Tropospheric ozone columns from S5P/TROPOMI

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Outlook

– Method
  – Operational Product: Convective cloud differential (S5P CCD)
  – Research Product: Combined TROPOMI with assimilated MLS (S5P-BASCOE)

– Comparison
  – S5P-CCD versus OMI and GOME-2 CCD
  – S5P-BASCOE versus CCD

– Results
  – Global
  – Central Africa
  – Northern America
  – Mediterranean
  – East Asia
Retrieval Algorithms

S5P CCD

S5P Total Ozone

S5P Total Ozone

S5P BASCOE

MLS O$_3$

Trop. O$_3$

Trop. O$_3$
Comparison between OMI / GOME-2 CCD tropospheric O3 column and TROPOMI CCD

– OMI / GOME-2 based on CCI GODFIT total columns
  – Similar to S5P OFFL total columns
  – But use different cloud products

– CCD algorithm similar to S5P:
  – Top of tropospheric column at 270hPa
  – Resolution of 1° x 2°

– Good agreement to OMI

– Overestimation compared to GOME-2 B affected by daily O3 cycle?
Tropospheric Ozone Trends (CCD on GOME, SCIAMACHY, OMI, GOME-2)

- CCI project
  - CCD retrieval using GODFITv4 total ozone data from GOME, SCIAMACHY, OMI, GOME-2 (A & B)
  - Harmonized time series from 1995 to 2018 (23 Years)

- Resolution 2.5° x 1.25°

- Monthly means

*Heue et al AMT, 2016*

Global tropical trend \(0.753 \pm 0.122\) DU/decade

Update with data up to 2018

Global tropical trend \(0.724 \pm 0.112\) DU/decade
S5P CCD Tropospheric O₃ Validation

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biomass burning?
S5P BASCOE Tropospheric $O_3$ Validation using Sondes

- Validation for April 2018 to March 2019
- Highest number of sonde data in Northern midlatitude
- Mostly small positive bias
- Largest deviations in polar regions

- Thanks to all the PIs of the Soundings stations for providing the data to SHADOZ and to the World Ozone and Ultraviolet Radiation Data Centre
Comparison between the S5P CCD and BASCOE tropospheric ozone columns

Different tropopause levels
Mean 9.83 DU

Climatology added to CCD to correct for different tropopause levels
Mean 1.86 DU
Global tropospheric ozone column, 2018-05-14 to 2018-05-20
Central Africa in June 2018

Fires June 2018
Modis Active fires
https://fires.globalforestwatch.org/map/
South-Eastern US in July 2018

S5P HCHO columns
Courtesy of Isabelle de Smedt and Ka Lok Chan
East Asia in August 2018 and yearly cycle
Summary

– S5P CCD is an operational TROPOMI product and regularly validated

– S5P BASCOE is a research TROPOMI product, initial validation performed

– Good agreement between S5P-BASCOE and S5P-CCD when altitude difference is considered

– High tropospheric ozone columns were observed over
  – Atlantic ocean close to Central Africa
  – South eastern US – transport to the east Atlantic
  – East Asia Transport from China over Korea to Japan