Preliminary Results from the TOPAZ Ozone Lidar Deployment at the CABOTS Campaign

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NOAA/ESRL/CSD & CU/CIRES

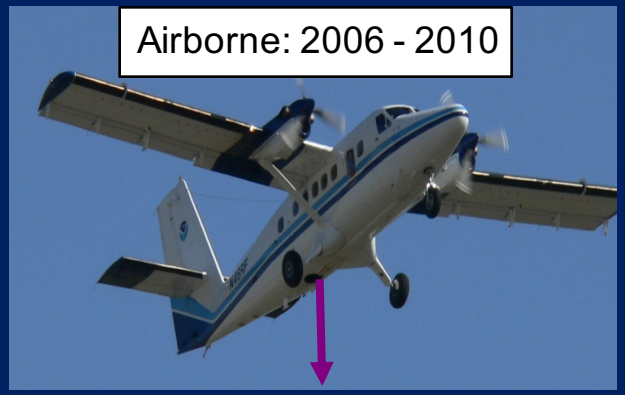
- Instrument & data overview, boundary layer ozone dynamics (Chris)
- STT ozone (Andy)

3rd Annual TOLNet Workshop, 28 Jun 2016

NOAA TOPAZ Ozone Lidar

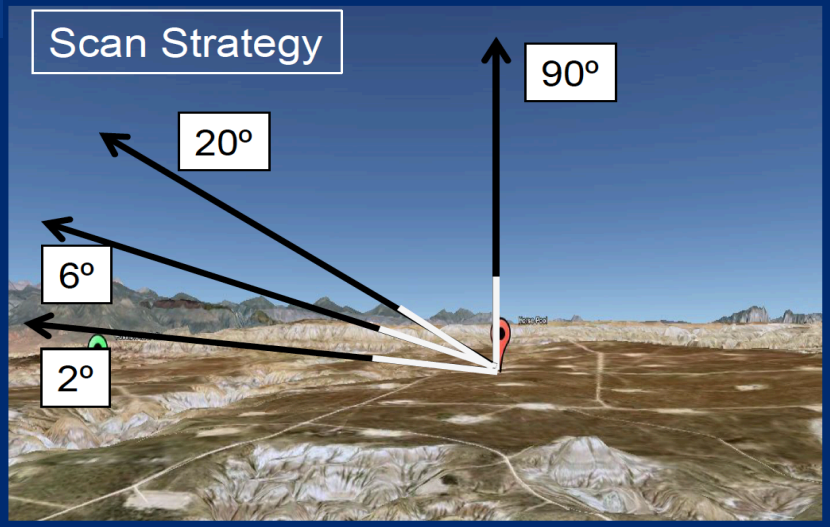
(TOPAZ = Tunable Optical Profiler for Aerosol and oZone)

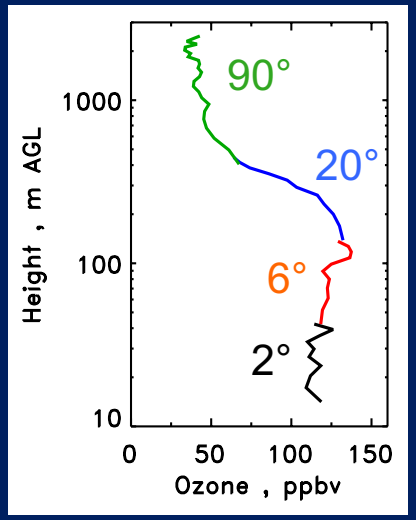
- Compact, tunable UV ozone DIAL
- Ozone and aerosol back-scatter profiles from ~ 15 m up to 8 km AGL



