Observation of a reverse ozone weekend effect in the South Coast Air Basin (SoCAB) during summer 2010

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**Weekend Effect in Ozone**

- Weekend effect in ozone ($O_3$) is a phenomenon in which a higher level of ambient $O_3$ is observed on the weekends compared to the weekdays.
- It has been observed in the South Coast Air Basin (SoCAB) since mid 1970s.
- Lower NO (NO + NO$_2$) emissions from heavy duty diesel trucks during the weekends is considered as the major reason for the increased $O_3$ concentration.
- Reduced NO emissions on weekends can affect $O_3$ levels via two processes:
  1. decreased $O_3$ loss by titration
  2. increased $O_3$ production due to higher volatile organic compounds (VOCs) to NO$_x$ ratio.
- The weekend effect provides ambient experimental evidence to evaluate how changes in NO$_x$ may affect $O_3$ response.

**Instrumentation**

Platform: NOAA Twin Otter
CU AMAX-DOAS: NO$_2$, HCHO, CHOCHO columns and profiles
NOAA TOPAZ lidar: $O_3$ and aerosol profiles, boundary layer height (BLH) $O_3$ vertical column: $O_3$ profile integrated to BLH
U. of Leeds Doppler lidar: wind profiles

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**One very hot weekend in July 2010**

- Saturday, July 17, 2010 had very similar meteorological conditions in SoCAB.
- Flights with identical flight plans were flown on the two days (9:30-13:10 PST)

Higher $O_3$ was not observed on the weekend, despite the usual ~ 35% reduction in NO$_x$.
Higher temperature increases biogenic VOC emissions.
$O_3$ chemistry in SoCAB shifts to NO$_x$ limited regime during hot weekends.

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**$O_3$ Chemistry and NO$_x$ trends in SoCAB**

- $O_3$ chemistry in SoCAB is currently in NO$_x$ suppressed regime.
  - reduction in NO$_x$ emission results in higher $O_3$ concentration
- NO$_x$ levels in SoCAB has been decreasing at a rate of ~7% per year for the last 5 years.
- Current regulations in California is expected to further reduce NO$_x$ emissions:
  1. greater than 50% during summer months from heavy duty diesel engines by 2015.
  2. 75% from cars and light duty vehicles from 2014 to 2025.

**Conclusion**

- A first case-study finds ‘reverse’ $O_3$ weekend effect during a hot weekend in July 2010 in SoCAB.
- The ‘regular’ $O_3$ weekend effect was observed by both column and in-situ measurements of $O_3$ and NO$_x$ in June 2010.
- Indication of $O_3$ chemistry transitioning towards NO$_x$ limited regime under hot summer conditions.
- Future reductions in NO$_x$ emissions are likely to result in fewer $O_3$ non attainment days in SoCAB during the ozone season (July-September).

**References**


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