

**Slide 1**

**Informing North American Background  
Ozone from Observations:  
Characterizing the Diurnal Variation**

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Comments to the U.S. EPA CASAC

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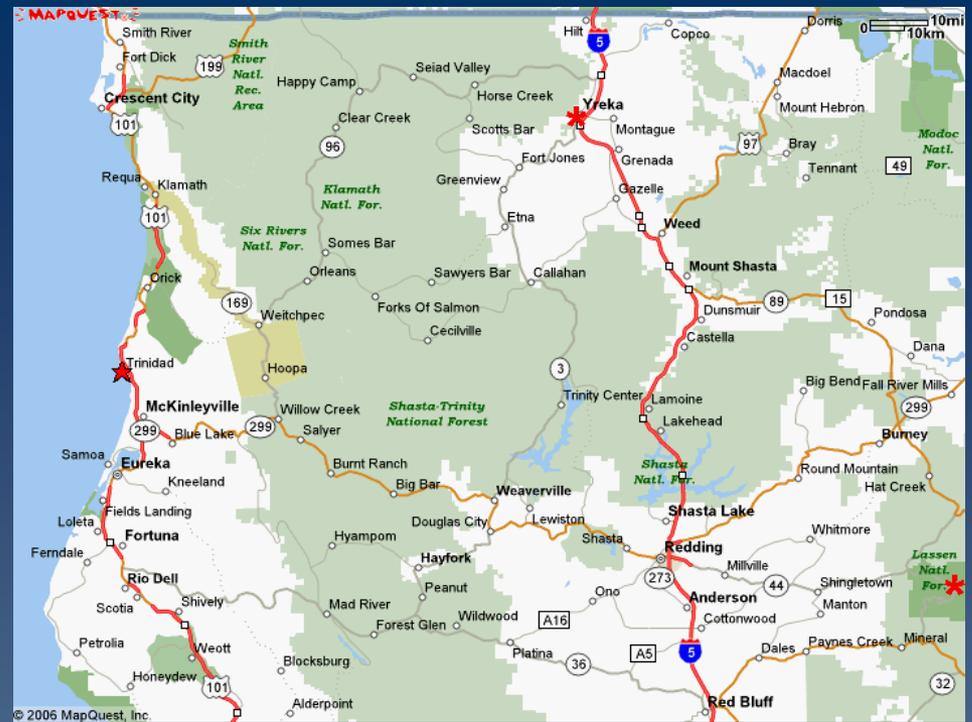


## Observations at west coast North American locations can inform background ozone values including their diurnal variation

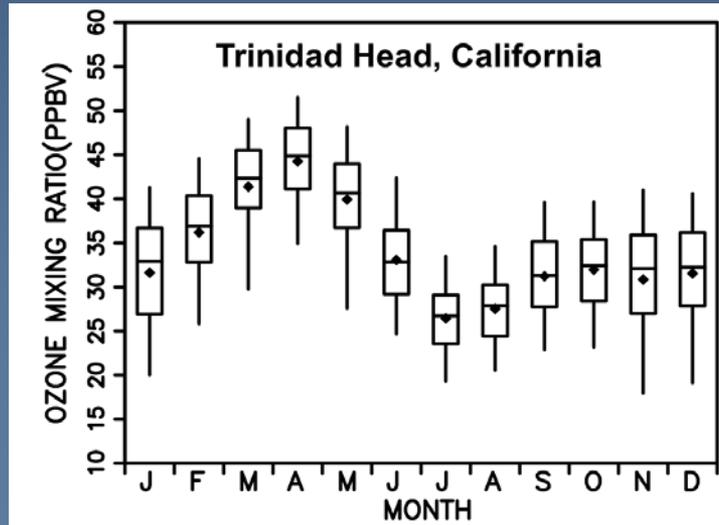
- ◆ Measurements at Trinidad Head, California are in large part (not just occasionally) of air from off the Pacific Ocean without influence from the North American continent.
- ◆ Although nighttime surface ozone observations at Trinidad Head more frequently see U.S. continental influence than daytime measurements there are sufficient nighttime observations to well characterize the diurnal variation under background conditions.
- ◆ These observations provide a picture of the full range of atmospheric concentrations.

# Slide 3

# Location of the NOAA Trinidad Head (THD) Observatory



Trinidad Head is a well exposed site in a relatively remote location.

