An overview of the *Fires, Asian, and Stratospheric Transport* - Las Vegas Ozone Study (*FAST*-LVOS)

LVOS
Las Vegas Ozone Study
2013

2017
FAST- LVOS
Fires, Asian, and Stratospheric Transport
Las Vegas Ozone Study

Where does the high springtime ozone in the Southwest come from?

Angel Peak

Andrew O. Langford

NOAA/ESRL Chemical Sciences Division

NOAA ESRL Global Monitoring Annual Conference 2018

CSD: *Ken Aikin, Raul Alvarez, Tim Bonin, Alan Brewer, Steve Brown, Zach Decker, Bill Dubé, Dorothy Fibiger, Guillaume Kirgis, Richard Marchbanks, Jeff Peischl, Tom Ryerson, Scott Sandberg, Christoph Senff, Ann Weickmann, Michael Zucker*

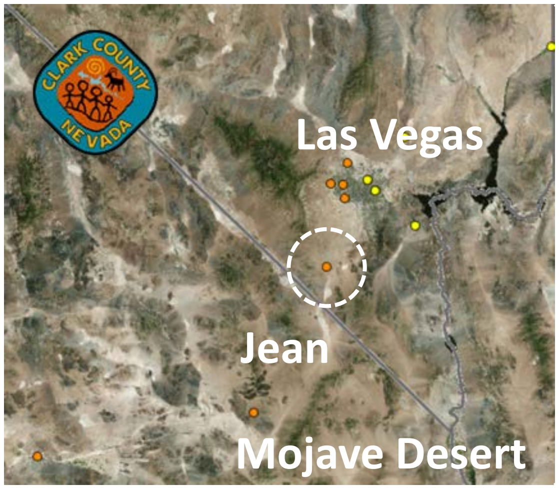
GMD: *Patrick Cullis, Bryan Johnson, Chance Sterling, Irina Petropavlovskikh*

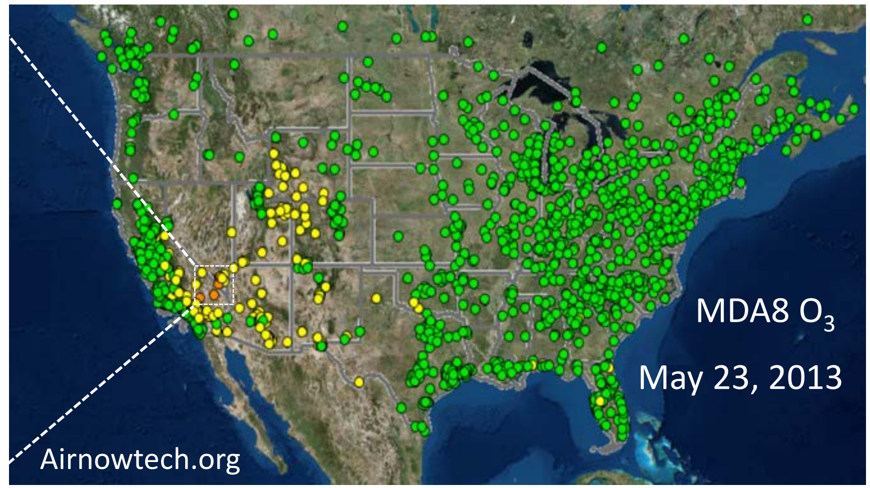
SciAv: *Steve Conley , Zaheer Kamal, Justin Pifer, Dani Caputi*

