

Slide 1

# North American Background Ozone REA Comments

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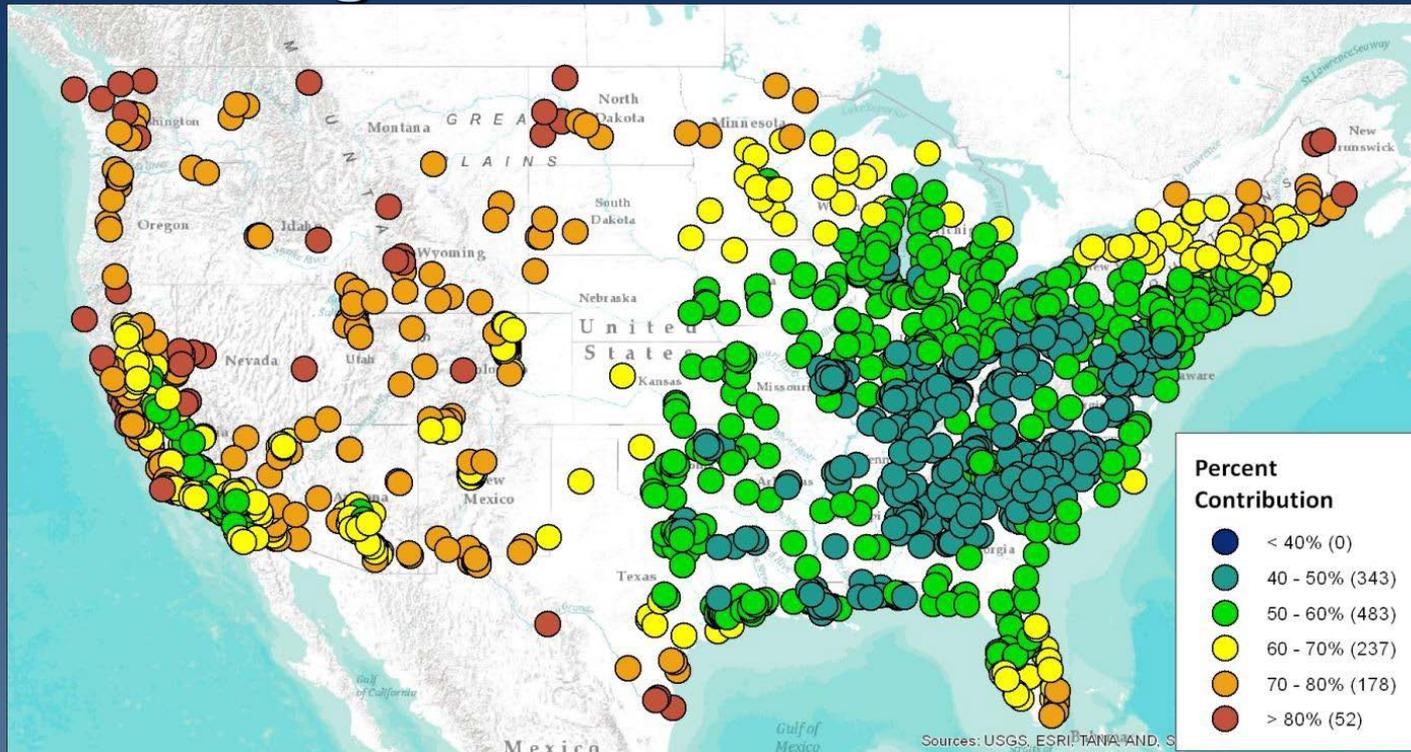
Comments to the U.S. EPA CASAC Ozone Review Panel