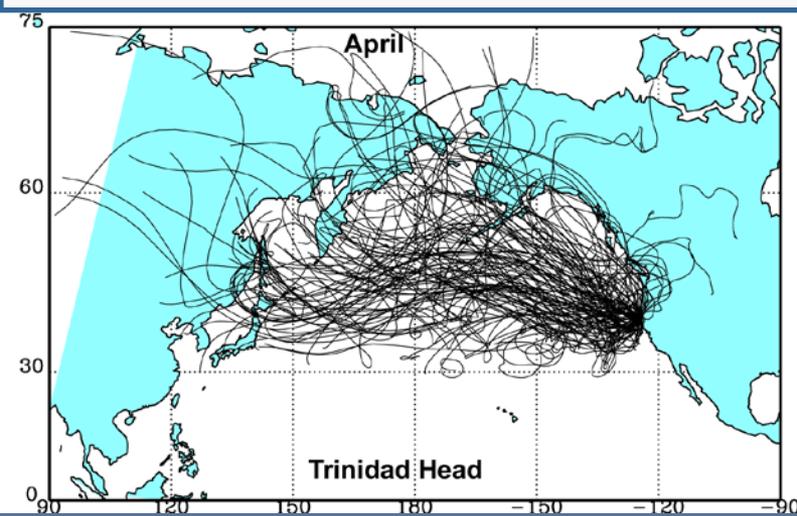


Diamond = Mean  
Horizontal Line Inside Box = Median  
Box = Inner 50<sup>th</sup> Percentile (25<sup>th</sup> & 75<sup>th</sup>)  
Whiskers = Inner 90<sup>th</sup> Percentile (5<sup>th</sup> & 95<sup>th</sup>)

## Slide 4

# Is surface ozone measured at Trinidad Head representative of air entering the coast?

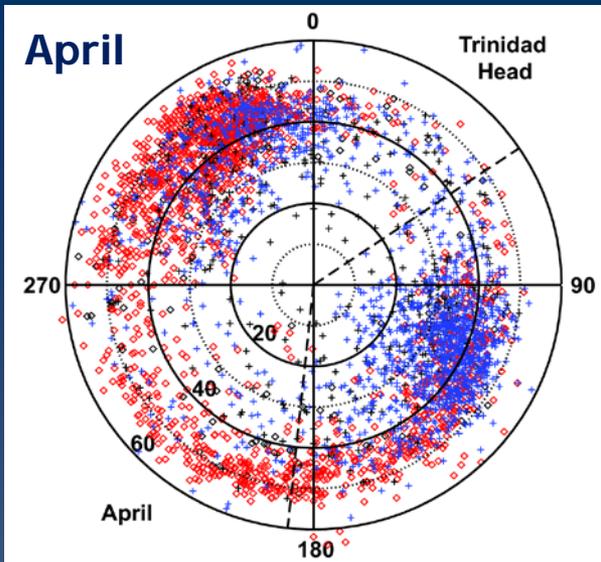
Back trajectories (10-day) to THD for days in April with hourly avgs.  $\geq 50$  ppbv



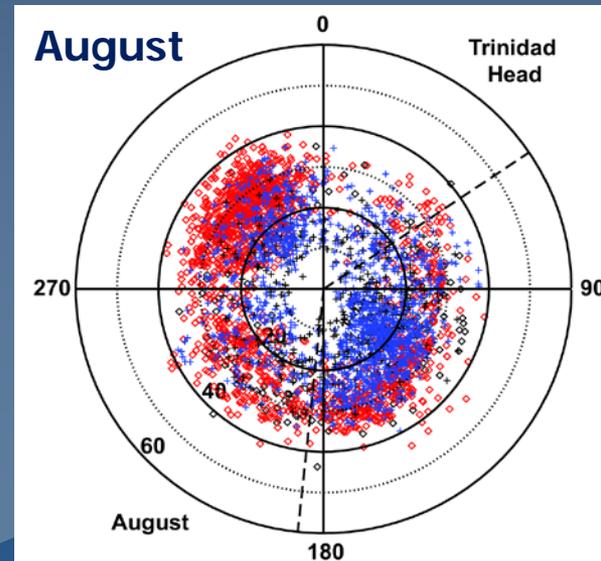
**Conclusion: During the day**  
**Overwhelmingly**  
**At night – Some of the time**  
**Overall – 60-80% of the time**  
**time**  
**(Goldstein et al., 2004)**

**Air from off the ocean in April:**  
**Day ~30-55ppb**  
**Night ~25-50ppb**  
**(lower O<sub>3</sub> from off the land)**

**In August off the ocean:**  
**Day ~25-40ppb**  
**Night ~15-30ppb**



Trinidad Head surface ozone separated by day (10-21 LST - red) and night (22-09 LST - blue)

