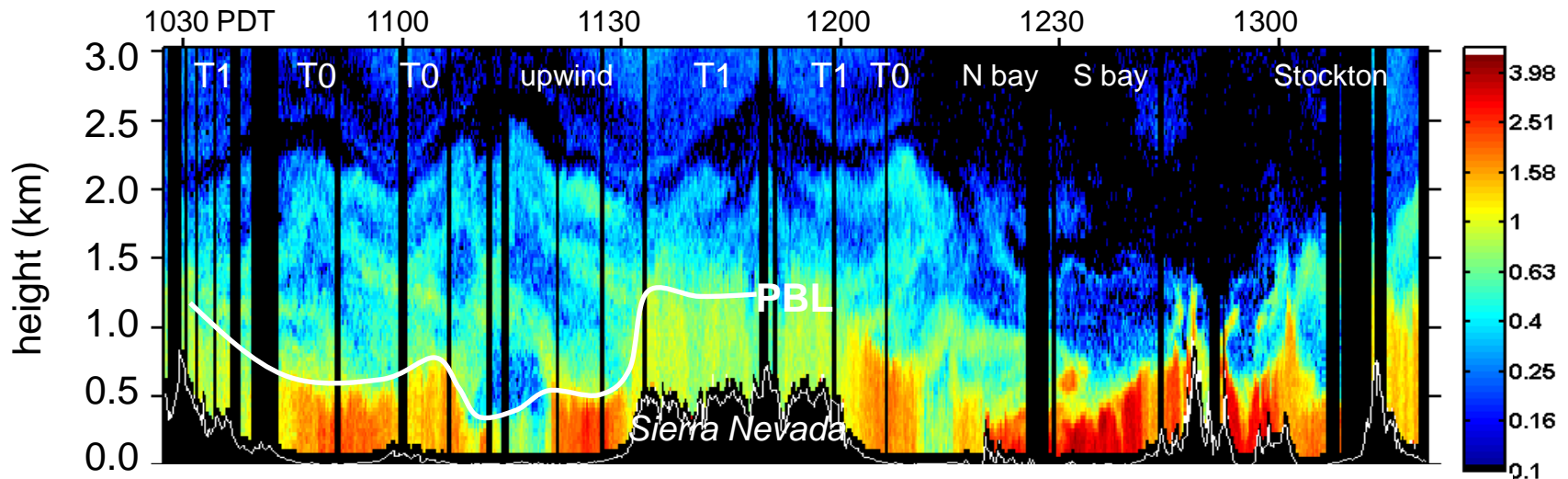


Meteorological Processes Contributing to Aerosols Above the Boundary Layer

Jerome Fast

Aerosol Backscatter from High Spectral Resolution Lidar, June 28 Flight 1

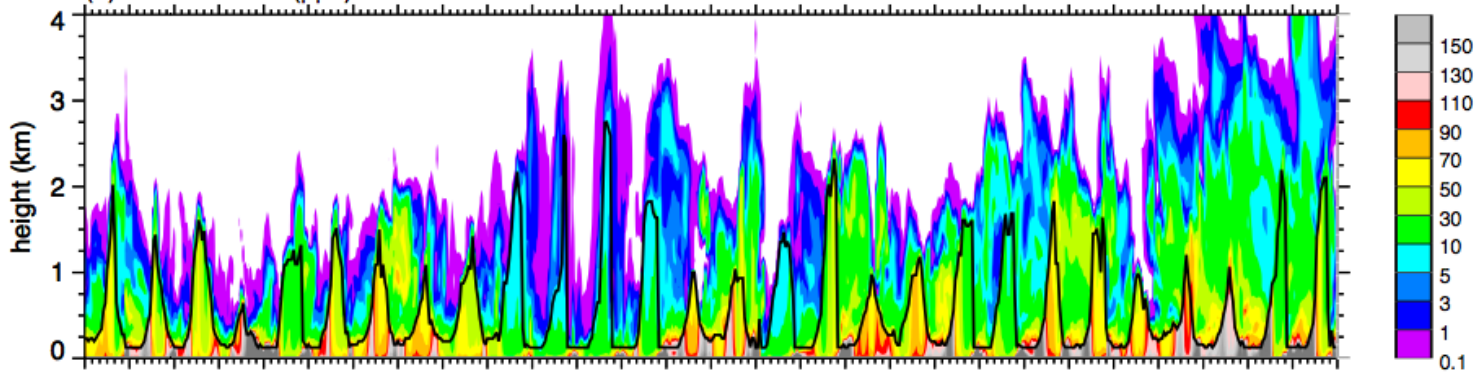
Rich Ferrare, Chris Hostetler



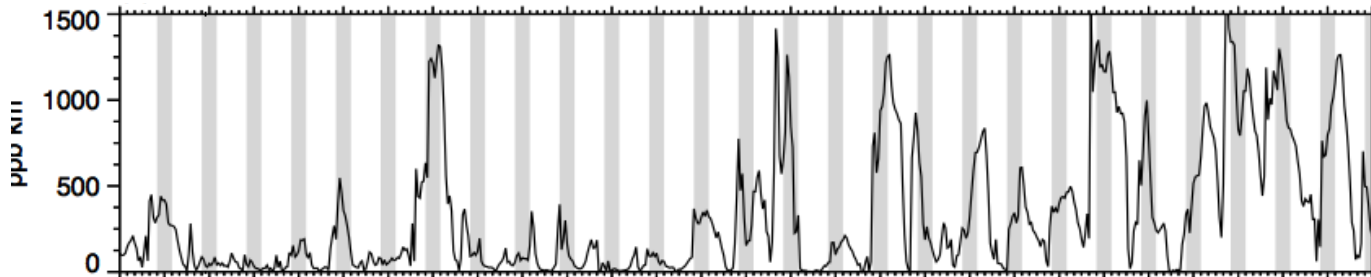