March 26, 2014



# Slide 2

## Background Ozone Over the U.S.



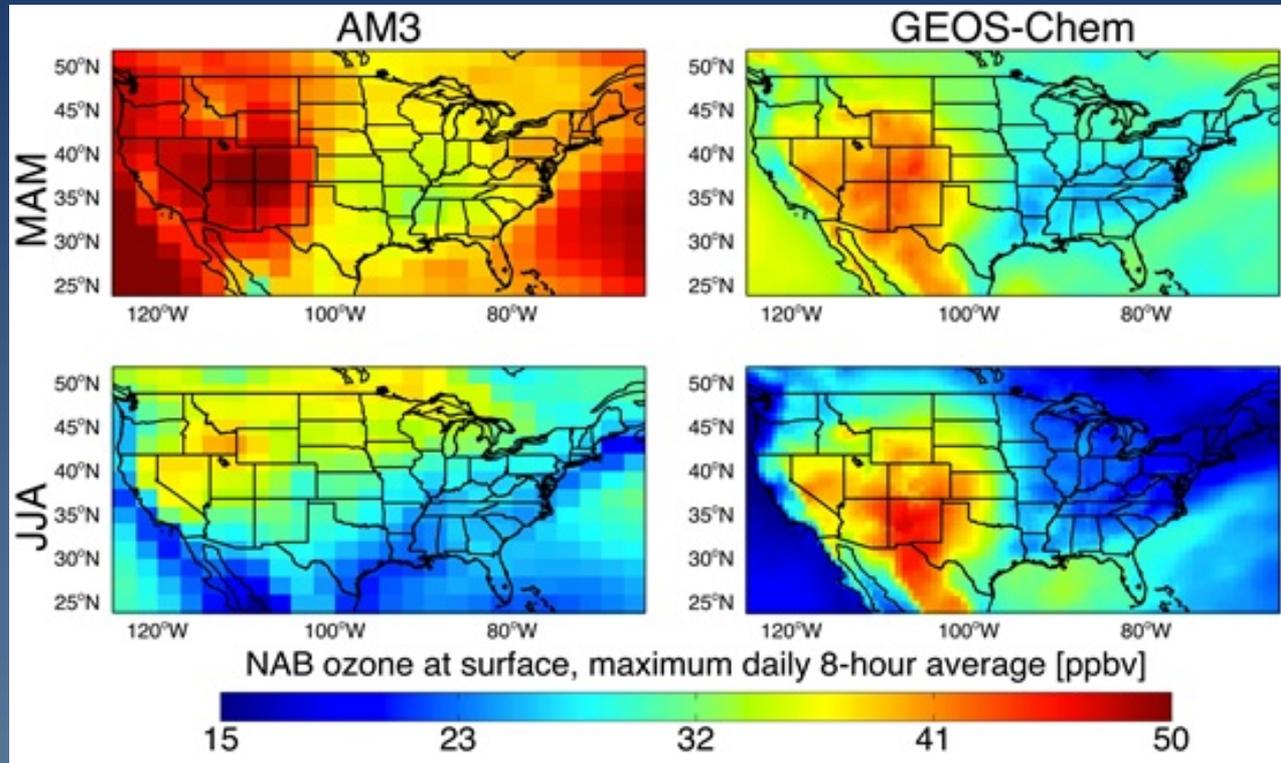
Map of apportionment-based U.S. background percent contribution to seasonal mean O<sub>3</sub> based on 2007 CAMx source apportionment modeling. (Source: page 2-18 of PA).

**Note the very high contribution in the western U.S. and portions of the northeast U.S.**

What are the implications for western U.S. ozone levels?

## Slide 3

# Spring and Summer North American Background O<sub>3</sub> From Two Models (GFDL AM3 and GEOS-Chem)



Mean MDA8 values of North American Background Ozone (NAB) in the lowest model layer for the GFDL AM3 (left) and GEOS-Chem (right) simulations for spring (top row) and summer (bottom row) 2006 (from Fiore et al., 2014, Atmos. Environ., in review)

