No change detected on Earth's mid-latitude atmospheric ozone by the 2017 Total Solar Eclipse

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HARBOR

Outline

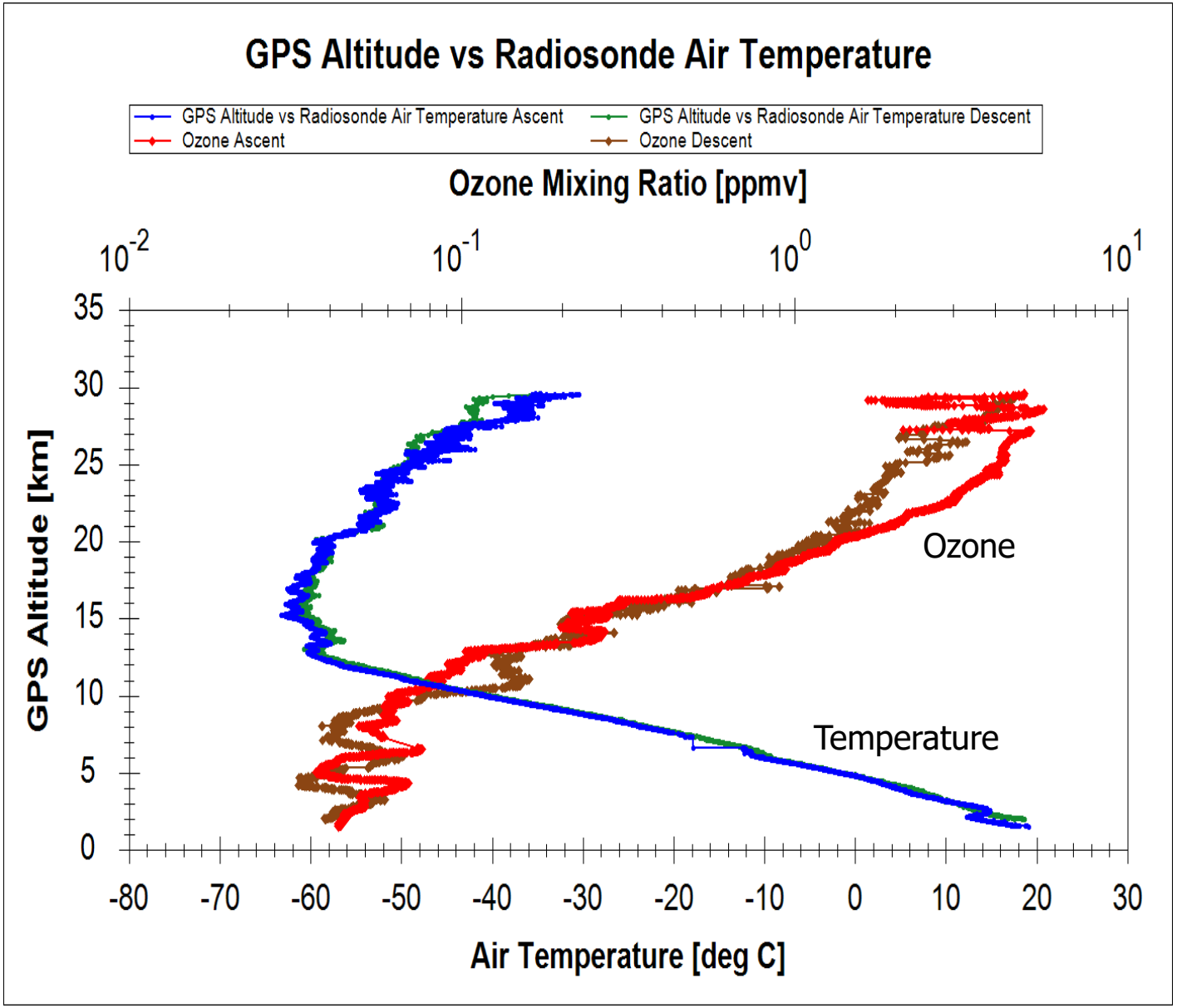
- Introduction
  - Earth’s ozone layer and photochemistry
- Data
  - Previous data
    - Data from the two other eclipse measurements
  - Eclipse data
- Results and Analysis
- Conclusions