**What processes contribute to the aerosol layers aloft ?
Are these the result of long-range transport or local sources ?**

Operational WRF Forecasts

CO over T0 Site

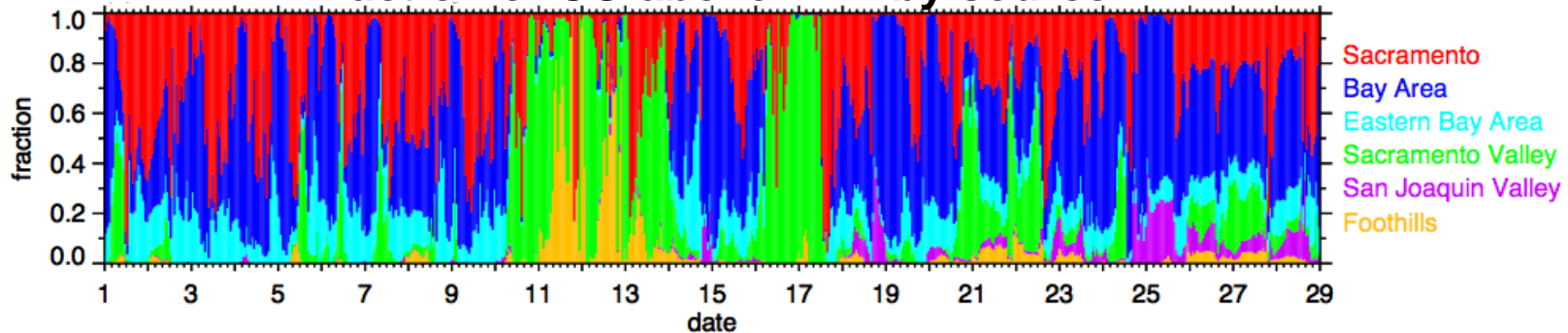


CO burden above PBL



meteorological processes during the last week more favorable for layers aloft from California sources

