BrO stratospheric / tropospheric separation

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TEMPO Science Team Meeting
June 1, 2016, NMAI, Washington DC.
Retrieval concept: (Hormann et al., AMTD, 2016)

- Separation of stratospheric and tropospheric SCDs using only satellite measurements
- It assumes small “local” stratospheric SCD dependence with latitude and longitude
- First work out local stratospheric correction using satellite measurements
- Calculate local tropospheric SCD by subtracting local stratospheric correction to total SCD for each pixel
- Calculate tropospheric VCD using tropospheric AMF based in model climatology
Model climatology

Total Column

Stratospheric Column

Tropospheric Column

CAM model (2.5°x1.875°), latitudinal and longitudinal invariance
Model climatology

Questions to further investigate:
1. Diurnal variation
2. Temporal variation
3. Variability scale, what is the most representative size for smoothing kernel?
4. Interference with NO$_2$ and O$_3$
Experiment with OMI data: Stratospheric correction

- Compute latitudinal mean, that requires a careful definition of longitudinal contributions
- Identify individual pixels contributing to background by defining cut off value and clouds
- Compute smoothed stratospheric SCD column for example using a 2D box car smoothing kernel
- Compute tropospheric SCD
Experiment with OMI data: Stratospheric correction over US

January 15, 2015

L3 running monthly mean OMBRO data with cloud fraction < 0.3 and spatial resolution 0.2x0.2°. Pixels with predominant stratospheric contribution are found for each 0.5° latitudinal bin. Their columns are defined as:

\[ SCD \leq SCD_{mean} + a \cdot \sigma \]

\[ a = 0 \]
Experiment with OMI data: Stratospheric correction over US

Boxcar smoothing kernel considers a width of ±1.25° for each pixel in each direction (N/S and E/W)
Experiment with OMI data: Stratospheric correction US

BrO VCDs 2005m0829

Smoothened stratospheric background

0.00e+00  9.00e+13

Background mask  100018

Tropospheric VCDs

0.00e+00  1.00e+13

Row stratospheric background

Tropospheric VCDs

0.00e+00  9.00e+13

0.00e+00  8.18e+12

Great Salt Lake
Experiment with OMI data: Stratospheric correction

Salt Lake Tropospheric BrO columns

Salt Lake Stratospheric BrO columns
Experiment with OMI data: Stratospheric correction (Aral Sea)

Smaller region to work out the mean of latitudinal bands provides a better estimate of the local mean stratospheric contribution.
Experiment with OMI data: Stratospheric correction (Aral Sea)
Future steps

• Optimize scheme for the selection of the longitudinal size for the latitudinal bins.
• Experiment with other smoothing kernels/schemes.
• What is the impact of clouds? Can we use cloudy pixels to increase the information about stratospheric columns?
• Improve tropospheric climatology for AMFs calculations.
• Carry on experiment using OMI L2 data.

Thank you