Earth's Ozone Layer: $3O_2 + \gamma \rightarrow 2O + 2O_2 \rightarrow 2O_3$

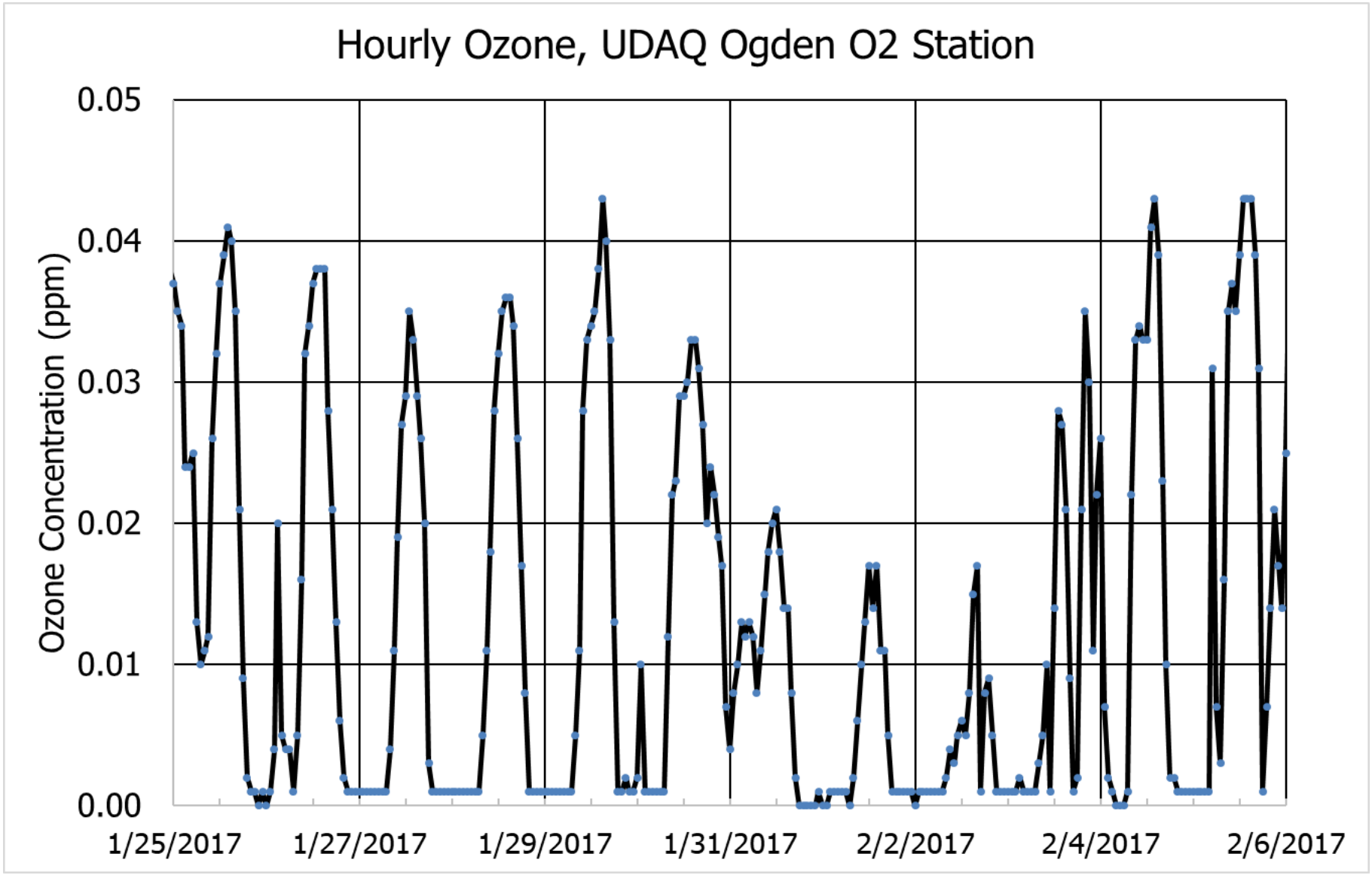
Data taken
21 August 2017

Lower Stratosphere

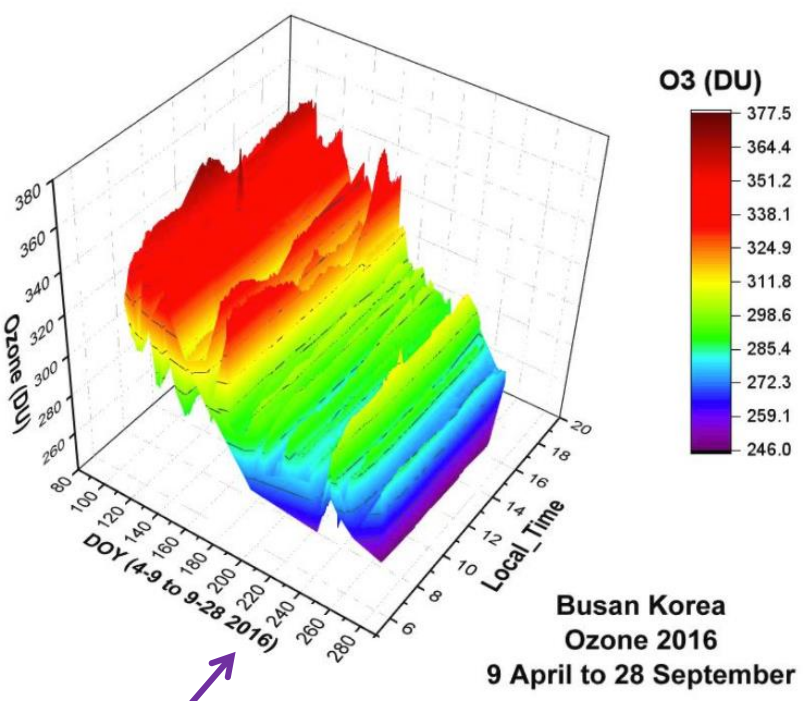
Troposphere

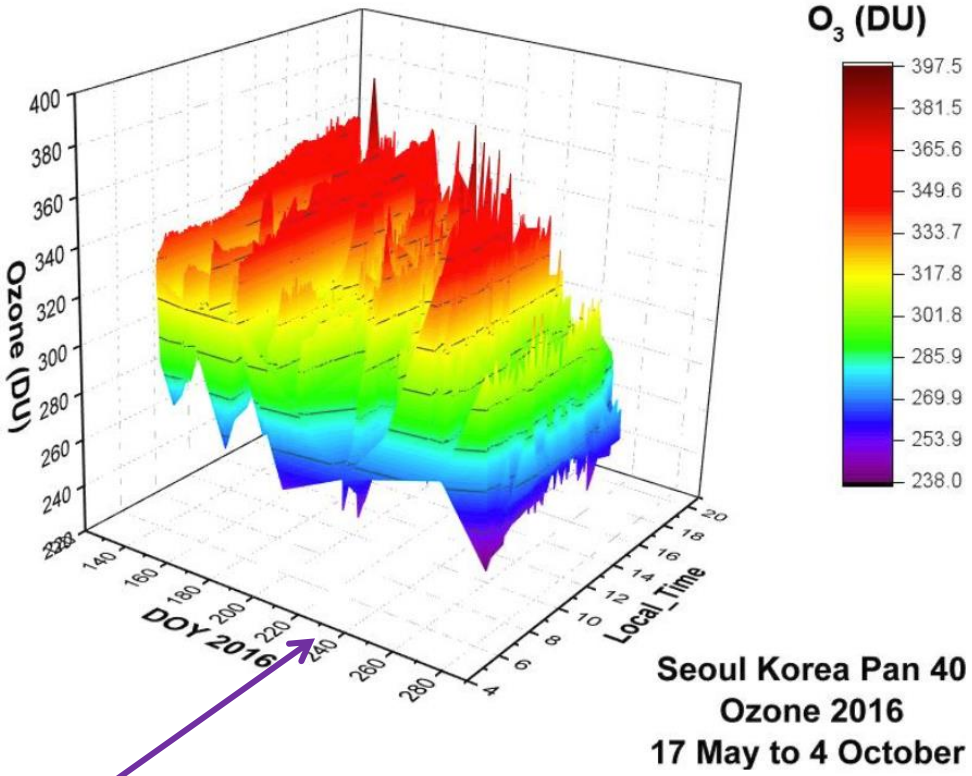


Typical ground level diurnal ozone cycle



Evidence for a diurnal O3 Pattern in the total column ozone.





