



V8 Total Ozone Algorithm on NDE and ICVS Monitoring

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OUTLINE

- Introduction to V8TOz Algorithm
- J1 Implementation of V8TOz on NDE
- Soft Calibration Adjustments
- Products and Applications
- ICVS Monitoring
 - OMPS Product Demo Site URL
 - SBUV/2 V8 Operational Performance
 - GOME-2 V8 (Metop A/B)
 - V8 OMPS, GOME-2, and OMI Maps
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 - New OMPS EDR Site Features
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Introduction to V8TOz Algorithm

The Version 8 total O₃ algorithm (V8TOZ), developed by **NASA Ozone Science Team**, is the most recent version of a series of BUUV (backscattered ultraviolet) total O₃ algorithms

V8TOz is currently used to generate operational products for **SBUV/2**, **GOME-2**, **OMI**, **OMPS** and **TOMS** at NOAA and NASA

The V8TOz makes retrievals of **total column ozone**, **reflectivity**, **volcanic sulfur dioxide**, **aerosol index**, and the output file includes error flags and retrieval efficiencies, residuals and sensitivities, and other parameters.

Introduction to V8TOz Algorithm

Three steps in V8TOz Algorithm:

Step 1:

Using a pair of wavelengths to derive reflectivity from 331 nm and ozone from 318nm by using radiative transfer look-up tables. (Given an initial guess ozone, through an iterative process, to make the measured radiances equal to or close to the calculated ones for the estimates)

Step 2:

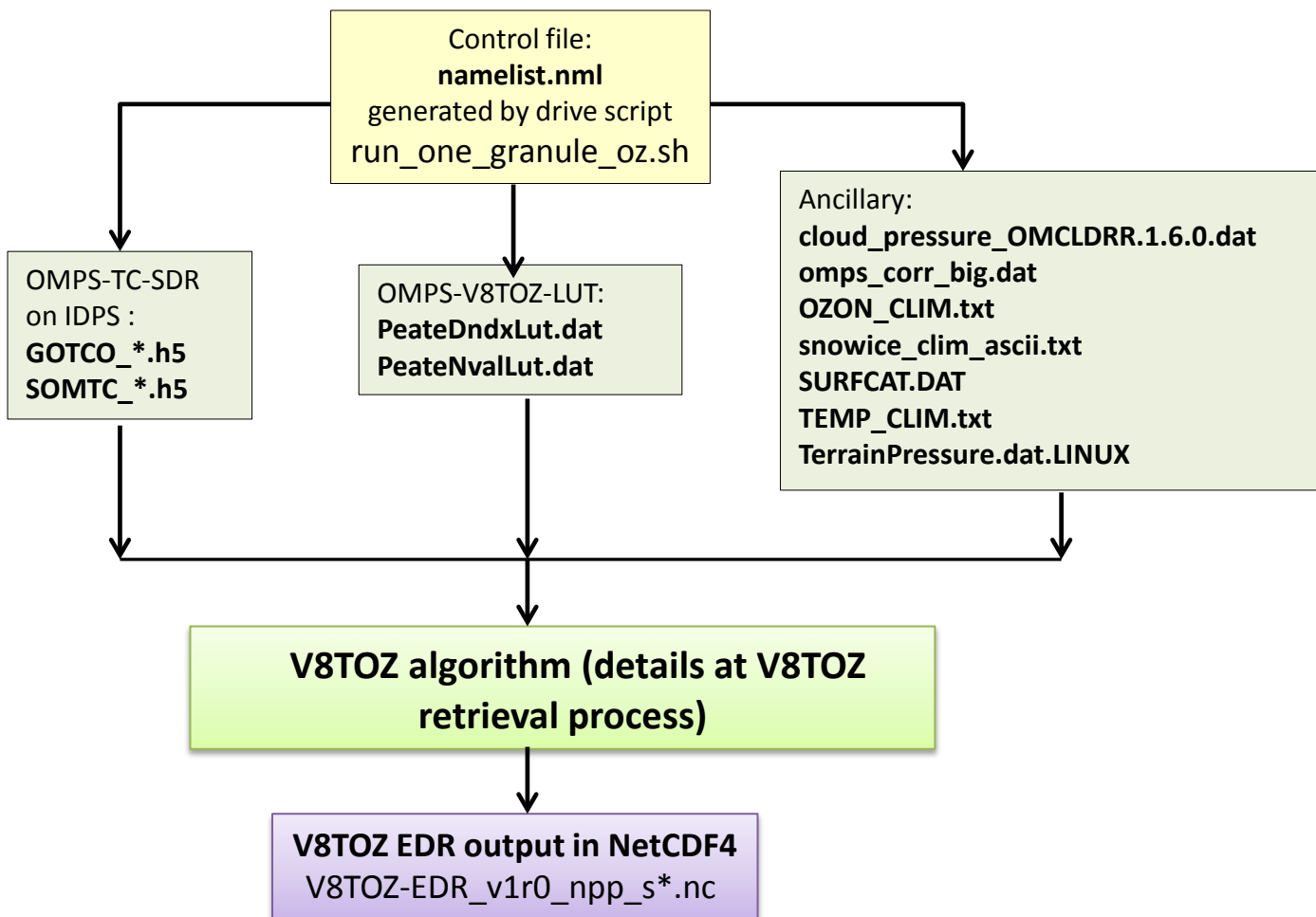
Ozone and temperature climatologies are applied at all levels to account for seasonal and latitudinal variations in profile shape.

Step 3:

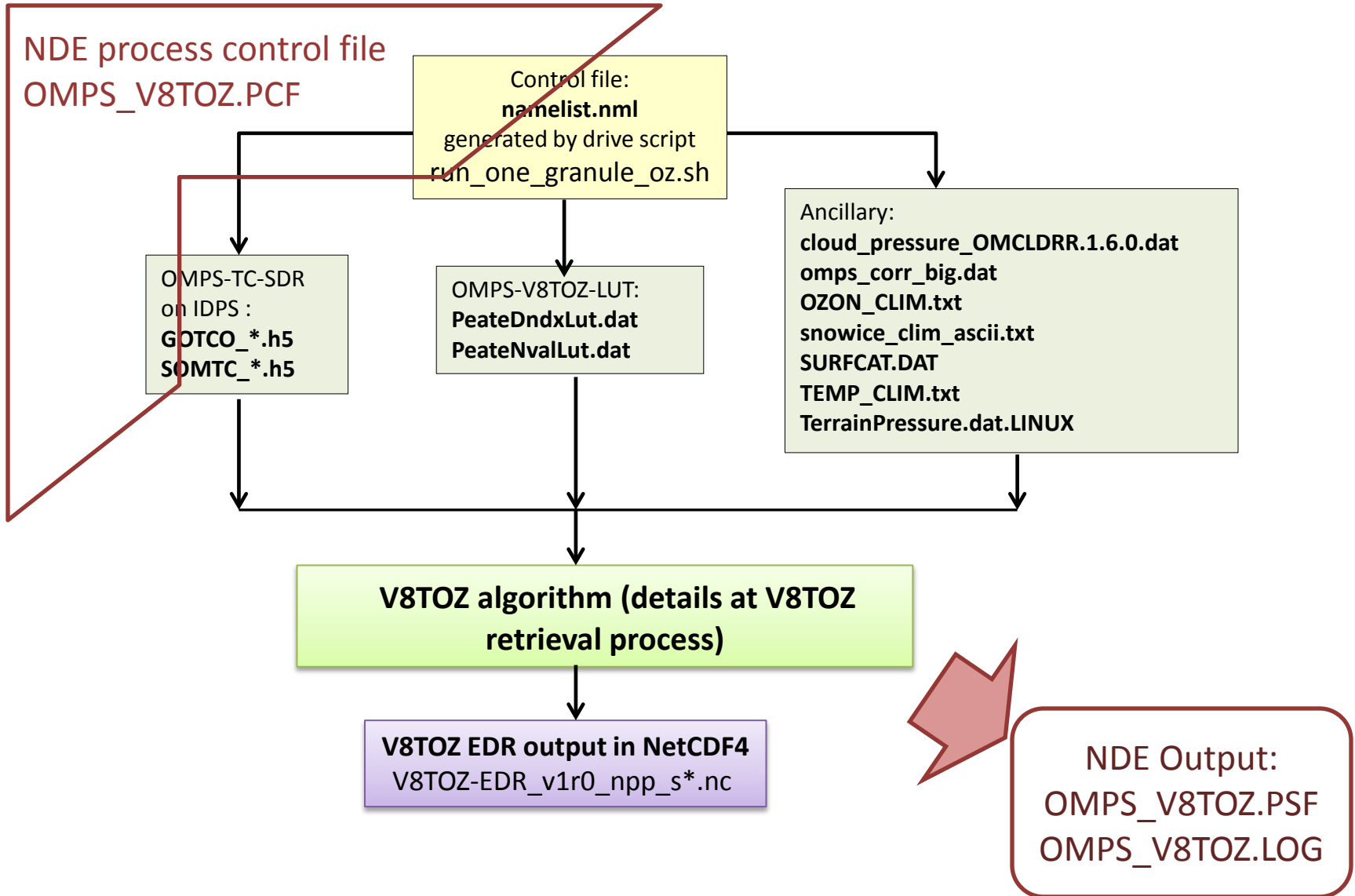
Correct step 2 ozone for wavelength dependence effects, such as tropospheric aerosol, sun glint, and local upper level profile shape effects.