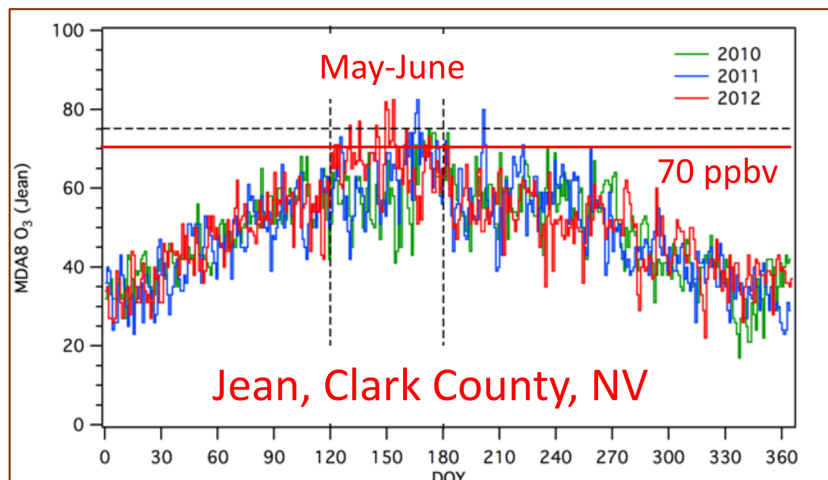
CCDAQ: *Paul Fransioli, Rodney Langston, Zheng Li, Mick Turner*

GFDL: *Meiyun Lin and Alex Zhang*

Surface ozone often exceeds the NAAQS in parts of the rural West during late spring and early summer







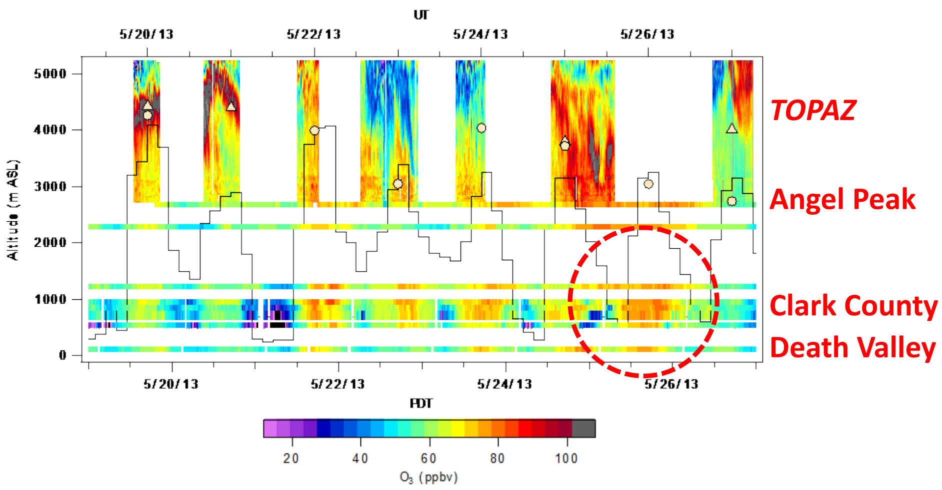
Daily max 8-h ozone (MDA8)

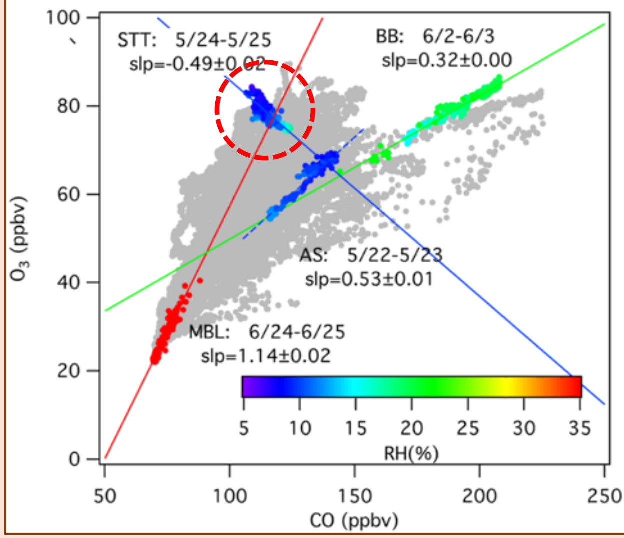
Las Vegas Ozone Study (LVOS)

May 19 - June 29, 2013

TOPAZ lidar and *in situ* CO and O_3 on Angel Peak
45 km NW of Las Vegas at 2.7 km asl (8680 ft)