August 21, 2017 is Day 233

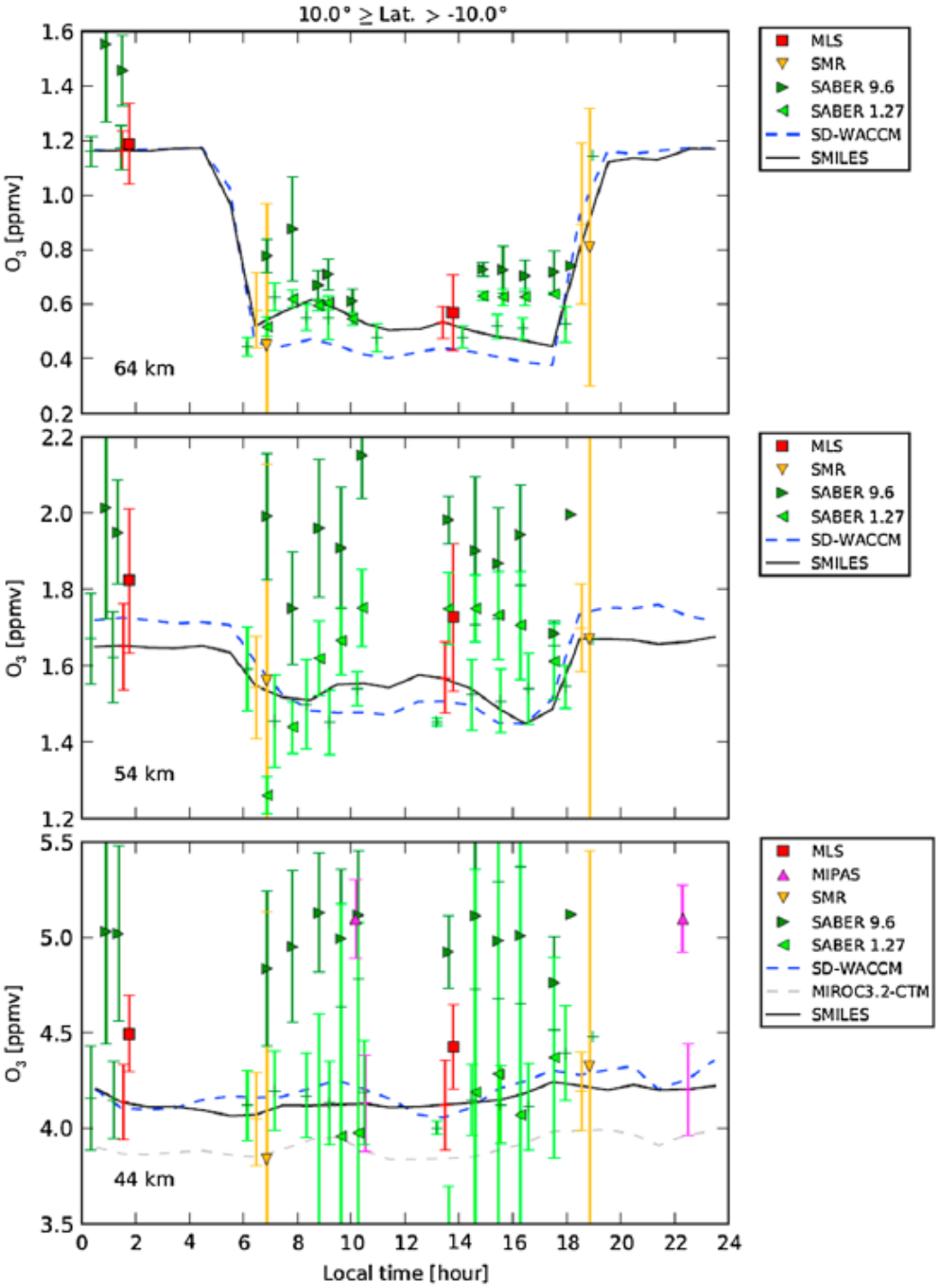
https://acd-ext.gsfc.nasa.gov/Projects/Pandora/KORUS-AQ_Data.html