**Note the differences in spring the western U.S. and Southwest in summer.**

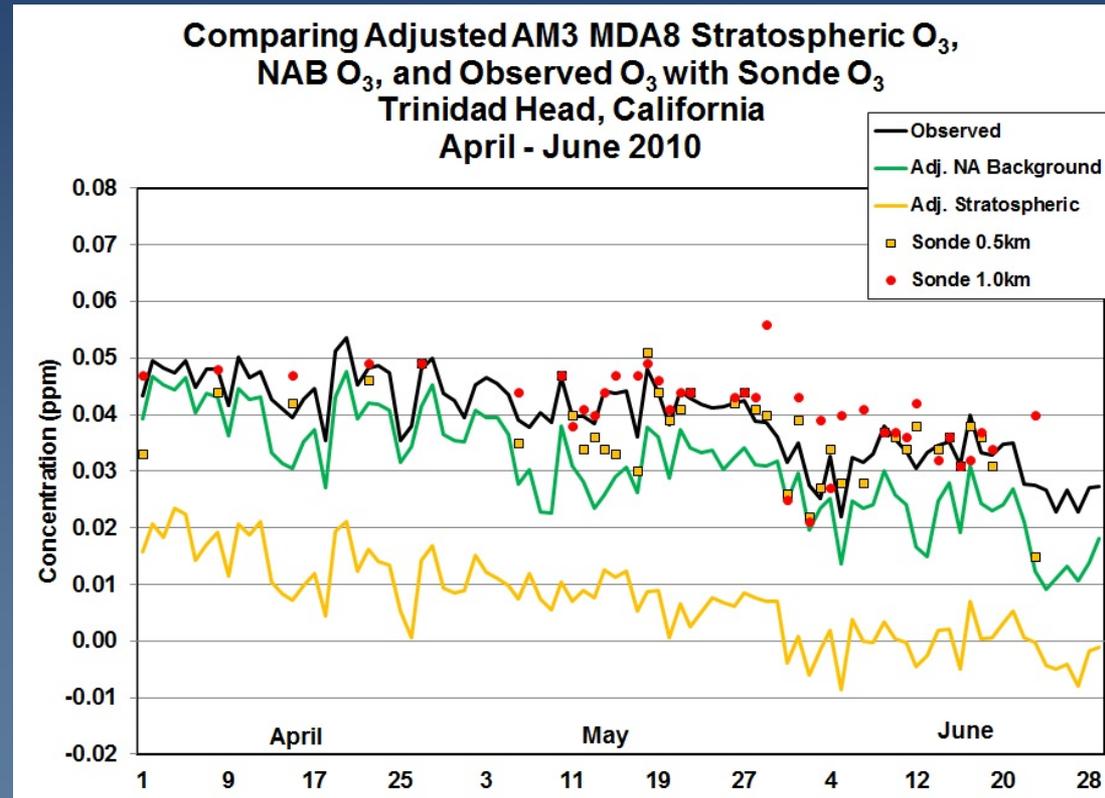
## Slide 4

# Comparison of Observations with Model Results: Impact of Background at the Coastal Background Site at Trinidad Head, California

Comparison of model results from the GFDL AM3 with ozonesonde observations over the western US in April-June 2010.

**Do bias adjustments to AM3 give reasonable values for NAB?**

NAB is the primary contributor to measured  $O_3$  at Trinidad Head and the stratosphere is not a major contributor to NAB. This is consistent with Lefohn et al. (2012) and Lin et al. (2012).



