Informing North American Background Ozone from Observations and Recent Modeling Results

Sam Oltmans

Cooperative Institute for Researh
in the Environmental Sciences (CIRES)
University of Colorado
Boulder, Colorado

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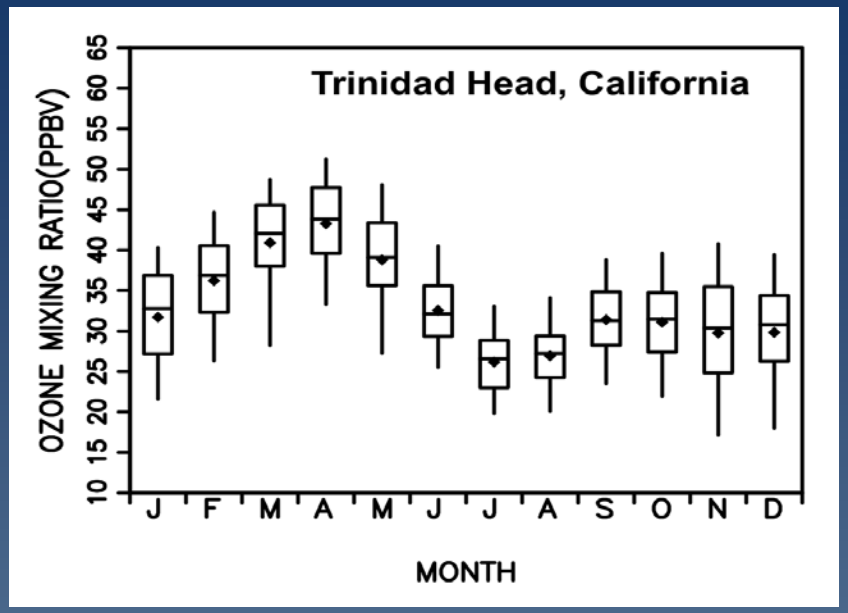
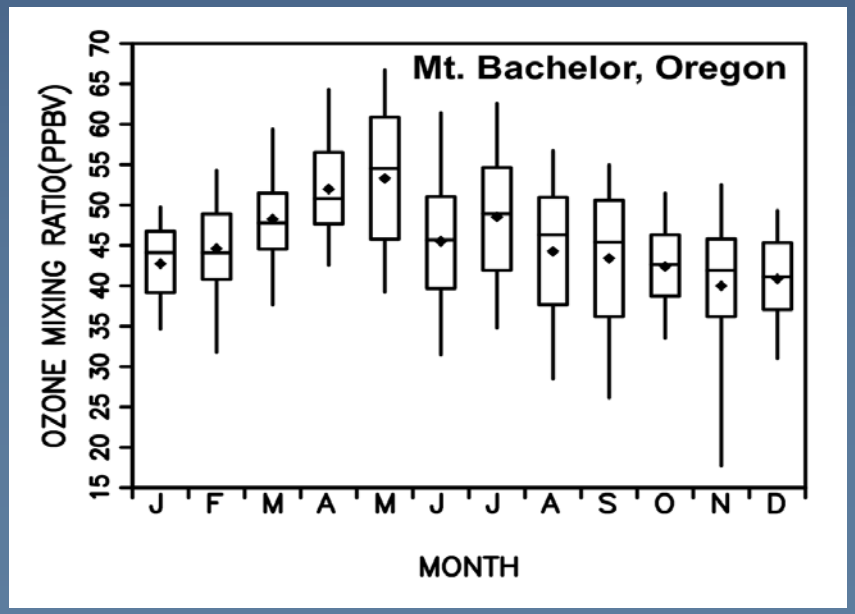
Surface ozone at Trinidad Head and Mt. Bachelor under conditions representative of background ozone