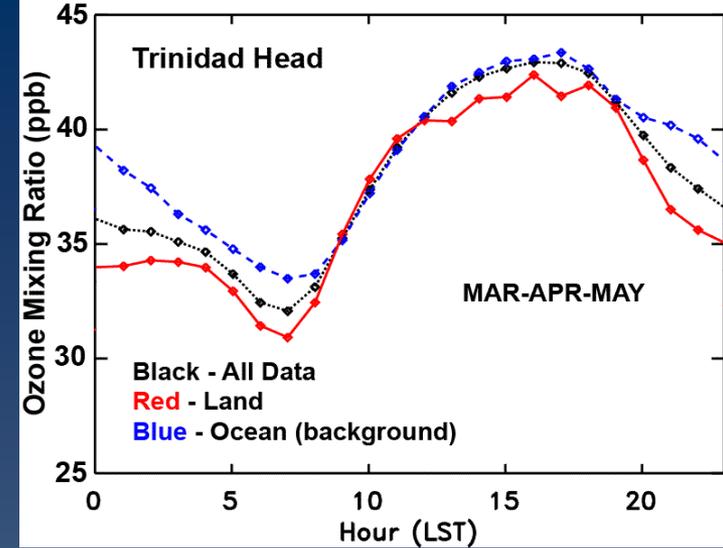


## Slide 5

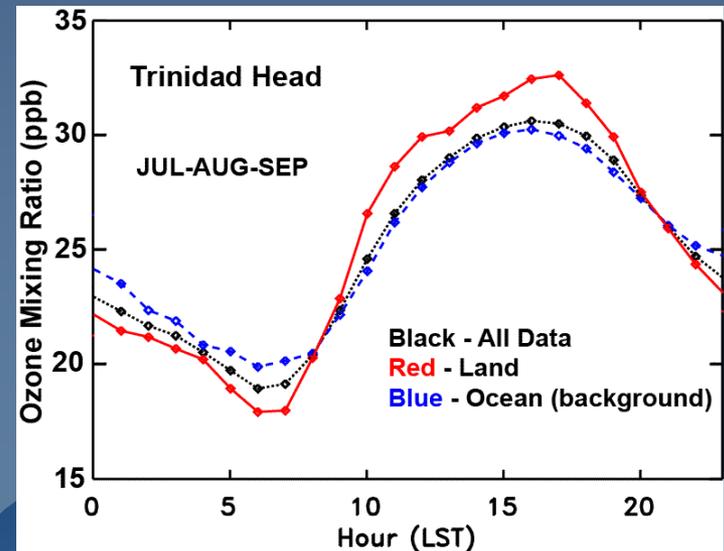
What is the average daily variation of ozone in air reaching Trinidad Head from off the ocean?

**Conclusion: Average daily variation for background conditions**  
**In spring**  
**34-43 ppb**  
**(Range ~25-55 ppb)**