J1 Implementation of V8TOz on NDE

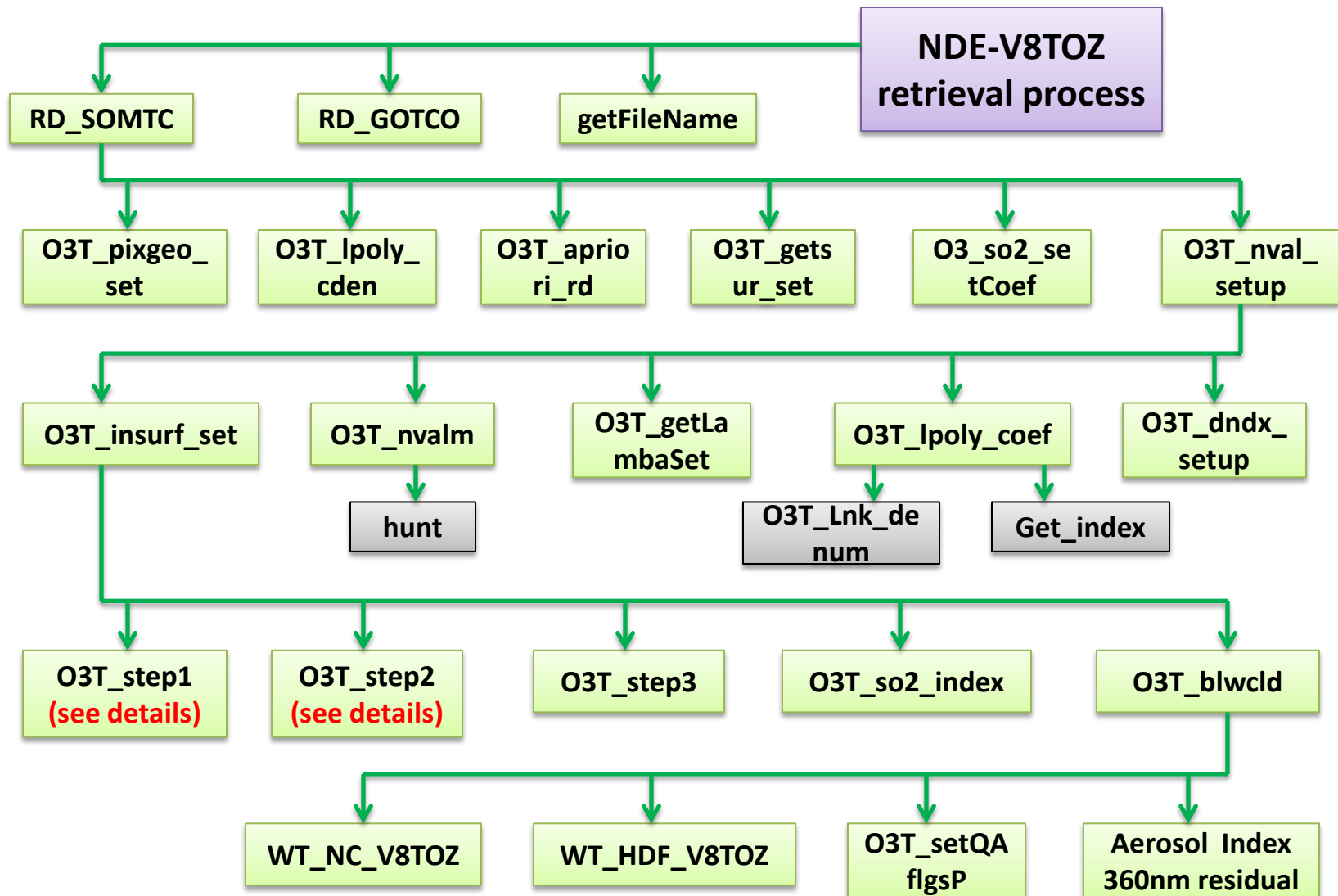
---- Deliver entire package of V8TOz to NDE