fraction of CO above PBL by source

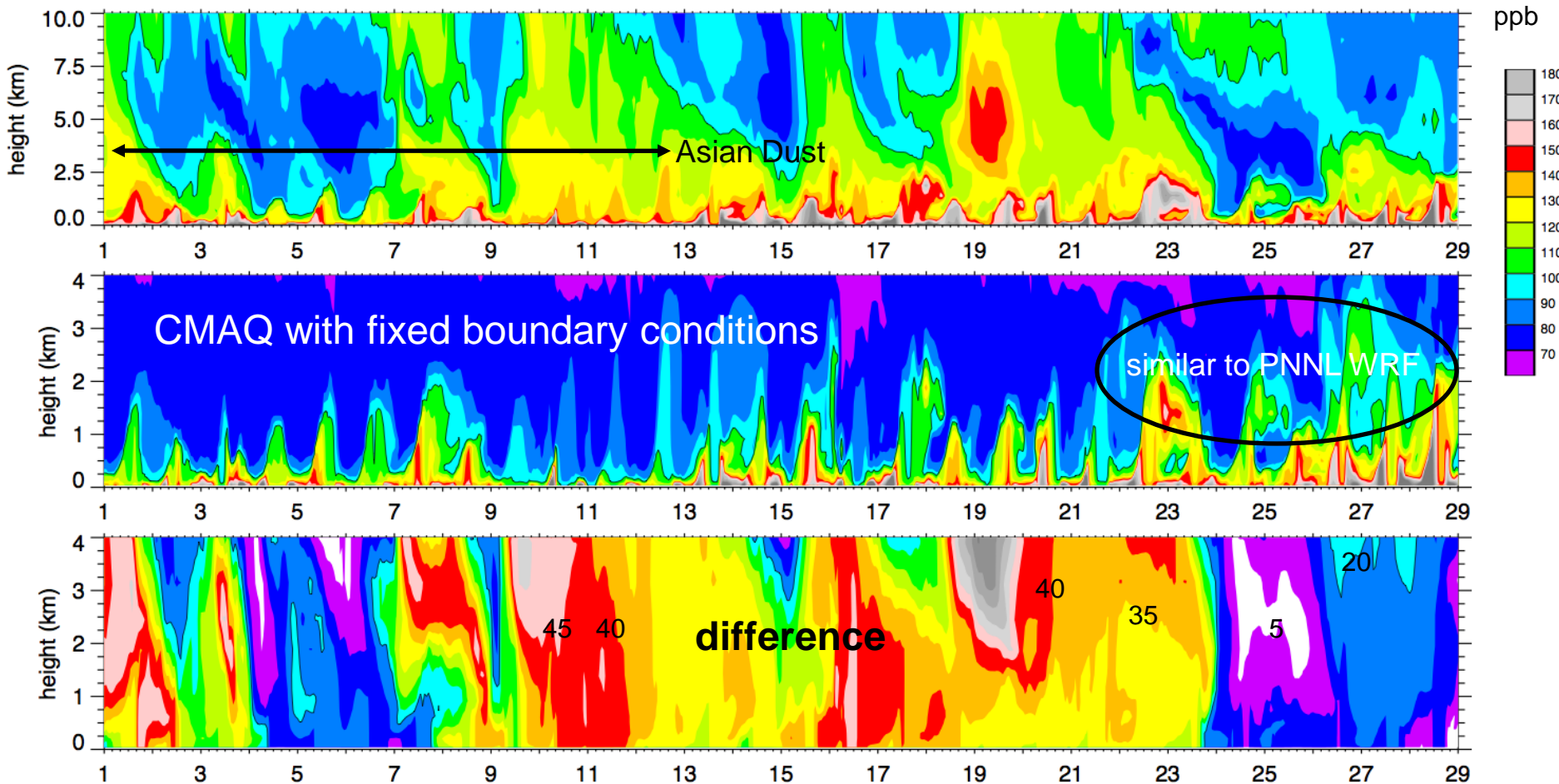


model suggests sources in California can account for layers aloft, but ...