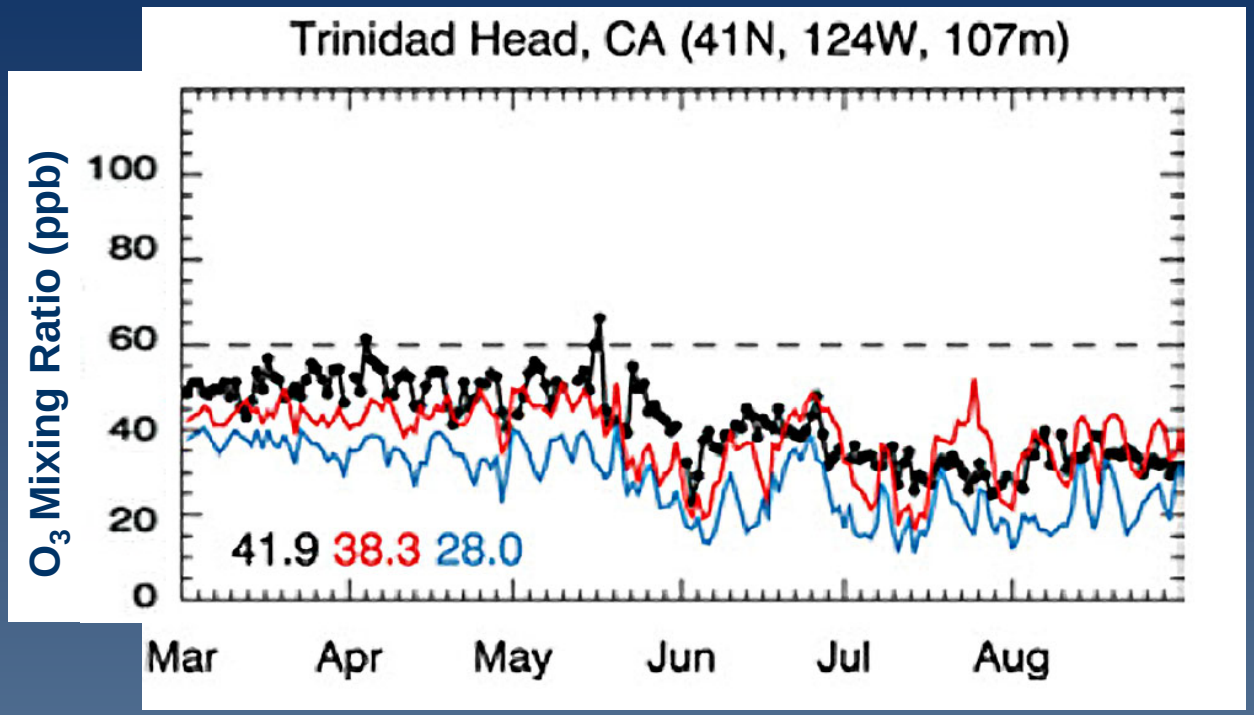




Diamond = Mean
Horizontal Line Inside Box = Median
Box = Inner 50th Percentile (25th & 75th)
Whiskers = Inner 90th Percentile (5th & 95th)

1) Background ozone is thought of as only obtainable from models, however, there are sites that make observations under conditions representative of background.
2) At Trinidad Head (a marine boundary layer site) spring daytime (or 8-hr max) surface ozone exceeds 45 ppb 25% of the time.
3) At Mt. Bachelor (a higher altitude site) in May ozone levels exceed 60 ppb 25% ot the time.