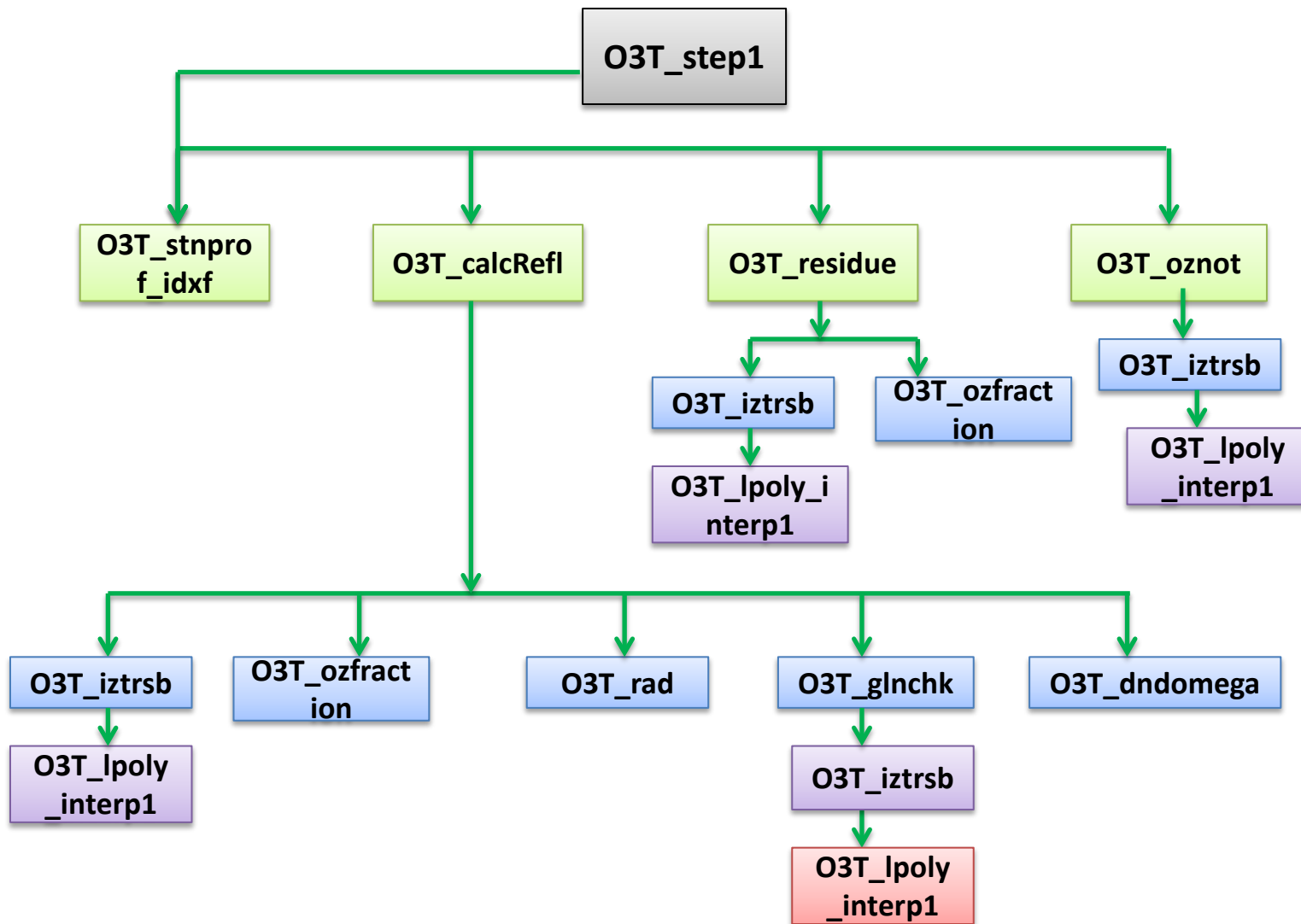
J1 Implementation of V8TOZ on NDE



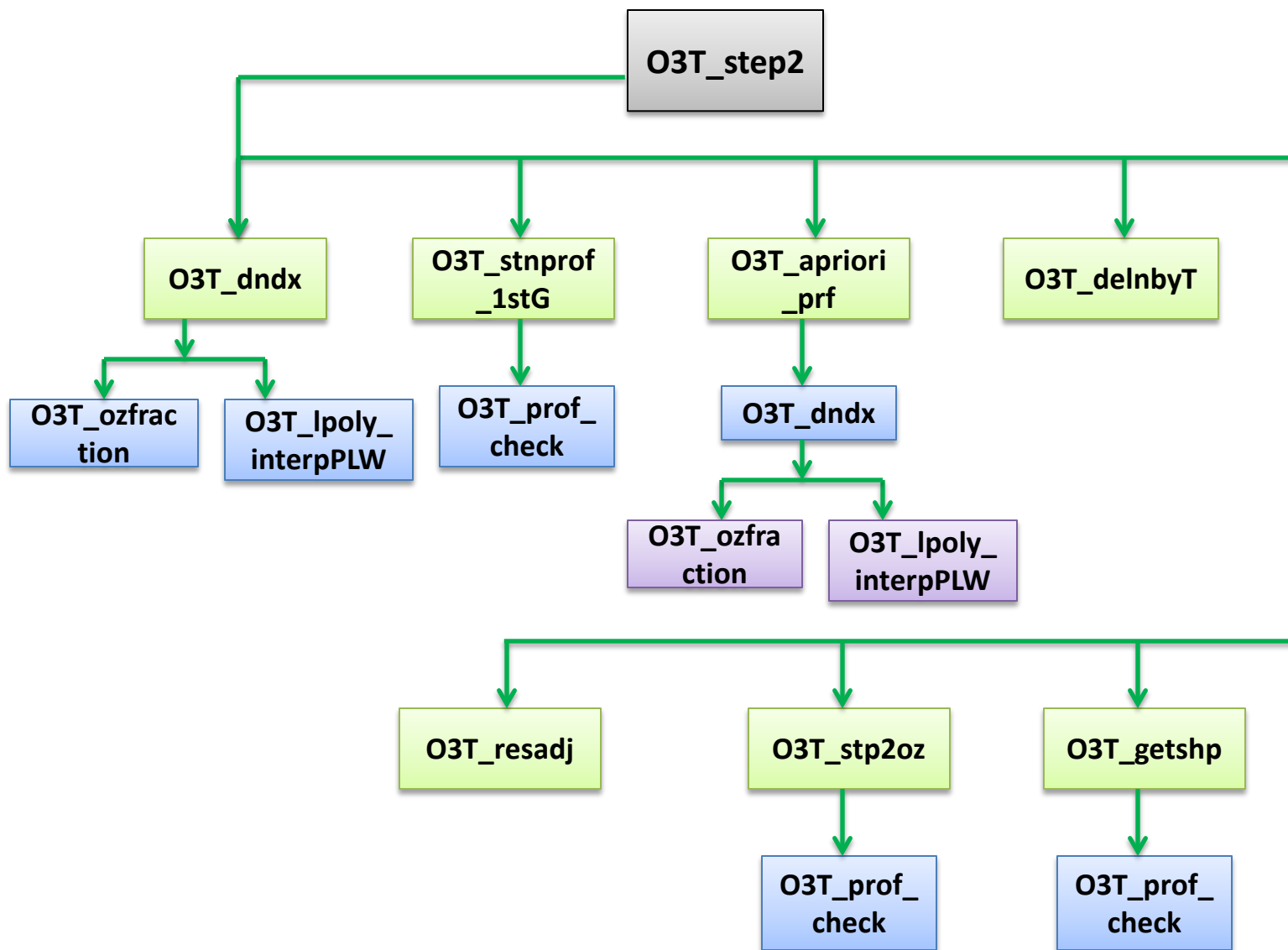
J1 Implementation of V8TOz on NDE



J1 Implementation of V8TOz on NDE



J1 Implementation of V8TOz on NDE



Soft Calibration Adjustments

The main purpose of soft-calibration:

- Remove bias between the retrieved total ozone and a “truth” data set.
- Remove the systematic cross-track bias in ozone, reflectivity and aerosol index.

The procedure of soft-calibration:

- 1) Determine $\Delta\Omega$ and ΔR , the bias of retrieved total ozone and reflectivity related to cross-track positions
- 2) Calculate N-Value adjustments for ozone(318nm) and reflectivity(331nm), using N-Value sensitivity to ozone and reflectivity

$$\Delta N_{(318)} = \Delta R * dN_{(318)}/dR + \Delta\Omega * dN_{(318)}/d\Omega$$

$$\Delta N_{(331)} = \Delta R * dN_{(331)}/dR + \Delta\Omega * dN_{(331)}/d\Omega$$

- 3) For the rest of 10 channels, calculate the N-Value adjustments by averaging the adjusted step2 residuals from $\Delta\Omega$ and ΔR

$$\Delta N_{(wl)} = \text{mean}(\text{Step2Res}_{(wl)} - \Delta R * dN_{(wl)}/dR - \Delta\Omega * dN_{(wl)}/d\Omega)$$

Soft Calibration Adjustments

The data used for soft-calibration:

Jan. 11, 2016 to Jan. 19, 2016 OMPS V8TOz retrievals

(choosing 9 day's data because OMPS orbits will go back close to the same position after 9 day's run)

Region,

[lat(0N ~ 30N), lon(-180w ~ -45w)], [lat(0N ~ 30N), lon(45E ~ 180E)]

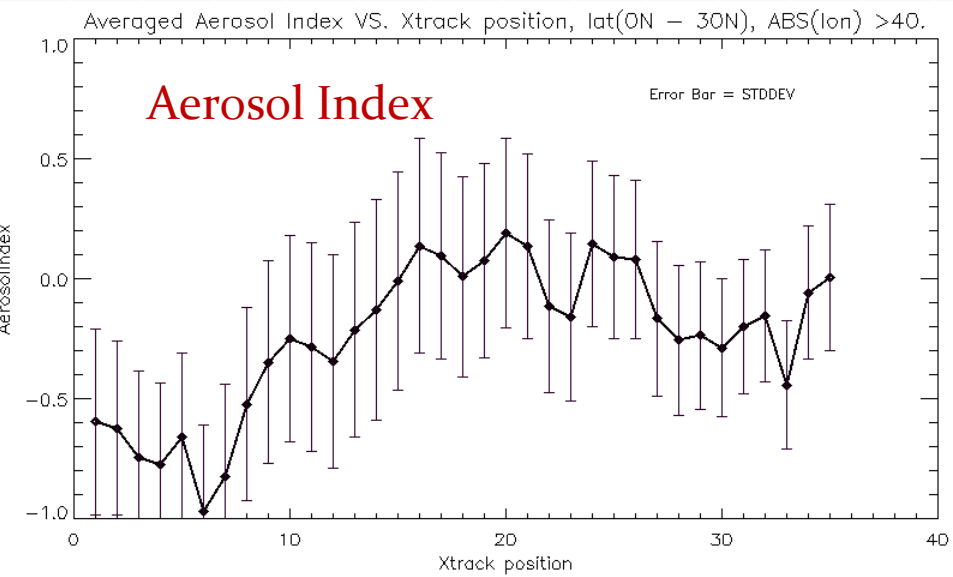
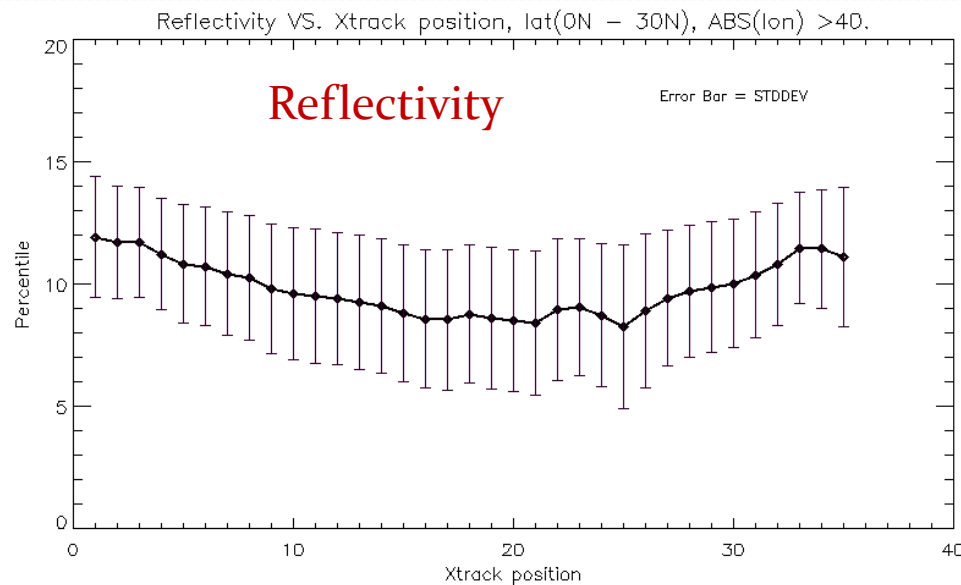
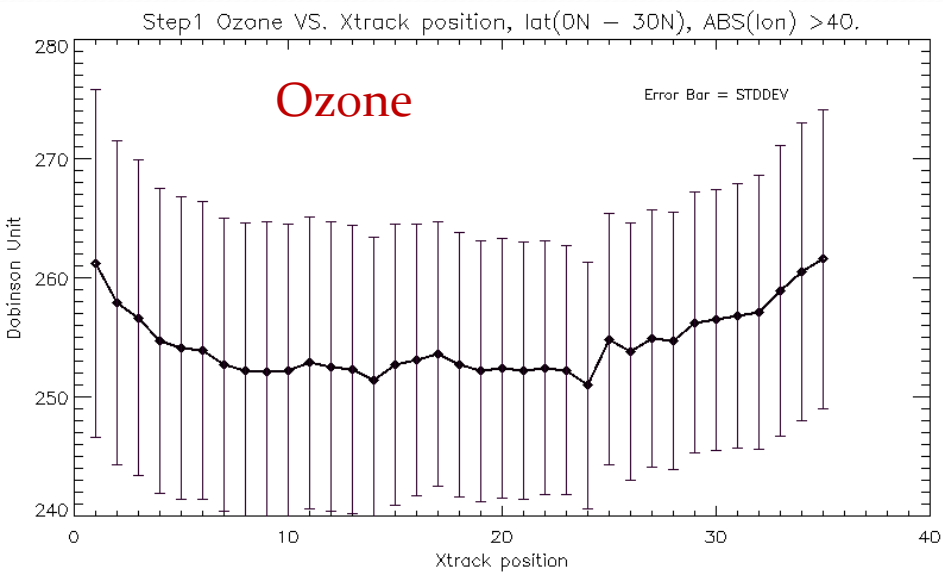
(to avoid potential contamination from sun glint and Sahara dust loading)