≤ 8 km AGL

~15 m AGL



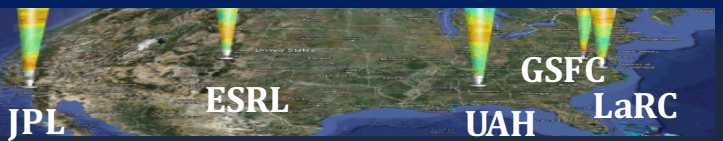


Composite vertical O_3 and aerosol profiles every 8 min

TOLNET

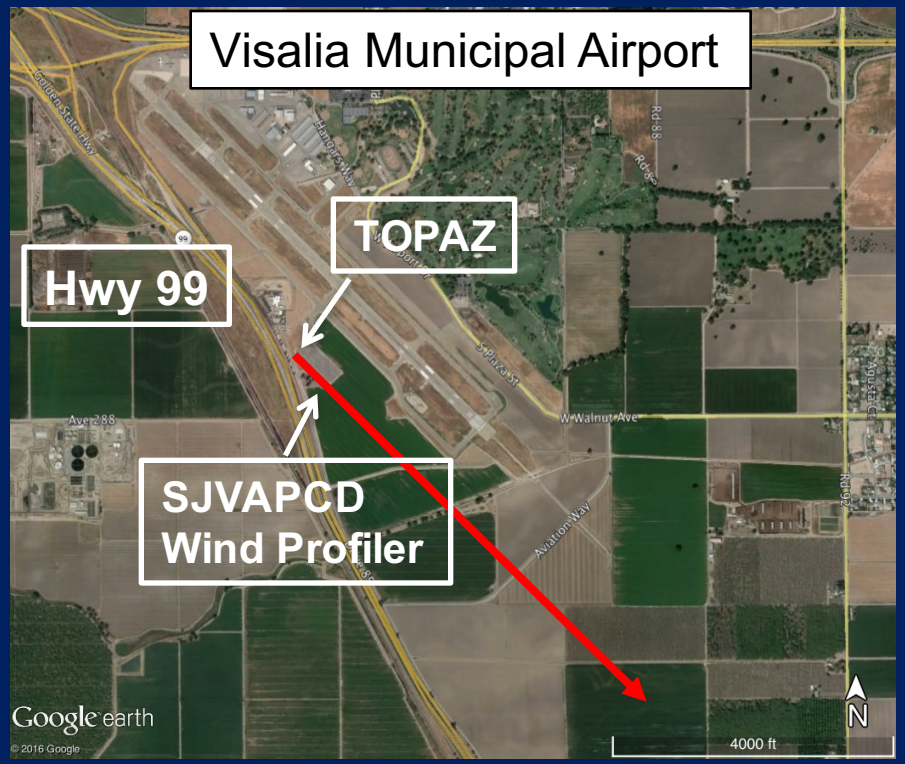
Tropospheric Ozone LIDAR Network

www-air.larc.nasa.gov/missions/TOLNet/



TOPAZ lidar @ CABOTS

CABOTS Objective: Understand to what extent trans-Pacific long-range transported ozone mixes down to the surface and affects air quality in the San Joaquin Valley.