LVOS
Las Vegas Ozone Study



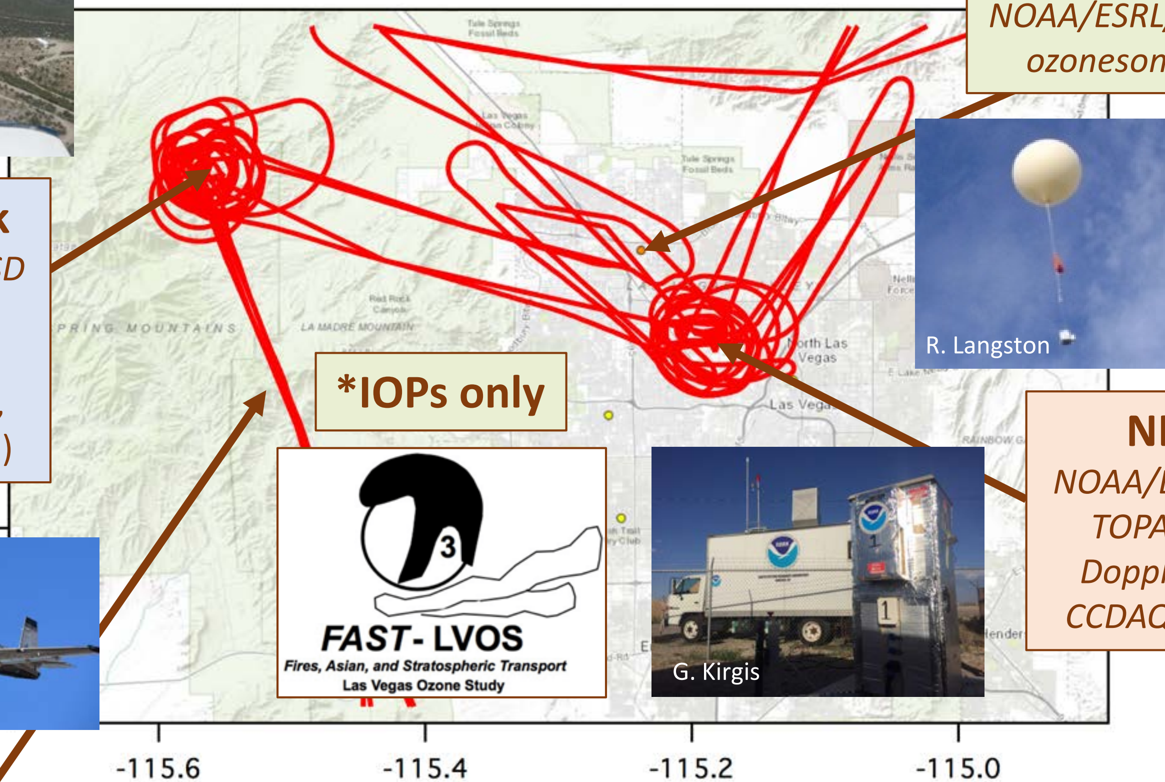


NAAQS exceeded in the Las Vegas Valley after high O_3 layers pass over Angel Peak

Fires, Asian, and Stratospheric Transport - Las Vegas Ozone Study (*FAST*-LVOS)

May 17 - June 30, 2017

Angel Peak
NOAA/ESRL/CSD
mobile lab
(O_3, CO, CO_2, CH_4, NO, NO_2, NO_y, N_2O, H_2O)



***IOPs only**

***Joe Neal**
NOAA/ESRL/GMD
ozonesondes

(O_3, T, RH, winds)

FAST-LVOS
Fires, Asian, and Stratospheric Transport
Las Vegas Ozone Study

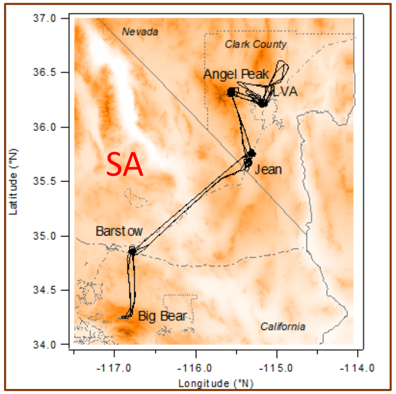
NLVA
NOAA/ESRL/CSD
TOPAZ lidar
Doppler lidar
CCDAQ profiler