Pixels, cloud fraction < 0.1

(to avoid potential contamination from cloud)

Soft Calibration Adjustments(before)

Averaged Ozone, Reflectivity and Aerosol Index (01/11/2016-01/19/2016)

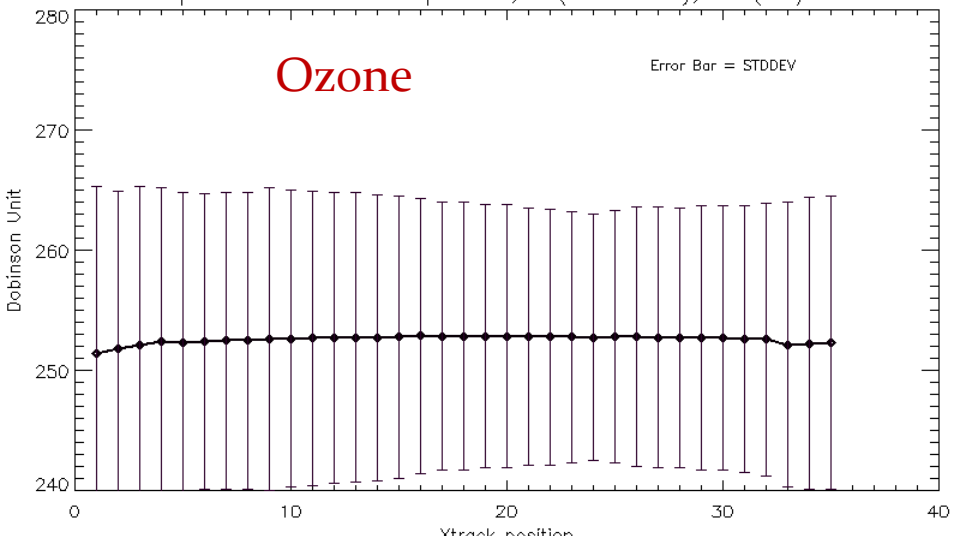


These cross-track bias are from:
instrument
measurements
models
...

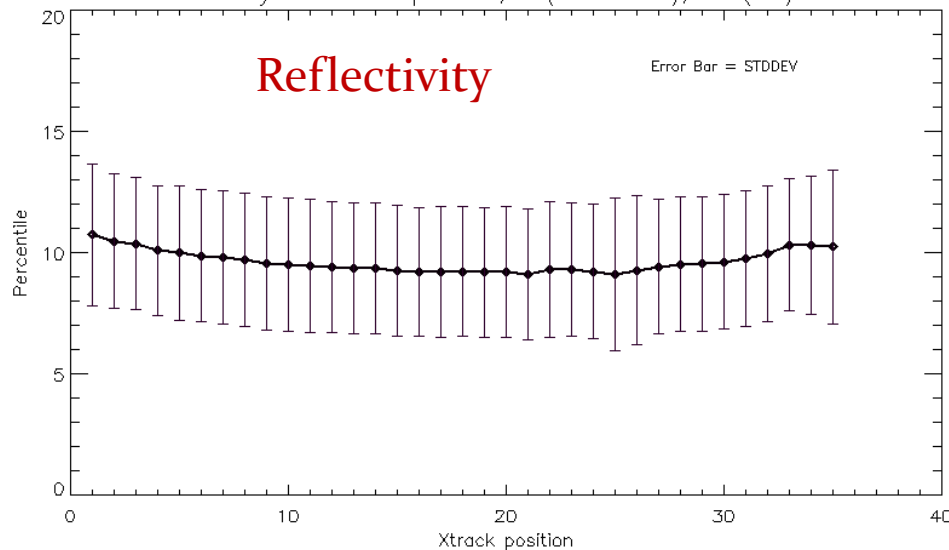
Soft Calibration Adjustments(after)

Averaged Ozone, Reflectivity and Aerosol Index (01/11/2016-01/19/2016)

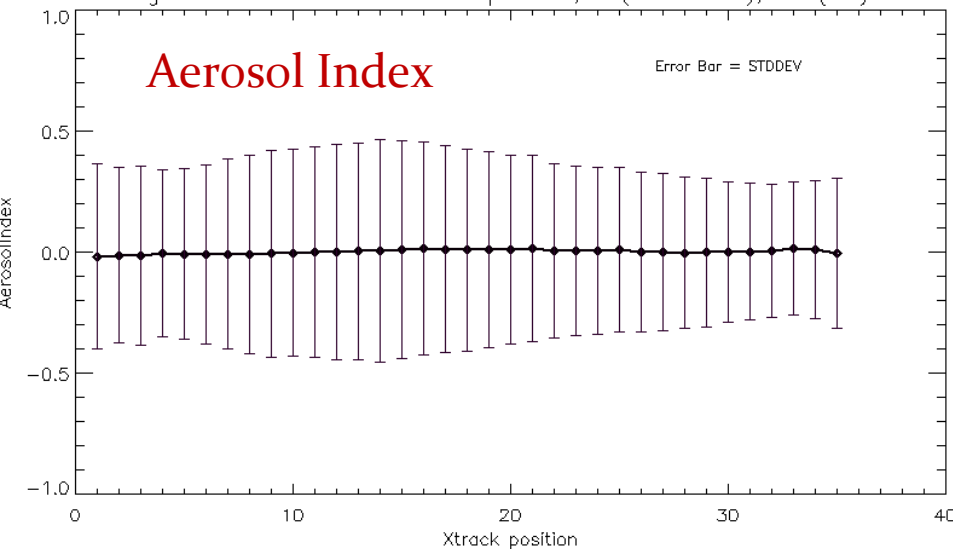
Step1 Ozone VS. Xtrack position, lat(0N - 30N), ABS(lon) >40.



Reflectivity VS. Xtrack position, lat(0N - 30N), ABS(lon) >40.