29 May – 18 Jun, 2016	1st TOPAZ deployment ✔
18 Jul – 7 Aug, 2016	2nd TOPAZ deployment

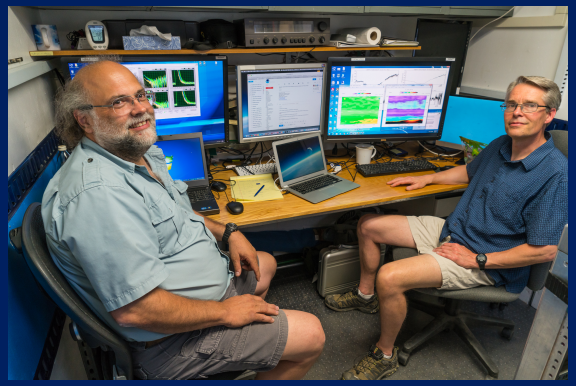
TOPAZ lidar @ CABOTS

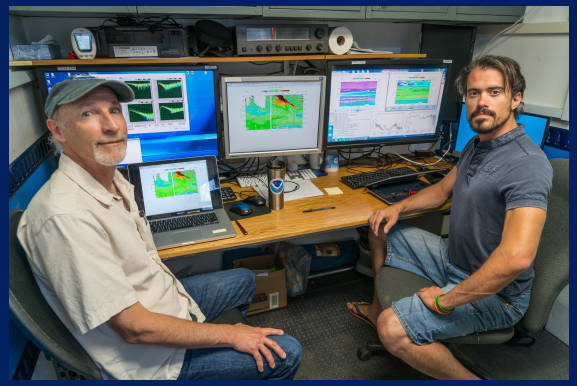
Photo Credit:
Will von Dauster

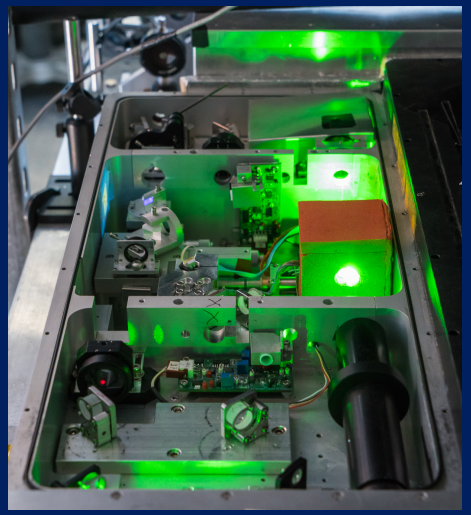
NASA Ames Alpha Jet

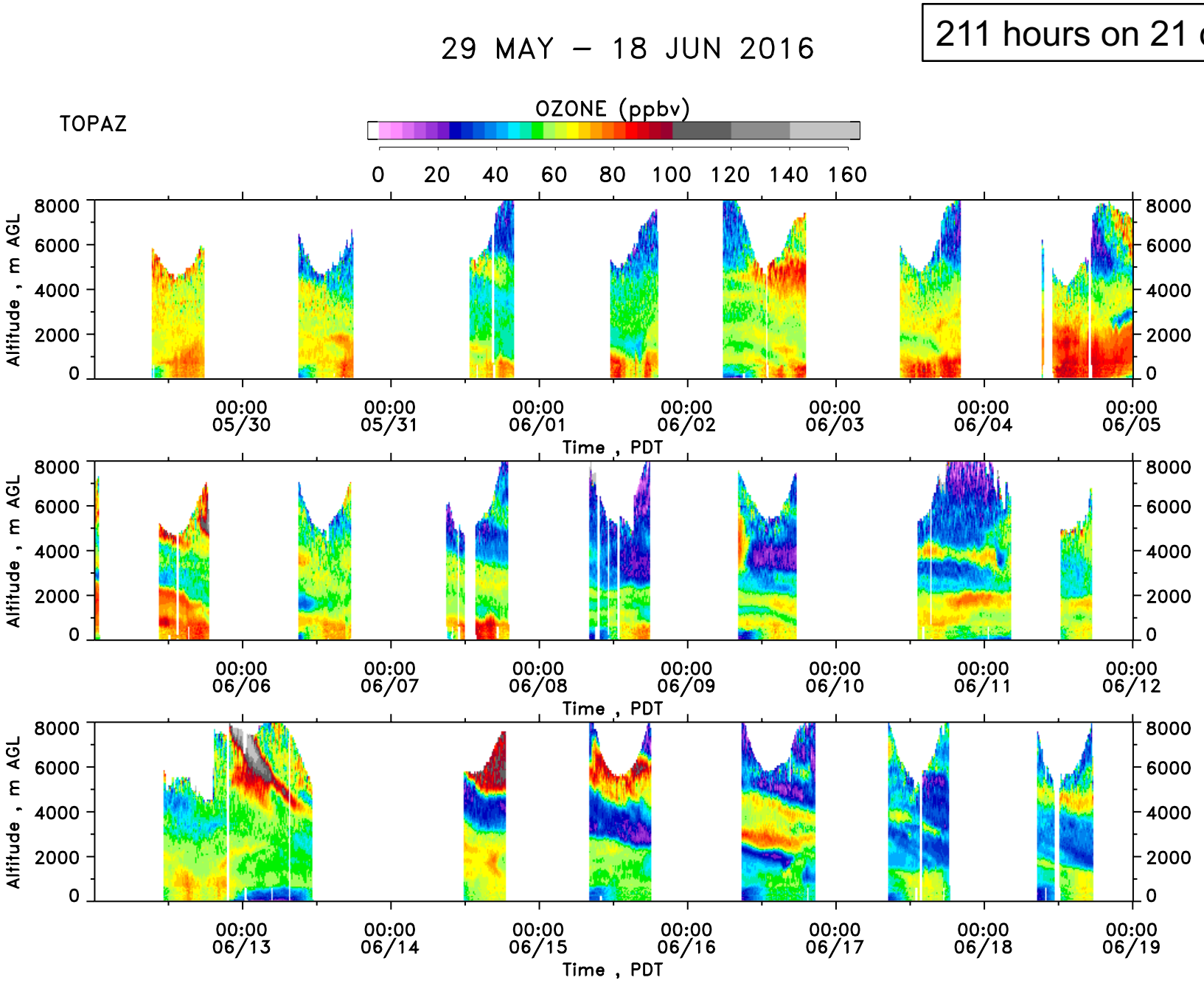
TOPAZ Truck

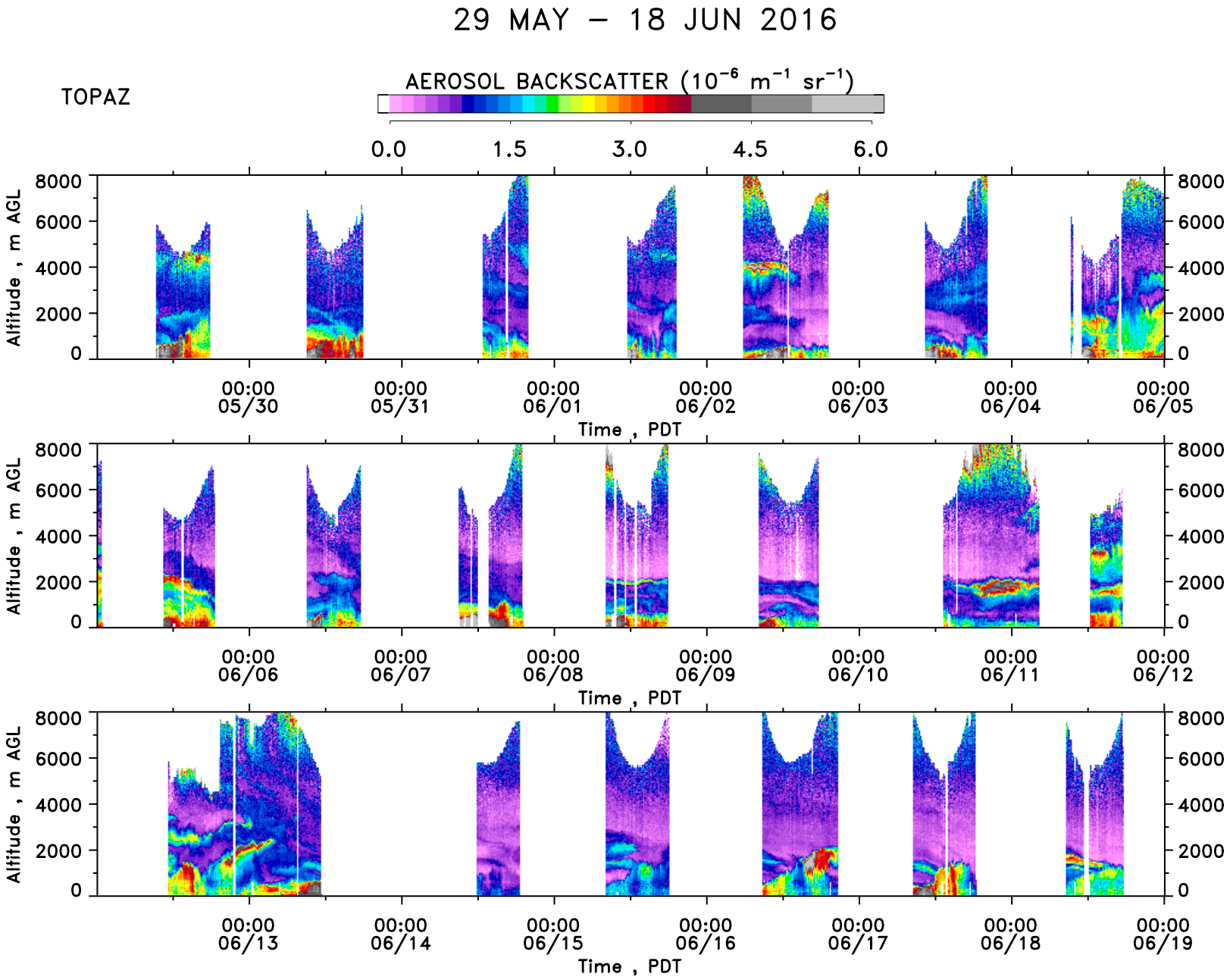
UC Davis / Sci. Aviation Mooney








211 hours on 21 days
29 MAY – 18 JUN 2016
TOPAZ
OZONE (ppbv)
0 20 40 60 80 100 120 140 160
Altitude , m AGL
8000
6000
4000
2000
0
00:00 05/30
00:00 05/31
00:00 06/01
00:00 06/02
00:00 06/03
00:00 06/04
00:00 06/05
Time , PDT
00:00 06/06
00:00 06/07
00:00 06/08
00:00 06/09
00:00 06/10
00:00 06/11
00:00 06/12
00:00 06/13
00:00 06/14
00:00 06/15
00:00 06/16
00:00 06/17
00:00 06/18
00:00 06/19


