Ozone Forecasting Tools

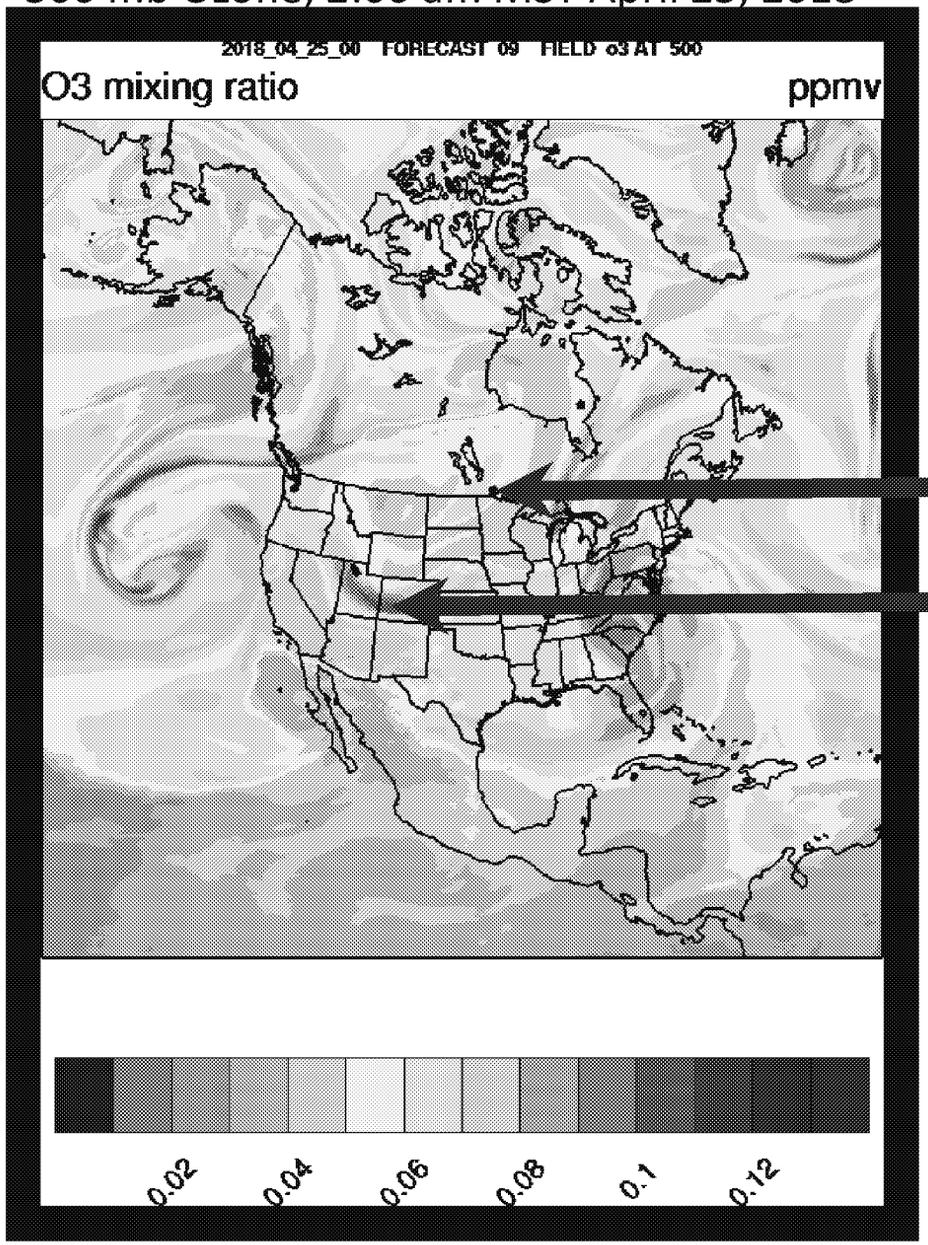
Updated May 15, 2018

NOAA RAP Chem (https://rapidrefresh.noaa.gov/RAPchem/Welcome.cgi)

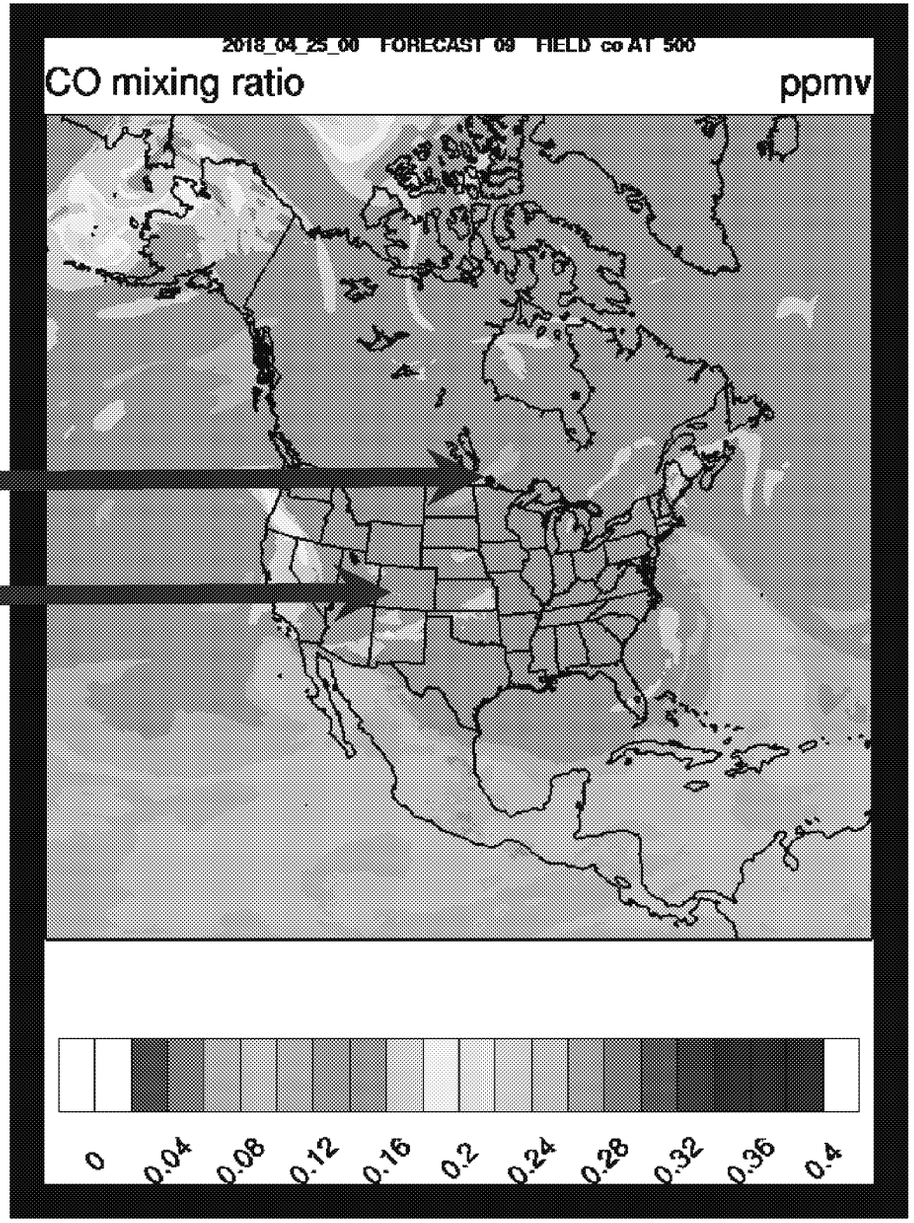
- Capabilities (North America, archived back to June 27, 2016):
  - 4 Domains: North America, Continental US, Central Rockies, and Mid-North Atlantic Coast
  - Static plots, 48 hour forward forecasting of O_3 & CO concentration at surface, 850 mb, 700 mb and 500 mb pressure heights
  - Static plots, 48 hour forward forecasting of 300, 500, 700 and 850 mb pressure heights
  - Looped 48 hour forecast maps
    - For now, editing date in https://rapidrefresh.noaa.gov/RAPchem/jsloopLocalDiskDateDomainZipTZA.cgi?dsKeys=rap-chem:&runTime=2018041700&plotName=ozone_500&fcstInc=180&numFcsts=17&model=rr&ptitle=RAP%20Chem%20Model%20Fields%20-%20Experimental&maxFcstLen=48&fcstStrLen=-1&resizePlot=1&domain=d_01, e-mail in to NOAA for ad hoc forecast loop web page.

NOAA RAP Chem Example

500 mb Ozone, 2:00 am MST April 25, 2018



500 mb CO, 2:00 am MST April 25, 2018

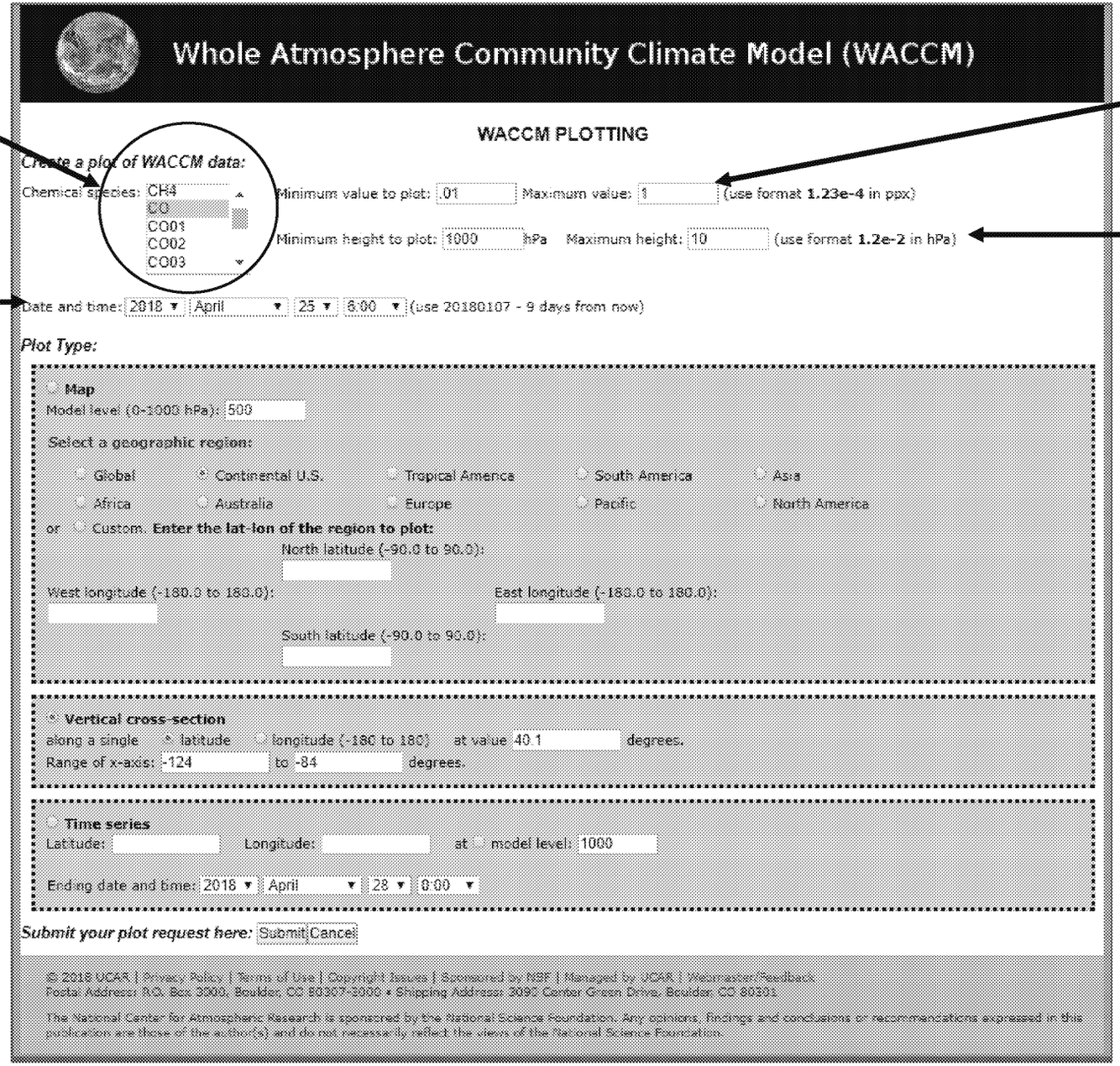


Simultaneous O3 Enhancement, CO minima

NCAR Whole Atmosphere Community Climate Model (WACCM)