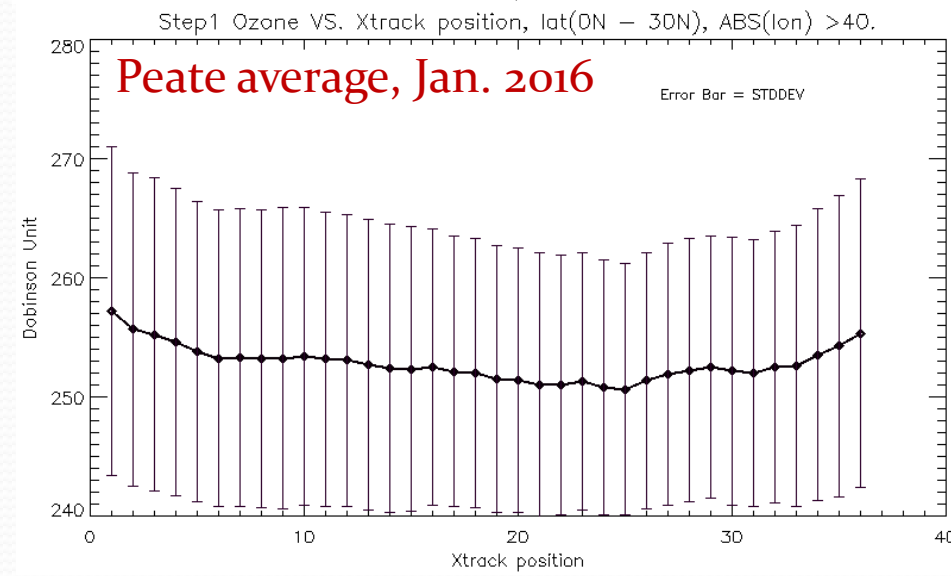
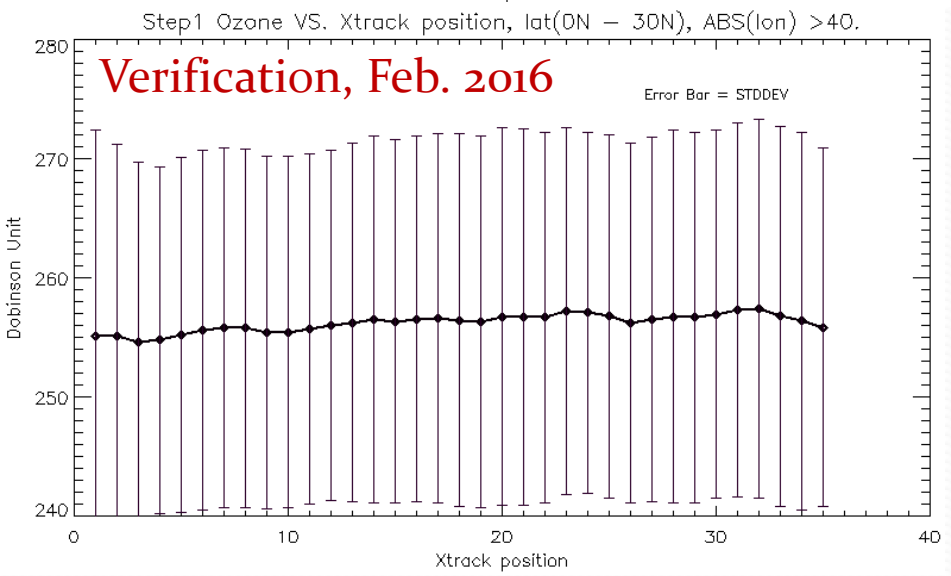
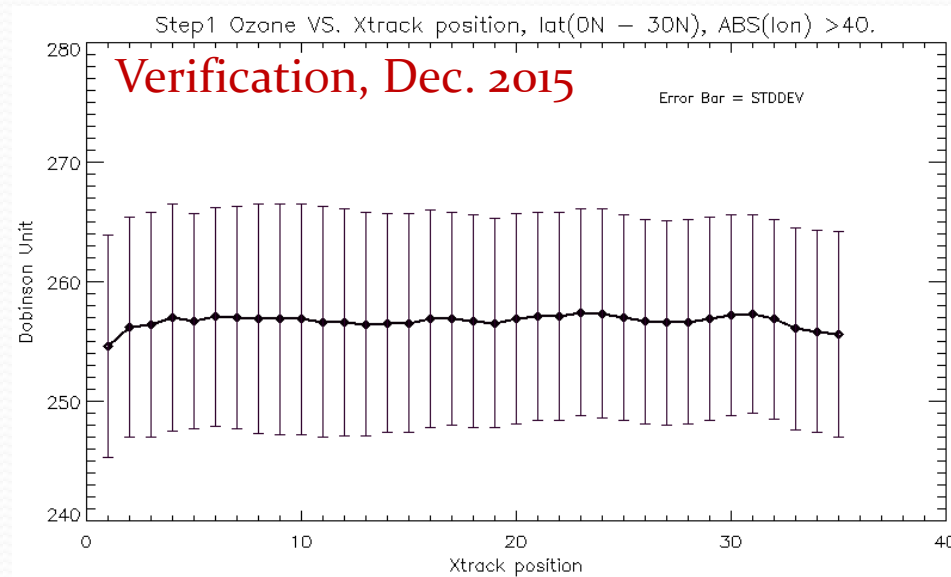
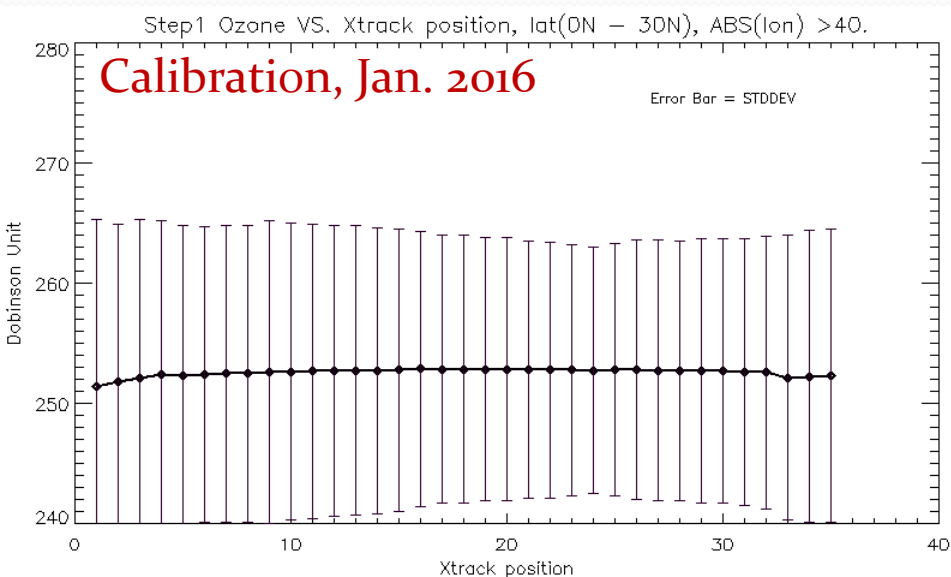
Averaged Aerosol Index VS. Xtrack position, lat(0N - 30N), ABS(lon) >40.



Cross-track bias are mostly removed from our first adjustment, we can make even flatted through second or third calibration...

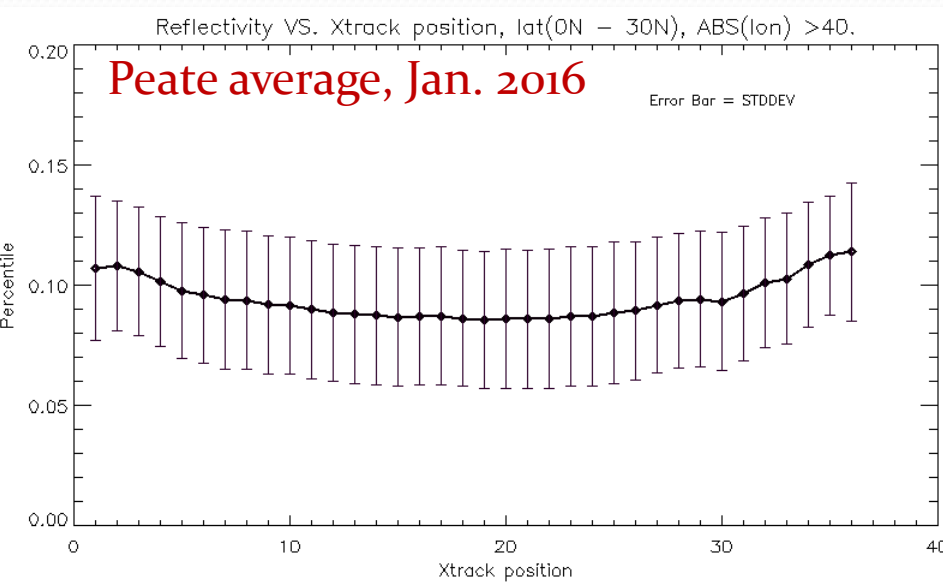
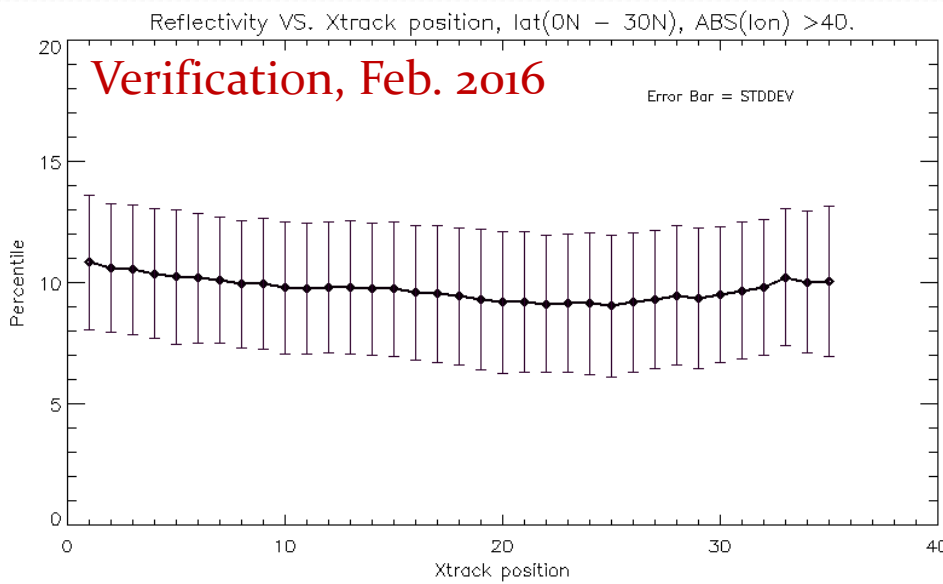
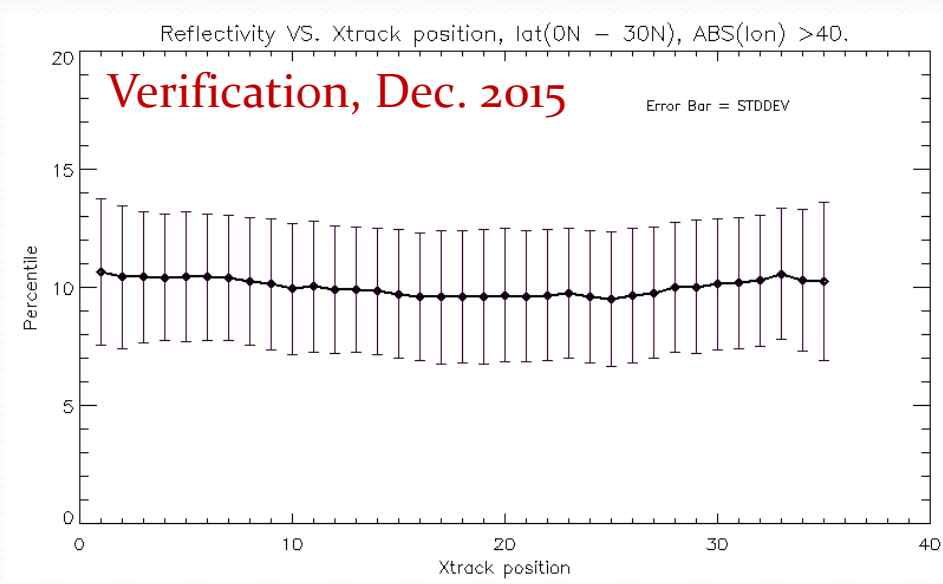
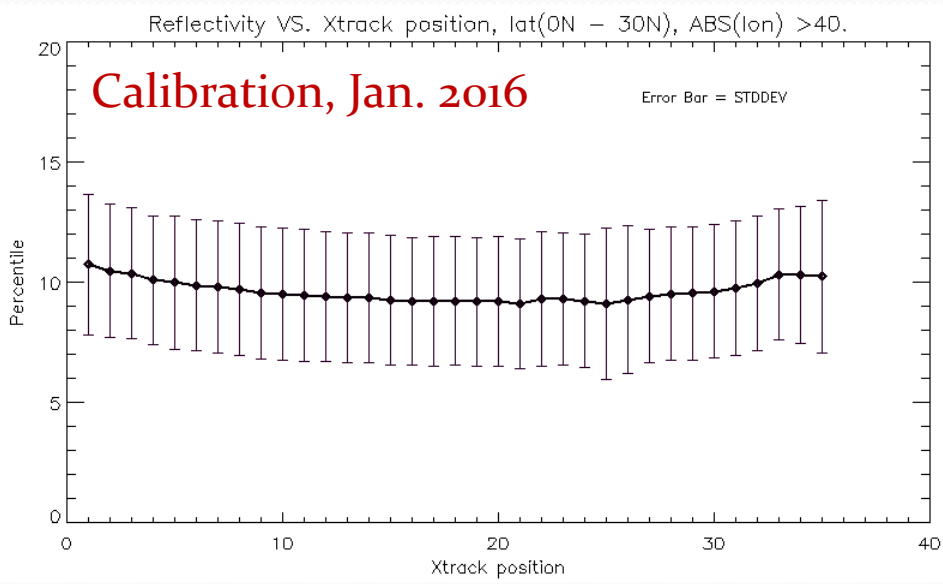
Soft Calibration Adjustments