29 MAY – 18 JUN 2016
TOPAZ
AEROSOL BACKSCATTER (10^{-6} m^{-1} sr^{-1})
0.0
1.5
3.0
4.5
6.0
Altitude , m AGL
8000
6000
4000
2000
0
00:00 05/30
00:00 05/31
00:00 06/01
00:00 06/02
00:00 06/03
00:00 06/04
00:00 06/05
Time , PDT
00:00 06/06
00:00 06/07
00:00 06/08
00:00 06/09
00:00 06/10
00:00 06/11
00:00 06/12
00:00 06/13
00:00 06/14
00:00 06/15
00:00 06/16
00:00 06/17
00:00 06/18
00:00 06/19

Complex wind flow pattern and low summertime BL heights play an important role in the transport and distribution of pollutants in the San Joaquin Valley

Summertime low-level wind flow patterns in California's Central Valley

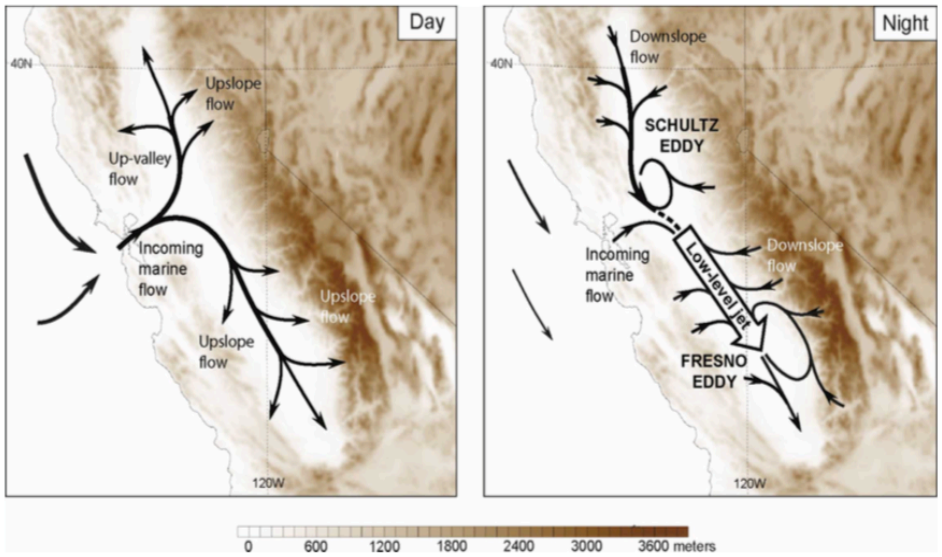
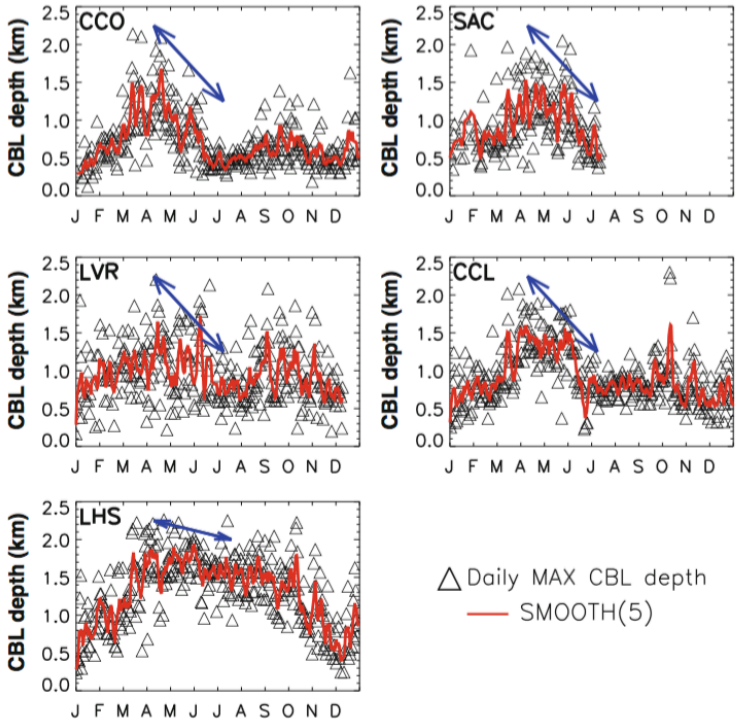


