The Alpha Jet Atmospheric eXperiment (AJAX): Past, present & future

Emma Yates,

Laura Iraci, Caroline Parworth, Ju-Mee Ryoo,

NASA Ames Research Center

AJAX Overview

2011 1st Flt of O_3, GHG instruments

2013 1st Flt of MMS 100th AJAX Flight

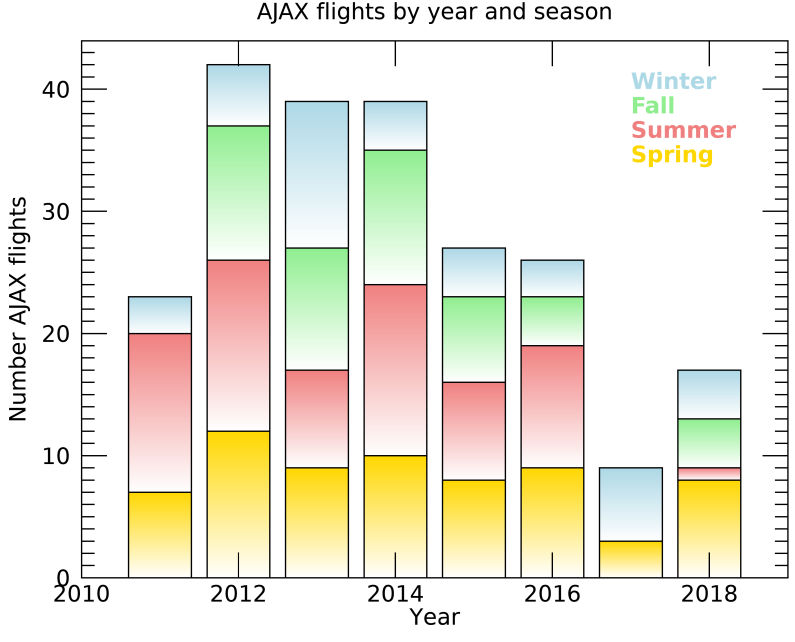
2015 1st Flt of HCHO

2018 SNAAX partnership

2019 Replacement aircraft

Ceiling	Up to ~13 km, typically ~9 km
Speed	~100-280 m/s
Range	~1,000 km
Endurance	2-2.5 hrs

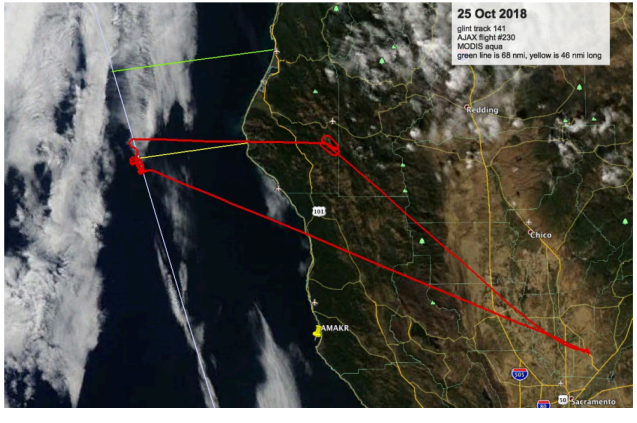
- **Total flights: 234 between 2011 & 2019**
- Payload: O_3, CH_4, CO_2, H_2O, HCHO, 3D winds
- Public Private Partnership with H211, LLC
- 22 peer reviewed publications