Independent verification and comparison (step1 ozone)



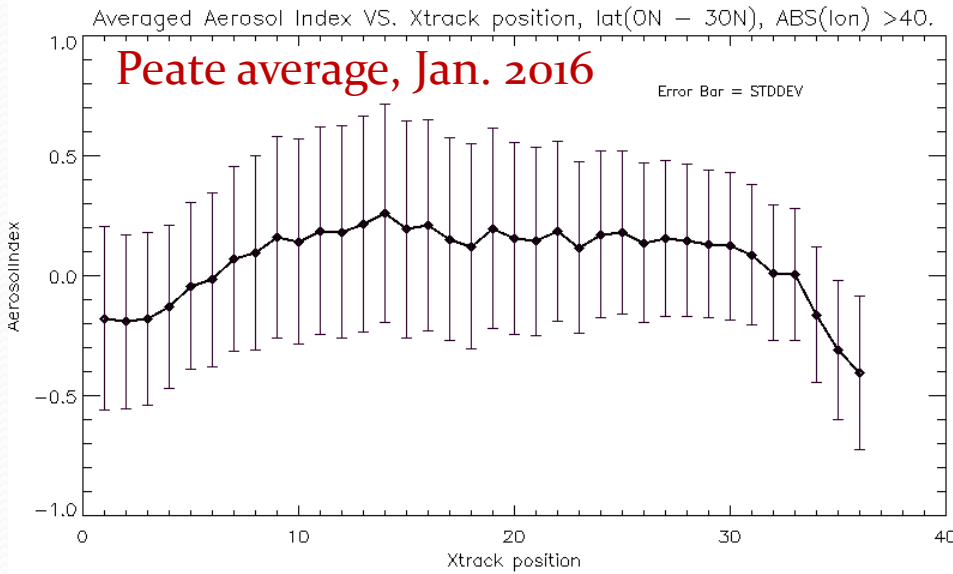
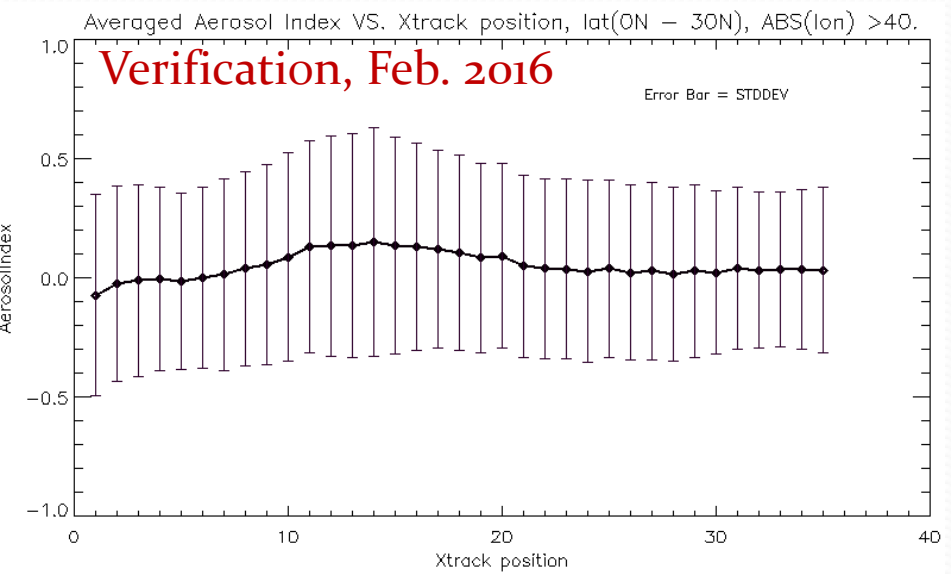
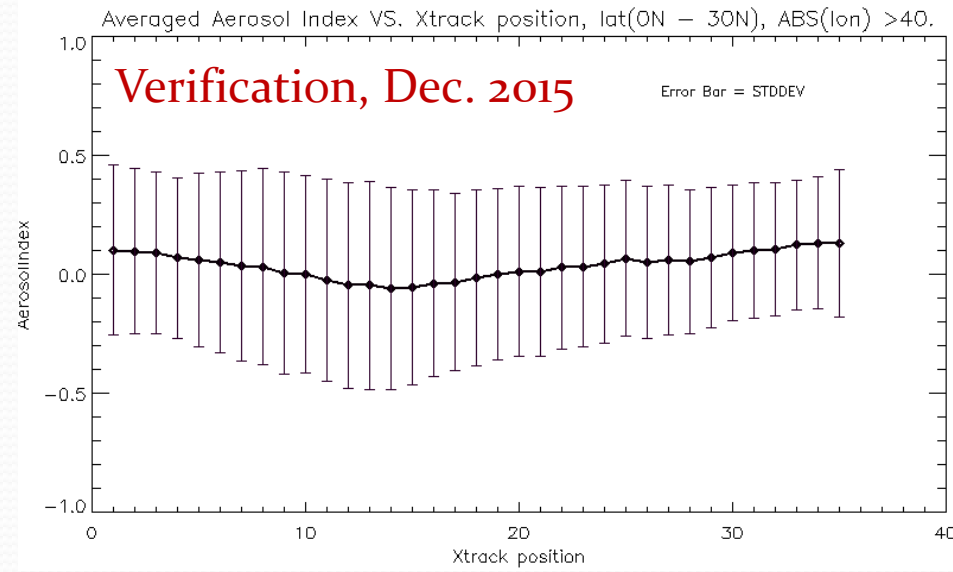
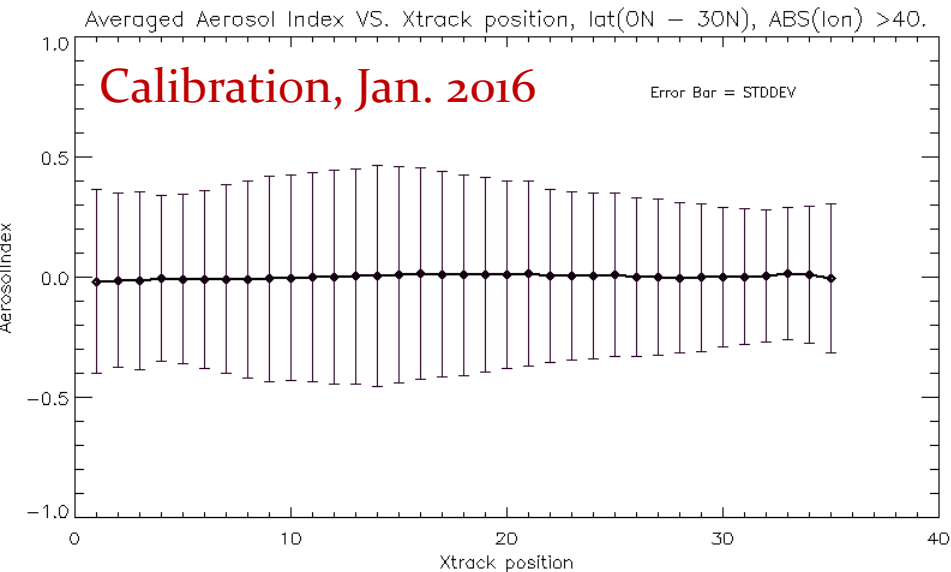
Soft Calibration Adjustments