**In summer**  
**20-28 ppb**  
**(Range ~15-30 ppb)**

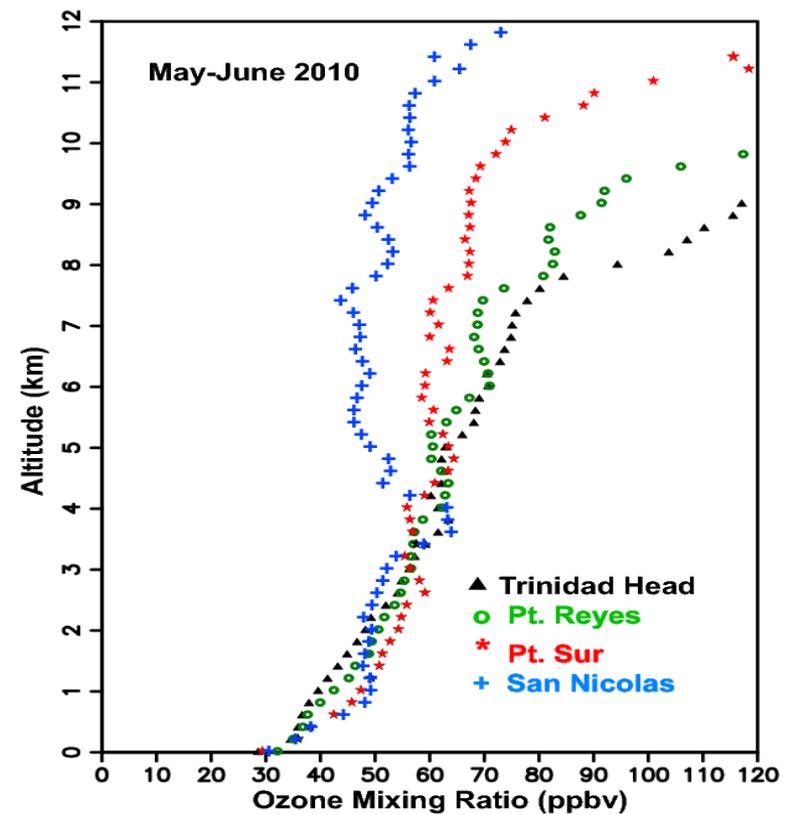


Diurnal variation of surface ozone at Trinidad Head when air is coming from off the ocean (blue) representative of background or off the land (red).



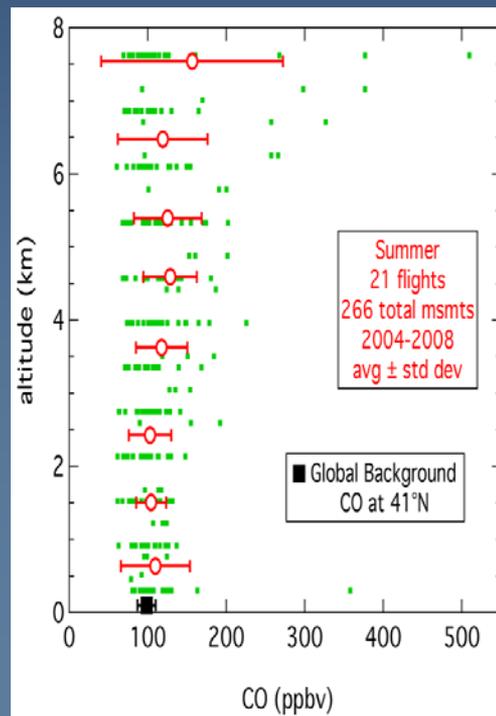
# Slide 6

## What do vertical profiles say about ozone reaching the California coast?



Average ozone mixing ratio profiles at four sites making ozonesonde observations during the IONS 2010-CalNex Campaign in May-June 2010. **Conclusion: In the lower troposphere (<4 km) average ozone amounts are similar along the California coast.**

Vertical profiles of carbon monoxide measured in flasks collected on aircraft flights above Trinidad Head CA. The green pts give the individual obs and the red circles indicate avgs and standard deviations .