Diurnal Ozone Variations in the Stratosphere

64 km

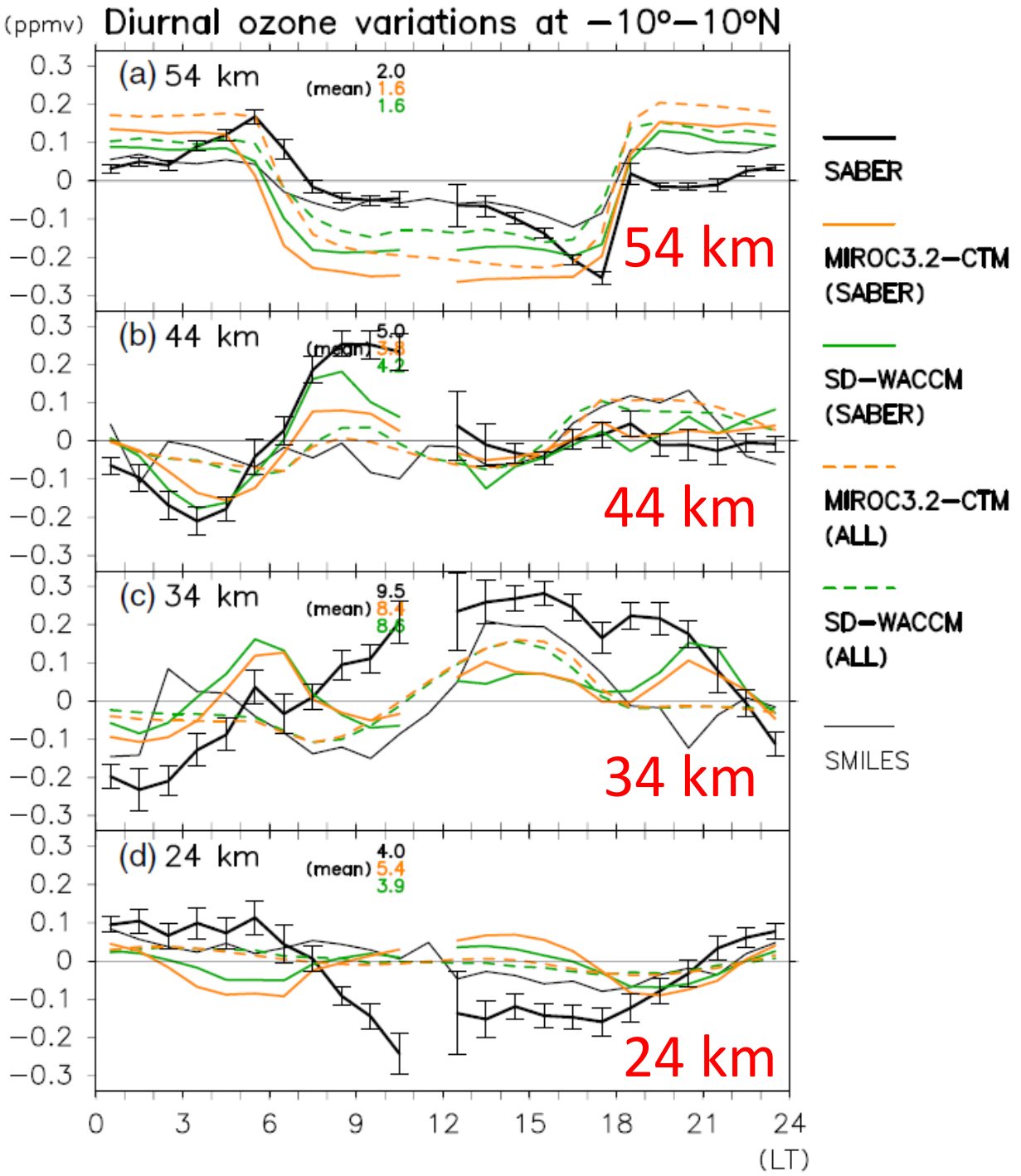
54 km

44 km



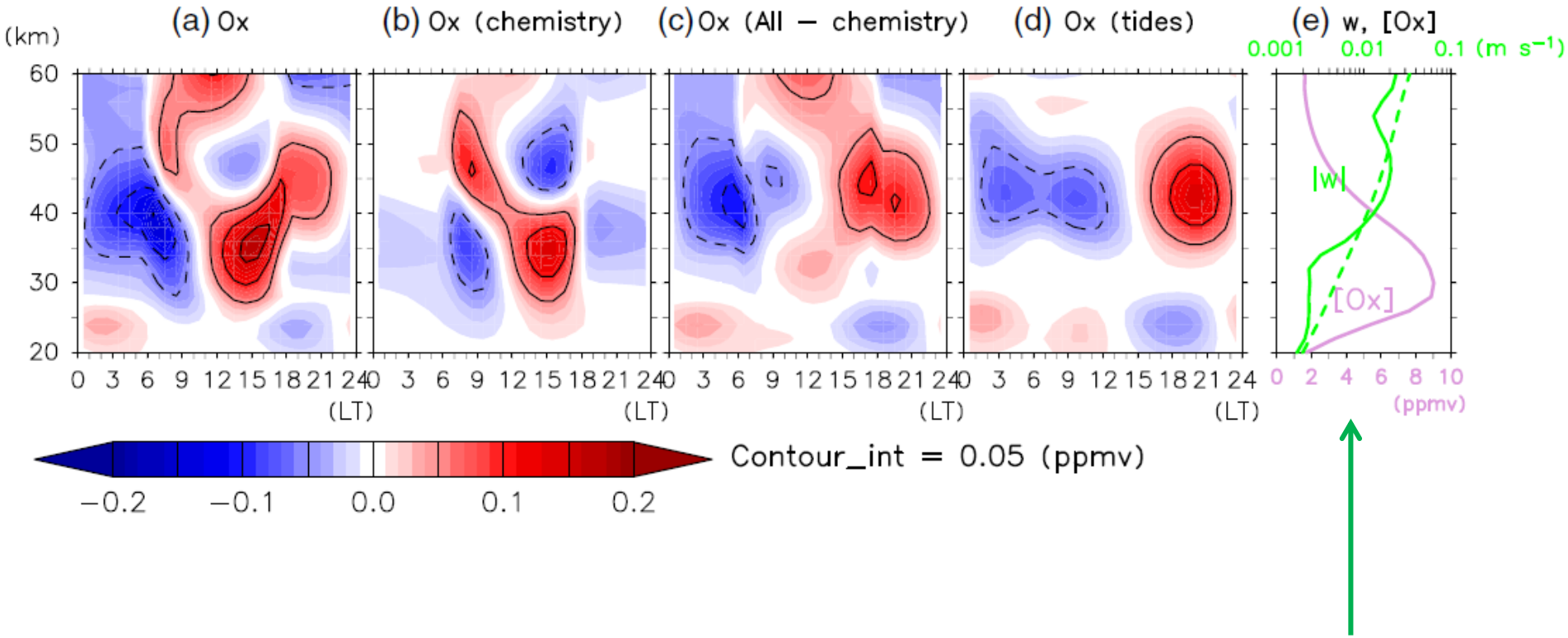
Takatoshi Sakazaki,
JGR, 118, 5750–5769
doi:10.1002/jgrd.50434, 2013

Diurnal Ozone Variations in the Stratosphere



Takatoshi Sakazaki,
JGR, 118, 2991-3006
doi:10.1002/jgrd.50220, 2013

Expected variation in ozone by cause.