- Capabilities (Global and North America Domains, archived back to March 29, 2018, but earlier datasets may be available off-line):
  - Vertical cross sections, maps, and time series plots at location/elevation
    - Plot Interface: https://www.acom.ucar.edu/waccm/plot.shtml
    - Global and Regional Map interface: https://www.acom.ucar.edu/waccm/forecast/
  - Numerous parameters: CO, O_3, but also hydrocarbons, black carbon, SO_2, NOx and others

WACCM Interface: https://www.acom.ucar.edu/waccm/plot.shtml



Select Parameter

Select Date/Time

Specify Concentration Range

Specify Altitude Range

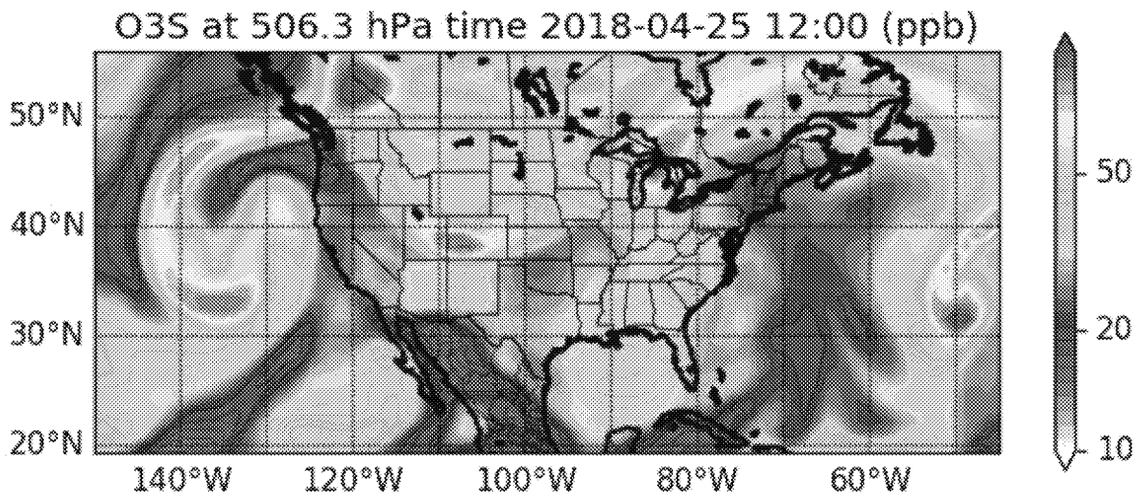
Map Option Selection and Extent

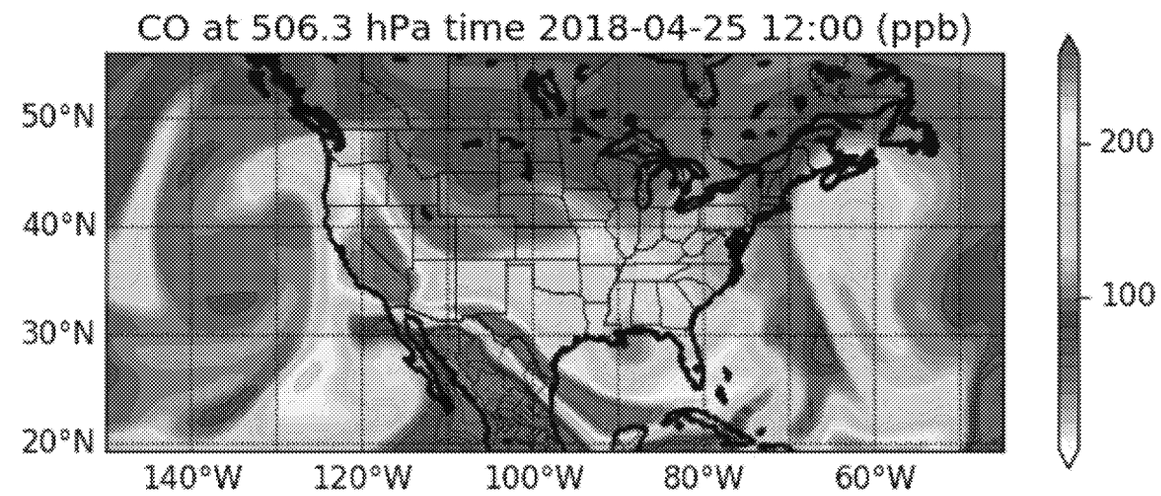
Vertical Profile Option Selection and Extent

Time Series Option Selection and Location/Altitude

WACCM Maps, O3 and CO, 506 hPa, April 25, 2018, 12:00 UTC

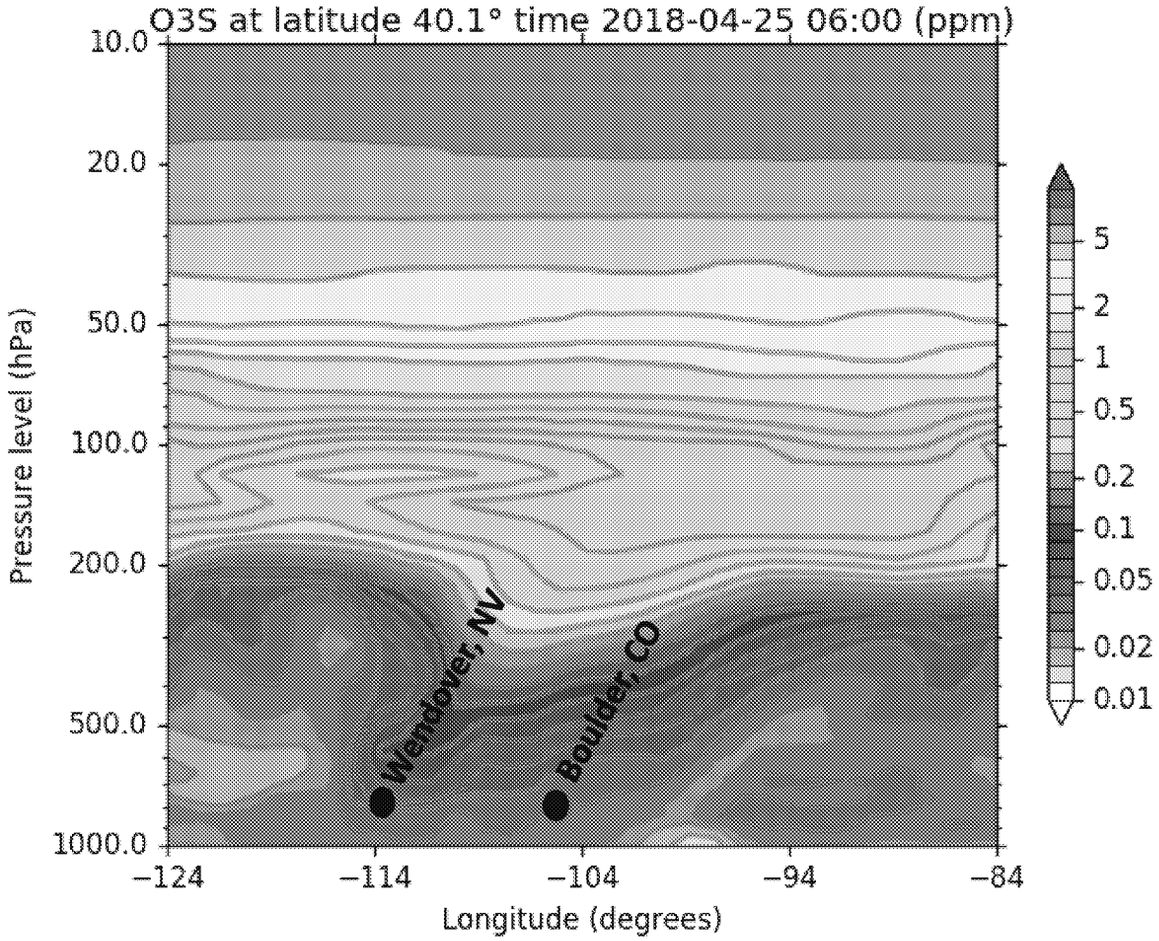
Map Option Controls: Species O3S and CO, Start date Apr. 25, 2018 OZ, Min Value 10, Max value 100 O3 or 300 CO, Model Level 500 hPa, Domain Continental U. S.