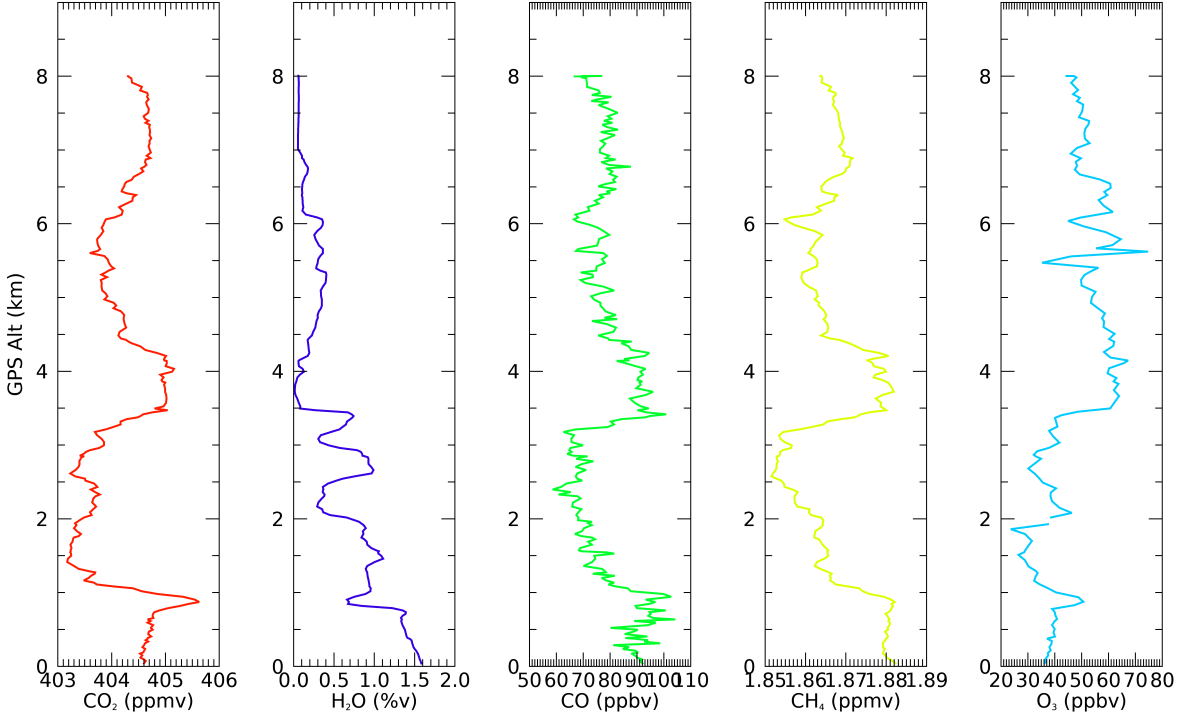


2018: A challenging year!

Scientific Aviation NASA Ames Airborne eXperiment (SNAAX)