***NLVA-Jean-Barstow-Big Bear** Scientific Aviation Mooney (O_3, NO_2, CH_4, C_2H_6, H_2O)

FAST-LVOS Measurements

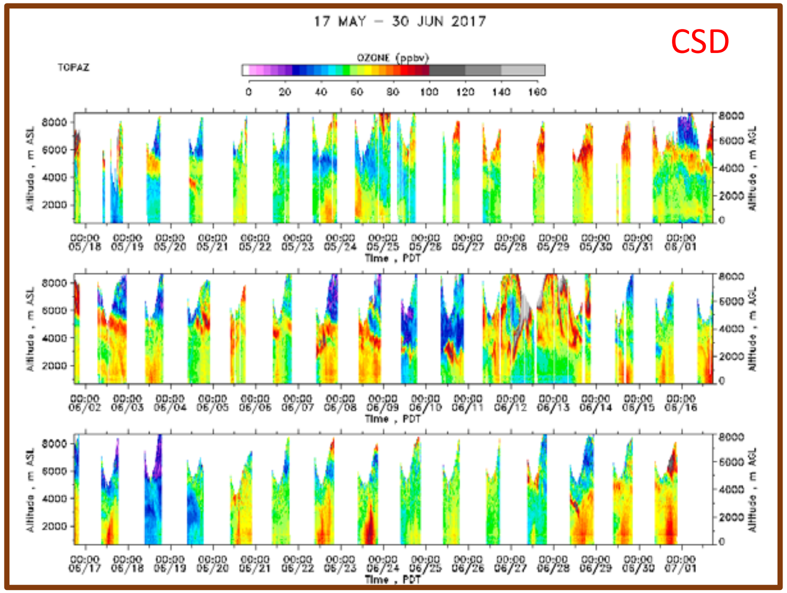
(May 17 - June 30, 2017)

Scientific Aviation (90 hours/14 days)

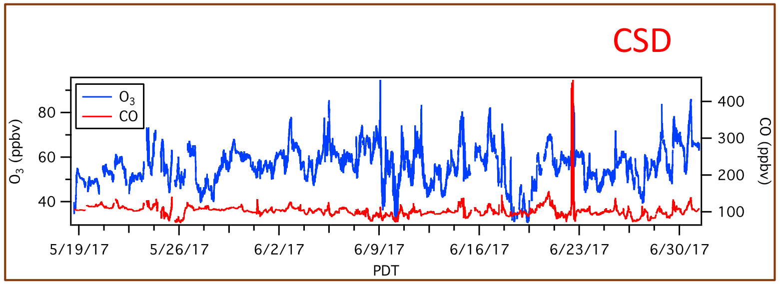


6 hour flight plan

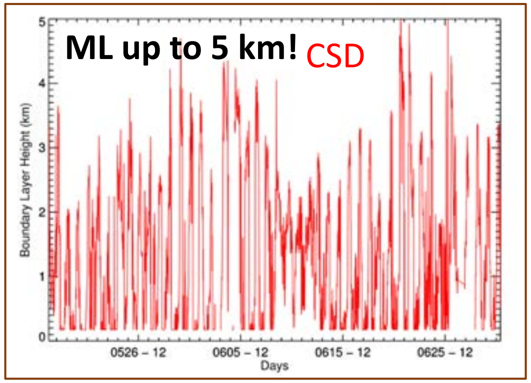
TOPAZ (523 hours on 45 days)