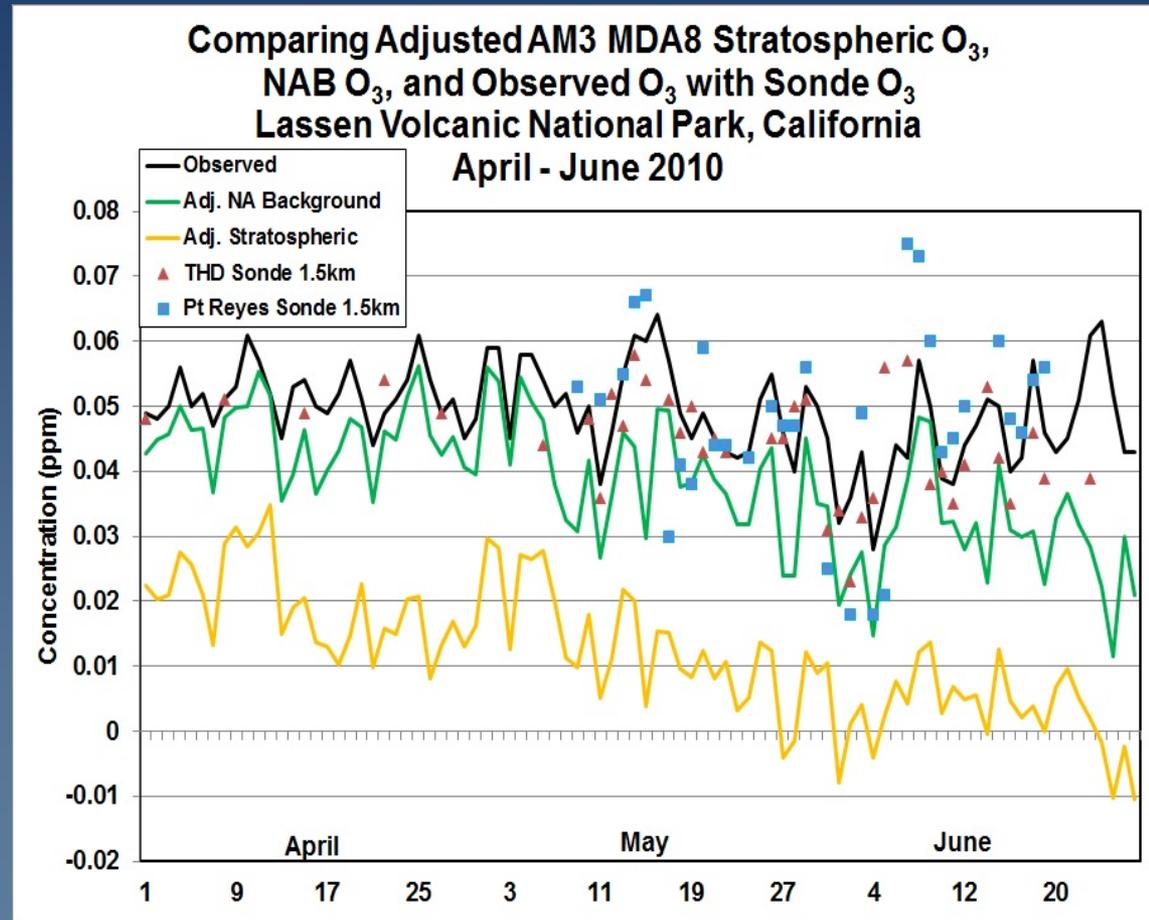
## Slide 5

# Comparison of Observations with Model Results: Impact of Background at the Higher Altitude (1.5 km) Lassen Volcanic NP, California

Comparison of model results from the GFDL AM3 with ozonesonde observations over the western US in April-June 2010.

Do bias adjustments to AM3 give reasonable values for NAB?

The adjusted NAB is consistent with sondes. NAB is the major contributor to observed  $O_3$  in spring. More of a contribution from the stratosphere in spring to NAB but not dominant.