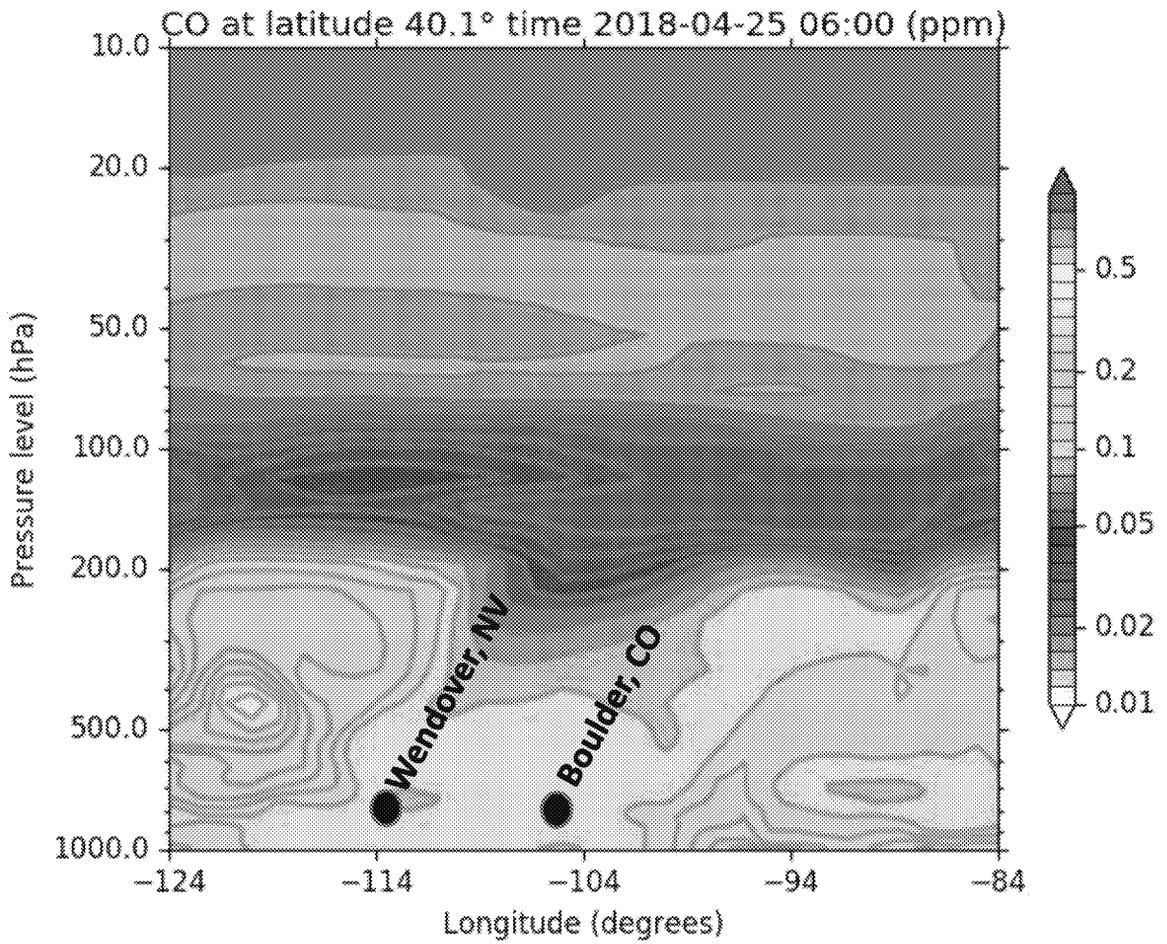




WACCM Vertical Profiles, O3 and CO, April 25, 2018, 06:00UTC

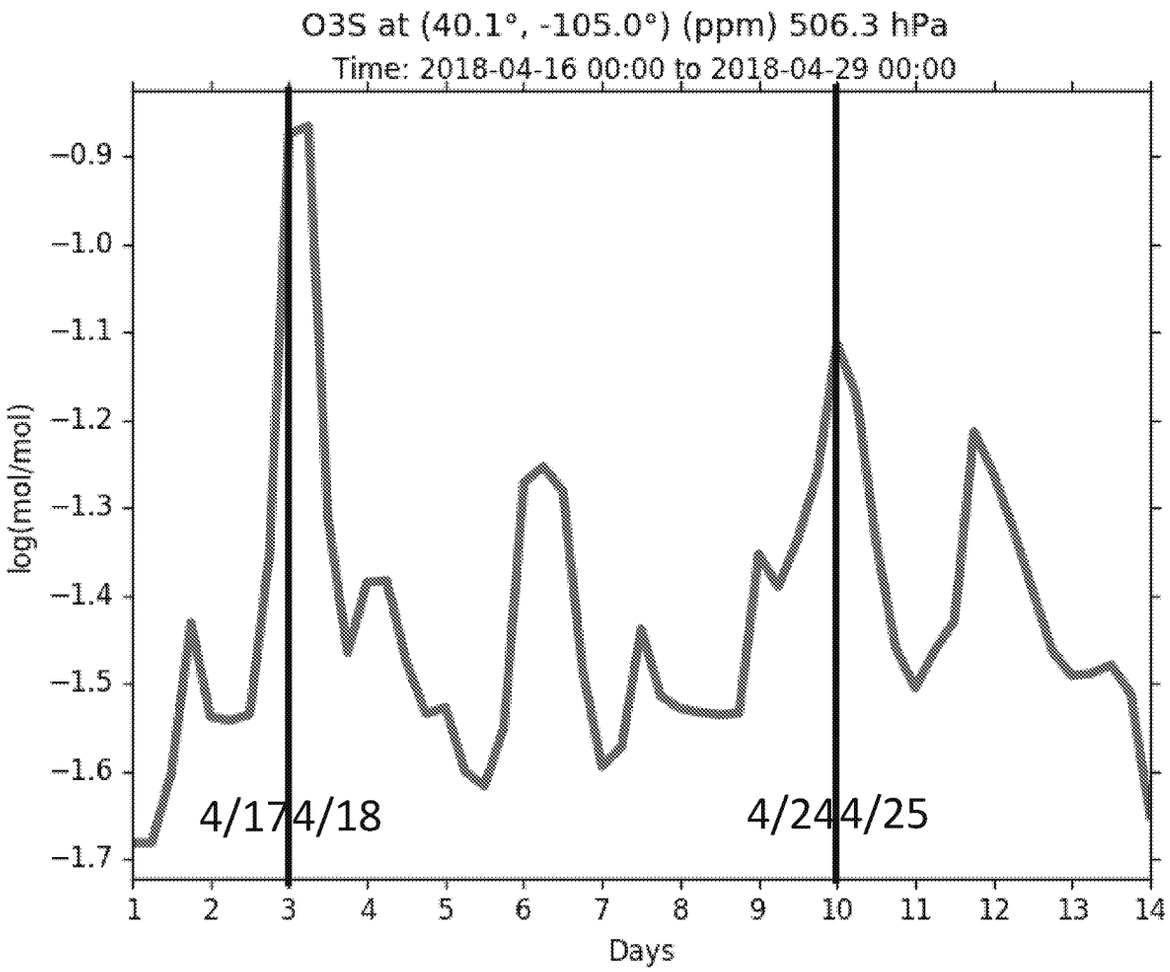
Vertical Cross Section Option Controls: Species O3S and CO, Start date Apr. 25, 2018 6Z, Min Value 0.01, Max value 10 O3 or 1 CO, Latitude 40.1, x-axis -124 to -84 degrees

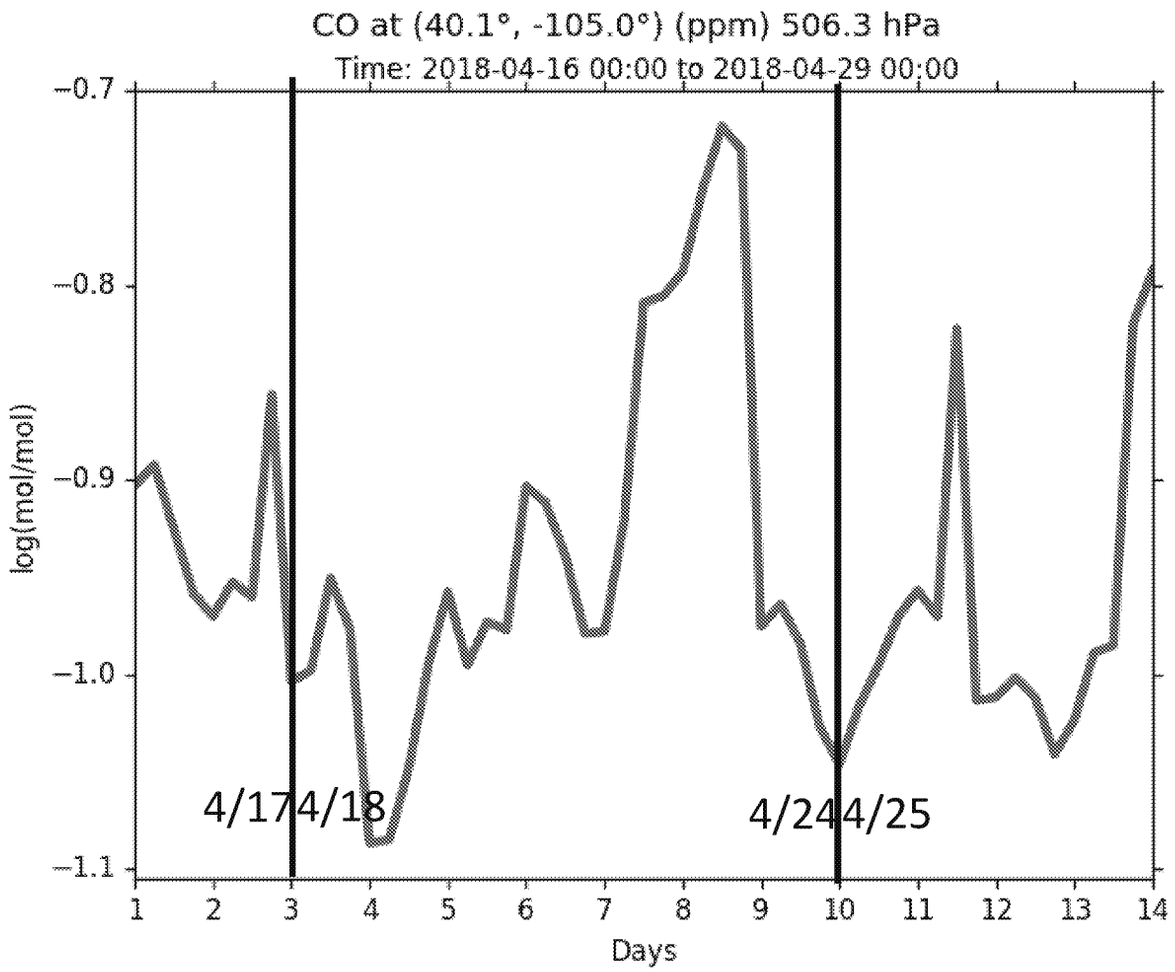




WACCM Time Series

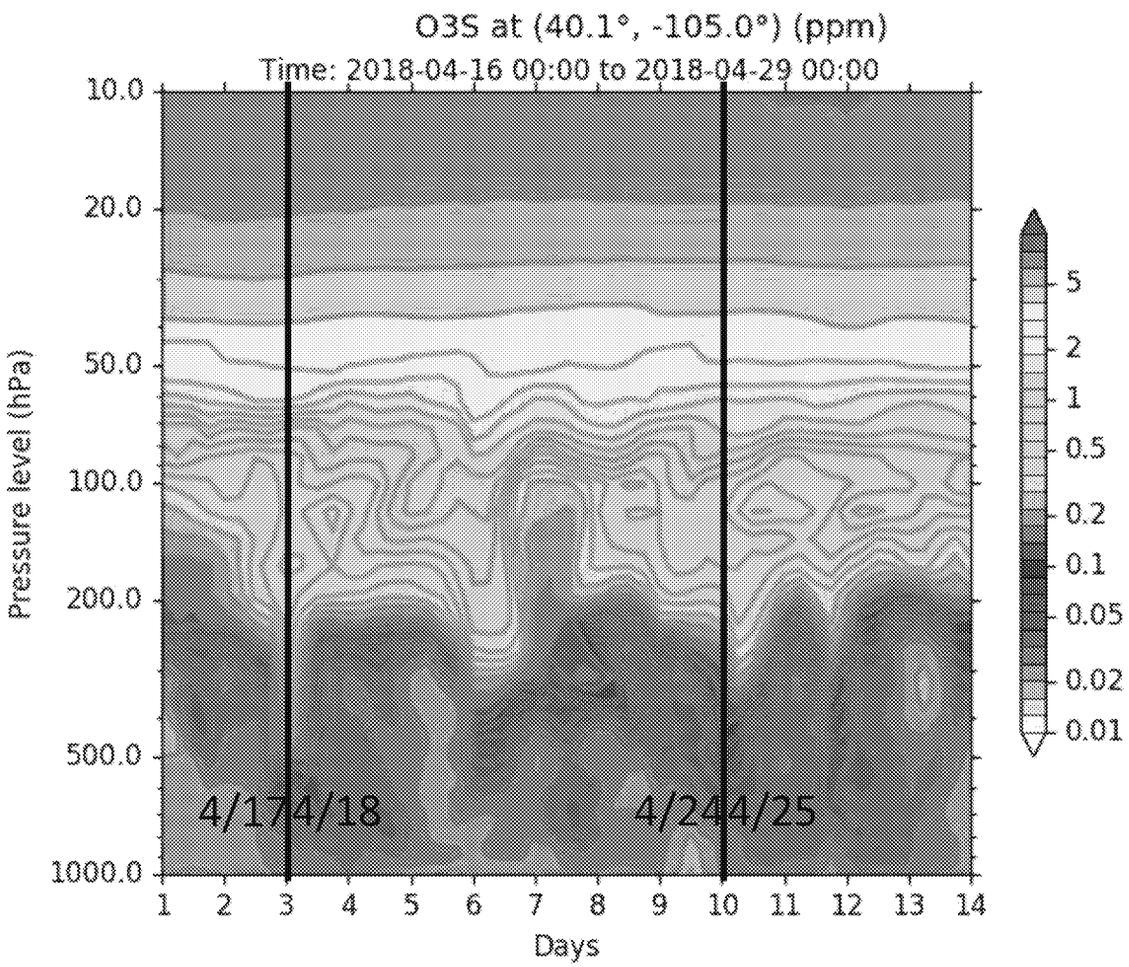
Time Series Option Controls: Species O3S and CO, Start date Apr. 16, 2018 0Z, Latitude 40.1, Longitude -105, model level option at 500 hPa, end date Apr. 29, 2018 0Z. Note: units are in ppm; 10^-0.9= 0.126 ppm