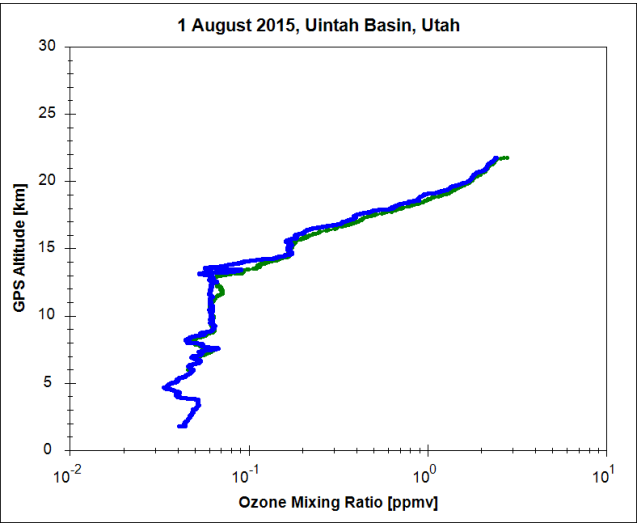


"w" is equatorial vertical wind (green)

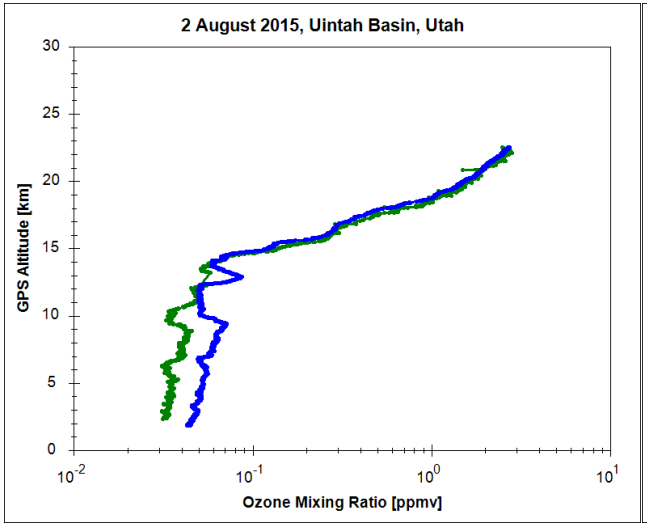
$O_x \approx O_3$)

