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Evaluation of Version 3 total and tropospheric ozone columns from EPIC on DSCOVR for studying regional scale ozone variations

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Abstract

In this study, we present evaluation of version 3 ozone products derived from the DSCOVR EPIC instrument. EPIC's total and tropospheric ozone columns have been compared with correlative satellite and ground-based measurements at time scales from daily averages to monthly means. We found that the agreement improves if we only accept retrievals derived from the EPIC 317 nm triplet and limit solar zenith and satellite looking angles to 70°. With such filtering in place, the comparisons of EPIC total columns with correlative satellite and ground-based data show mean differences within ±5-7 DU (or 1.5-2.5%). The biases with OMI and OMPS NM tend to be mostly negative in the Southern Hemisphere (SH), while there are no clear latitudinal patterns in ground-based comparisons. Evaluation of the EPIC ozone time series at different ground-based stations with the correlative ground-based Brewer and Pandora instruments and ozonesondes demonstrated good consistency in capturing ozone variations at daily, weekly and monthly scales with a persistently high correlation (r^2>0.9) for total and tropospheric columns. We examined the quality of EPIC tropospheric ozone columns by comparing with ozonesondes at 12 stations and found that differences in tropospheric column ozone are within ±2.5 DU (or ˜±10%) after removing a constant 3 DU offset at all stations between EPIC and sondes. The analysis of the time series of zonally averaged EPIC tropospheric ozone revealed a statistically significant drop of ˜2-4 DU (˜5-10%) over the entire NH in spring and summer of 2020, which is partially related to the unprecedented Arctic stratospheric ozone losses in winter-spring 2019/2020 and reductions in ozone precursor pollutants due to the COVID-19 pandemic.

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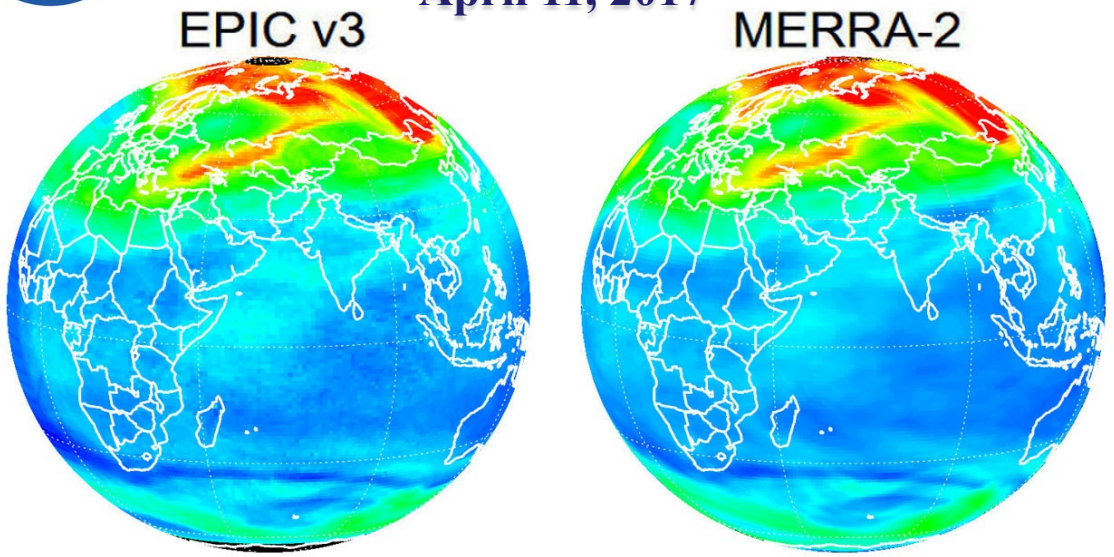
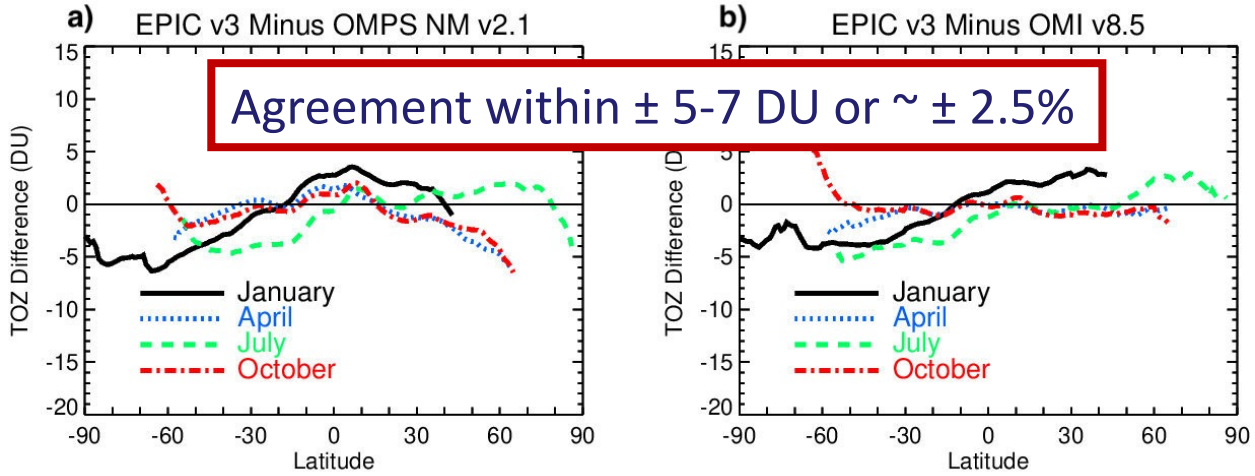
EPIC VERSION 3 OZONE PRODUCTS

