

Remote sensing to understand sources of high ozone

Christoph Senff



Motivation

Knowing the vertical distribution of pollutants and atmospheric dynamics is critical to understanding the processes controlling surface air quality.

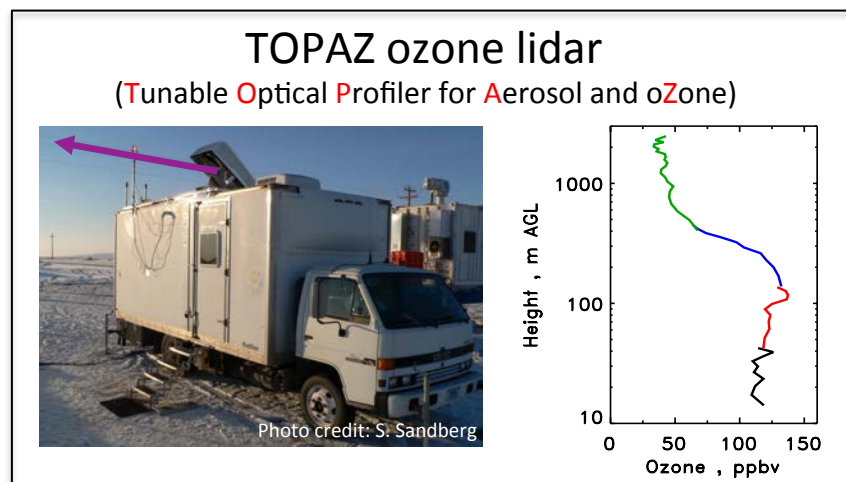
Methodology

CSD builds and deploys **lidar remote sensing** instruments to observe the vertical chemical and dynamical structure of the atmosphere (profiles of ozone, aerosols, wind, turbulence).

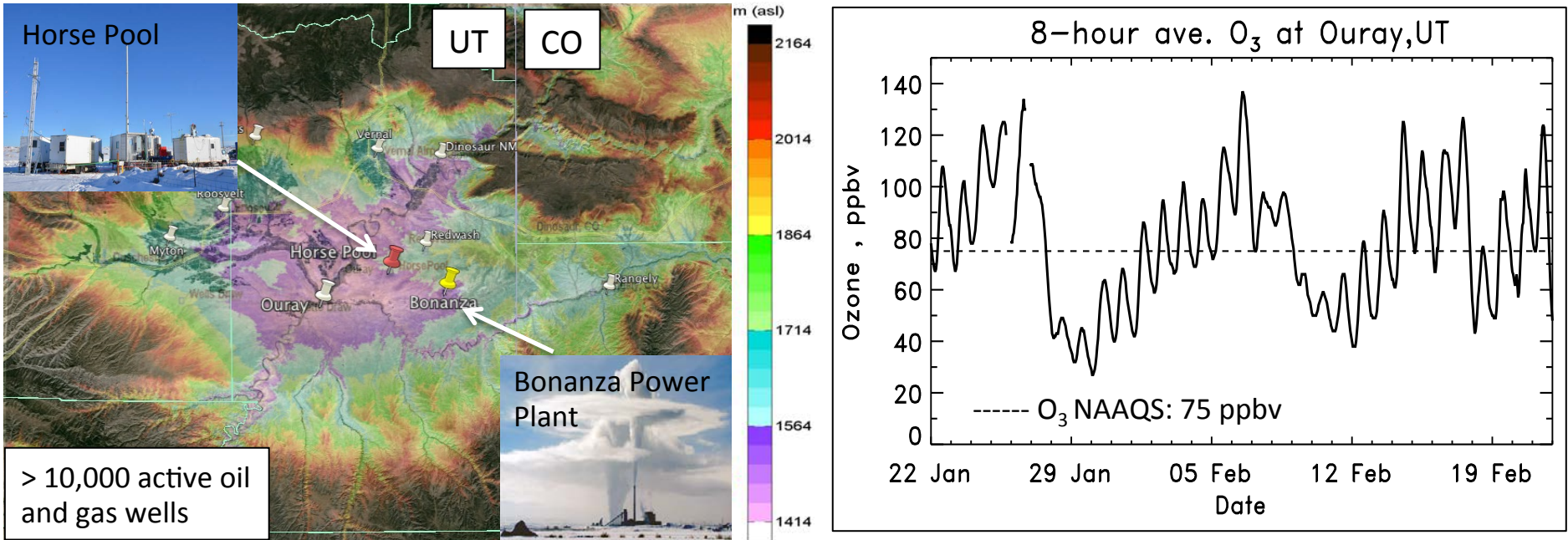
Application:

Utah Basin Wintertime Ozone Study

CSD used its lidar instruments and state-of-the-art in situ sensors to **understand the mechanisms contributing to high wintertime surface ozone in the Utah Basin**, an oil and gas producing region in NE Utah.