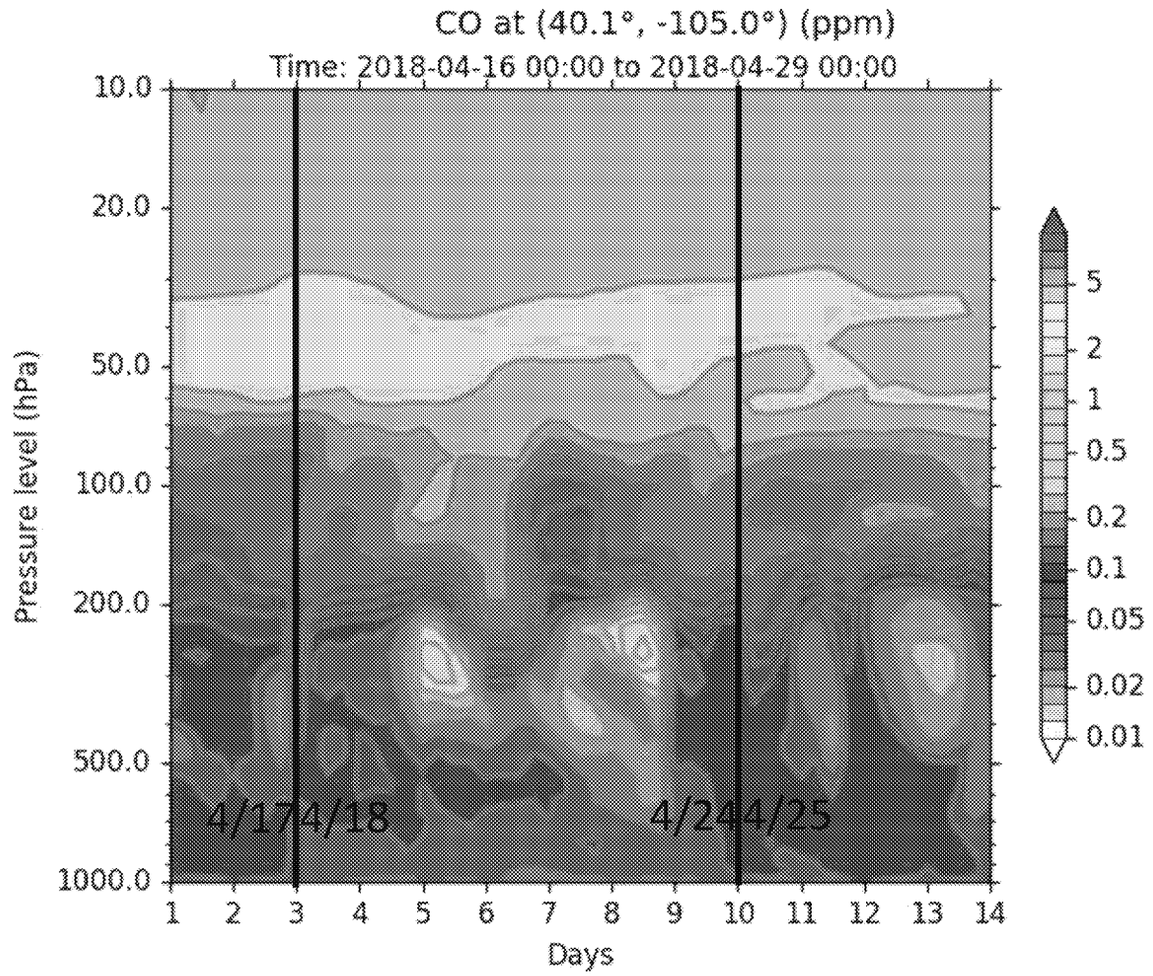




WACCM Curtain Plot Time Series

Time Series Option Controls: Species O3S and CO, Start date Apr. 16, 2018 OZ, Min Value 0.01, Max 10, Height 1000 hPa to 10 hPa, Latitude 40.1, Longitude -105, model level option off, end date April 29, 2018 0Z