Synoptic Total Ozone Maps
April 11, 2017



Comparisons with polar orbiting satellite measurements



**EPIC measurements are limited to retrievals from 317.5 nm triplet and SZA/SLA <70°*

From [Kramarova et. al, 2021], doi 10.3389/frsen.2021.734071

EPIC V3 total and tropospheric ozone data are available at:
https://asdc.larc.nasa.gov/project/DSCOVR/DSCOVR_EPIC_L2_TO3_03
https://asdc.larc.nasa.gov/data/DSCOVR/EPIC/L4_TrO3_01/

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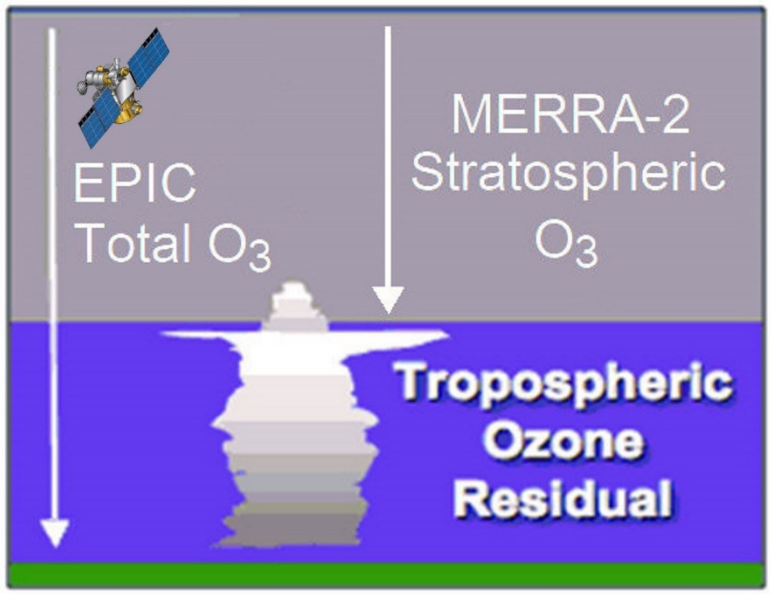
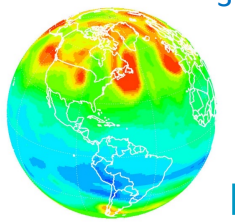
EPIC TROPOSPHERIC OZONE

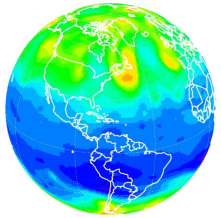
RESIDUAL METHOD



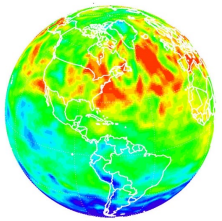
EPIC Total O_3

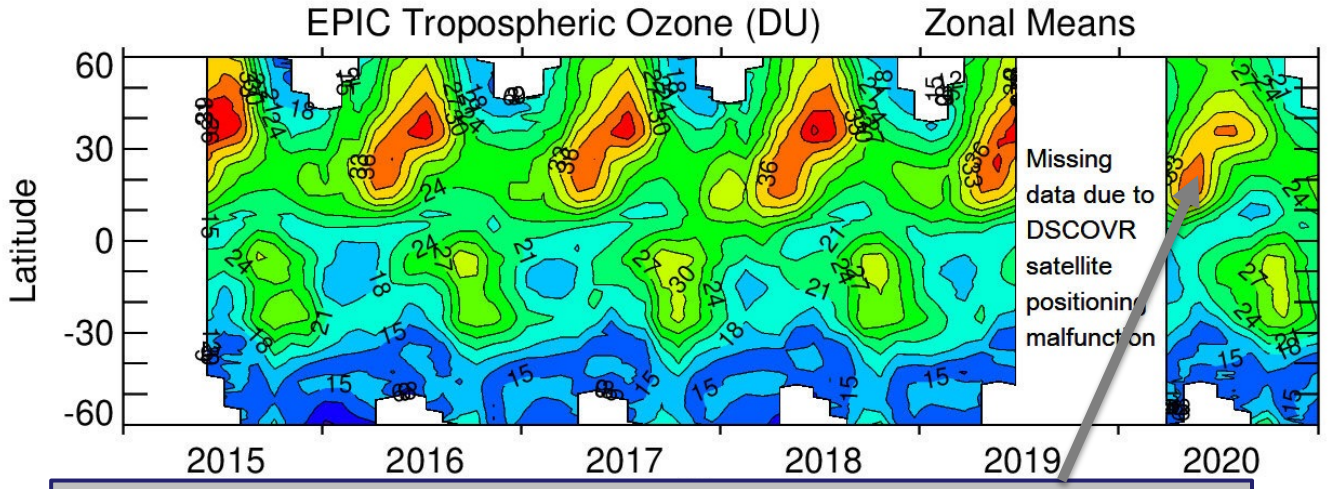


MERRA-2 SOC



EPIC TCO





Drop of 2-4 DU in EPIC TCO in NH in spring-summer 2020 is partially related to the unprecedented 2019/2020 Arctic ozone depletion and reductions in ozone precursor pollutants due to the COVID-19 pandemic.

Tropopause pressure is derived from MERRA-2 potential vorticity (2.5 PVU) and potential temperature (380 K)

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From [Kramarova et. al, 2021], doi 10.3389/frsen.2021.734071