Takatoshi Sakazaki,
JGR, 118, 2991-3006
doi:10.1002/jgrd.50220, 2013

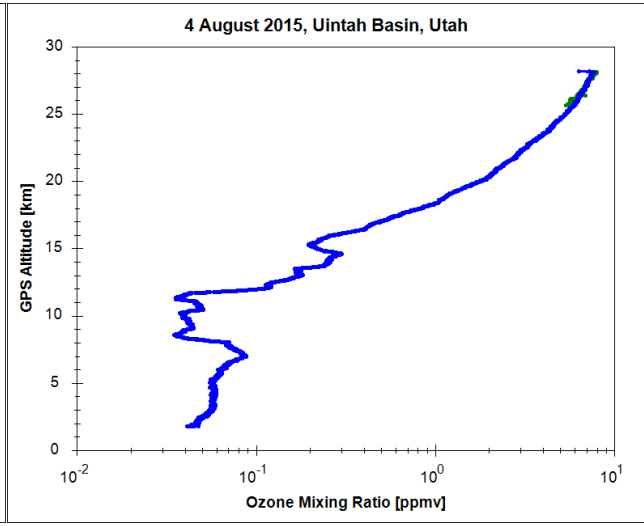
Baseline Flight Data, August 2015-2016



1 Aug 2015

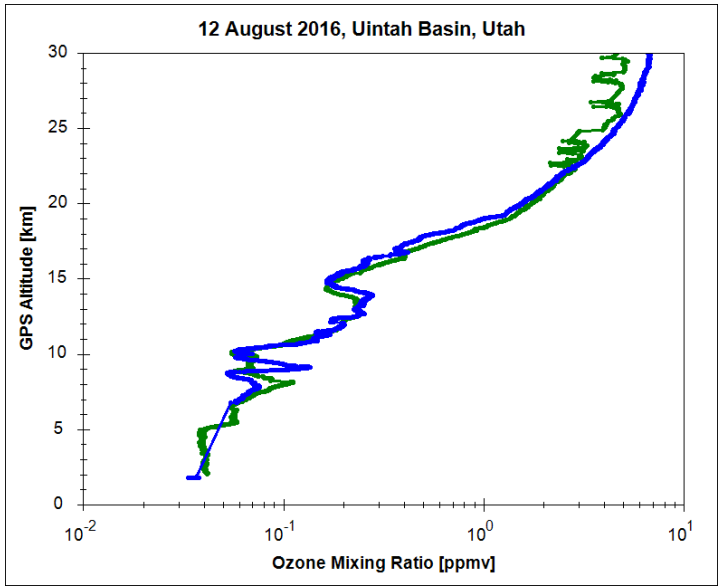


2 Aug 2015

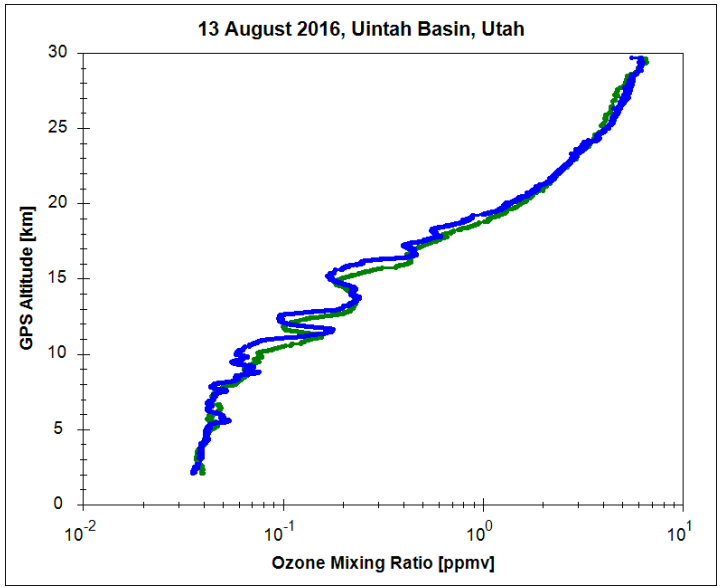


4 Aug 2015

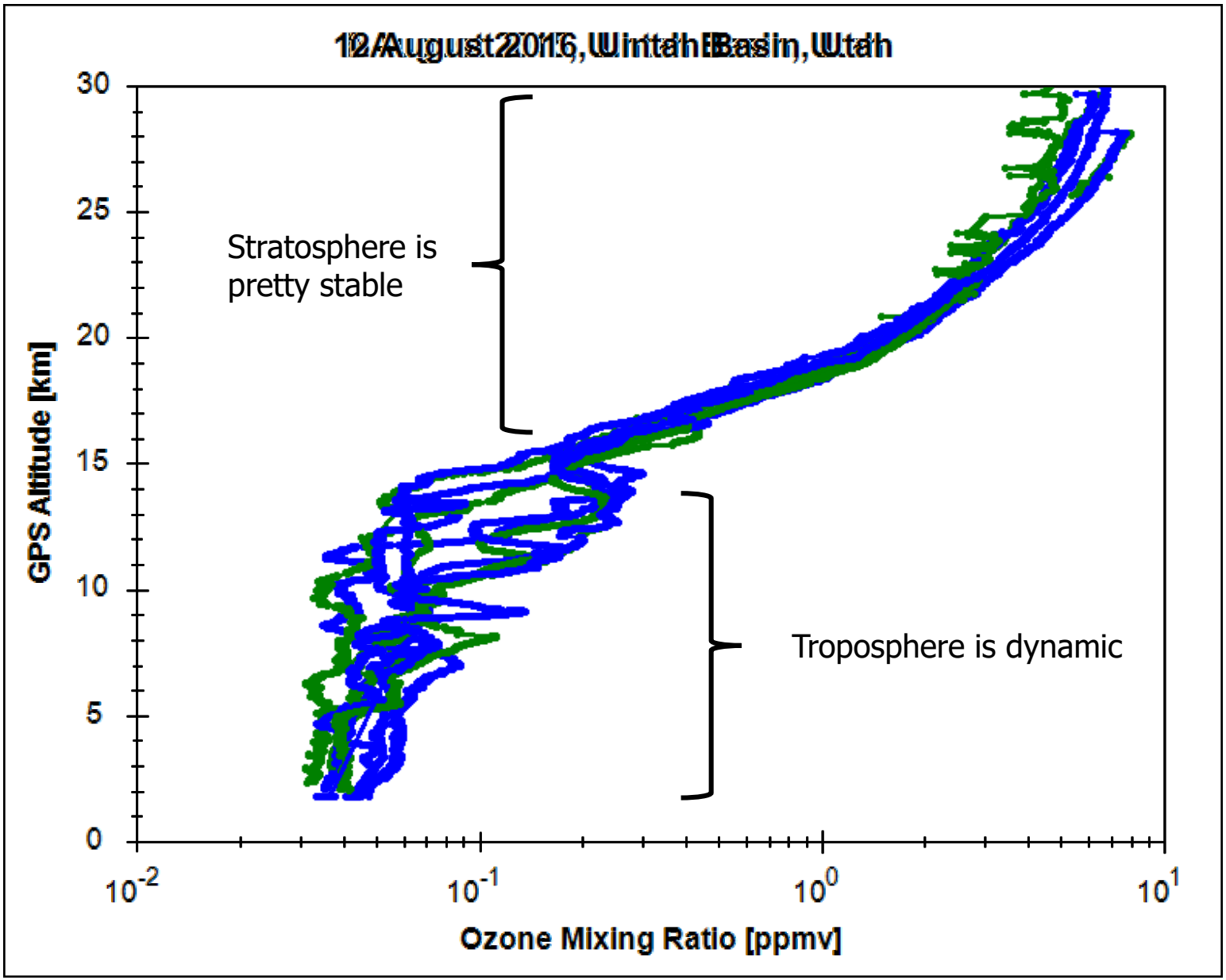
12 Aug 2016



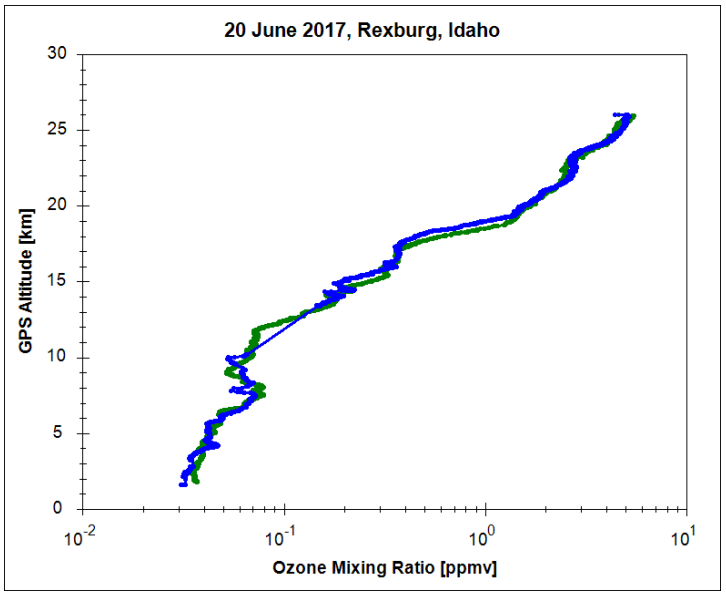
13 Aug 2016



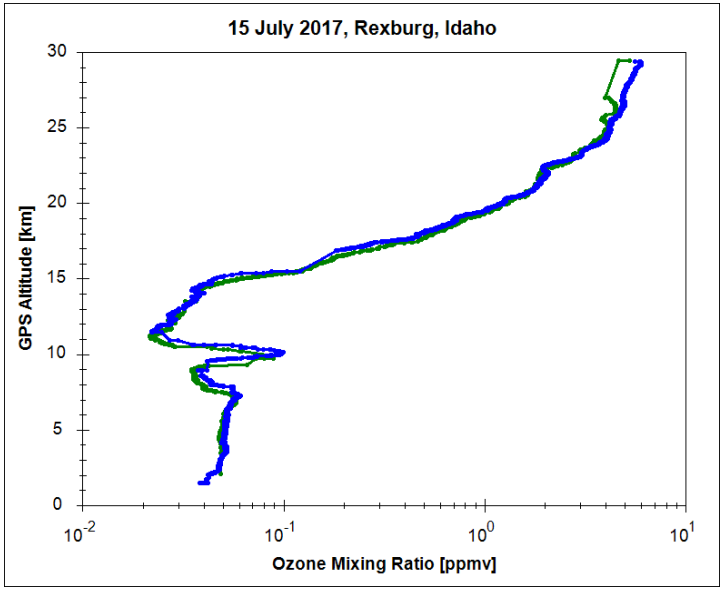