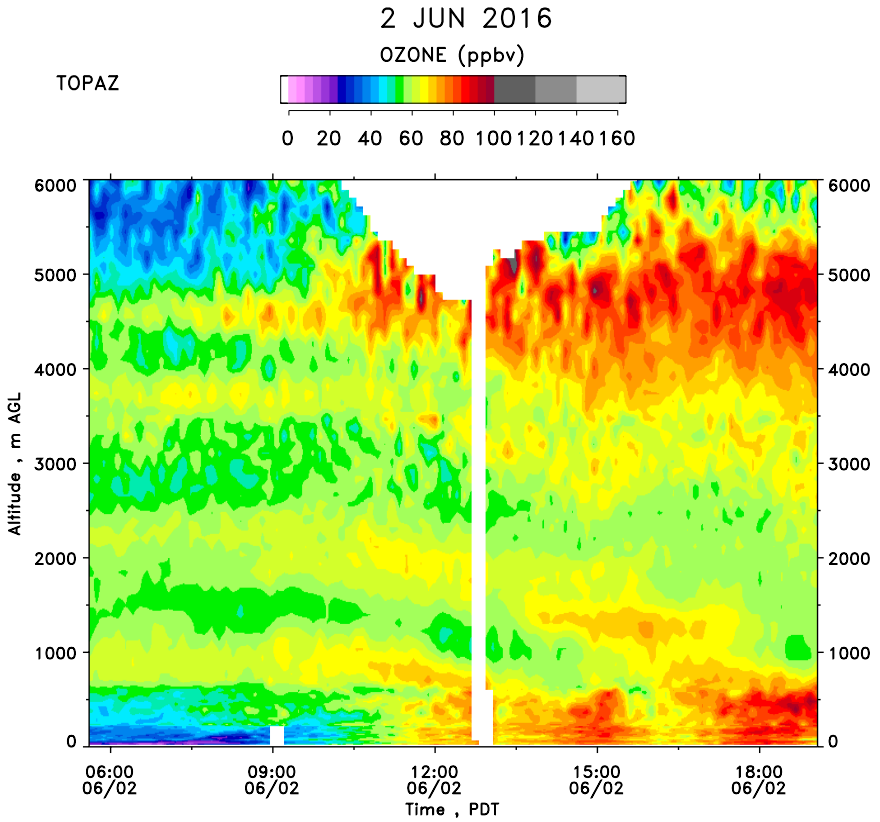
FIG. 11. Conceptualization of the daytime and nighttime low-level wind regimes during the 5-day episode.

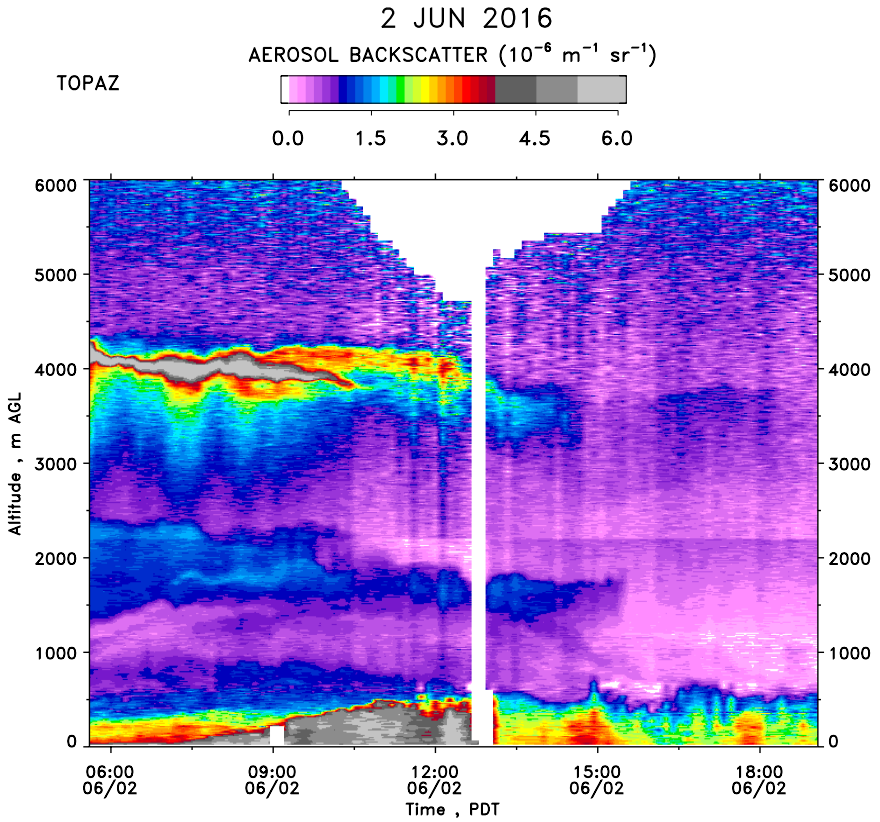
Bao, J.-W. et al., 2008: Observed and WRF-Simulated Low-Level Winds in a High-Ozone Episode during the Central California Ozone Study, *J. Appl. Meteor. Climatol.*, **47**, 2372-2394.