2018: A happy ending

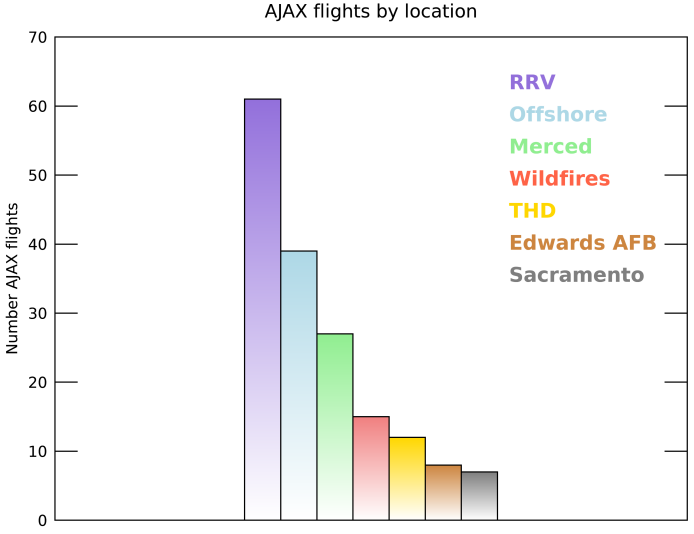




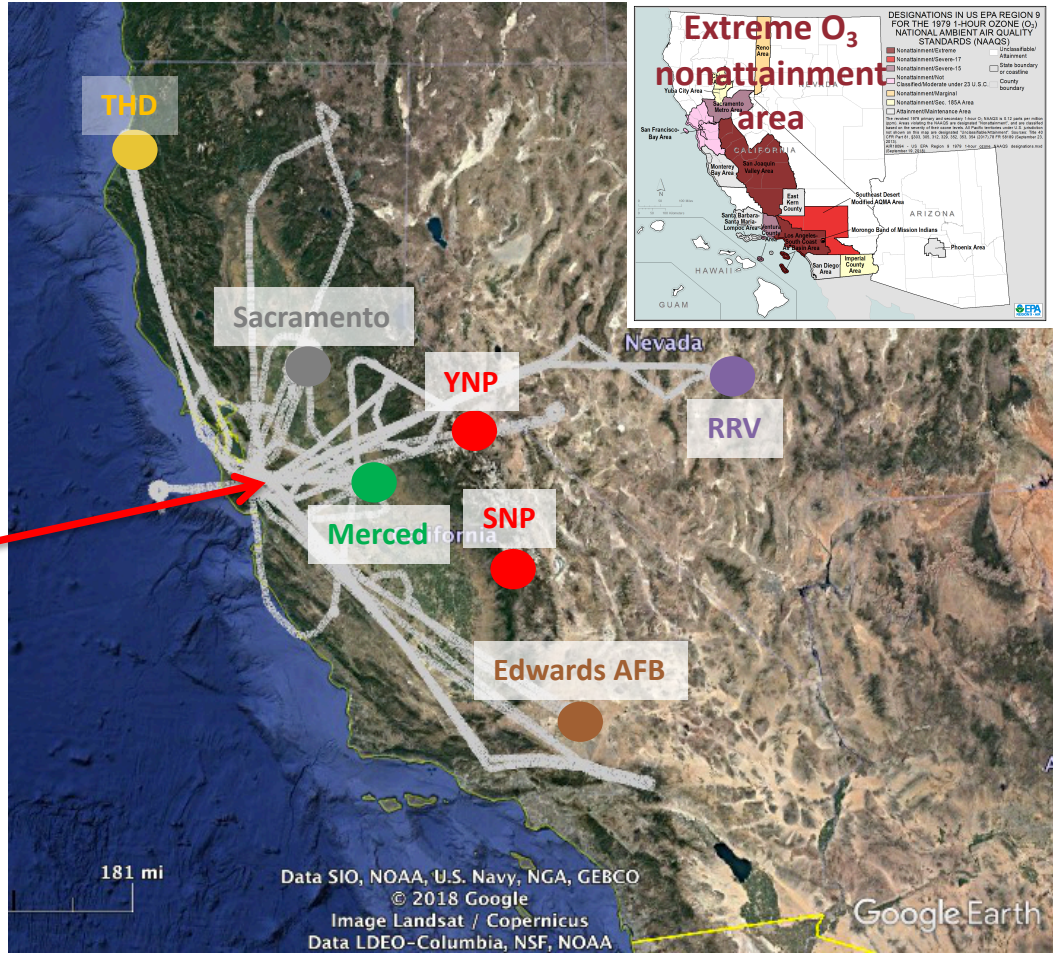
The Future: AJAX 2.0

- New (to us) Alpha Jet undergoing updates to avionics & wiring, aim to complete in Fall 2019.
- Adding NO_2 instrument to the payload (CO_2, CH_4, O_3, HCHO, NO_2, Met parameters)