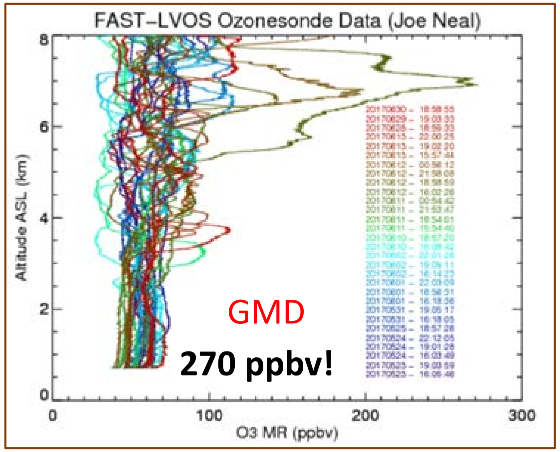
Angel Peak in situ (41 days, 6 mobile)



µ-Doppler lidar (45 days)



Ozonesondes (30 sondes/14 days)

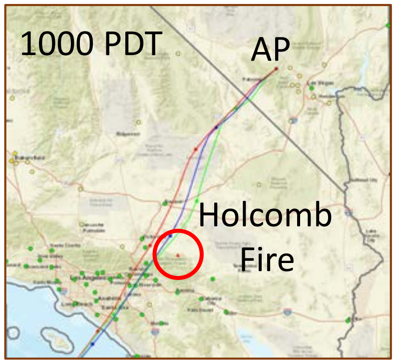


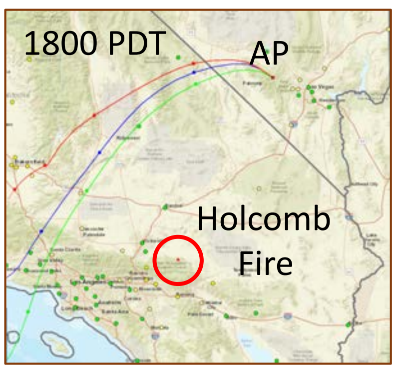
Example 1: Entrainment of Holcomb ***Fire*** plume