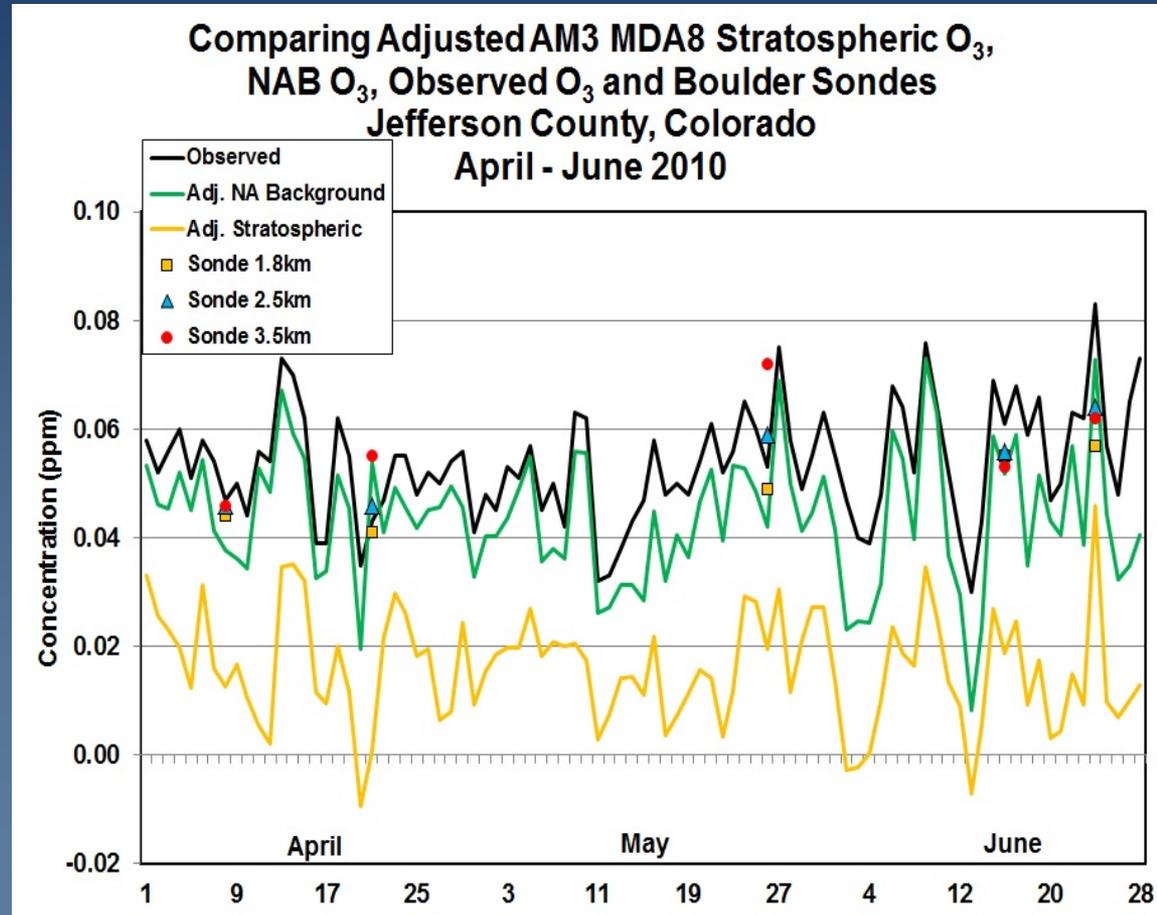
## Slide 6

# Comparison of Observations with Model Results: Impact of Background Over the Intermountain West

Comparison of model results from the GFDL AM3 with observations at Jefferson County (Denver) in April-June 2010.

**A large fraction of observed attributed to NAB**

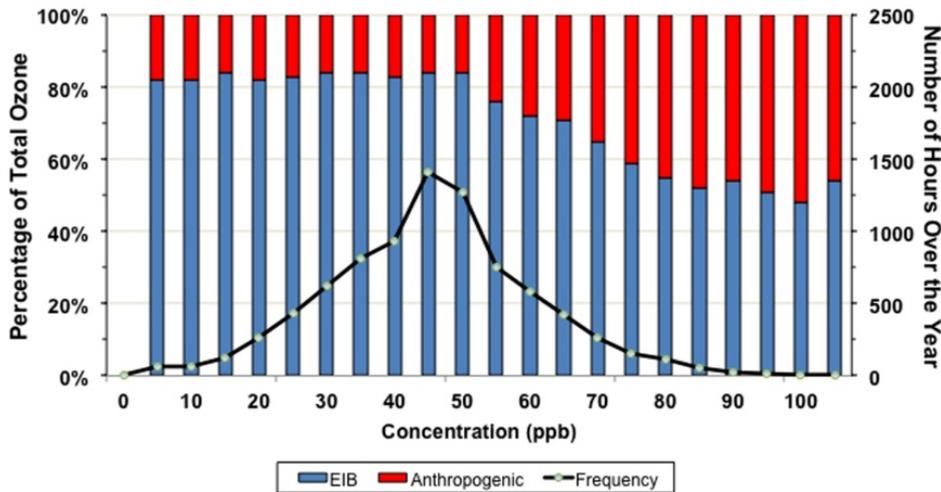
The contribution from the stratosphere is important to NAB even into early summer