CMAQ (regional) + RAQMS (global) Forecasts

Provided by Brad Pierce (NOAA) as part of CalNex

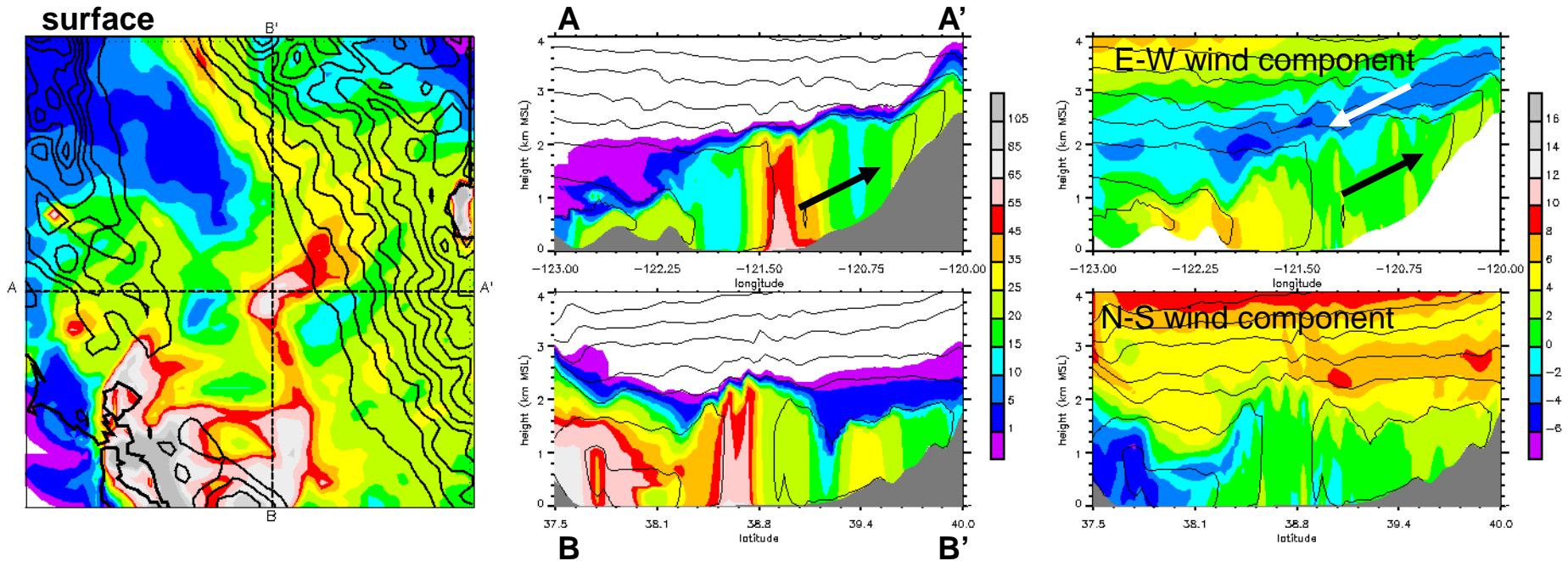
CO over Sacramento



long-range transport from Asia could also be important

Vertical Cross Sections (1)

