



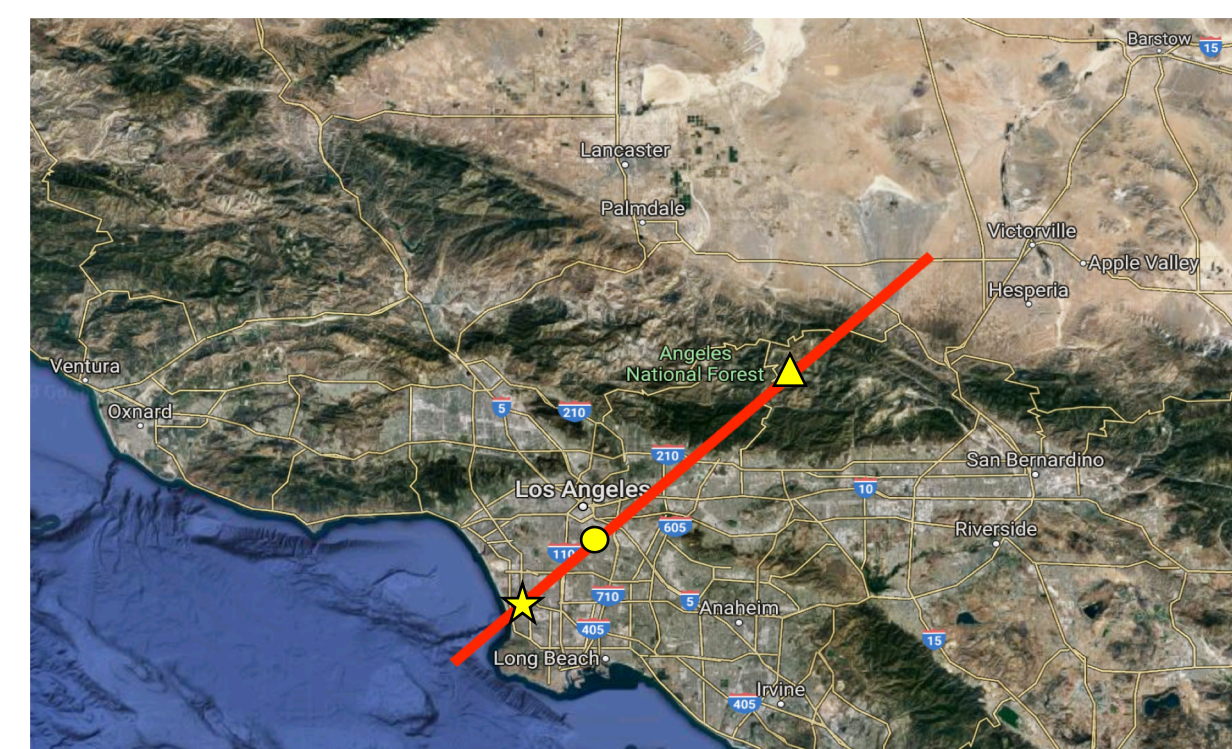
Vertical Distribution of CMAQ NO₂ Over Los Angeles

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Introduction

- Nitrogen oxides (NO_x = NO + NO₂) react in the atmosphere to form smog, acid rain, ground-level ozone, and particulate matter.
- In cities, cars and trucks are a major source of NO_x emissions, which vary over the course of the day due to traffic patterns. Local meteorology and chemical environment also affect NO₂ columns in urban areas.
- Here we examine the diurnal cycle of NO₂ using vertical distribution plots produced by CMAQ.