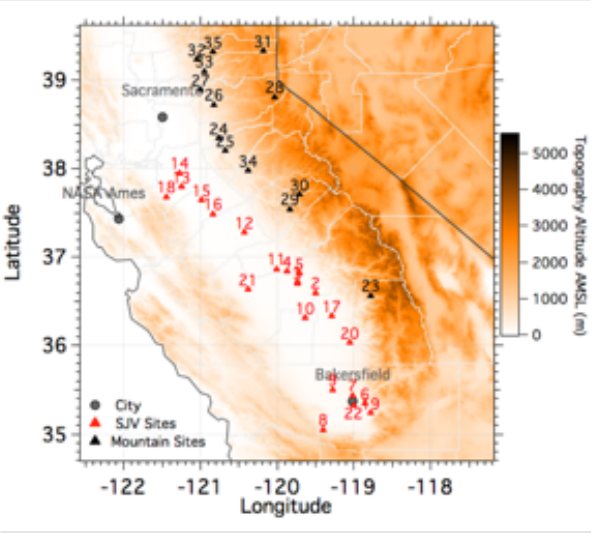
Where We Fly



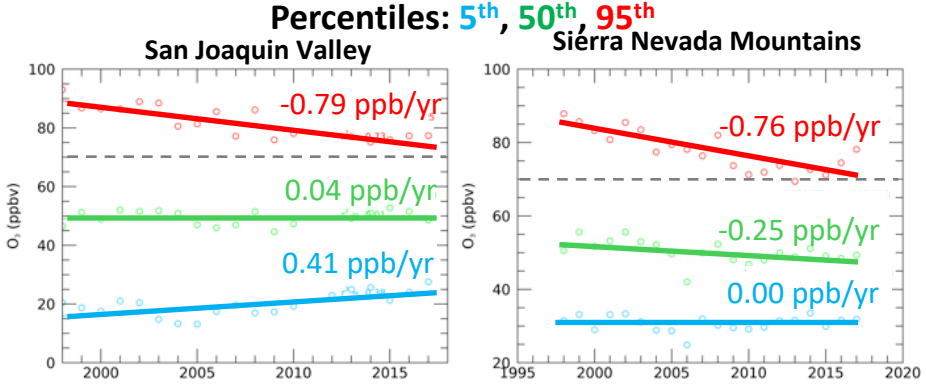
- Located in San Francisco Bay Area
- Research priorities:
  - Air Quality
  - Satellite/TCCON Cal/Val
  - Wildfires, see Caroline Parworth's talk tomorrow at 2 pm



Sierra Nevada & SJV Ozone Trends



- 20-yr trends show a compression of the O_3 range.



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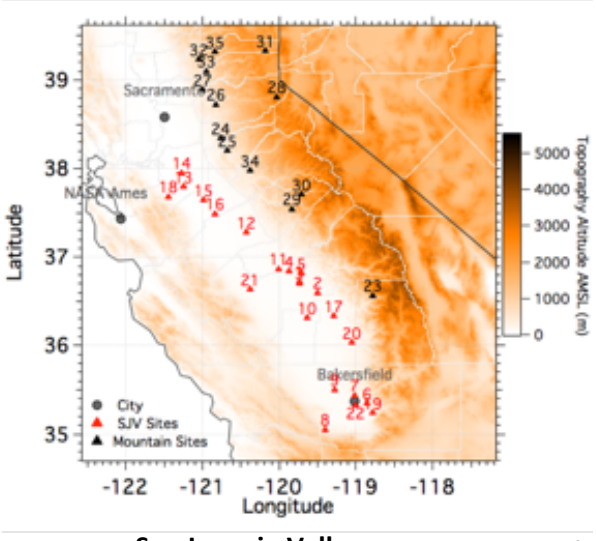

