A11M-0182: Airborne Measurements of Ozone and Other Trace Gases Captured by the Alpha Jet Atmospheric eXperiment (AJAX) during the 2016 California Baseline Ozone Transport Study (CABOTS)

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INTRODUCTION

California Baseline Ozone Transport Study (CABOTS)
Problem: Ozone (O_3) concentrations can be affected by several factors, including local emissions, transport from Asia, wildfires, and stratospheric intrusions. The CABOTS campaign aimed to understand if the contributions of local emissions and incoming (baseline) O_3 impacted the high O_3 levels in the San Joaquin Valley (SJV). It was a collaboration between the California Air Resources Board (CARB), the National Oceanic and Atmospheric Administration (NOAA), and San Jose State University (SJSU).The campaign ranged from May to mid-August in 2016.

Alpha Jet Atmospheric eXperiment (AJAX) performed science flights with an Alpha Jet (**fig. 1**) to measure the horizontal and vertical gradients of ozone, carbon dioxide, methane, water vapor, formaldehyde, and 3D winds (**fig. 2**). AJAX also provided a connection between ground-based in-situ and lidar measurements and ozonesondes. AJAX flew 8 CABOTS flights, and here only 5 flights in June and July were analyzed.

Figure 1: Alpha Jet at NASA Ames Research Center, Moffett Field, CA

Figure 2: Wingpod for Picarro (measures CO_2 and CH_4), O_3, and MMS attached to the Alpha Jet

AJAX'S CABOTS FLIGHT LOCATIONS

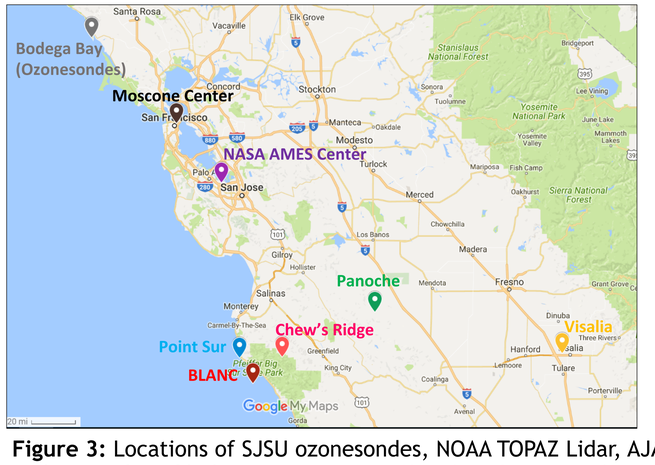

Figure 3: Locations of SJSU ozonesondes, NOAA TOPAZ Lidar, AJAX, and vertical profile locations (Pt. Sur, Chew's Ridge, Panoche, Visalia, Bodega Bay, and BLANC) performed during the CABOTS flights. The Moscone Center is also marked as a relative location to the other pinpoints.

RESULTS OF AJAX FLIGHTS FOR CABOTS

How does O_3 vary going West to East?

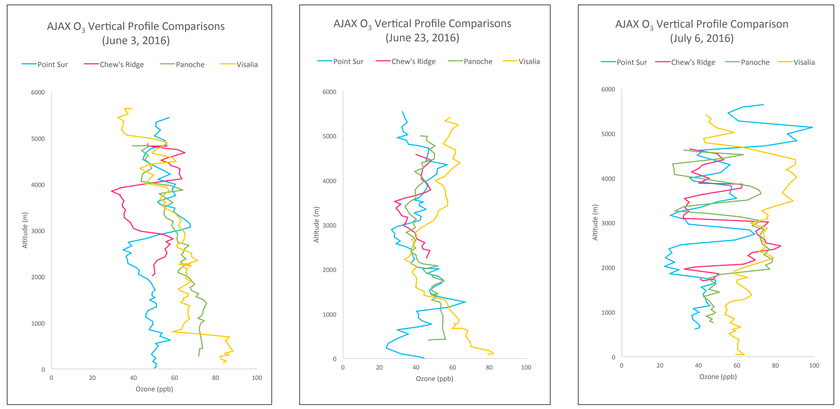

Figure 4 (Top): Vertical profiles of O_3 along a **west-to-east transect** of locations: Point Sur, Chew's Ridge, Panoche, and Visalia. Above 1km, all locations appear to follow a similar pattern and there is overlap between the locations. The differences below 1km are most likely due to surface interactions.

