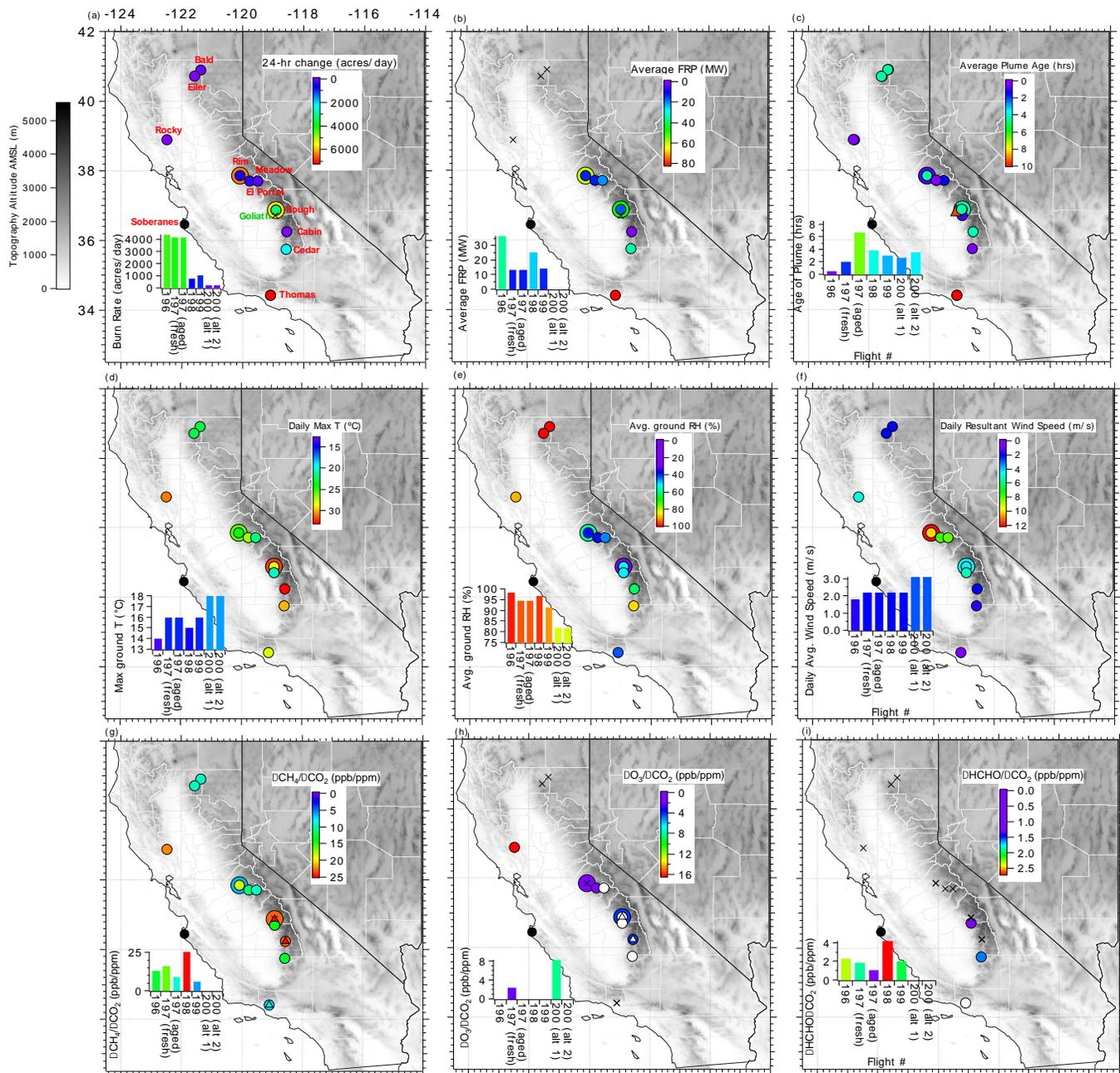
**Abstract:** Biomass burning, which includes wildfires, prescribed, and agricultural fires, is an important source of trace gases and particles, and can influence air quality on local, regional, and global scales. With the threat of wildfire events increasing due to changes in land use, increasing population, and climate change, the importance of characterizing wildfire emissions is vital. In this collection we document airborne in situ trace gas measurements sampled in and around the emissions from 12 wildfires and 1 prescribed fire event in California between 2013 and 2017, in some cases with multiple measurements of an individual fire performed on different days. Airborne measurements of carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), water vapor (H<sub>2</sub>O), ozone (O<sub>3</sub>), and formaldehyde (HCHO) were made by the Alpha Jet Atmospheric eXperiment (AJAX). The majority of these measurements were made as close as possible to each fire and represent fresh emissions from known fire sources. This archive also includes meteorological parameters measured in situ (pressure, temperature, 3-dimensional winds), as well as information collected from other sources and used to analyze the in situ measurements, including vegetation type, fire radiative power (FRP), and longer-term meteorological information.

**Table 1 identifies the fifteen flights included in this collection and provides links to the data itself, as well as individual flight analysis documents. This collection is a subset of the larger AJAX project archive (doi:10.5067/ASDC/SUBORBITAL/AJAX/DATA001).**

This Compendium also includes a comma separated variable text file ([Data Table](#)) summarizing the vegetation, fire and meteorological information assembled from multiple ancillary sources, as well as derived quantities including estimated plume age, sampling distance, and trace gas emission ratios (ERs). Figure 1 illustrates nine of the parameters contained in this summary file.