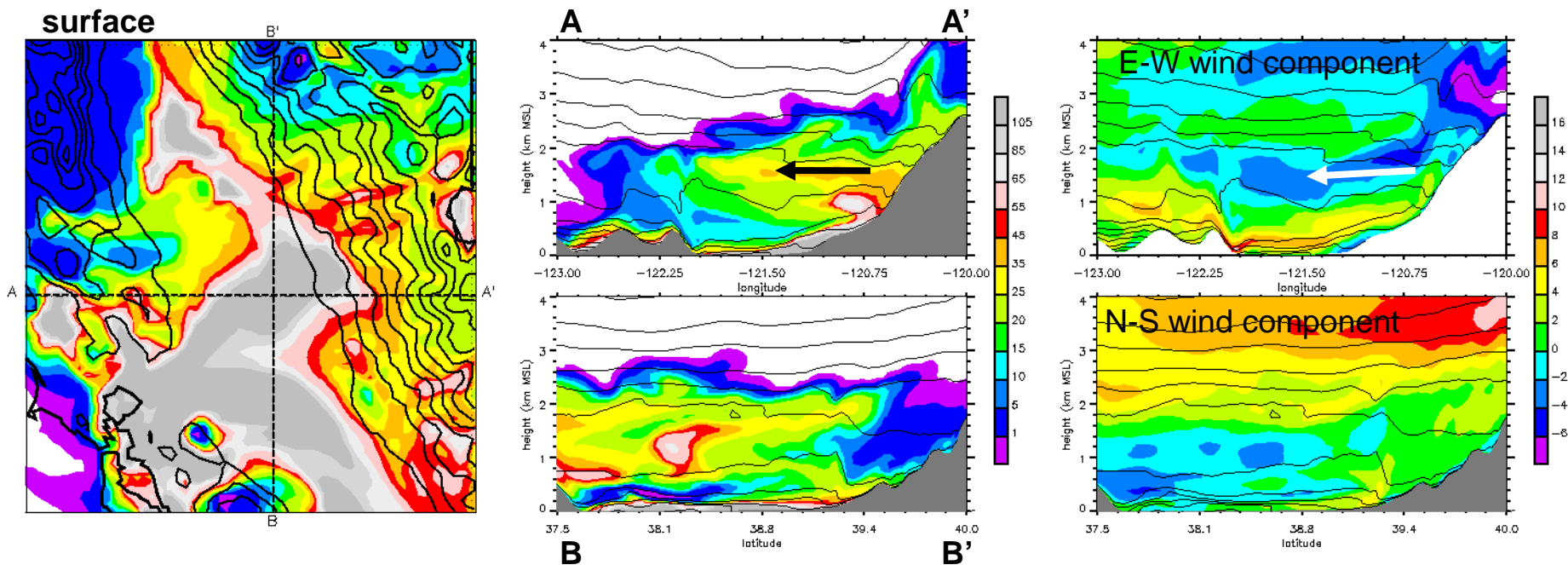
Ensemble CO from WRF, 17 PDT June 22



up-slope flow transports CO in the boundary layer into foothills, but
vertical wind shear predicted at top of boundary layer

Vertical Cross Sections (2)

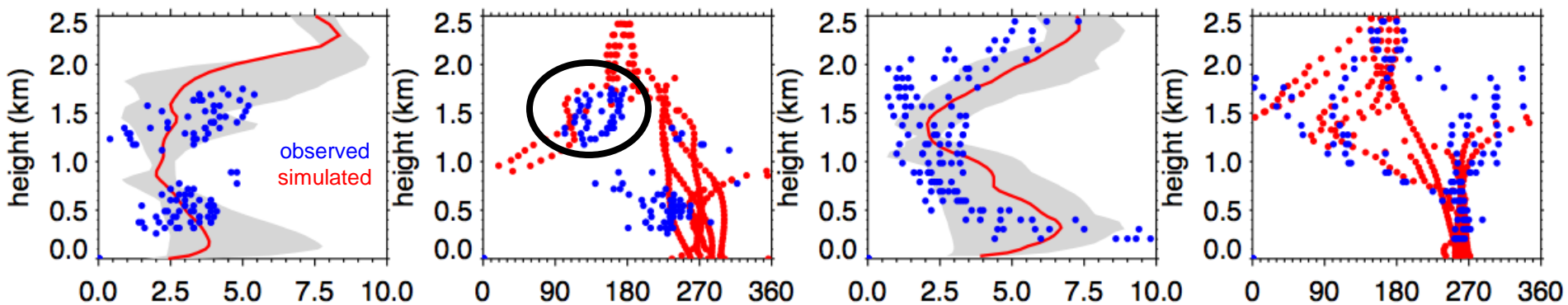
Ensemble CO from WRF, 23 PDT June 22



SE winds aloft transport some of CO previously transported over foothills back over the valley