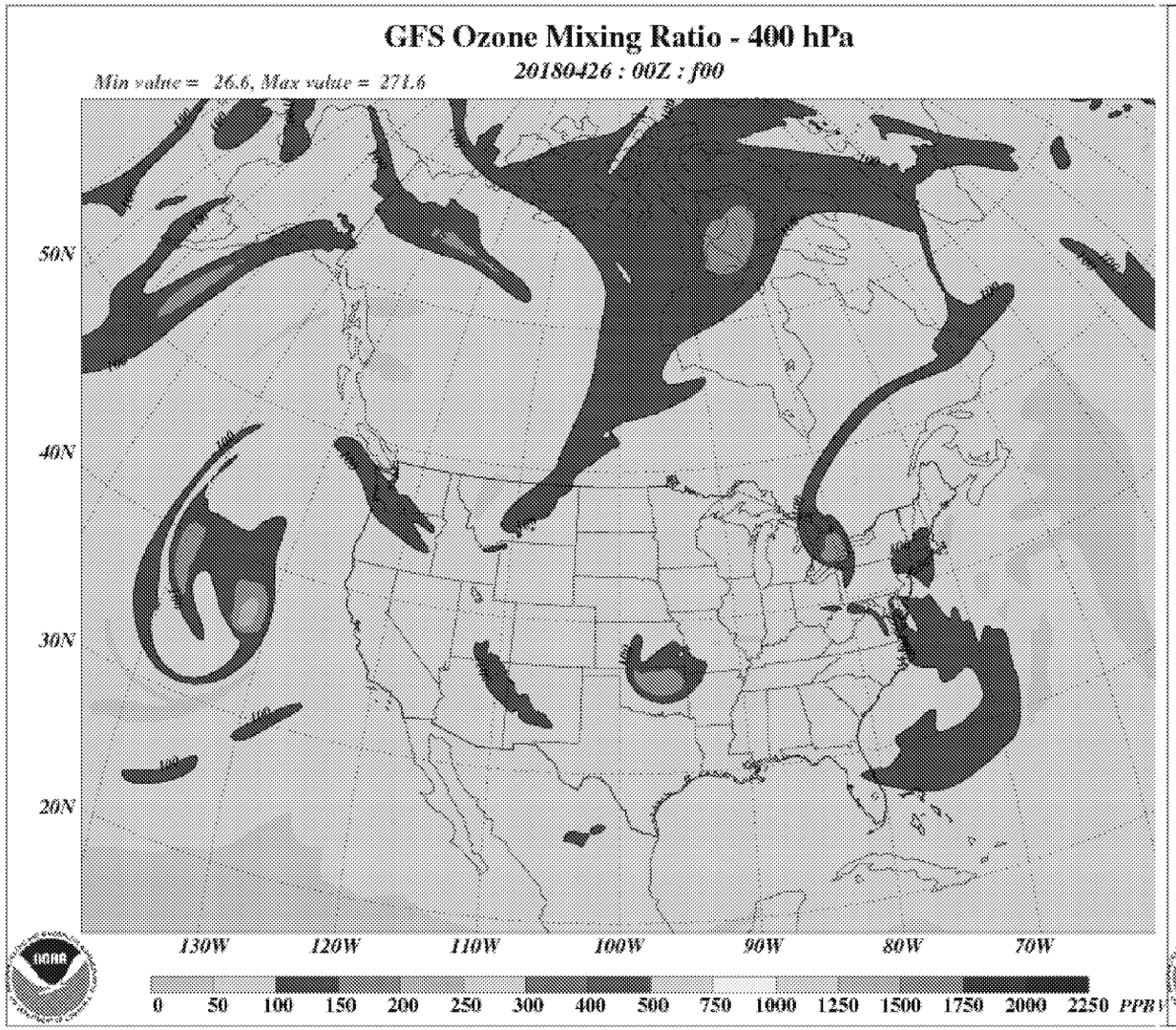


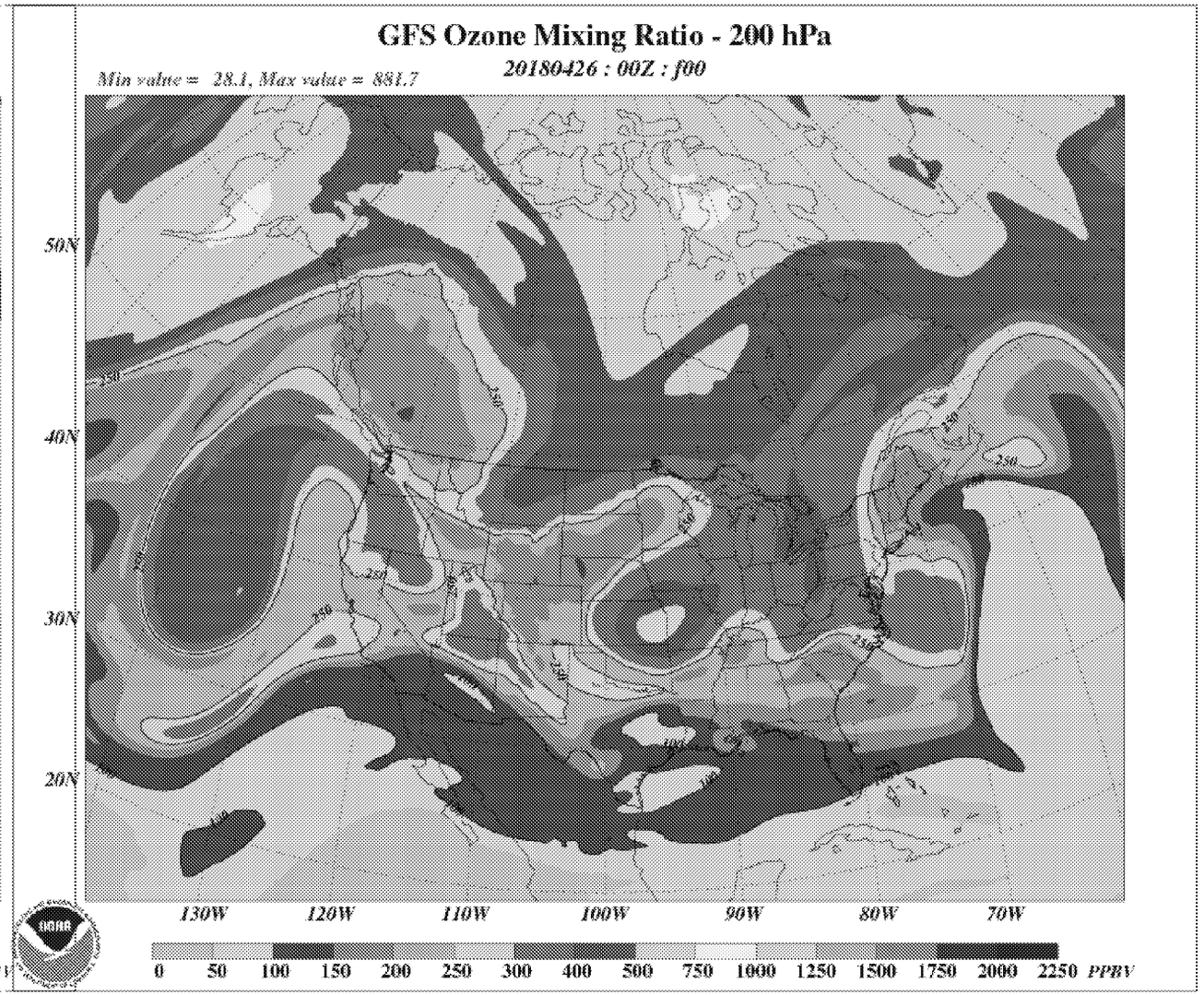
NOAA NCEP/GFS Forecasts

- http://www.cpc.ncep.noaa.gov/products/stratosphere/strat_int/
- Maps of 120 hour GFS forecast:
  - Ozone at 400 hPa to 100 hPa
  - Tropopause height
  - PV on the 320K surface
  - Height of the 2 PVU surface
- 12 hour time steps
- No archiving at present

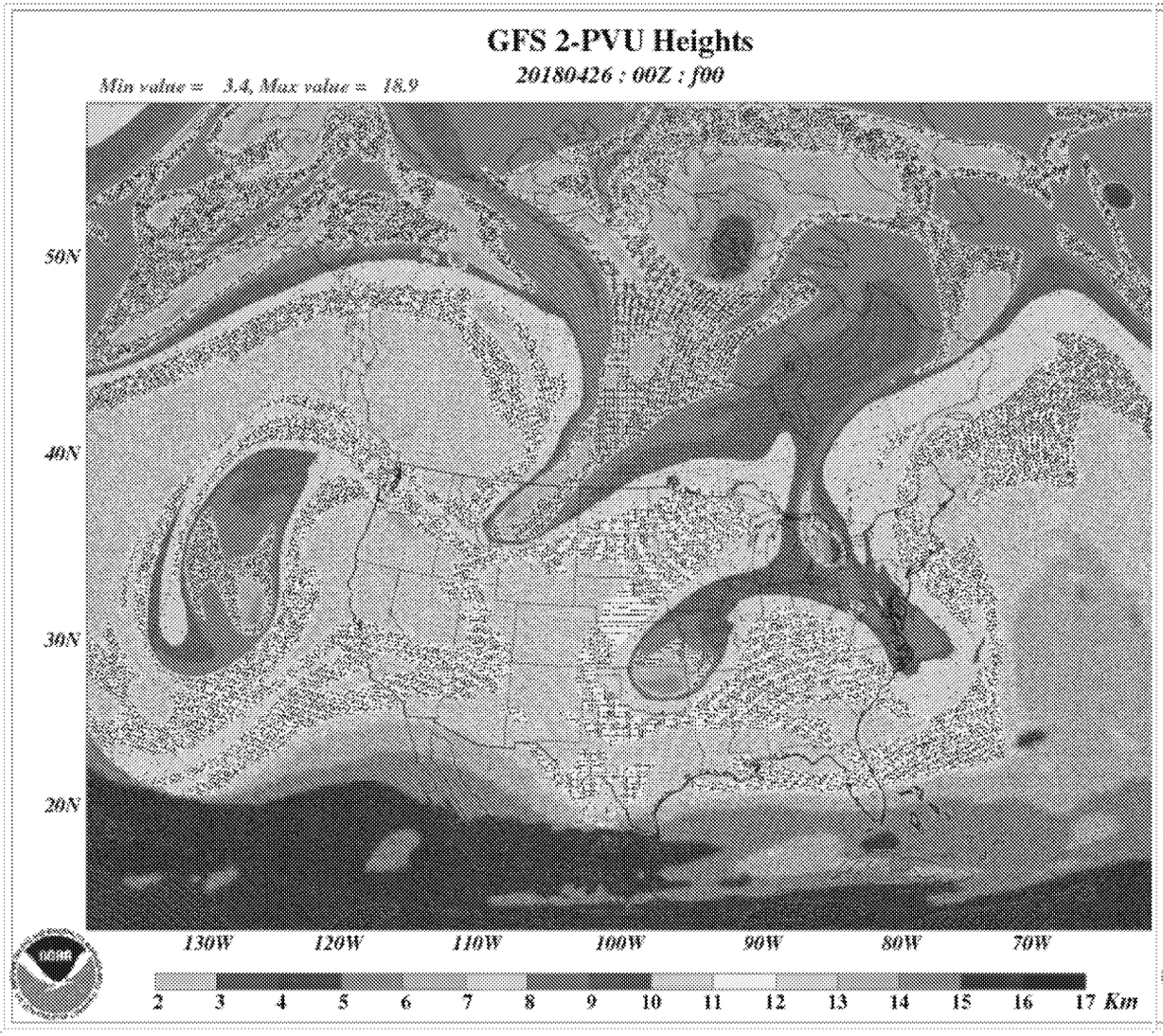
GFS Ozone at 400 hPa and 200 hPa, Apr. 26, 2018, 0Z

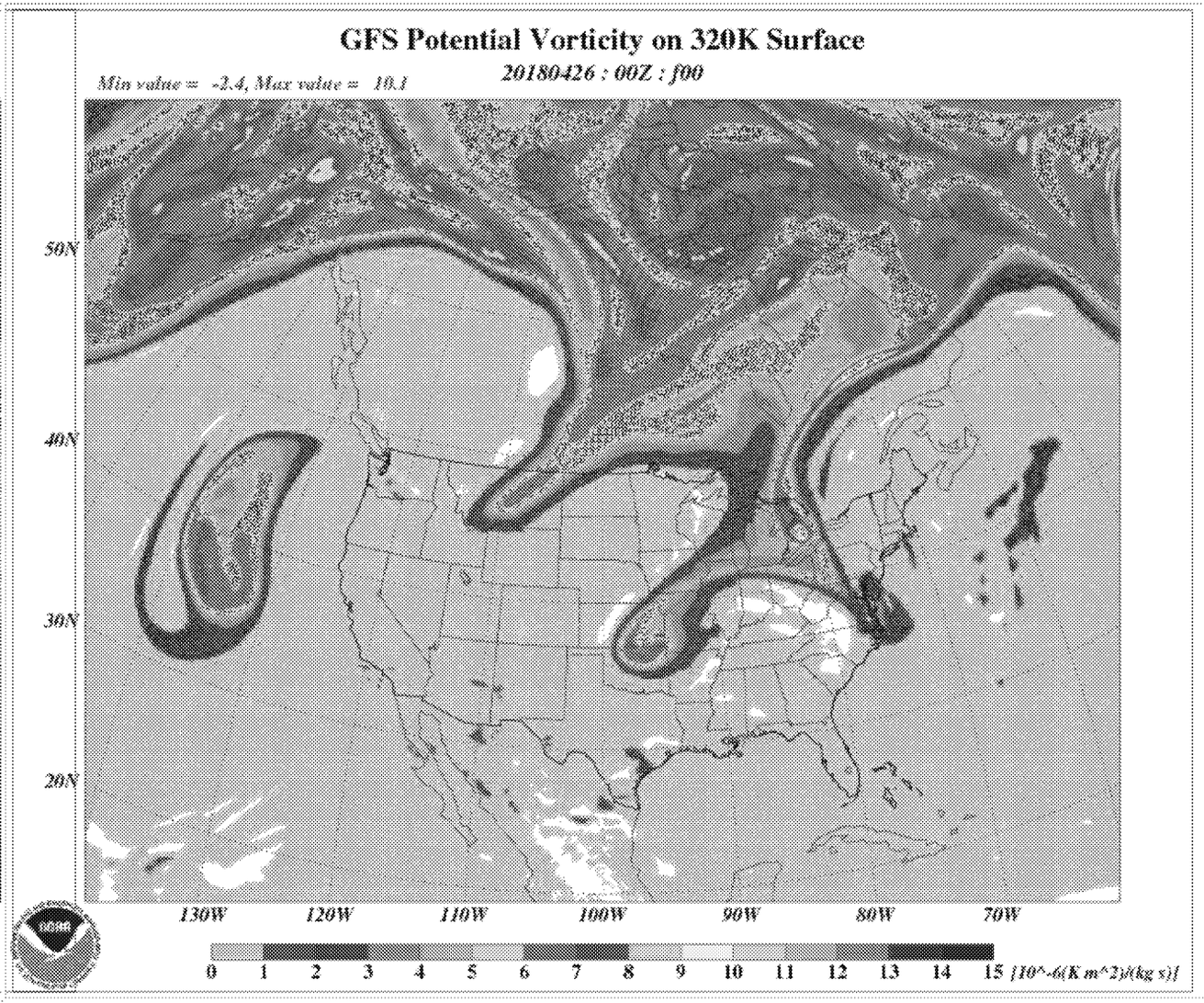
(approximately 23,000 and 39,000 feet)