FAST - LVOS
Fires, Asian, and Stratospheric Transport
Las Vegas Ozone Study

June 22, 2017

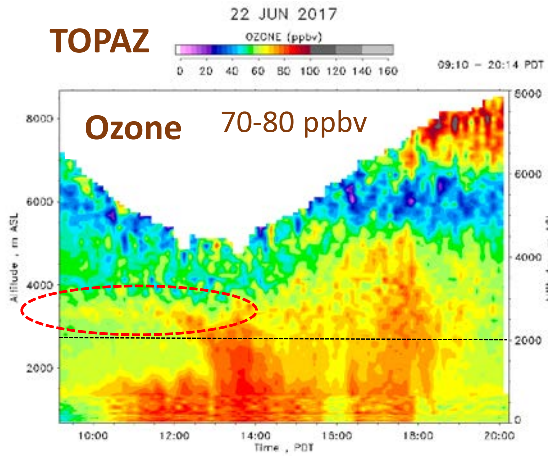
AirNow NOAA HYSPLIT -24 h

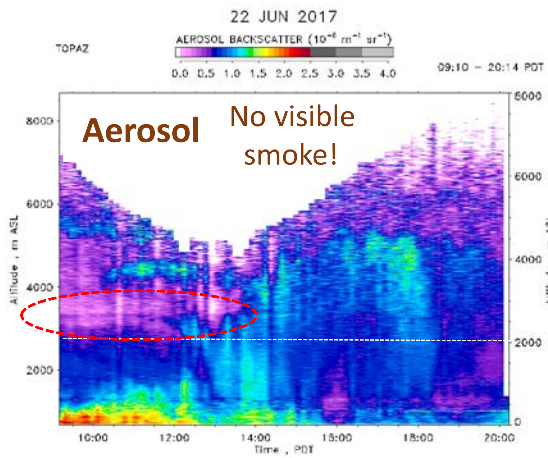




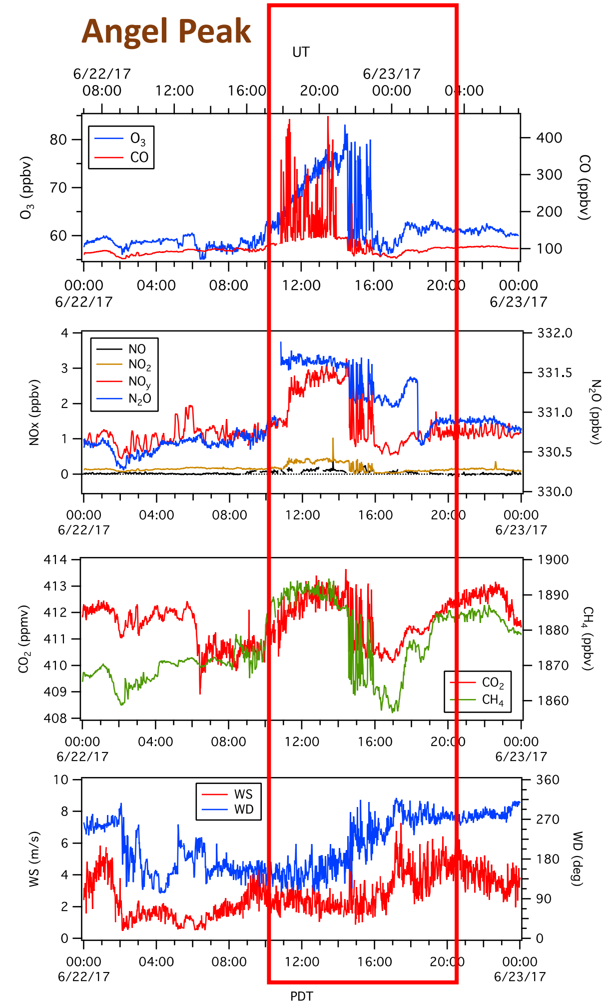