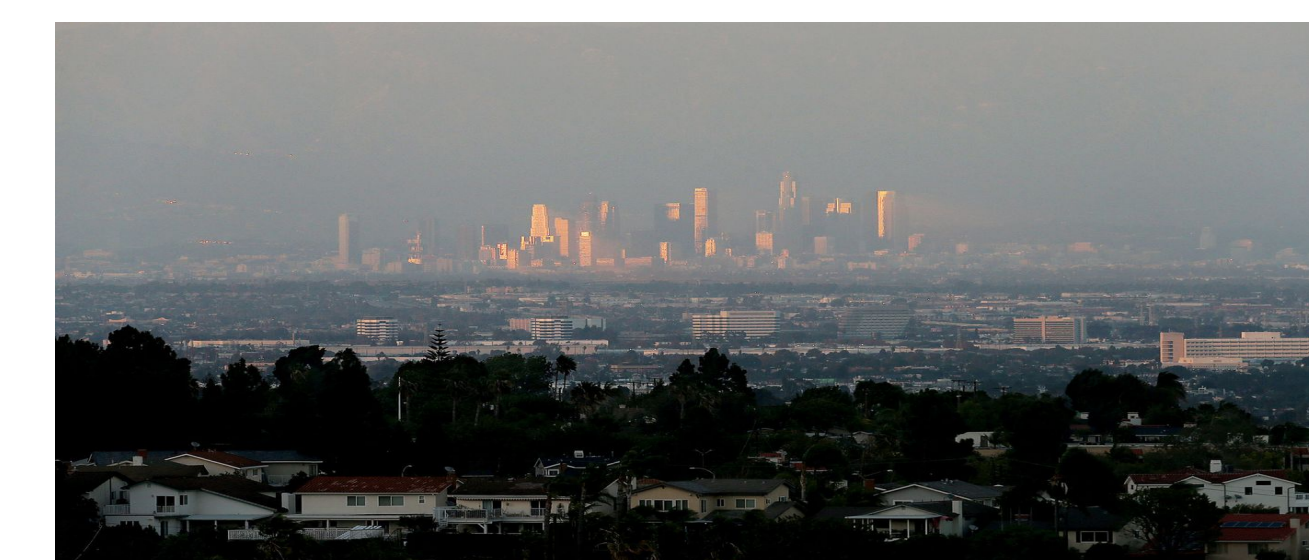
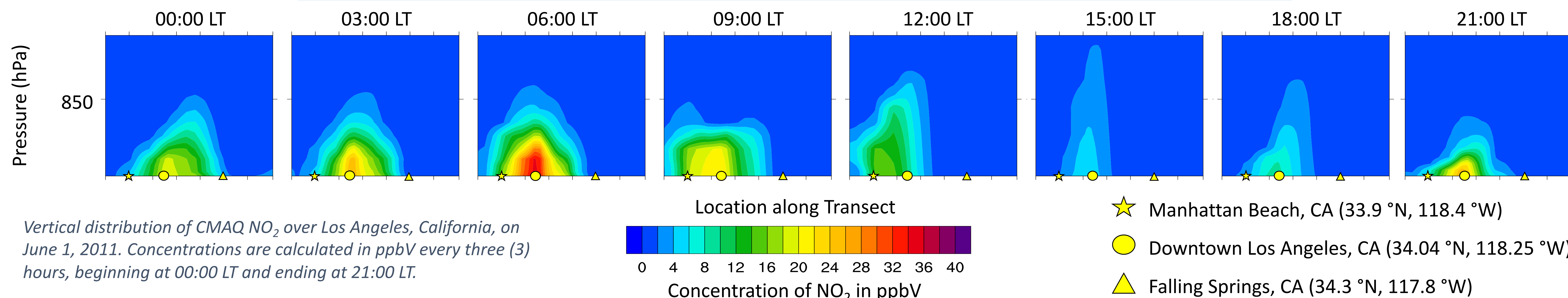