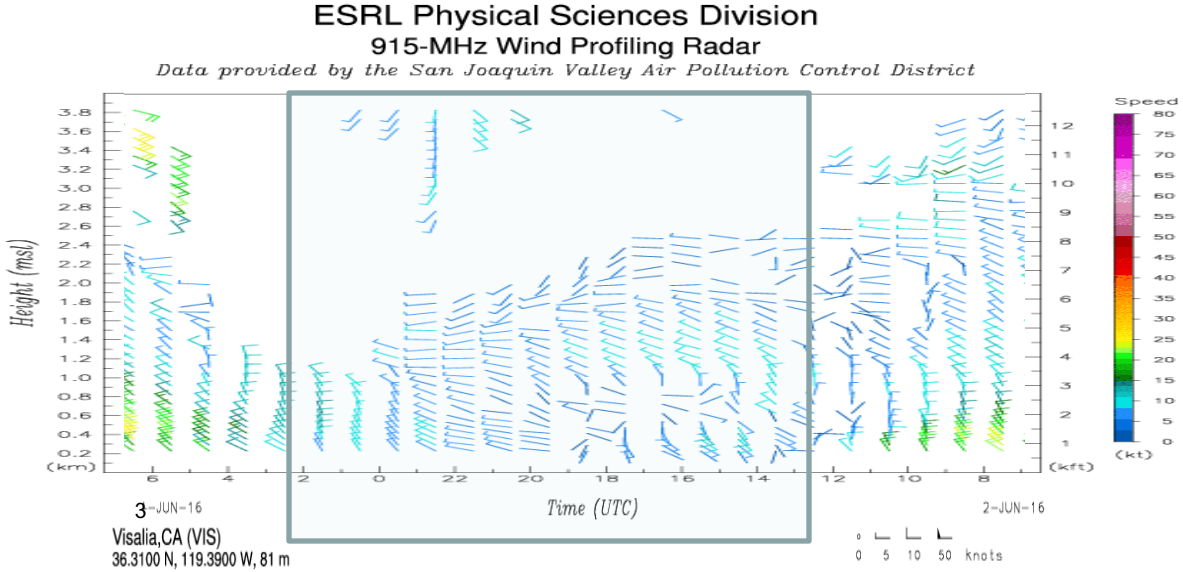
Annual variability of BL height in California's Central Valley