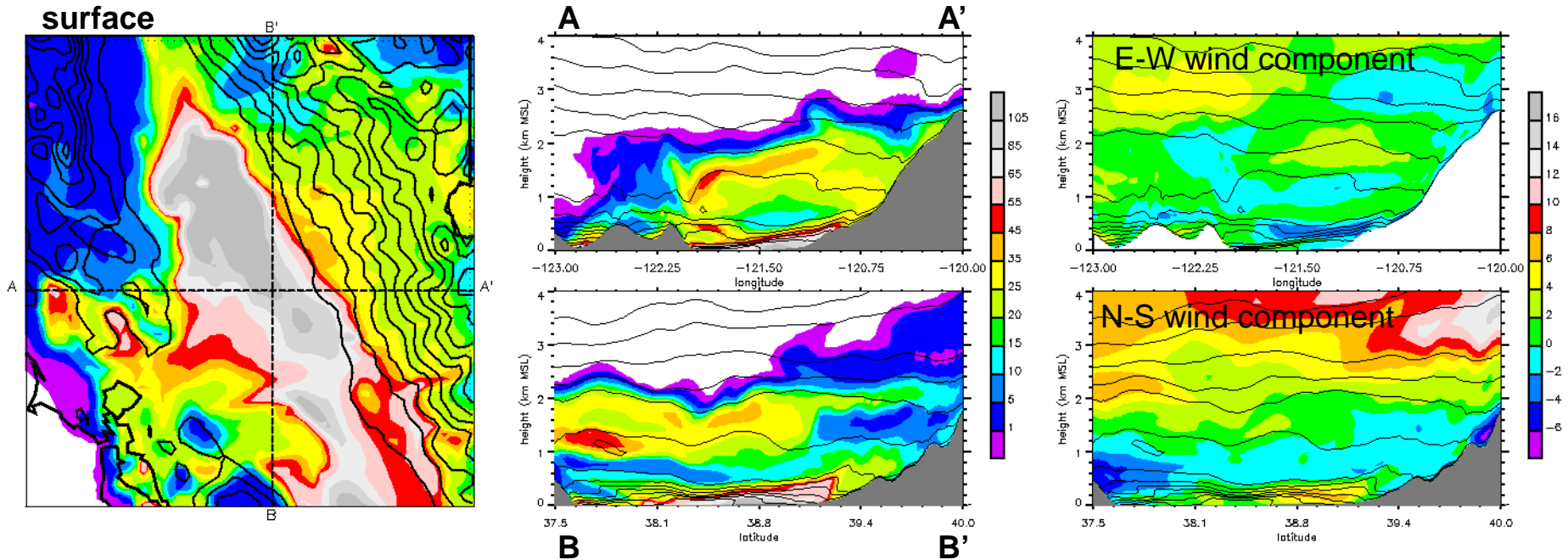
T1 Profiler 17 – 23 PDT

T0 Profiler 17 – 23 PDT



Vertical Cross Sections (3)

Ensemble CO from WRF, 05 PDT June 23

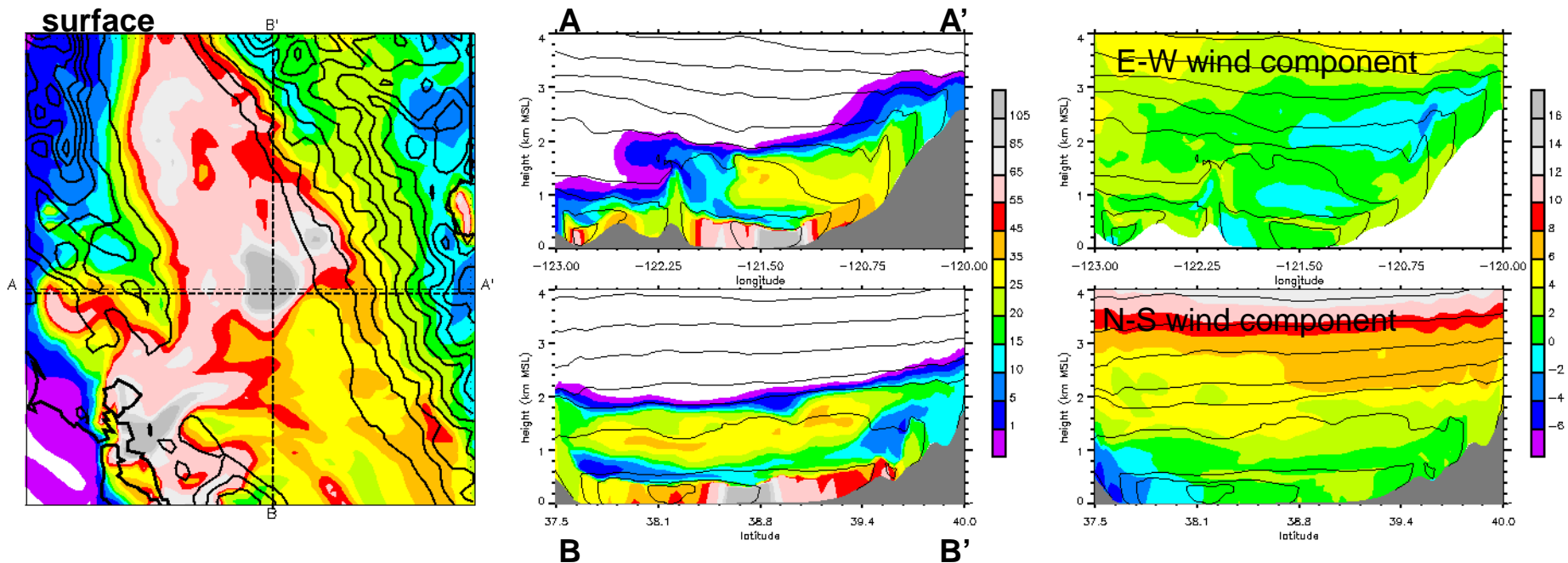


easterly winds aloft diminish by sunrise, but CO remains over central valley because winds aloft are light

biogenic species emitted the previous afternoon over the slope of the Sierra could also be mixed with anthropogenic sources and transported over the valley along