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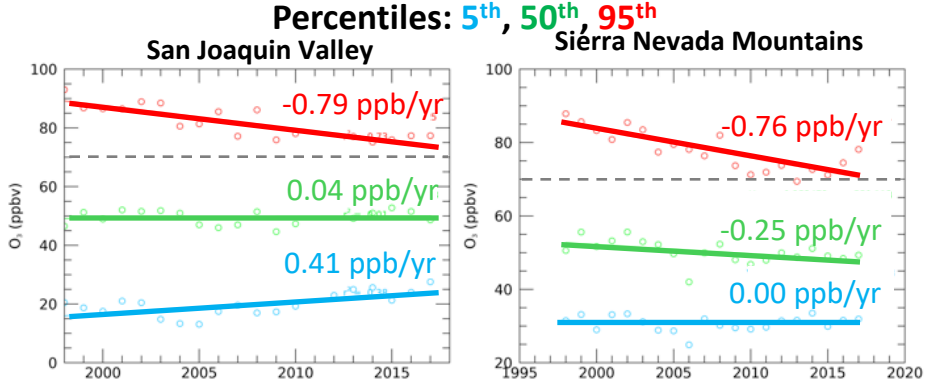
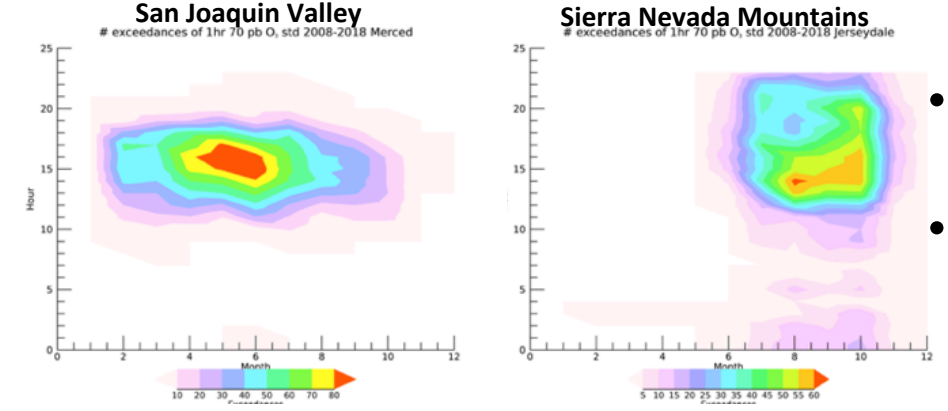
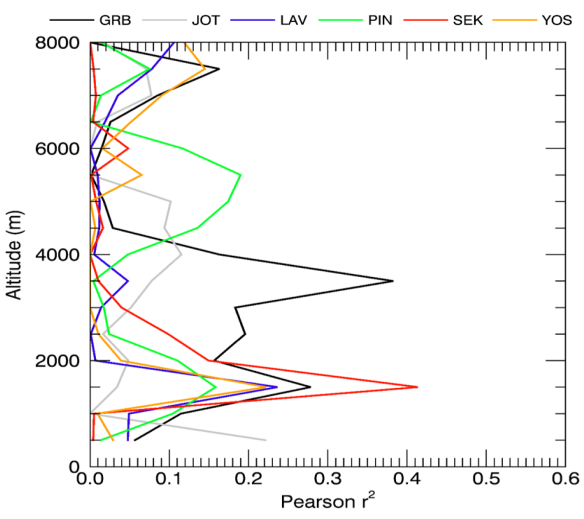
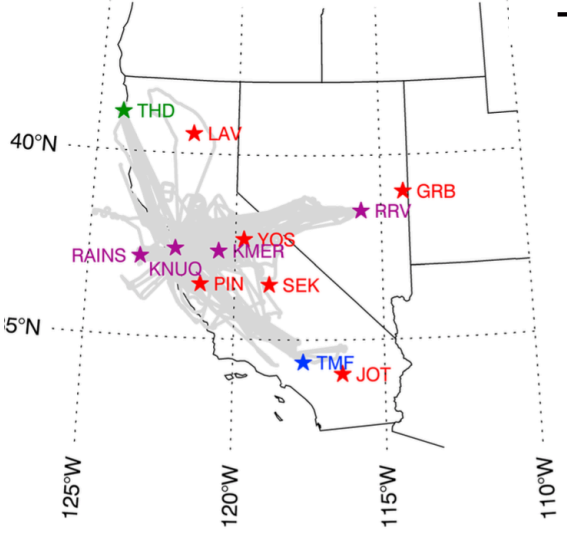


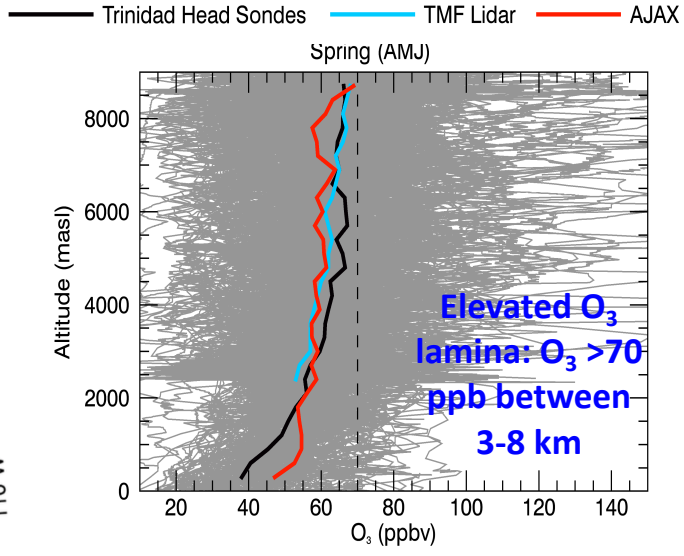


- SJV: High O_3 events in all seasons but defined time of day (12-5pm)
- High elevation sites (>600 m): High O_3 events in a defined season (dry season) but across all times of day.