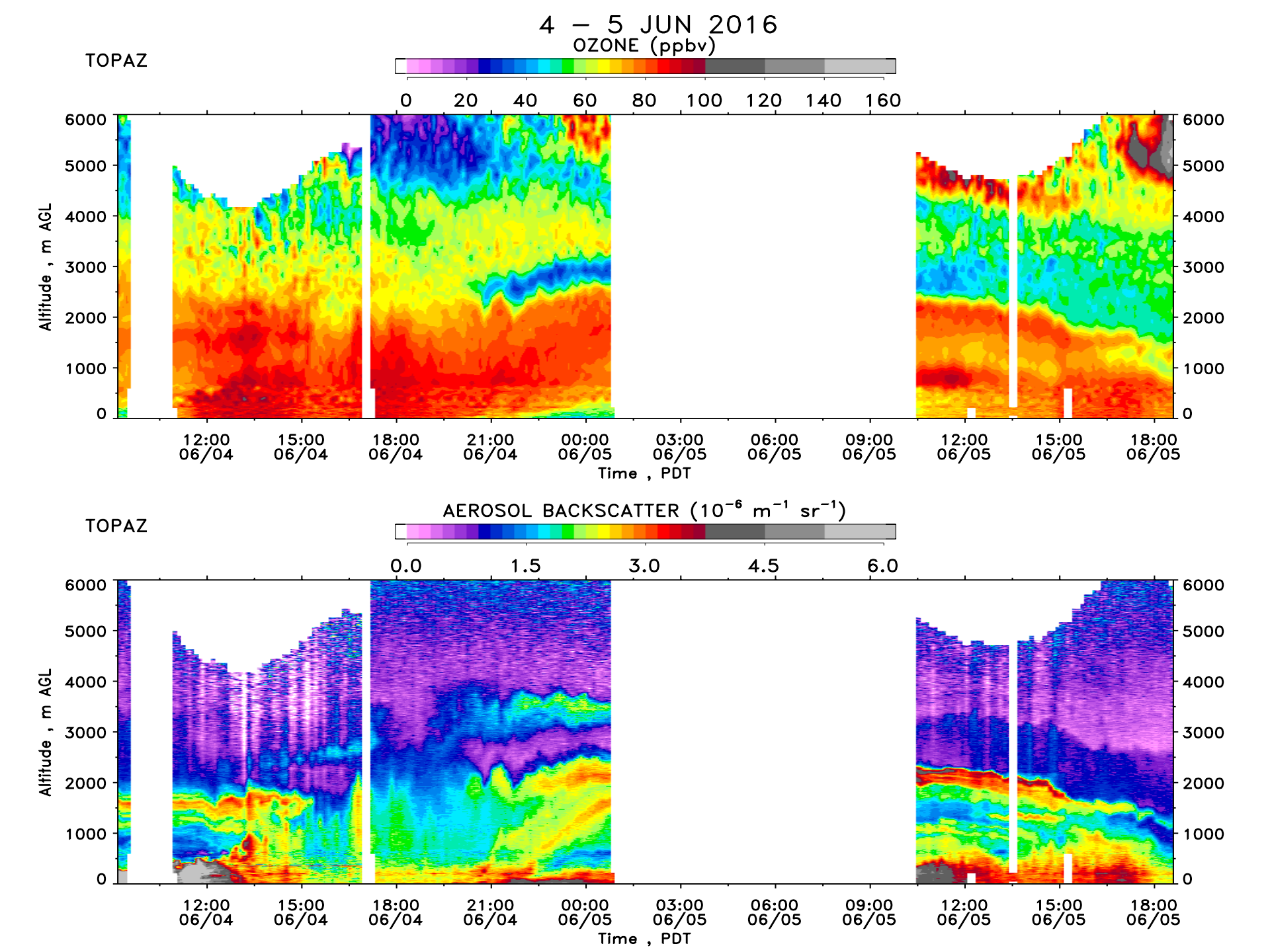


Bianco, L. et al., 2011: Diurnal Evolution and Annual Variability of Boundary-Layer Height and Its Correlation to Other Meteorological Variables in California's Central Valley, *Boundary-Layer Meteorol.*, **140**, 491-511.


2 JUN 2016
OZONE (ppbv)
TOPAZ
0 20 40 60 80 100 120 140 160
Altitude , m AGL
0 1000 2000 3000 4000 5000 6000
06:00 06/02
09:00 06/02
12:00 06/02
15:00 06/02
18:00 06/02
Time , PDT


2 JUN 2016
AEROSOL BACKSCATTER (10^{-6} m^{-1} sr^{-1})
TOPAZ
0.0 1.5 3.0 4.5 6.0
Altitude , m AGL
0 1000 2000 3000 4000 5000 6000
06:00 06/02
09:00 06/02
12:00 06/02
15:00 06/02
18:00 06/02
Time , PDT


ESRL Physical Sciences Division
915-MHz Wind Profiling Radar
Data provided by the San Joaquin Valley Air Pollution Control District
Height (msl)
(km)
(kft)
Speed
(kt)
Time (UTC)
3-JUN-16
2-JUN-16
Visalia,CA (VIS)
36.3100 N, 119.3900 W, 81 m
0 5 10 50 knots


4 – 5 JUN 2016
TOPAZ
OZONE (ppbv)
0
20
40
60
80
100
120
140
160
Altitude , m AGL
6000
5000
4000
3000
2000
1000
0
12:00
06/04
15:00
06/04
18:00
06/04
21:00
06/04
00:00
06/05
03:00
06/05
06:00
06/05
09:00
06/05
12:00
06/05
15:00
06/05
18:00
06/05
Time , PDT
TOPAZ
AEROSOL BACKSCATTER (10^{-6} m^{-1} sr^{-1})
0.0
1.5
3.0
4.5
6.0
Altitude , m AGL
Time , PDT