Vertical Cross Sections (4)

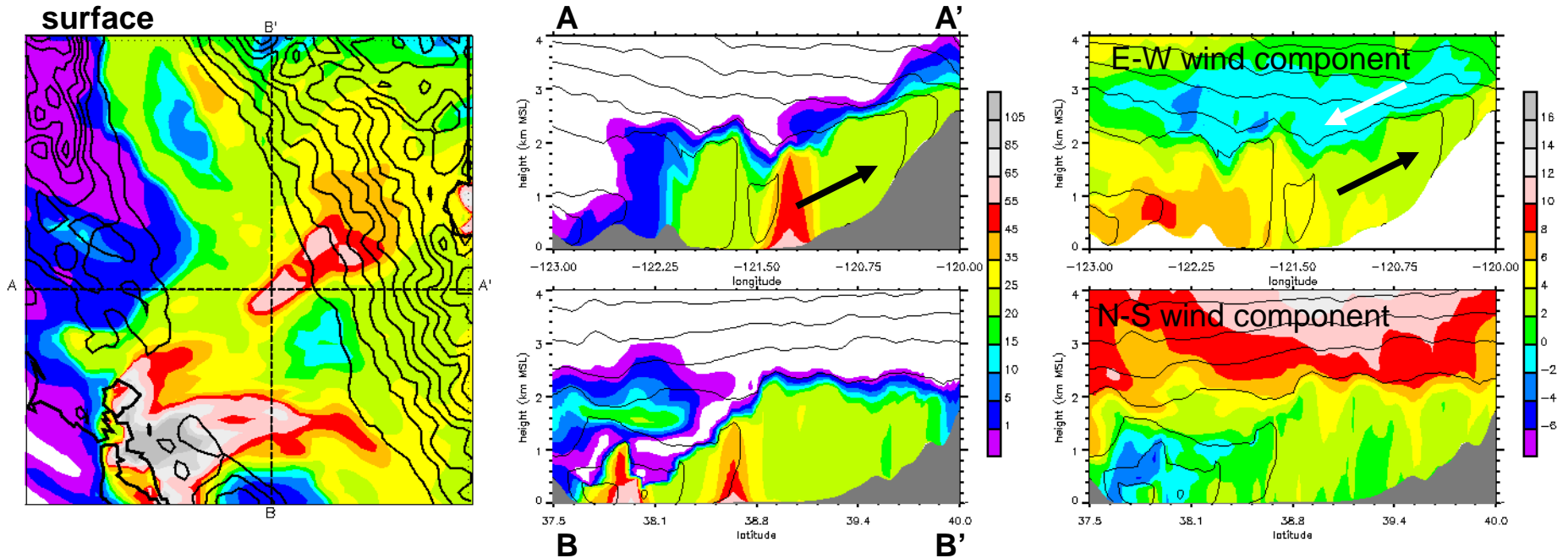
Ensemble CO from WRF, 11 PDT June 23



winds aloft remain light and portion of previous days emissions linger over the valley into the day

Vertical Cross Sections (5)

Ensemble CO from WRF, 17 PDT June 23



growing convective boundary layer mixes aged air aloft with fresh emissions, return circulation over the foothills re-establishes itself

Summary

Layers produced by “mountain venting”, similar to those observed by NOAA lidar in Los Angeles basin (*Langford et al.*, GRL 2010)

afternoon thermally driven flows in the boundary layer

nighttime flows 500 – 2000 m AGL

morning flows 500 – 2000 m AGL

strength of return flow and wind direction varies day to day

aged air entrained into growing CBL and transported back over the Sierra

possible pathway for San Joaquin pollutants to be transported into Sacramento Valley

Note: on some days, layers aloft simply a residual layer from the previous day with light winds aloft

upper-level ambient winds too strong (especially during the passage of 3 troughs with NW winds) for this flow pattern to occur frequently until the last week of the campaign