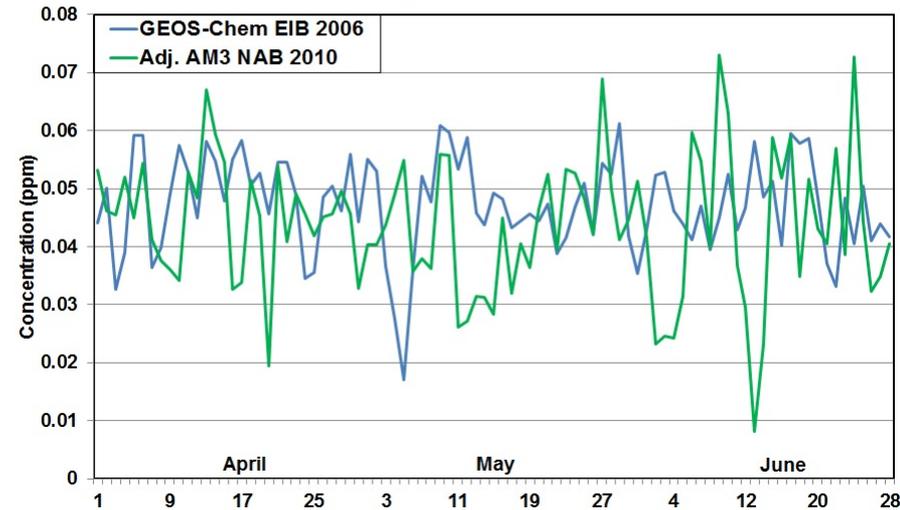
# Slide 7

## Relative Importance of Anthropogenic and Background O<sub>3</sub> Concentrations

Anthropogenic and Emissions-Influenced Background (EIB) Contributions to Total Ozone Concentration (b)  
Denver, CO  
Data for the Year 2006



Comparing MDA8 GEOS-Chem EIB O<sub>3</sub> (2006) with Adjusted AM3 NAB O<sub>3</sub> (2010) Jefferson County, Colorado April - June



Comparison of model emissions influenced background (EIB) with GEOS-Chem (2006) anthropogenic concentrations.

For the Jefferson County/Denver site, background O<sub>3</sub> plays a predominant role (i.e., > 50%) throughout the range of concentrations.

Comparison of GEOS-Chem/CAMx model emissions influenced background (EIB) with adjusted GFDL AM3 NAB.

Bias corrected EIB/NAB show very similar levels even when comparing different years.

## Slide 8

# Conclusions (the Bottom Lines)

- Using GEOS-Chem/CAMx (Lefohn et al., 2014a) and AM3 models (Lefohn et al., 2014b), we found that adjustments were required to account for likely underestimates (GEOS-Chem/CAMx) and overestimates (AM3).
- Two models indicate substantial contribution of background O<sub>3</sub> to observed levels in western U.S.
- We found that background O<sub>3</sub> is generally in the range of 30-45 ppb for the low-elevation background site at Trinidad Head (CA) as well as other low-elevation sites.
- We found that background O<sub>3</sub> is generally in the range of 30-70 ppb for the high-elevation sites in the West.

# Extra Slide



## Slide (extra)

# Comparison of Observations with Model Results in Continental U.S.

Monthly Mean MDA8 values for March-August 2006 for CASTNET observations (black) and simulations (thick lines) for GEOS-Chem (blue) and GFDL AM3 (red) for elevations >1.5 km (Intermountain West) and <1.5km.

Thin lines are NAB (from Fiore et al., 2014, Atmos. Environ., in review)

**Note : GEOS-Chem biased low at high elevations and AM3 is biased high at low elevations**