2.7±0.5 km ASL

TOPAZ





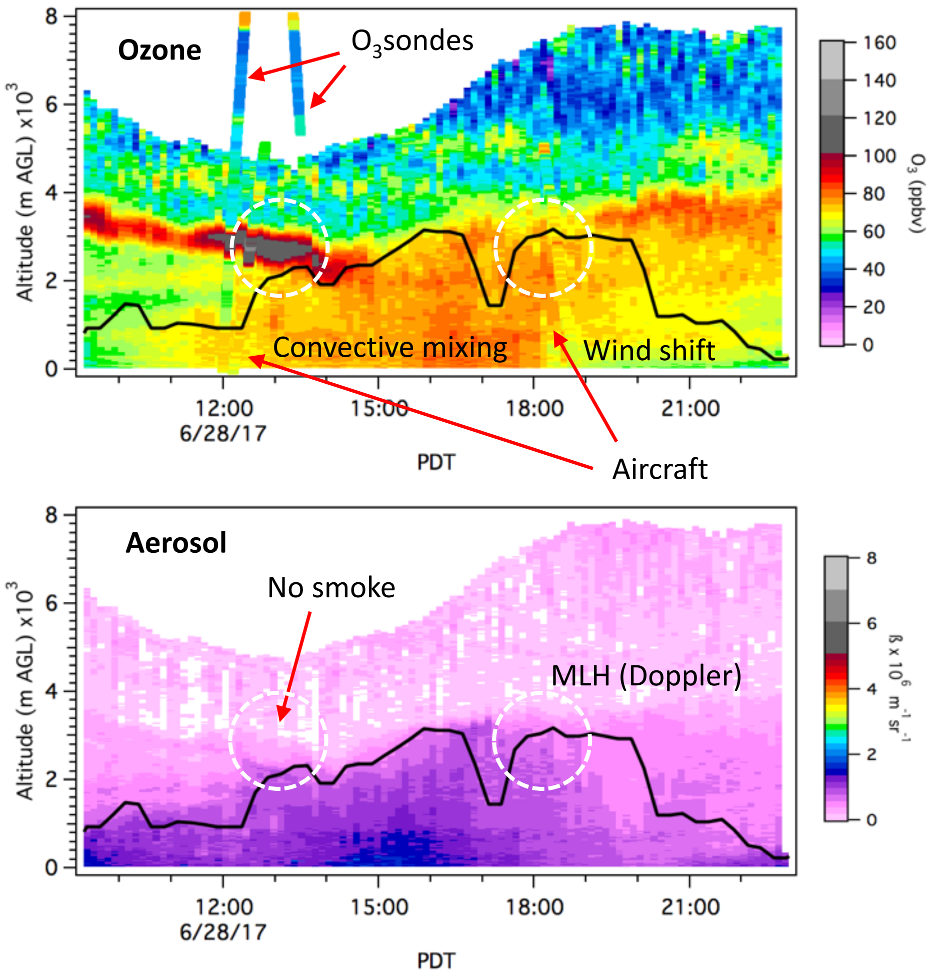
Angel Peak

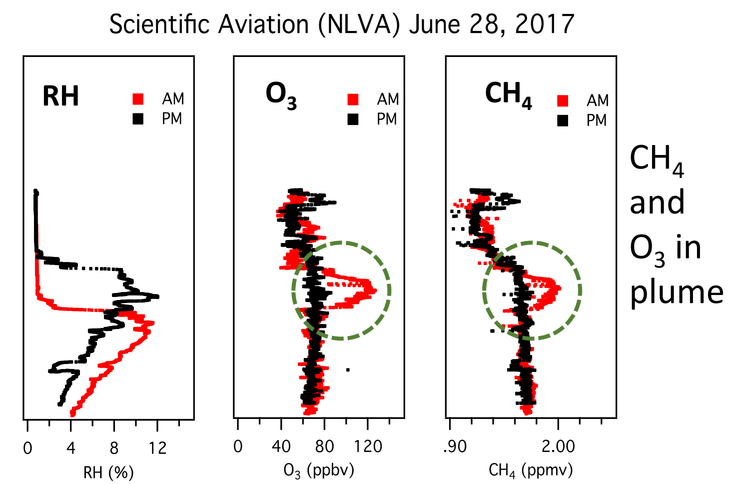


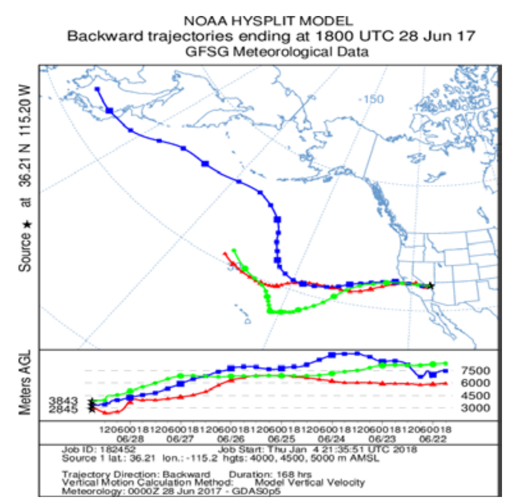
1503 acres near Big Bear: June 19 - July 13, 2017