The Importance of Ozone Aloft





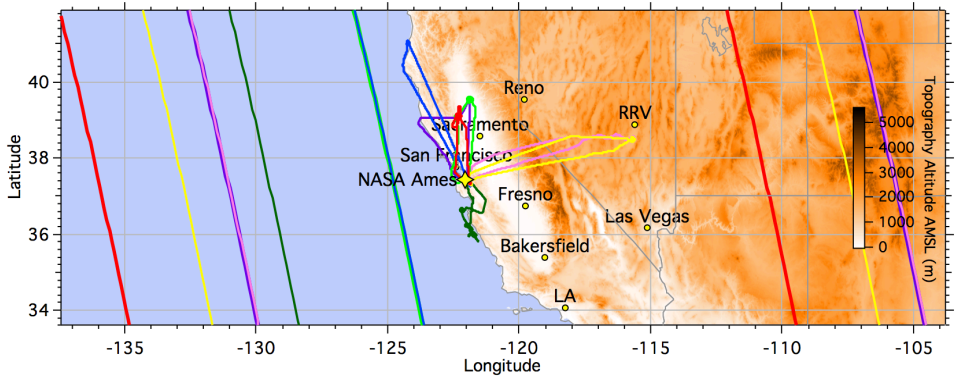


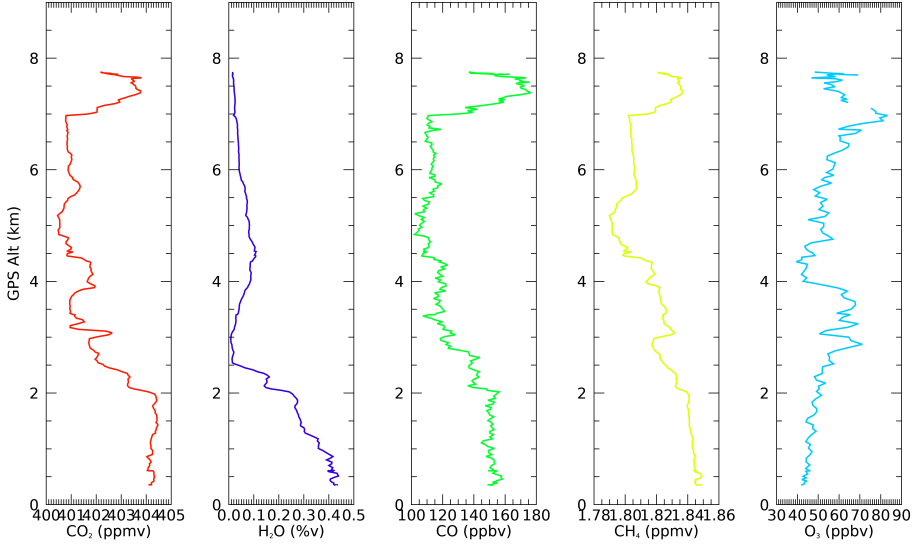
- Correlations between AJAX O_3 and surface sites are enhanced in spring (& summer) suggesting there are common influences impact O_3 at surface sites and aloft.
- Spring 72 %, summer 65 % of O_3 profiles have elevated O_3 lamina.

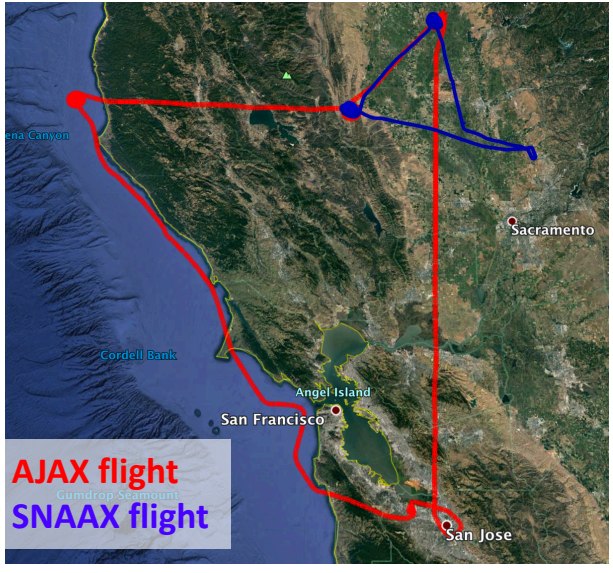
Yates et al., An Assessment of ground level and free tropospheric ozone over California and Nevada, JGR, 2017.