Overlaid Data, August 2015-2016



Baseline Flight Data, 2017

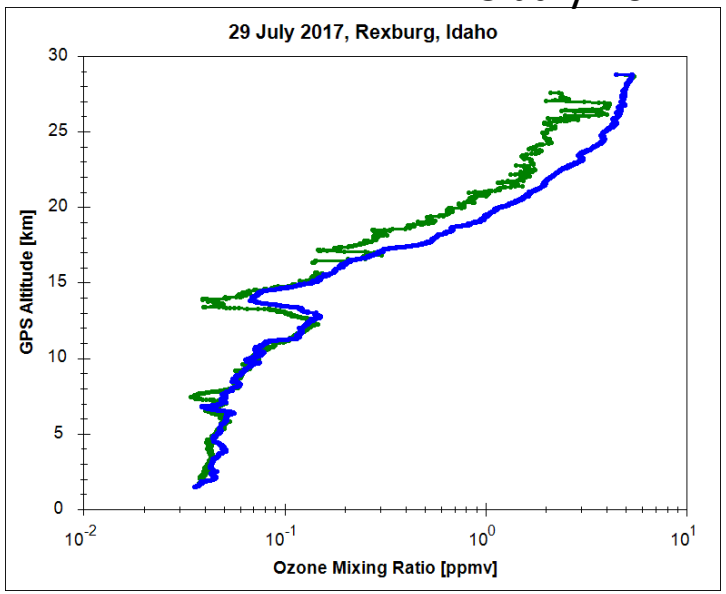


20 June 2017

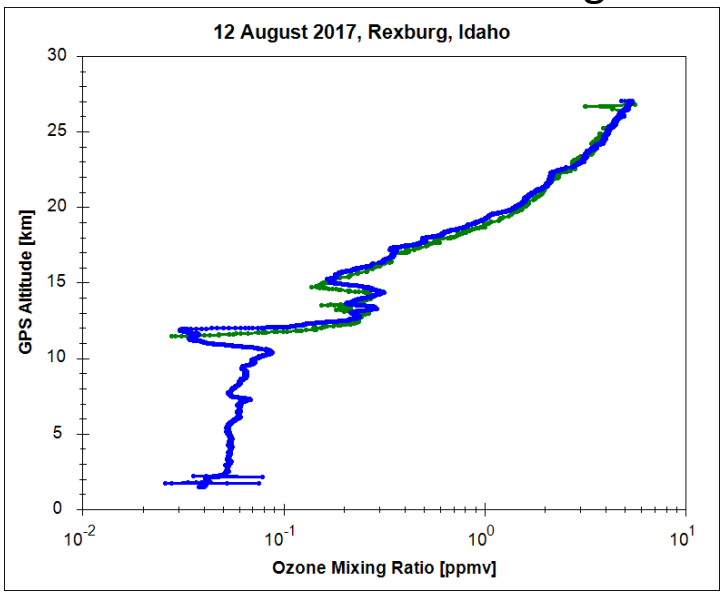


15 July 2017

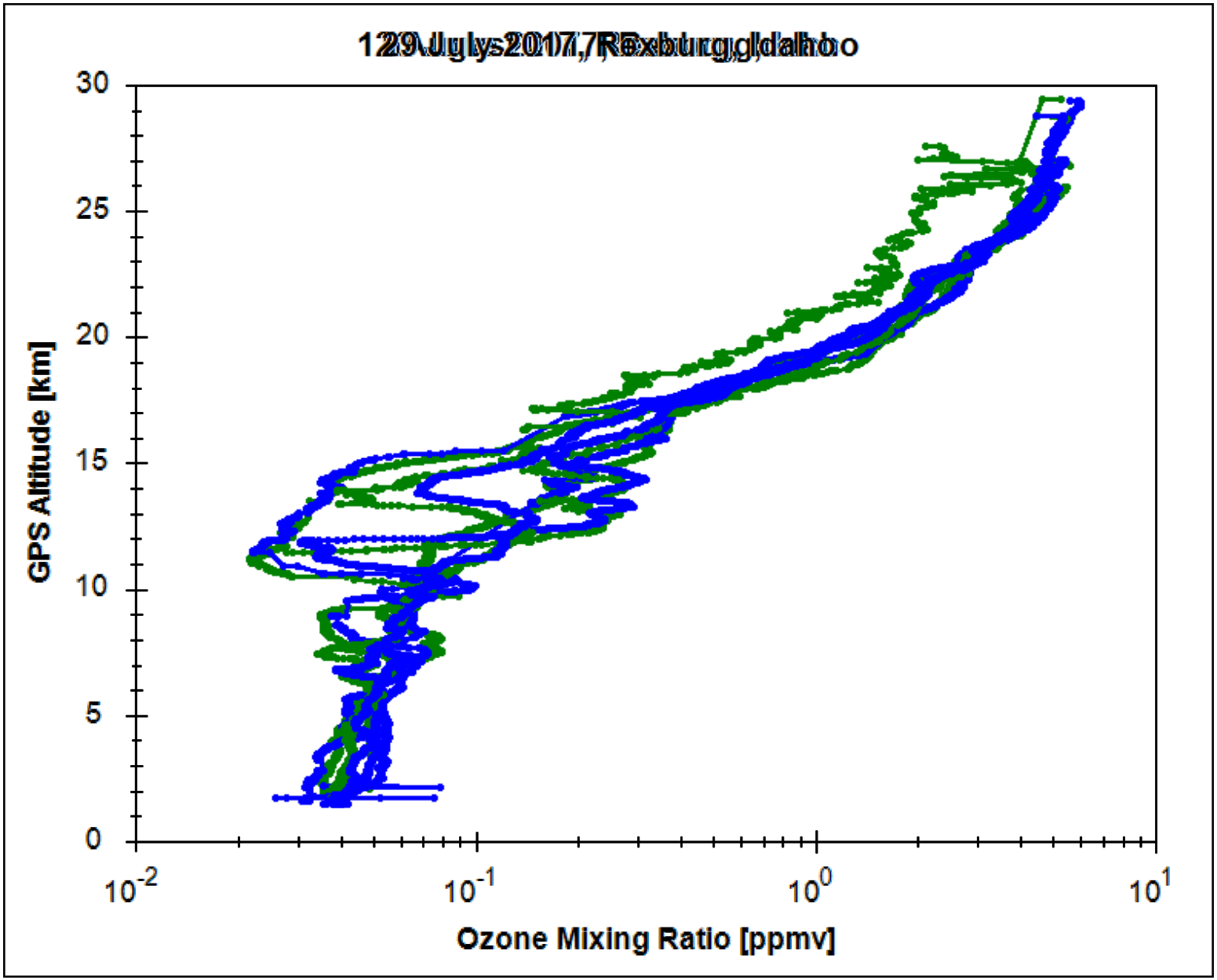
29 July 2017



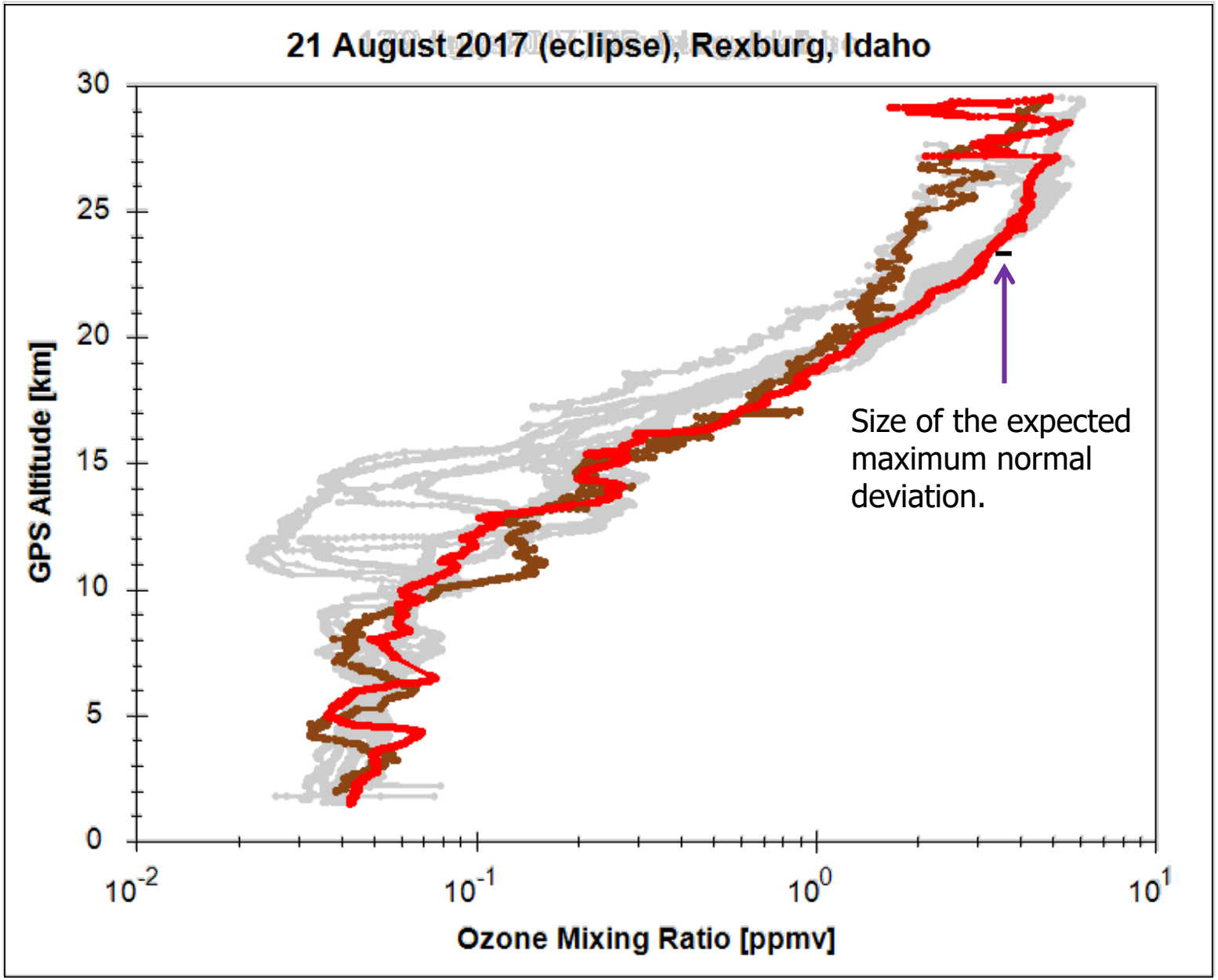
12 Aug 2017



Overlaid Flight Data, 2017



Eclipse day flight data overlaid on summer 2017 data.



Conclusions

- We saw no evidence for a significant change in ozone in the lower stratosphere as caused by photochemistry.
- Any variations are small in comparison to normal daily fluctuations.
- Only two other eclipse ozone measurements are published, not total eclipses.
  - One found a small post eclipse ozone increase.
  - Neither saw any ozone changes during the eclipse.
- Troposphere to stratosphere ozone transport from the tropics seems probable.