Comparison of Observations with Model Results

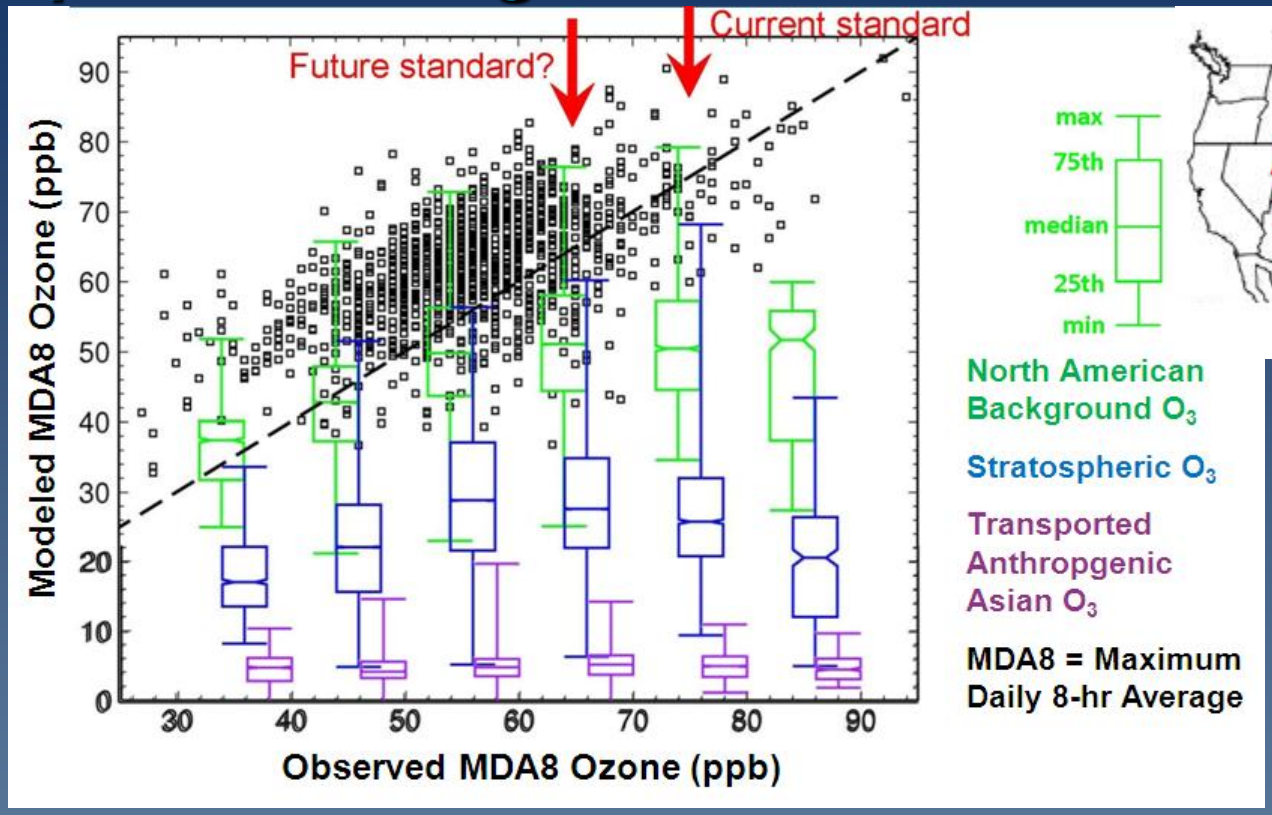


The modeled O_3 (red) is ~5 ppb less than observed (black) and background (blue) is ~10 ppb less than observed in the spring.

Comparison of daily maximum 8-h average O_3 predicted using GEOS-Chem at 0.5° × 0.667° with measurements at Trinidad Head, CA from March to August 2006. Source: US EPA (2012a).

This comparison suggests the model underestimates the background ozone levels since observed ozone at Trinidad Head under conditions representative of background is almost always higher than non-background conditions.

Comparison of Observations with Model Results: Impact of Background Ozone Over the Western U.S.



Other natural sources within North America such as wildfires also contribute to North American Background

- The GFDL AM3 model captures high O_3 events (>70 ppb).
- NA Background O_3 and its stratospheric component increases with increasing O_3 up to the level of the current standard.
- NA Background is largest in the 50-80 ppb range of observed O_3.
- Stratospheric O_3 contributes more than transported Asian anthropogenic O_3.

Final Points

- Observations at sites monitoring air entering the west coast of the U.S. regularly measure air under conditions representative of North American background – these measurements provide useful contraints on modeled background ozone.
- Current model estimates used by the EPA for estimating background ozone likely underestimate background over the western U.S.
- Unlike earlier work, recent model results suggest that background ozone has a greater contribution from stratospheric sources and that background can contribute substantially to measured ozone during high ozone events.
- Background ozone levels in the western U.S. leave limited opportunity for regulatory compliance for an ozone standard much below the current standard.