The fifteen flights in this collection sampled thirteen different fires, including five flights to the Soberanes megafire in 2016. Figure 2 shows the progression of the burned area for each flight day overlain on a map of land cover type.





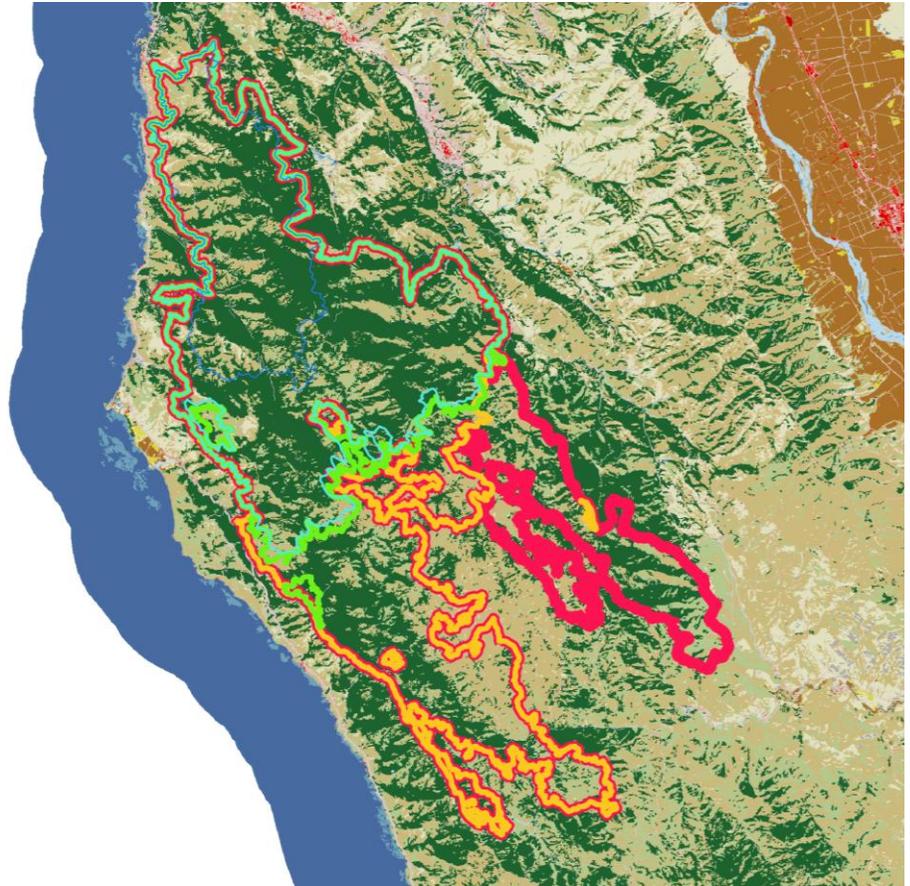
**FIGURE 1:** Topographical map showing the wide variety of environmental and fire conditions as well as trace gas observations among the multi-year record. (a) 24-hour change in acres burned; (b) fire radiative power (FRP) averaged for day and time of flight; (c) average plume age; (d) daily maximum temperature, (e) daily average relative humidity, and (f) daily average wind speed at nearby CARB monitoring stations; and (g-i) emission ratios (ERs). Multiple airborne measurements of same fire are shown with multiple circles (outer circle is earlier flight and inner circle is later flight), x markers signify no data, and white circles (ERs only) represent statistically insignificant Pearson's  $r^2$  values between the respective trace gas and  $\Delta\text{CO}_2$ . In plots (c and g-i) fire locations with a circle and a triangle represent fresh and aged emissions measured within one flight, respectively. Five flights were performed to measure the Soberanes fire, and results are shown in the bar graphs.

Soberanes AJAX Flights

- 2016-07-28
- 2016-08-09
- 2016-08-12
- 2016-09-14
- 2016-09-24

Land Cover Type

- Open water
- Perennial Ice/Snow
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Barren Land (rock/sand/clay)
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Shrub/Scrub
- Grassland/Herbaceous
- Pasture/Hay
- Cultivated Crops
- Woody Wetlands
- Emergent Herbaceous Wetlands



**FIGURE 2:** Land cover type and Soberanes fire perimeter for each of the five days AJAX measured in situ gases and meteorological parameters.

**TABLE 1:** List of AJAX Flights which sampled emissions from biomass burning in California. The first column contains links to flight data.

<b>Link to Data Flight Number</b>	<b>Fire(s) Sampled</b>	<b>Date</b>
<a href="#">100</a>	Rim	29-Aug-2013
<a href="#">101</a>	Rim	10-Sep-2013
<a href="#">136</a>	El Portal	29-Jul-2014
<a href="#">137</a>	Bald, Eiler	06-Aug-2014
<a href="#">141</a>	Meadow	09-Sep-2014
<a href="#">166</a>	Rocky	05-Aug-2015
<a href="#">167</a>	Cabin, Rough	19-Aug-2015
<a href="#">168</a>	Rough	02-Sep-2015
<a href="#">191</a>	Goliath	15-Jun-2016
<a href="#">196</a>	Soberanes	28-Jul-2016
<a href="#">197</a>	Soberanes	09-Aug-2016
<a href="#">198</a>	Soberanes	12-Aug-2016
<a href="#">199</a>	Soberanes, Cedar	24-Aug-2016
<a href="#">200</a>	Soberanes	14-Sep-2016
<a href="#">216</a>	Thomas	13-Dec-2017