Satellite Validation: TROPOMI

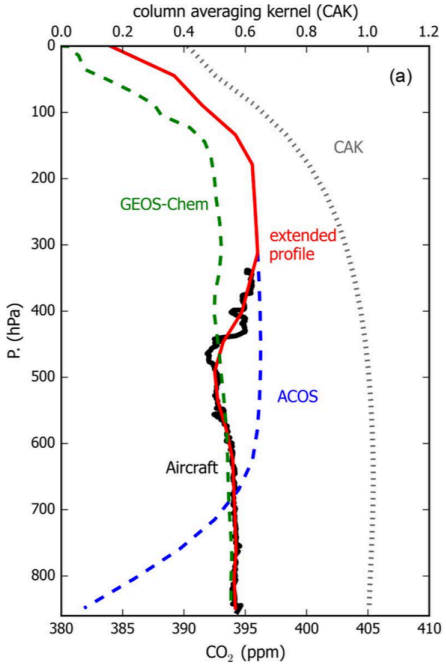
- Sentinel-5P/TROPOMI:
  - AJAX has 8 coincident flights
- Plans to add NO_2 instrument = cal/val with TROPOMI & future TEMPO satellite

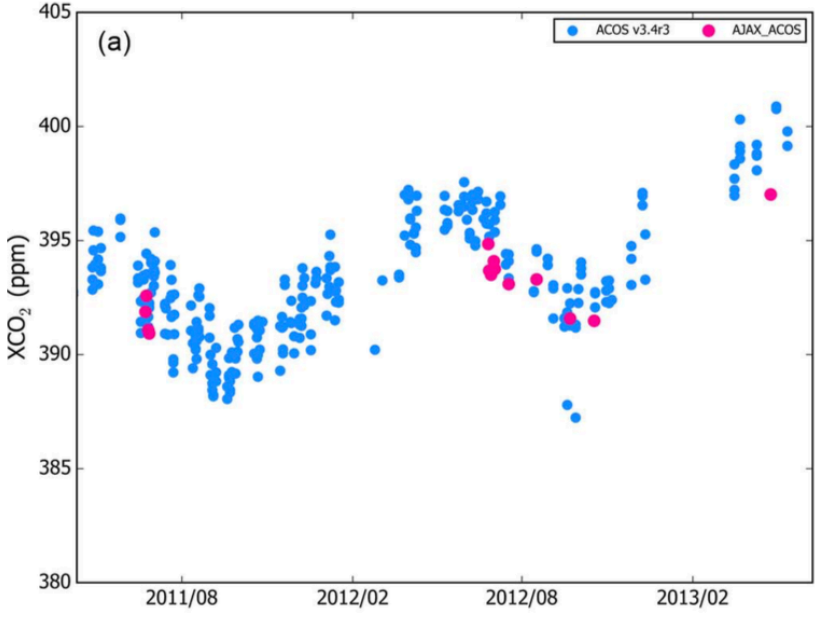






Satellite Validation: GOSAT





- Proven track record of flying under GOSAT and OCO-2 (target, glint, nadir)
- Over 60 flights to Railroad Valley (RRV) under GOSAT, since 2011
  - Average difference (GOSAT_ACOS minus AJAX_ACOS) is 1.01 ppm for CO_2

Tanaka et al., Two year comparison of airborne measurements of CO2 and CH4 with GOSAT at Railroad Valley, NV, IEEE, 2016.

Conclusions

- AJAX has 234 flights over California/Nevada, since 2011.
- Measure O_3, CO_2, methane, formaldehyde, meteorological parameters. For data inquires: laura.iraci@nasa.gov
- Scientific focus:
  - air quality,
  - satellite validation,
  - wildfire emissions (**see Caroline Parworth's talk at 2 pm tomorrow**),
  - urban outflow and atmospheric rivers (author: Ju-Mee Ryoo)
- 2020 Plans: Fly AJAX 2.0 and add NO_2 to payload.

Thank you

Acknowledgements:

- **Support and partnership of H211 L.L.C.**
- **Bay Area Environmental Research Institute**
- **NASA Ames Research Center Director's funds for instrumentation and aircraft integration**
- **Funding from NASA Tropospheric Composition & OCO-2 programs**
- **The extended AJAX Team:**

Laura Iraci
Caroline Parworth
Ju-Mee Ryoo
Kent Shiffer
Emmett Quigley
Matthew Johnson
Susan Kulawik
Zion Young
Roy Vogler
Pilots & Crew of H211, LLC
Scientific Aviation

NASA Postdoctoral Opportunities:
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