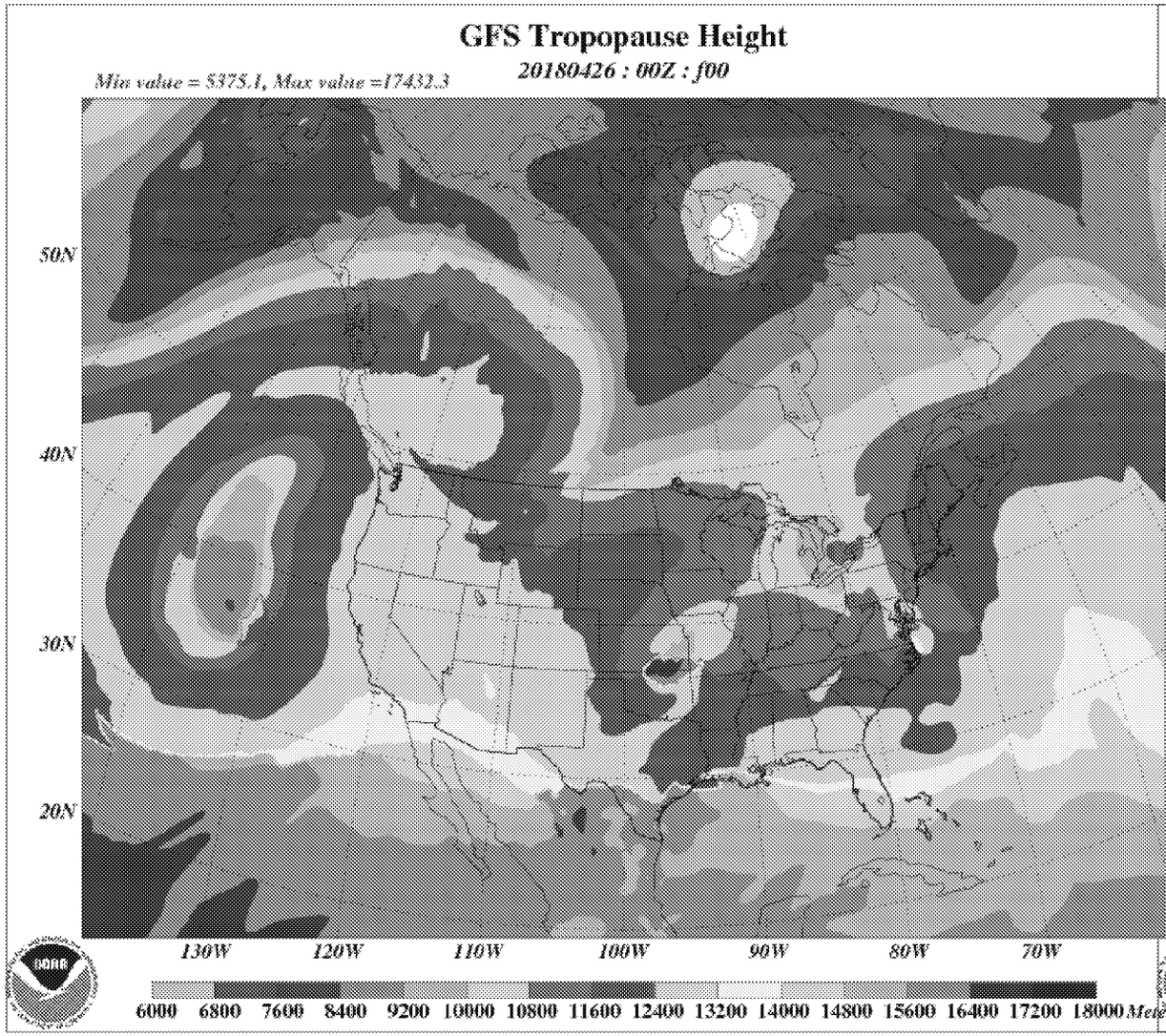


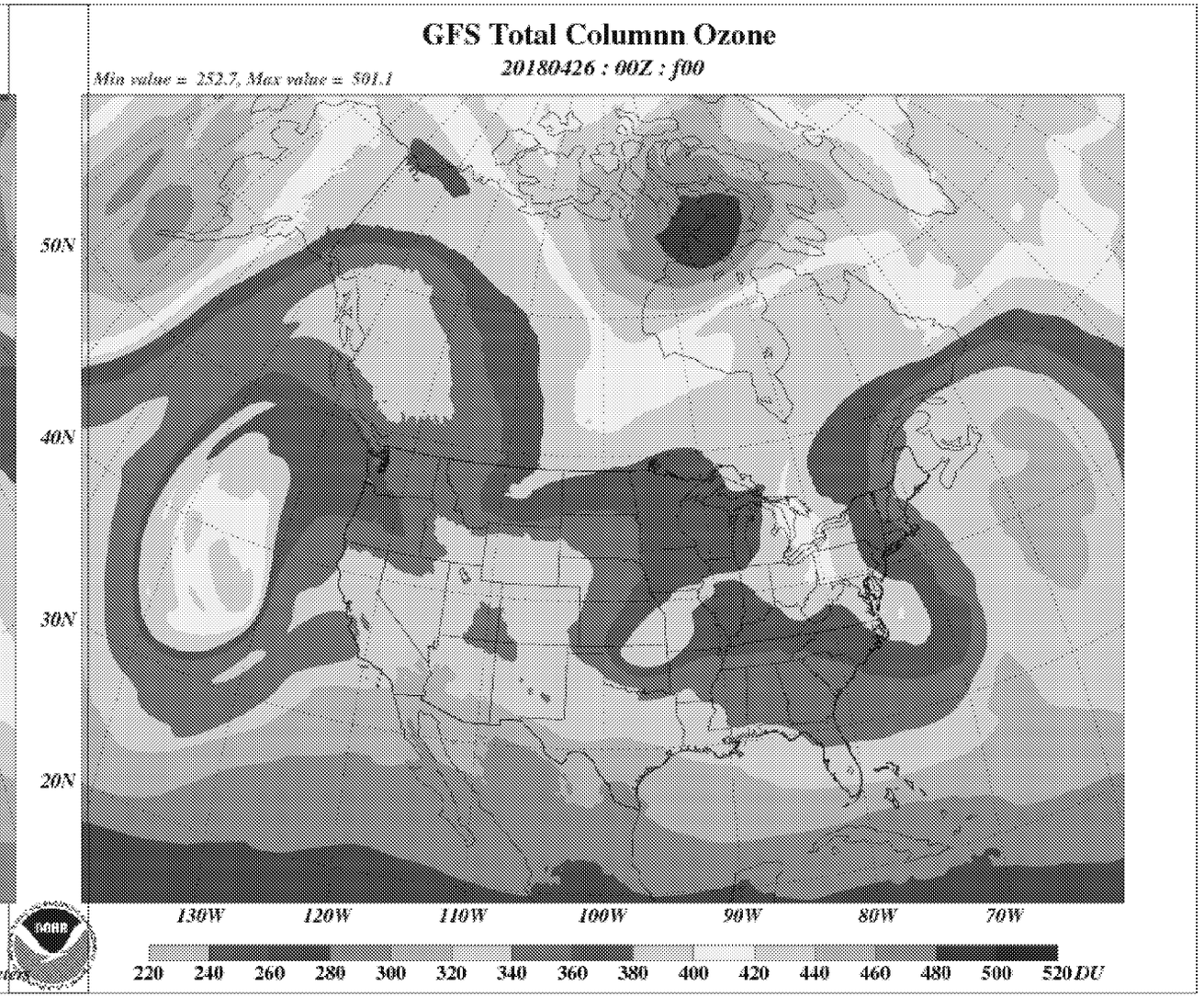
GFS 2-PVU Ht. (km) and 320k PV, Apr. 26, 2018 0Z





GFS Tropopause Ht. (m) and Total Column O3, Apr. 26, 2018 0Z

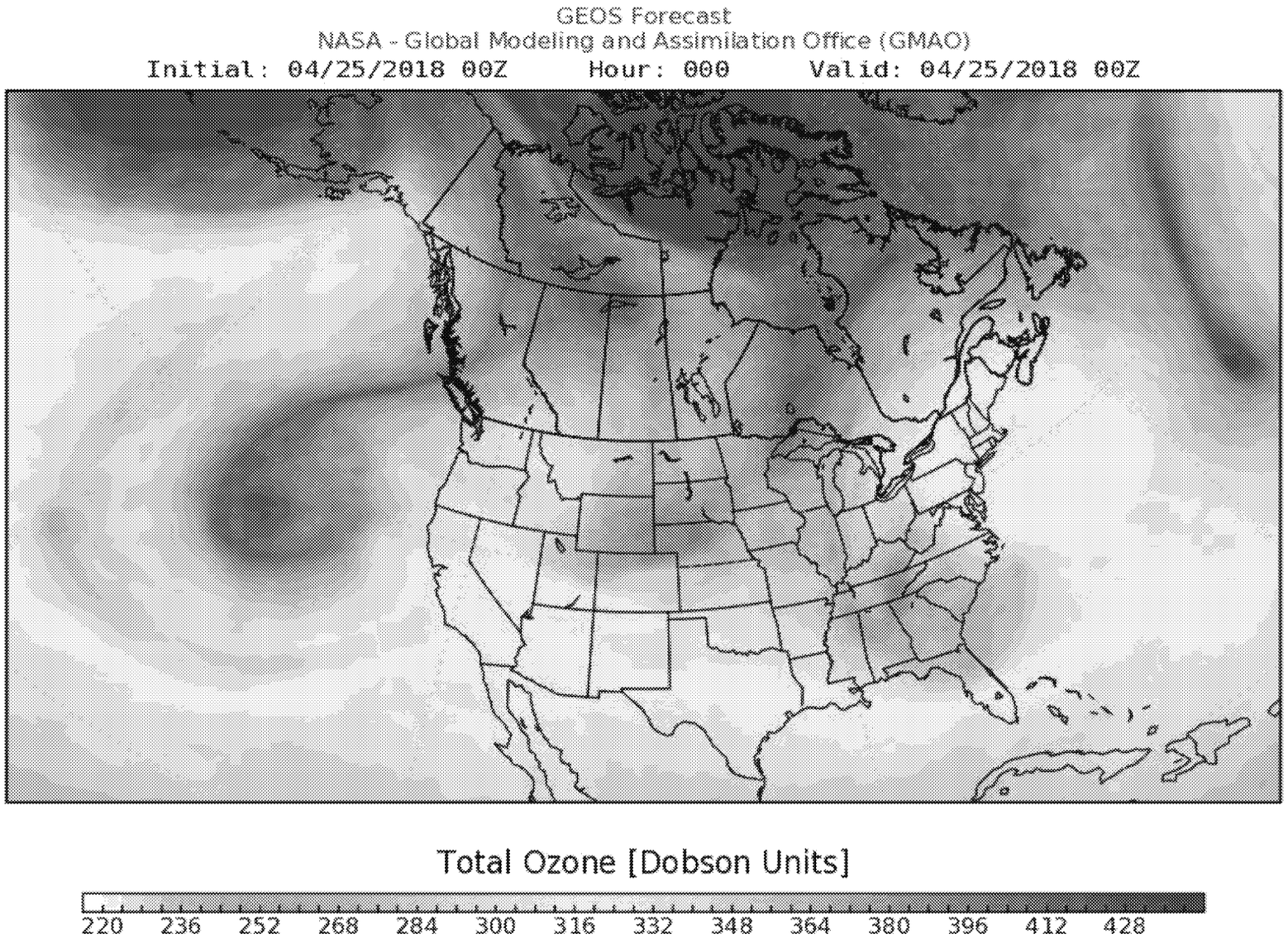




NASA GMAO Atmospheric Composition

- Currently, maps total column ozone in several domains
  - North America, Mid-Atlantic States, Global, Polar, etc.
- 3-D chemistry plots currently being developed off-line
  - May be public in the future
- https://fluid.nccs.nasa.gov/weather/wxmaps/chem2d/?one_click=1&tau=000&stream=G5FPFC&level=0&region=nam&fcst=20180417T000000&field=to3