Independent verification and comparison (**reflectivity**)



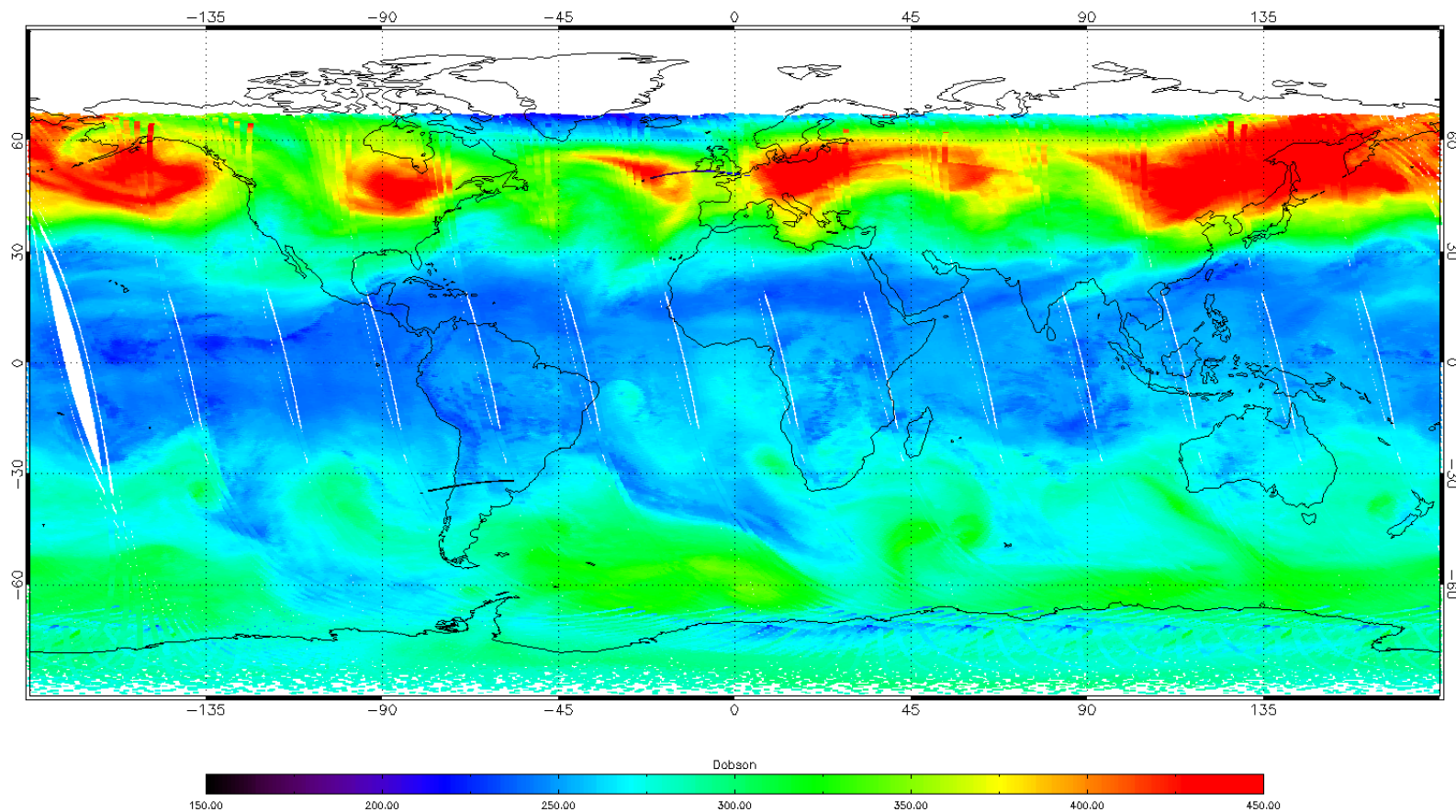
Soft Calibration Adjustments

Independent verification and comparison (**Aerosol Index**)



Products and Applications

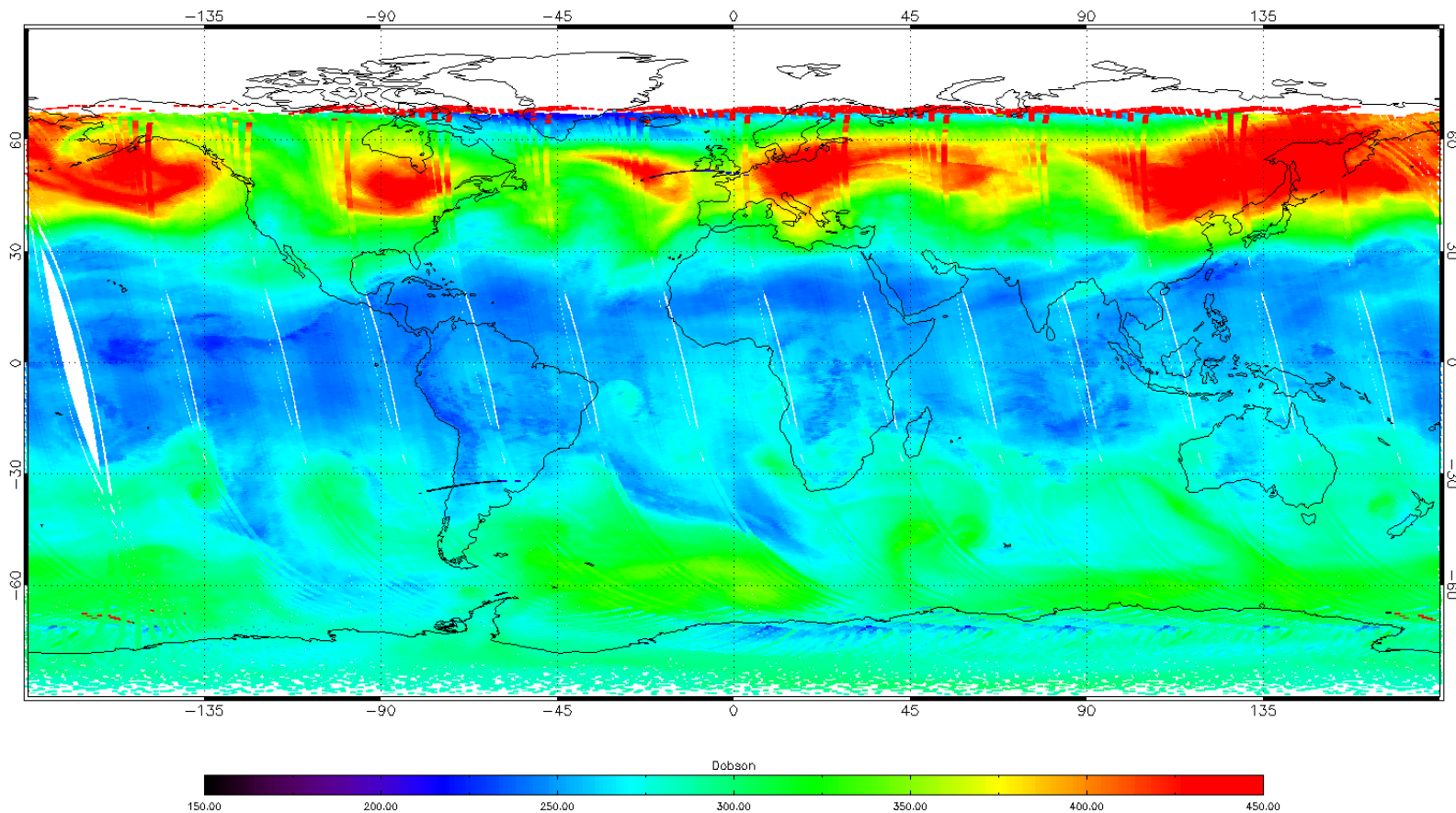
V8TOZ Total Column Ozone after Soft-Calibration, NOAA 20160117