Image above: Smog over Los Angeles, from the Los Angeles Times 08/11/2016



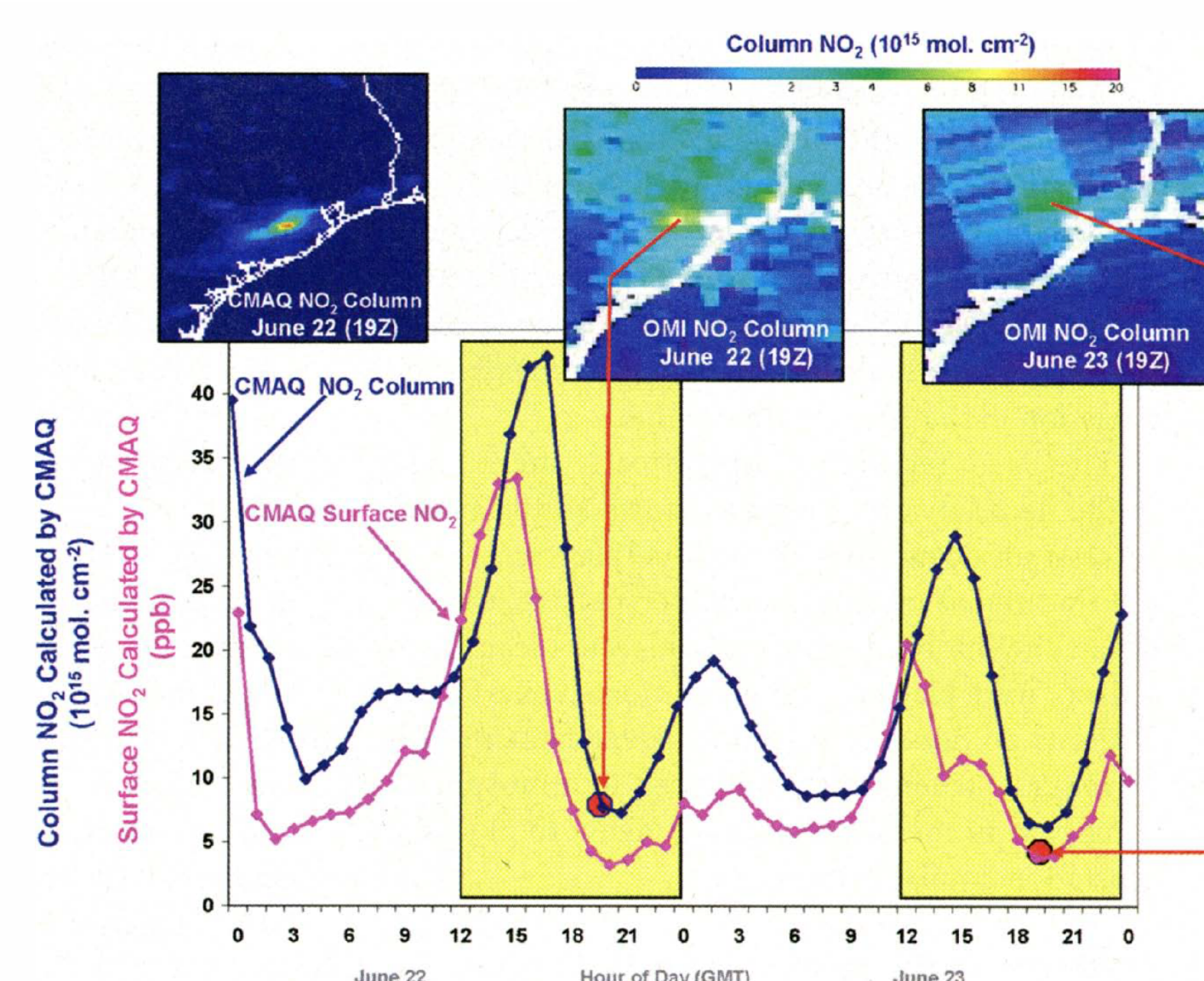
Vertical distribution of CMAQ NO₂ over Los Angeles, California, on June 1, 2011. Concentrations are calculated in ppbV every three (3) hours, beginning at 00:00 LT and ending at 21:00 LT.

- ★ Manhattan Beach, CA (33.9 °N, 118.4 °W)
- Downtown Los Angeles, CA (34.04 °N, 118.25 °W)
- ▲ Falling Springs, CA (34.3 °N, 117.8 °W)

Next Steps...

This study will assess the relationship between the diurnal cycle of CMAQ column and surface NO₂, as discussed in:

Fishman, J., Bowman, K. W., Burrows, J. P., Richter, A., Chance, K. V, Edwards, D. P., et al. (2008). Remote Sensing of Tropospheric Pollution from Space. *Bulletin of the American Meteorological Society*, 89(6), 805–822. <https://doi.org/10.1175/2008BAMS2526.1>



Data and Methods

- The **Community Multiscale Air Quality** modeling system (**CMAQ**) was created by the US EPA for conducting air quality simulations. Simulations here are for 2011 conditions, at 12 km x 12 km, using the National Emissions Inventory and meteorology from WRF.
- We employed a vertical distribution NCL script to plot the hourly concentrations of NO₂ over a 24-hour period, taken on a transect from (33.75 °N, 118.5 °W) to (34.5 °N, 117.5 °W).
- Three locations are examined for the day of June 1, 2011: the coastal city of Manhattan Beach, downtown Los Angeles, and the inland city of Falling Springs, CA.

Conclusions

- The above model simulation captures the following features:
 - Higher morning concentrations of NO₂ are localized in downtown Los Angeles (06:00 LT).
 - Lower afternoon concentrations of NO₂ are observed at all surface locations. It is during this time when the NO₂ plume protrudes the highest into the atmosphere (15:00 LT).
 - Concentrations of NO₂ increase into the evening hours and reside near the surface, perhaps trapped by the nocturnal boundary layer (21:00 LT).
- Results from this study will be extended to examine the relationship between the diurnal cycle of NO₂ and meteorological, chemical, and boundary layer processes. We are interested in how surface versus column NO₂ changes over the course of a day.

Acknowledgements

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