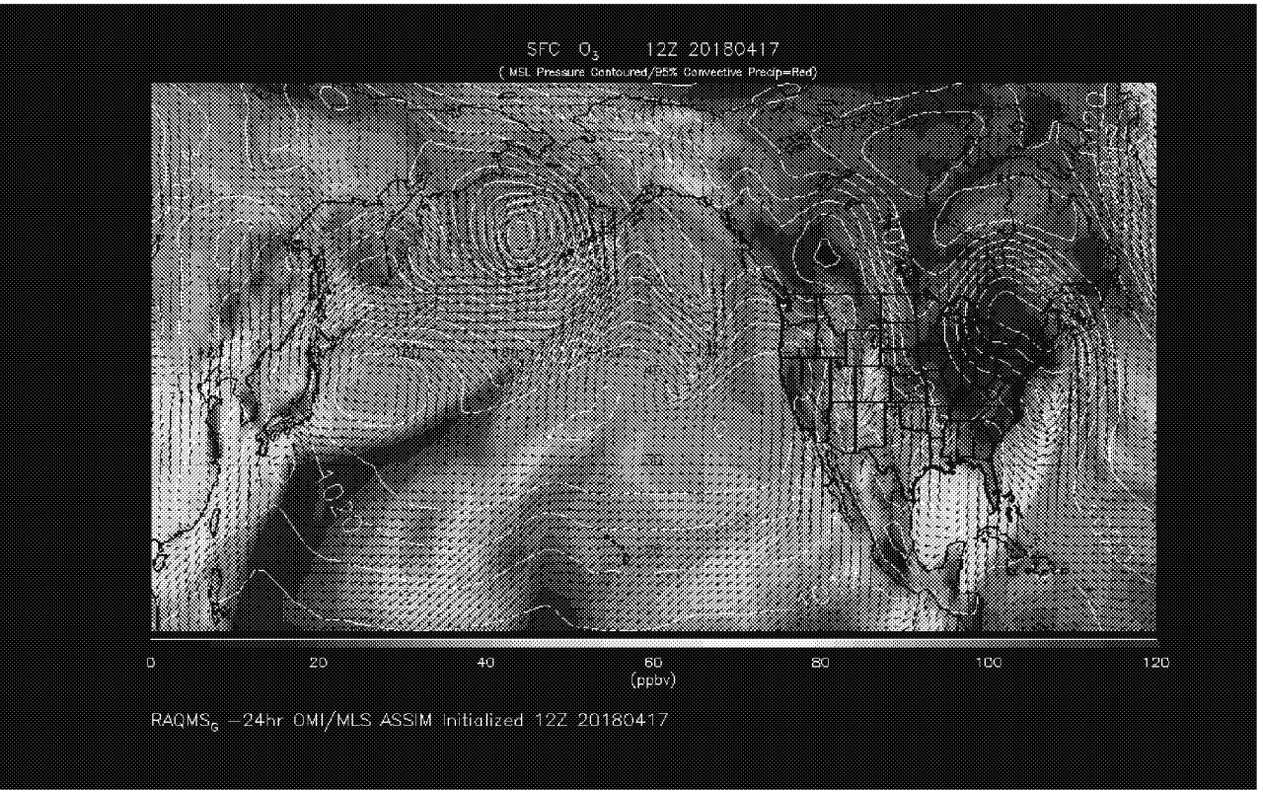
NASA GMAO Total Column Ozone, Apr. 25, 2018 0Z



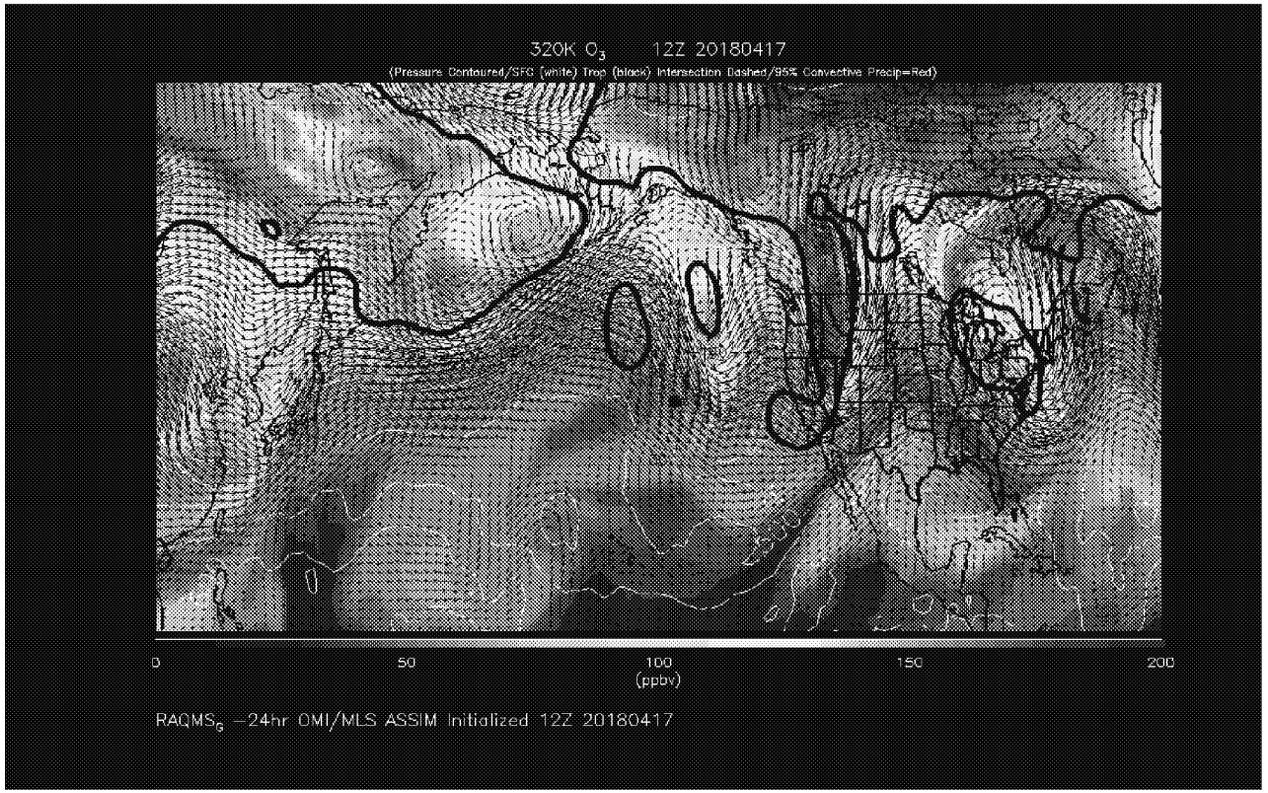
NASA/NOAA RAQMS

- http://raqms-ops.ssec.wisc.edu/
- Animated forecast maps of CO, O3, carbon, Sulfate at surface and elevation
- Tropospheric and total column animated maps
- Animated meridional cross sections at fixed longitudes
- Animated longitudinal cross section at 40° N, central Asia east to the Atlantic
- Model/Monitor correlation and time series plots
- Archived back to January 2010
  - (http://raqms-ops.ssec.wisc.edu/previous_products/)

RAQMS Surface and 320K Ozone Animated GIF, Apr. 17-22, 2018



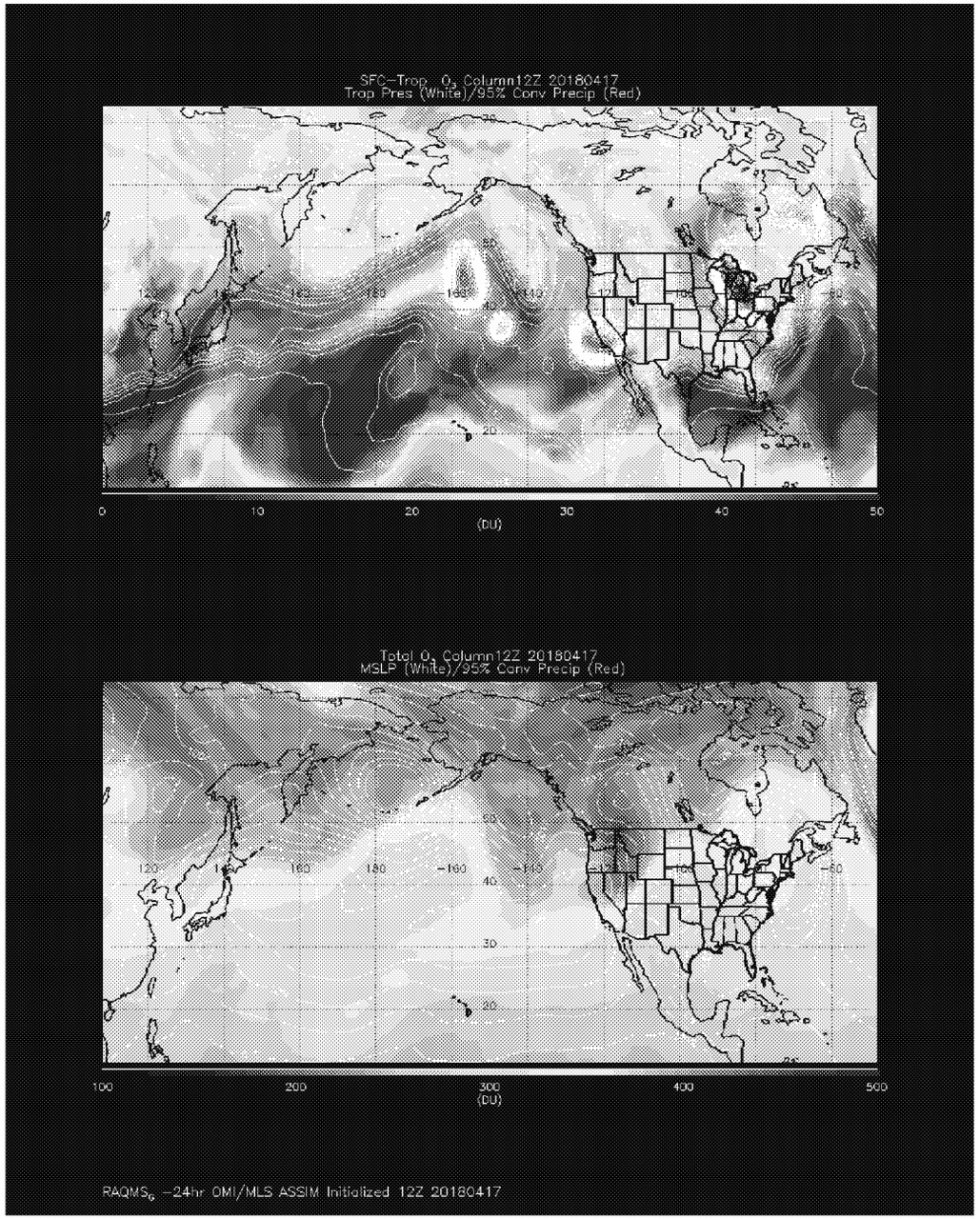
http://raqms-ops.ssec.wisc.edu/previous_products/20180417/O3_calnex_SFC_180417.gif



http://raqms-ops.ssec.wisc.edu/previous_products/20180417/O3_calnex_320K_180417.gif

