El Portal Fire

The El Portal fire started from unknown causes on July 26, 2014 and lasted until August 4, 2014, burning a total of 4,689 acres of mixed vegetation including Jeffrey pine, Red fir, White fir, and Snowbrush forest. At a nearby CARB ground monitoring site called Turtleback Dome in Yosemite National Park (3.5 miles east of the El Portal Fire), over the week preceding the start of the fire, RH dropped by 47% and the daily maximum temperature increased by 8% (Fig. 136-1). Strong increases in wind speed (30% increase) corresponded to fast growth of the El Portal fire within the first several days, followed by fluctuations in wind speeds until the end of the lifetime of the fire. AJAX executed a loop around the perimeter of the fire and crossed directly over the fire location (Fig. 136-2j) on July 29, 2014, 4 days after the start of the El Portal fire, and measured enhancements in gases around an average (±1σ) altitude of 2680 (±419) m. The average RH on this day was 39%, and temperatures reached 27°C. Wind measurements were not collected on this flight, so plume age was determined from linear interpolation of mean winds reported in the ERA5 reanalysis data set (Fig. 136-5). Plume age was estimated to be 0.25 hrs at the time of sampling, and thus the observed emissions are associated with a fresh smoke plume. Maximum mixing ratios of ΔCH₄, ΔCO₂, and ΔO₃ within the plume were 145.0 ppb, 16.3 ppm, and 18.5 ppb respectively, relative to the background portion of the flight marked by the cyan bar in Fig. 136-2. The calculated Emission Ratios (ERs) within the fire plume were 11.3 ppb CH₄ (ppm CO₂)⁻¹ and 2.0 ppb O₃ (ppm CO₂)⁻¹.
**AJAX Flight Analysis**

**Figure 136-1.** Time series of total acres burned for the El Portal fire (red) and timing of AJAX Flight 136 (green bar). Meteorological conditions from a nearby CARB ground monitoring site (Yosemite National Park-Turtleback Dome, 3.5 miles east of the El Portal fire) are also shown.
Figure 136-2. AJAX measurements during the El Portal fire. The aircraft altitude is shown in plot (a) followed by mixing ratios of trace gases in plots (b-e) (left y-axes) and enhanced mixing ratios (right y-axes). The gray bar represents the main fire plume. Scatter plots are shown for enhancements in (f) CH₄, (g) O₃, and (h) H₂O vs CO₂. The AJAX flight path colored by time and fire burn area for that flight day are shown on topographic maps in (i-j), with VIIRS fire hot spots sized by Fire Radiative Power (FRP).
Figure 136-3. Flight path colored by mixing ratios of (a) CO$_2$, (b) CH$_4$, (c) O$_3$, and (d) H$_2$O for Flight 136 (El Portal Fire), with VIIRS fire hot spots sized by Fire Radiative Power (FRP). See Figure 136-2i for FRP key. The expanded graphs show details close to the fire location.
Figure 136-4. Flight path colored by ratios of (a) CH₄ to CO₂ and (b) O₃ to CO₂ for Flight 136 (El Portal Fire), with VIIRS fire hot spots sized by Fire Radiative Power (FRP). See Figure 136-2i for FRP key.
Figure 136-5. Top: ERA5 wind speed as a function of altitude and time at 37.7265° N, 119.763° W on 29 July 2014. Dashed lines indicate time and altitude of interest. Bottom: Wind rose shows the frequency of winds from each direction (labeled in %), identifying the dominant southwesterly direction of wind throughout the column from the surface to ~5.6 km between 19 and 20Z. The legends show the color scales for the wind speeds (m/s).

<table>
<thead>
<tr>
<th>Time</th>
<th>July 29, 2014 @ 19: 49 UTC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Lat 37.7265, Lon - 119.763, GPS Alt 3436.76 m</td>
</tr>
<tr>
<td>Wind speed</td>
<td>14.8 m/s, u=12.4 m/s, v=8.1 m/s, w=95 hPa/day</td>
</tr>
<tr>
<td>Sampling distance (km)</td>
<td>13.2 (±6.5)</td>
</tr>
<tr>
<td>Estimated plume age at sampling (hr)</td>
<td>0.25</td>
</tr>
</tbody>
</table>

TABLE 136-1. ERA5 wind speed interpolation results used to estimate plume age for Flight 136.
Data Sources and Citations:

1. In situ trace gas data were produced by the AJAX project at NASA Ames Research Center.
   - https://asdc.larc.nasa.gov/project/AJAX

2. Fire Radiative Power (FRP) data were obtained from NASA’s Visible Imaging Radiometer Suite (VIIRS) 375 m fire data aboard the National Polar-orbiting Partnership (S-NPP) satellite.
   - https://earthdata.nasa.gov/earth-observation-data/near-real-time/firms

3. Meteorological data were obtained from the CARB Air Quality and Meteorological Information System (AQMIS) website
   - https://www.arb.ca.gov/aqmis2/aqmis2.php

4. The ERA5 dataset is provided by the European Centre for Medium-Range Weather Forecasts (ECMWF)

5. Burn scar areas for wildfires were obtained from the Geospatial Multi-Agency Coordination (GeoMAC) database. GeoMAC fire perimeters are based on a combination of incident intelligence sources, Global Position System (GPS) data, and infrared (IR) imagery.