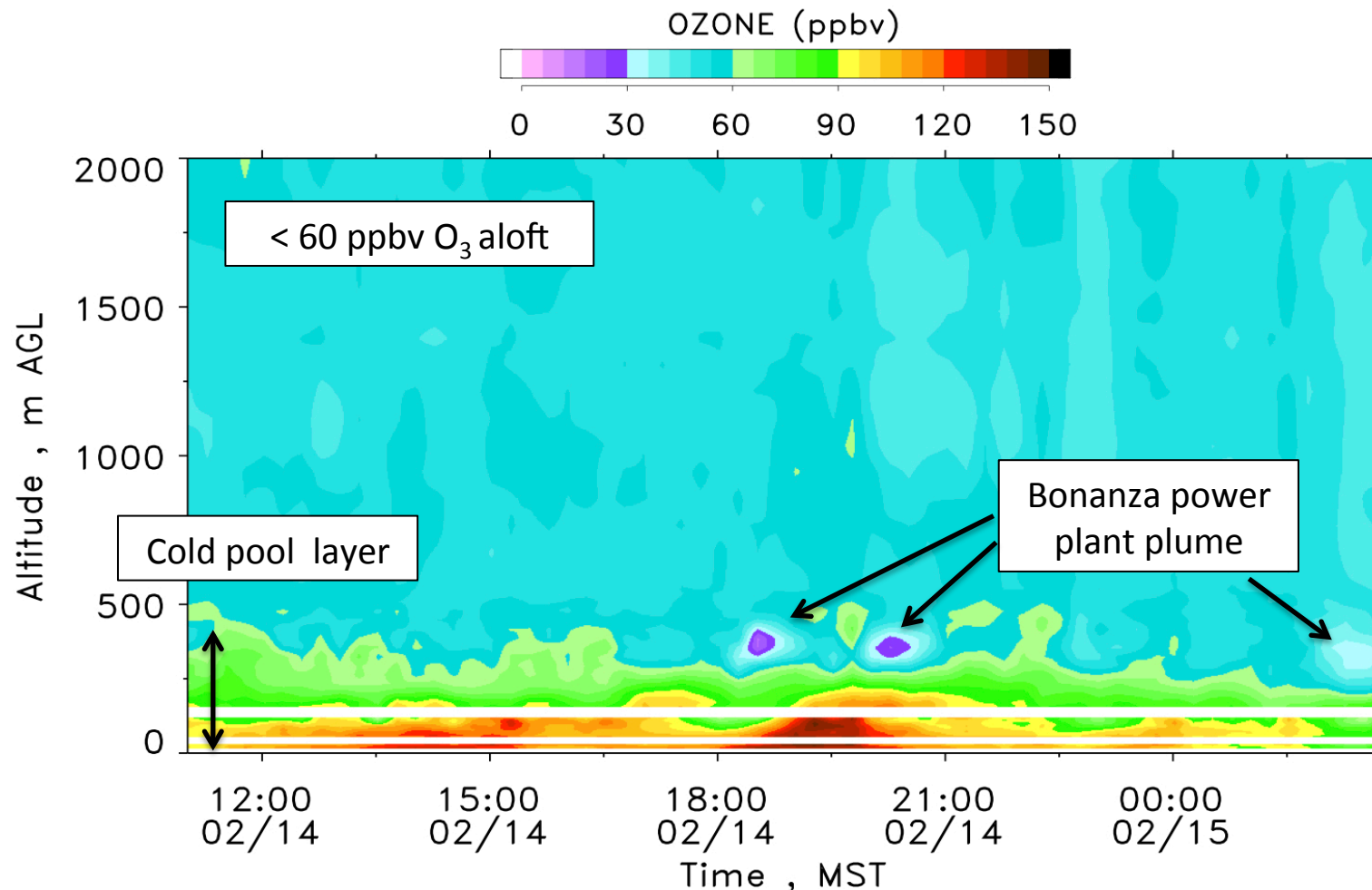
Uintah Basin Wintertime Ozone Study: Jan/Feb 2013



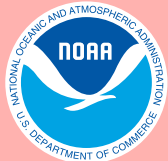
Main objectives of CSD ozone and wind lidar deployment

- 1) What is the vertical extent of the high ozone observed at the surface?
- 2) What are the sources of the high O₃ concentrations?
 - oil & gas emissions
 - NO_x from Bonanza power plant
 - regional/long-distance transport aloft
 - stratosphere-to-troposphere transport

Ozone distribution observed with CSD ozone lidar on 14/15 Feb 2013



- 1) High O₃ concentrations were confined to a 400-m deep cold pool layer.
- 2) NO_x from the Bonanza power plant did not mix down to the surface.
- 3) No indication of long-range or stratosphere-to-troposphere transport of high O₃.



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Findings

- Neither power plant emissions nor long-range transport/stratospheric intrusions contribute to high surface O₃ in the Uintah Basin.
- Local emissions from oil & gas extraction are the main driver of high O₃ concentrations.

Benefits

- ✓ CSD informed [Utah Department of Environmental Quality](#) on most effective approach to mitigate O₃ exceedances in the Uintah Basin.
- ✓ Vertical profile information from the lidar observations is key to [validating and ultimately improving AQ models](#).

Future focus

- Move from research-grade to more robust, autonomous lidar systems and use an observation network approach.