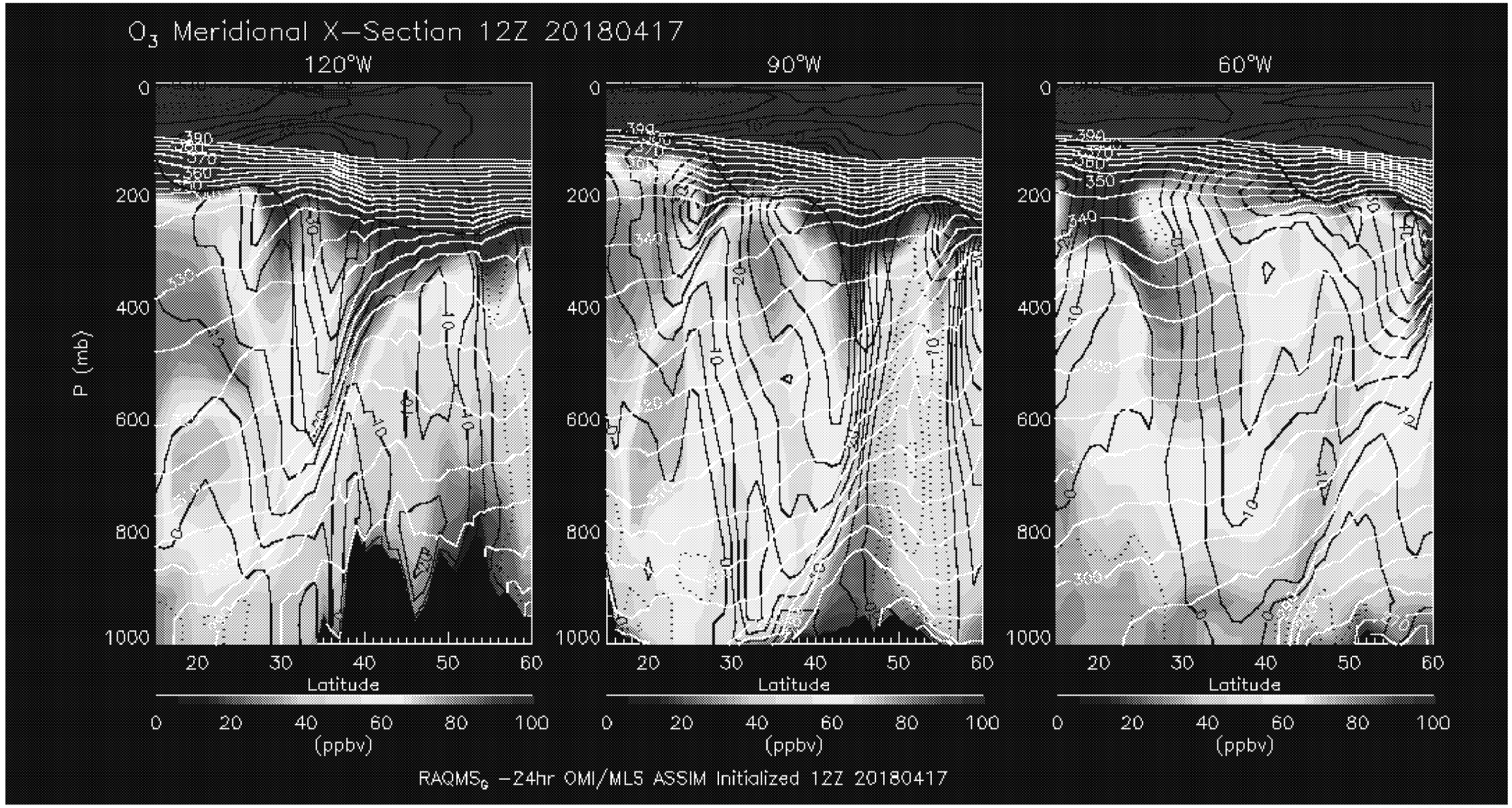
RAQMS Tropospheric (top) and Total Column O_3 Animated GIF, Apr. 17-22, 2018

http://raqms-ops.ssec.wisc.edu/previous_products/20180417/O3_columns_180417.gif



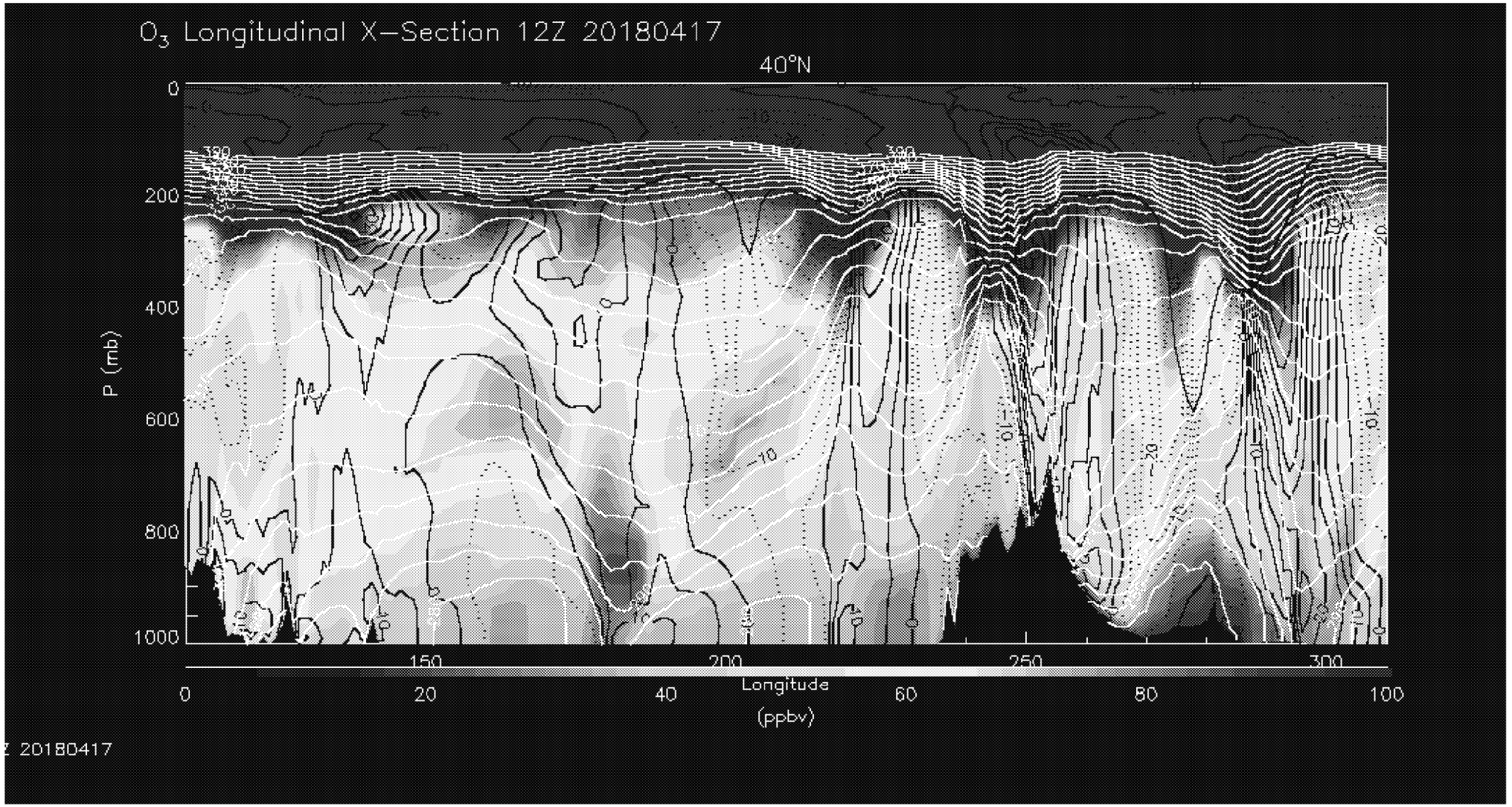
RAQMS Meridional Cross Section Animated GIF, April 17-22, 2018

http://raqms-ops.ssec.wisc.edu/previous_products/20180417/O3_xsection_180417.gif



RAQMS Longitudinal Cross Section Animated GIF, April 17-22, 2018

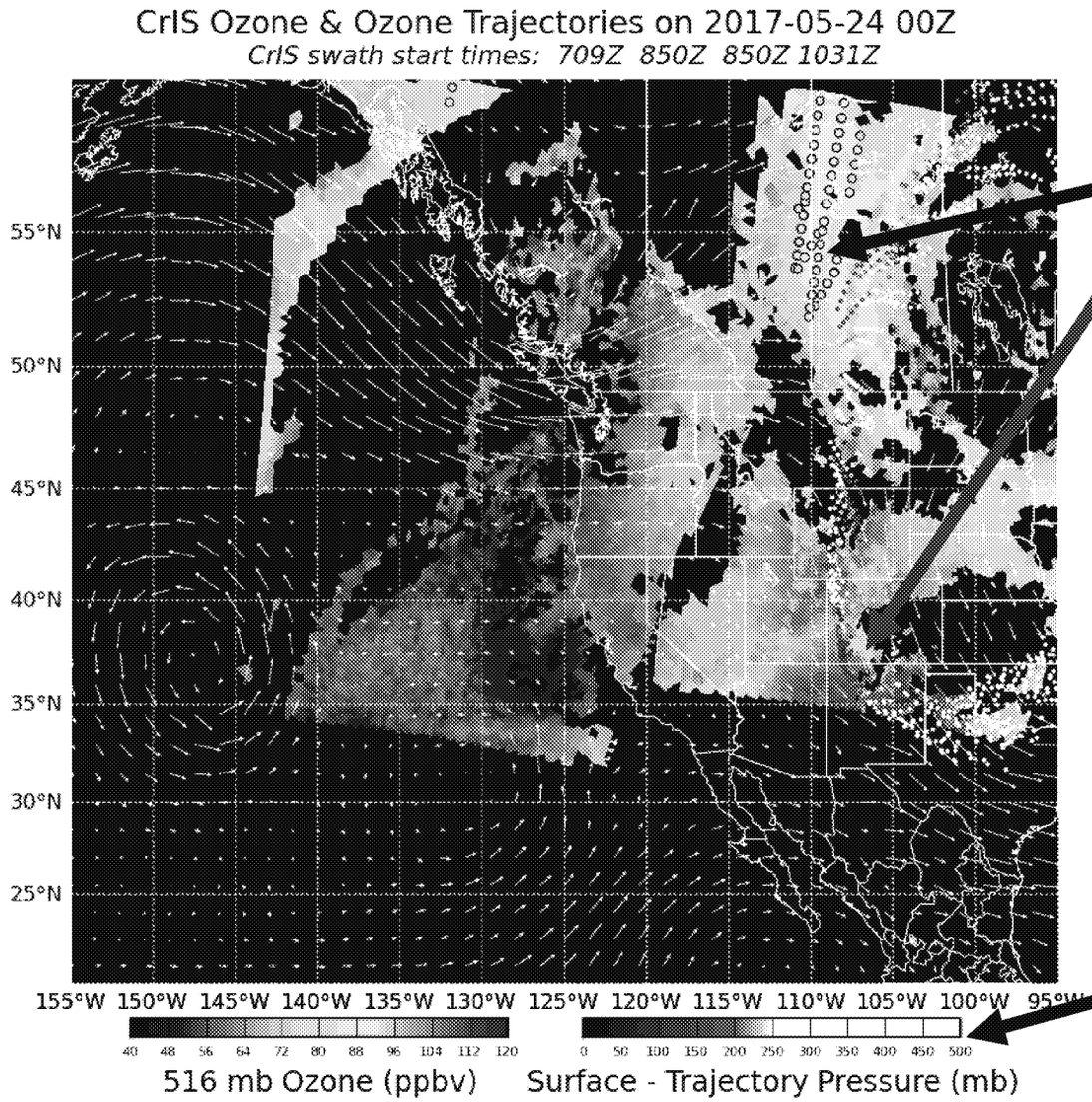
http://raqms-ops.ssec.wisc.edu/previous_products/20180417/O3_ysection_180417.gif



IDEA-I Satellite Ozone Trajectory Forecasts

- http://smoke.ssec.wisc.edu/idea-i-ozone-live-test/index.php
- Real-time projection of 516 mb satellite detected intrusion ozone forward using atmospheric trajectory models
  - 2-day forward trajectory animations
- Archived back to August 23, 2016
- Satellite ozone retrievals from both EOS Atmospheric Infrared Sounder (AIRS) and JPSS Cross Track Infrared Sounder (CrIS)

IDEA-I Trajectory Forecast, May 22, 2017



- CrIS 516mb ozone retrieval 09z, May 22, 2017
- 80 – 100 ppb ozone over Central Alberta
- Forward trajectories descend to below about 600 mb (surface – trajectory pressure < 200 mb) over SW Colorado at 00Z May 24 (39 hours in future)

Pressure altitude units for trajectory:
Surface pressure minus trajectory pressure