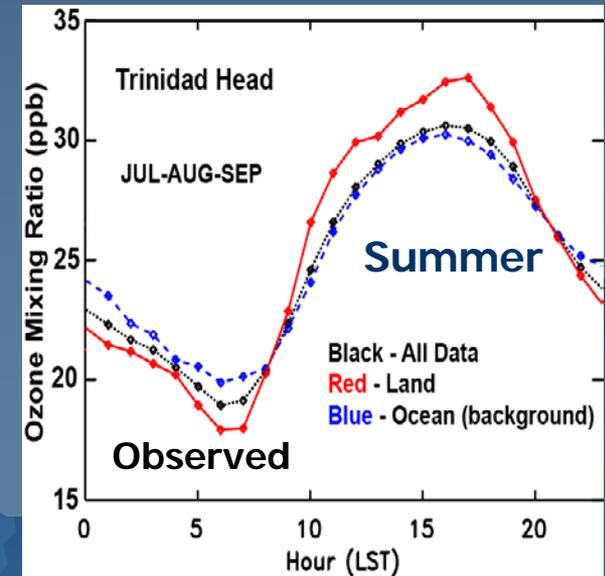
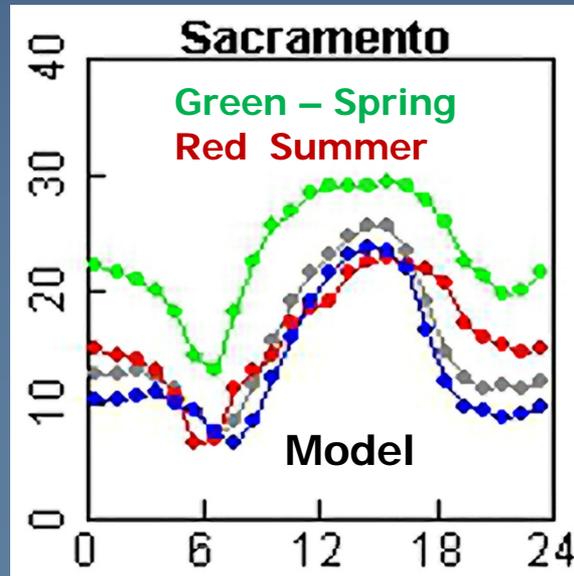
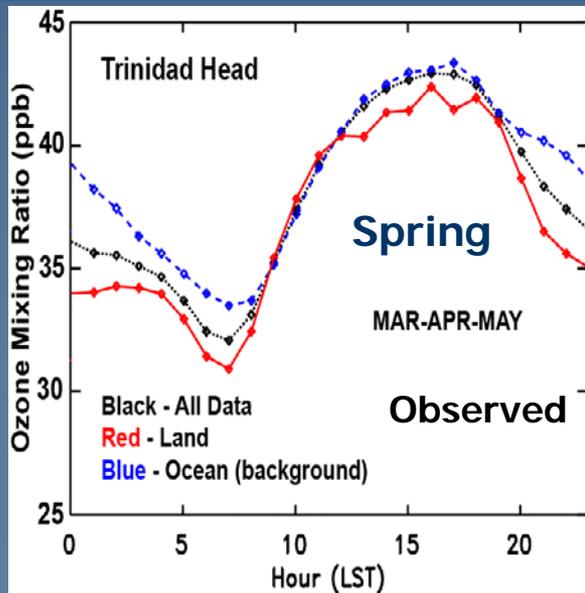
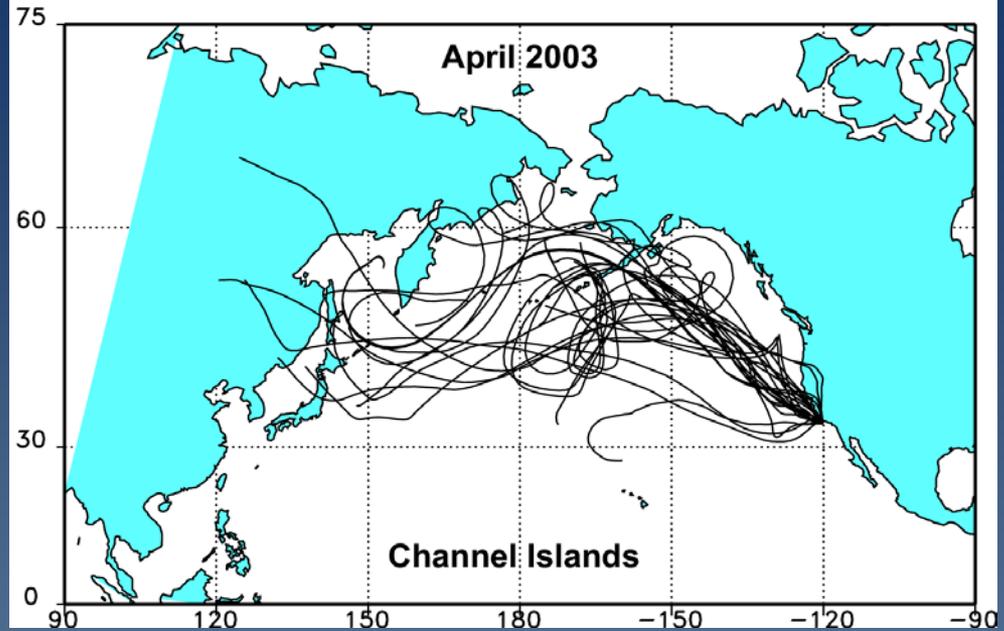
**Conclusion: Air flowing into Trinidad Head represents the Pacific "background".**

# Slide 7

## Is the background diurnal variation at Trinidad Head representative of air

**Conclusion: At the Channel Islands in southern California higher spring ozone values are associated with flow off the Pacific Ocean with little continental influence similar to the behavior at Trinidad Head (from Oltmans et al., 2008)**

**Back trajectories (10-day) to Channel Islands, CA for days in April with hourly O<sub>3</sub> averages of 50-60 ppbv**



## Slide 8

# Conclusions

- ◆ Trinidad Head Observatory in N. California is a well located site for monitoring air entering the west coast of the U.S. including the background diurnal variation.
- ◆ At Trinidad Head under background conditions the average diurnal variation in the spring is 34-43 ppb (range 25-55 ppb) and in the summer 20-28 ppb (range 15-30 ppb) with a large range of hourly values often exceeding 50 ppb in the spring. Values are significantly higher than model predicted both during the day and night for places like Sacramento and Los Angeles.
- ◆ A broader perspective on “background” ozone can be provided using observations along with the modeled background ozone.