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

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Rim Fire **Flight 101** **10 September 2013**

The Rim fire started on August 17, 2013 and grew to be the third-largest wildfire in California's history (at the time). The Rim fire started near Groveland, California and burned through 257,134 acres of brush, oaks, and pine conifer stands within the Stanislaus National Forest and into Yosemite National Park (37.86 N, 120.09 W). During the Rim fire progression, four flights carrying scientific payload sampled emissions from the fire. Two of the flights were by the Alpha Jet Atmospheric eXperiment (AJAX) on 29 August and 10 September, and two by the NASA DC-8 as part of the Studies of Emissions and Atmospheric Composition, Clouds, and Climate Coupling by Regional Surveys (SEAC4RS) mission on 26 and 27 August. During the first three flights, the main smoke plume from the Rim fire was transported by southwesterly winds and impacted regions to the north and northeast. By the final flight, the Rim fire was 80% contained and had burned 250,000 acres. The night prior, easterly downslope winds brought smoke from the Rim fire to the San Joaquin Valley, and a subsequent morning inversion kept smoke impacts high for the surrounding region (see Figure 100-2). This fire was the basis of a study detailing the chemical composition of emissions by Yates et al., (2016) and served as a case-study for model evaluation of wildfire smoke transport and chemical evolution by Baker et al., (2018).

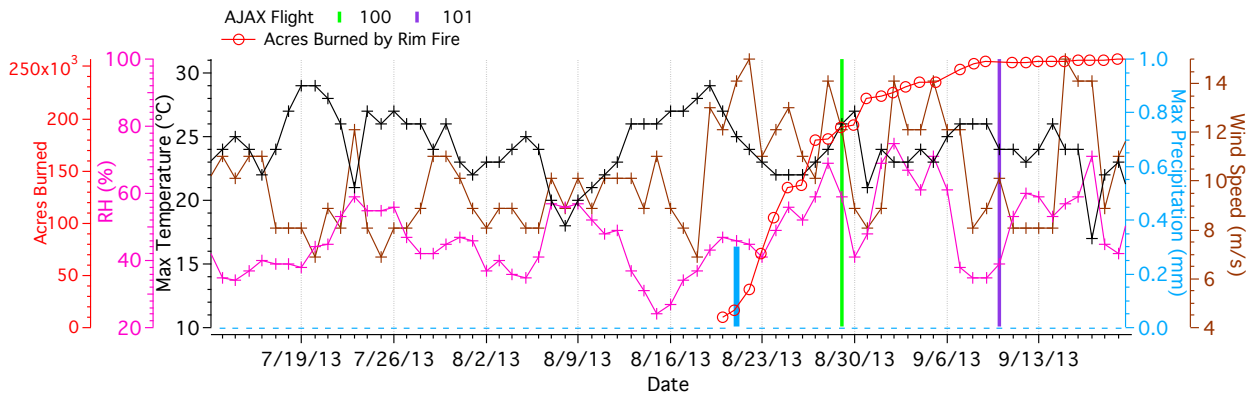

Figure 101-1. Time series of total acres burned for the Rim fire (red), with times of AJAX flight 100 (green bar) and 101 (purple bar) indicated. Meteorological conditions from a nearby CARB ground monitoring site (Crane Flat Lookout, 17 miles southeast of the Rim fire) are also shown.

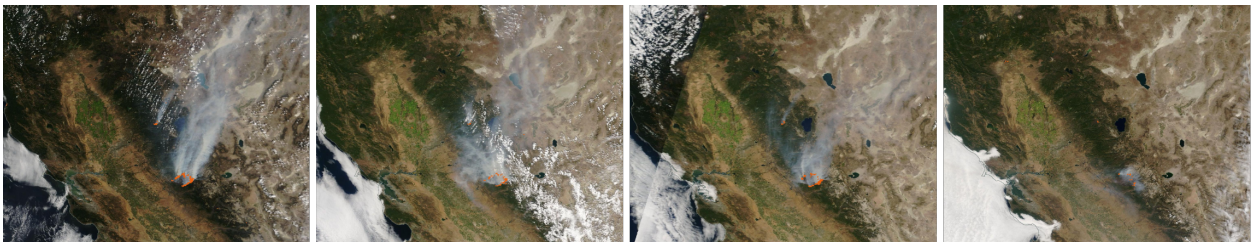

Figure 101-2. Rim fire progression: MODIS corrected reflectance (true color) image overplotted with the Aqua and Terra MODIS Fire and Thermal Anomalies layer on (left to right) August 26, August 27, August 29, and September 10, 2013. Images from https://worldview.earthdata.nasa.gov/ .

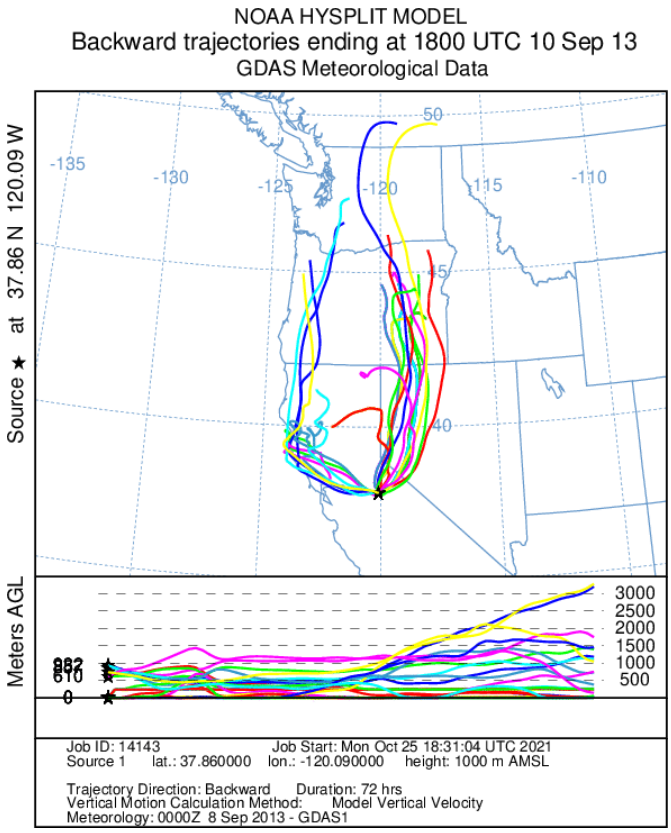

Figure 101-3. NOAA Hysplit 72-hour backtrajectory on September 10, 2013.

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. Back trajectories were computed using the Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) model. 72-hour back trajectories were computed every one hour during the same time period as each AJAX fire flight based on the large-scale meteorological fields available from the National Oceanic and Atmospheric Administration (NOAA) Global Data Assimilation System (GDAS). The horizontal spatial grid spacing of GDAS is 1°. All of the back trajectories originated from the aircraft altitude along each point of the flight, and vertical transport was based on the mean vertical velocities from GDAS.
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