June 3 specifically shows overlap between Point Sur, Panoche and Visalia around 4-4.5km, while July 6 shows overlap from Point Sur, Chew's Ridge, and Panoche around 3-4km. These observations could be an indication of air traveling inland from the coast.

How does O_3 vary going North to South?

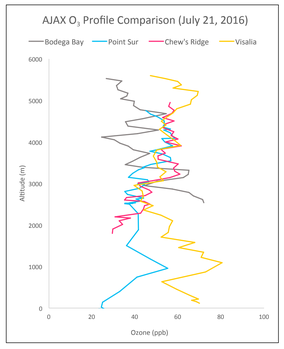

Figure 5: The plot of O_3 vertical from July 21 is comparing locations along a **north-to-south transect**: Bodega Bay and Point Sur.

There is little agreement between Bodega Bay and Point Sur with the latter showing more overlap with Chew's Ridge and Visalia especially around 3700m-4000m. This could indicate that the air from Point Sur traveled inland to Chew's Ridge and Visalia.

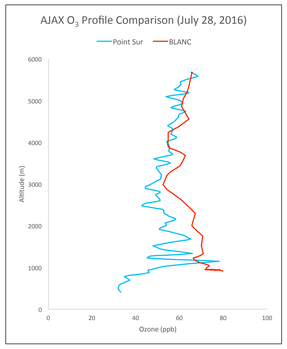

Figure 6: The plot of O_3 vertical profiles from July 28 is comparing locations along a **north-to-south transect**: Point Sur and BLANC.

Point Sur and BLANC show similar trends but BLANC has higher O_3 at all altitudes. Note that this profiles were observed during the Soberanes fire.

COMPARISON WITH TOPAZ AND OZONESONDE

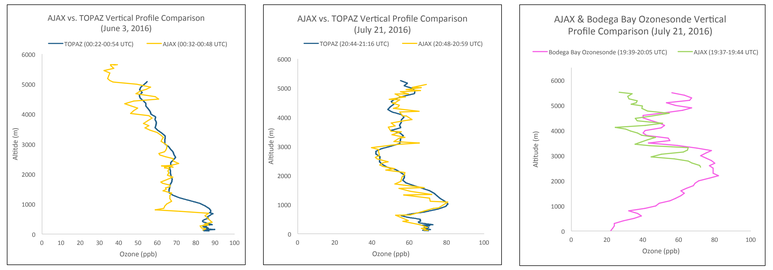

Figure 7: (Left, Middle) Comparisons of O_3 at Visalia measured by AJAX (Yellow) and NOAA's Tunable Optical Profiler for Aerosol and oZone lidar (TOPAZ, blue) based at Visalia airport. (Right) Comparison O_3 at Bodega Bay measured by AJAX (light green) against the O_3 captured by SJSU's ozonesonde (pink). These comparisons validate the O_3 data that AJAX measured on these specific flights.

CONCLUSIONS

West-to-East Transect
The locations along the west-to-east transect (Point Sur, Chew's Ridge, Panoche, and Visalia) showed more overlap on their O_3 vertical comparisons. This observation could be a sign that air from the coast did travel inward towards Visalia.

North-to-South Transect
Locations along the north-to-south transect (Bodega Bay to Point Sur and Point Sur to BLANC) showed less agreement between coastal locations so it is not clear if this air impacted inland locations.

TOPAZ & Ozonesondes
The AJAX O_3 vertical profiles matched the TOPAZ and the ozonesondes measurements. Therefore, AJAX elsewhere can be compared to TOPAZ and ozonesonde data.

FUTURE WORK

- Continue to compare our meteorological data to other data sets from the CABOTS campaign
- Create a wind timeseries for times earlier and later in the day to see if air from off the coast of California carried over inland towards Visalia.
- Traer-tracer correlations comparing O_3 against GHG measurements to understand the composition of air parcels measured by AJAX

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