Example 2: Entrainment of ***Asian*** pollution plume

June 28, 2017





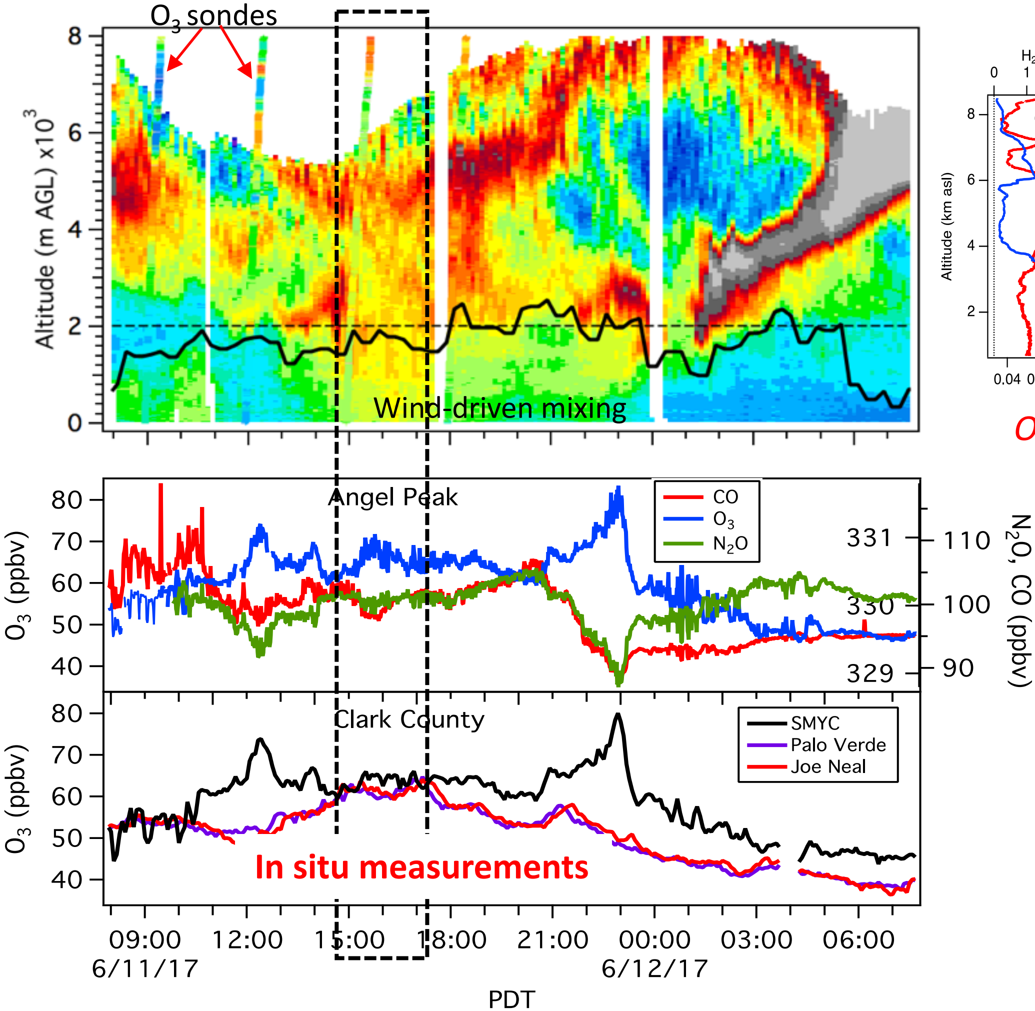


Mixed layer captures O_3/CH_4-rich pollution plume transported over Sierra Nevada

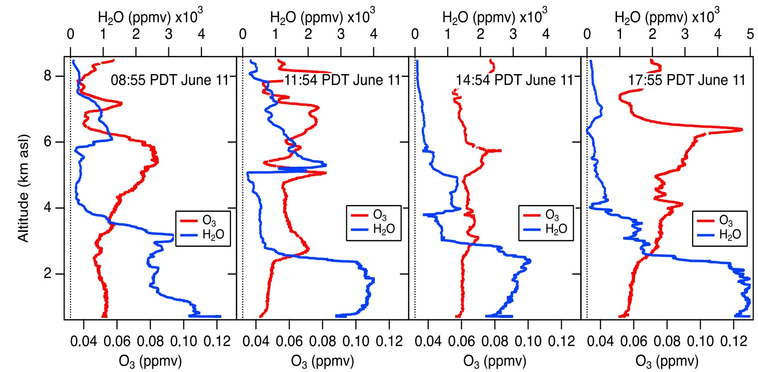
Example 3: Entrainment of deep ***Stratospheric*** intrusion

June 11-12, 2017

(24 of 60 hours shown)



GMD ozonesondes



Ozonesondes have greater range and also measure T, RH, and winds

Scientific Aviation flight track
(flight cut short because of winds)

Entrainment of UTLS air increased surface ozone to ≈60-65 ppbv in the Las Vegas Valley

Summary

- Entrainment of transported O_3 (fires, Asian, CA, STT) directly observed.
- Deep mixed mixed layers entrain transport layers *and* vent locally produced O_3.
- Stratospheric intrusions can indirectly cause high surface O_3 by capping ML.