Retrieved Total Column Ozone **after** Soft-Calibration

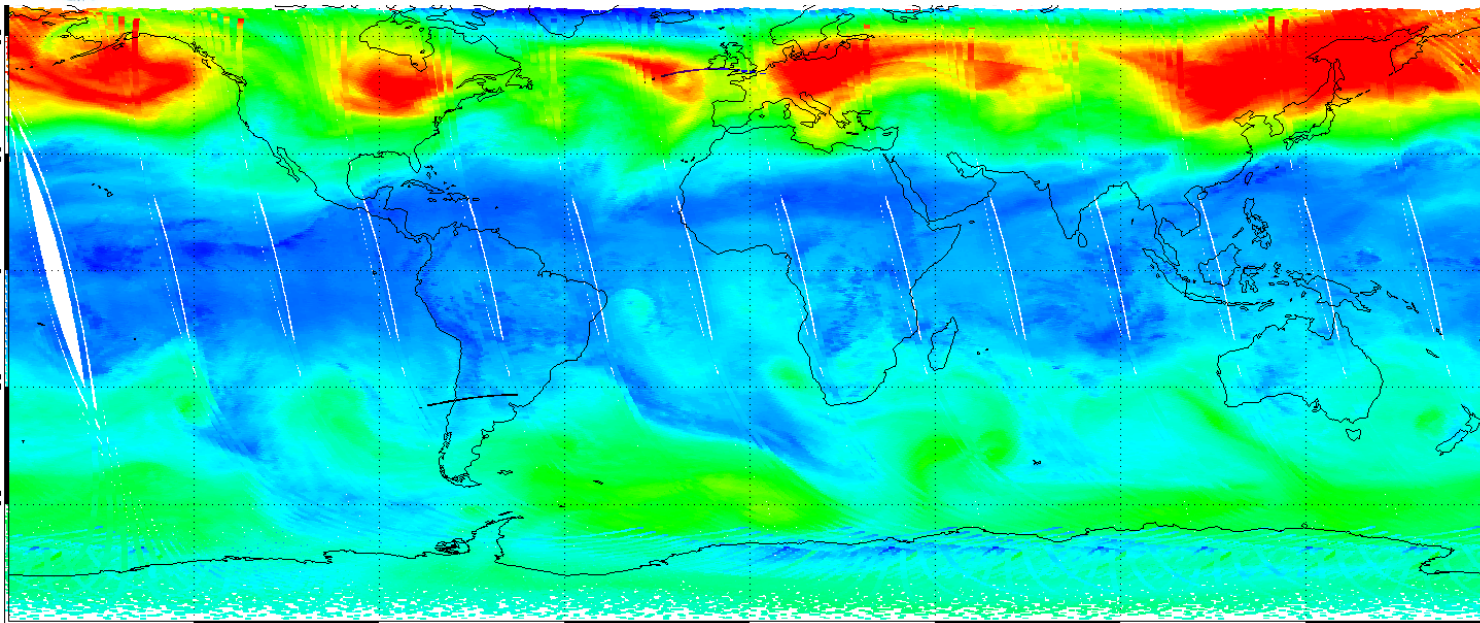
Products and Applications

V8TOZ Total Column Ozone without Soft-Calibration, NOAA 20160117

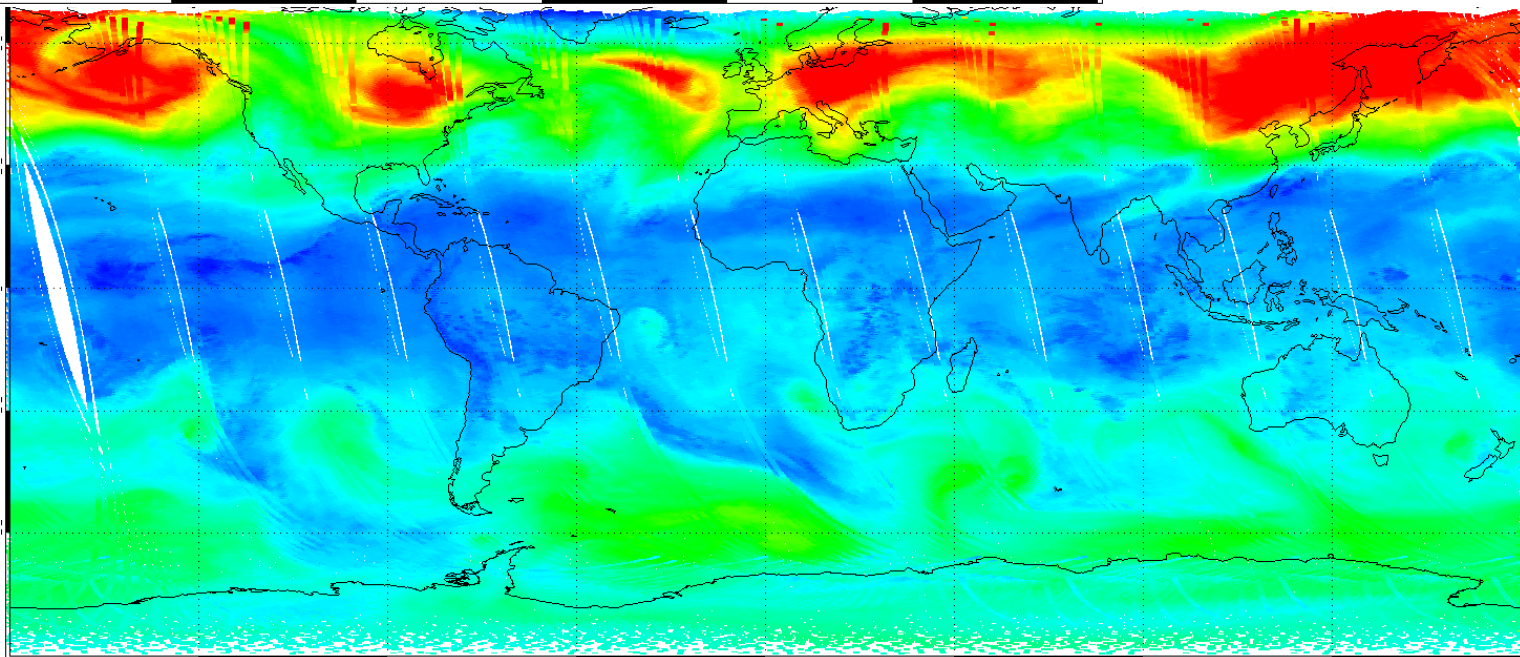


Retrieved Total Column Ozone **without** Soft-Calibration

Products and Applications



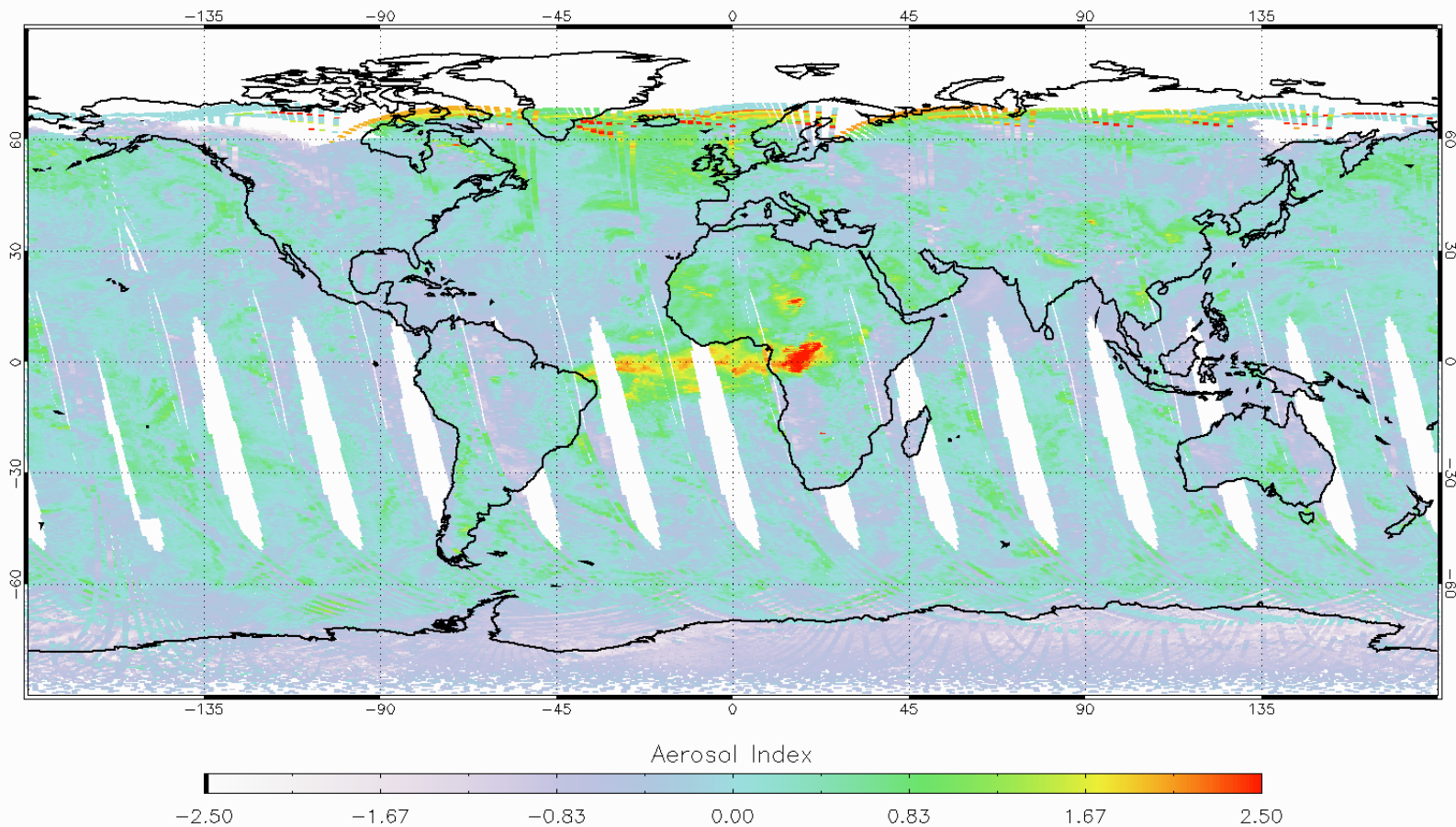
NDE OMPS
OZONE



PEATE OMPS
OZONE

Products and Applications

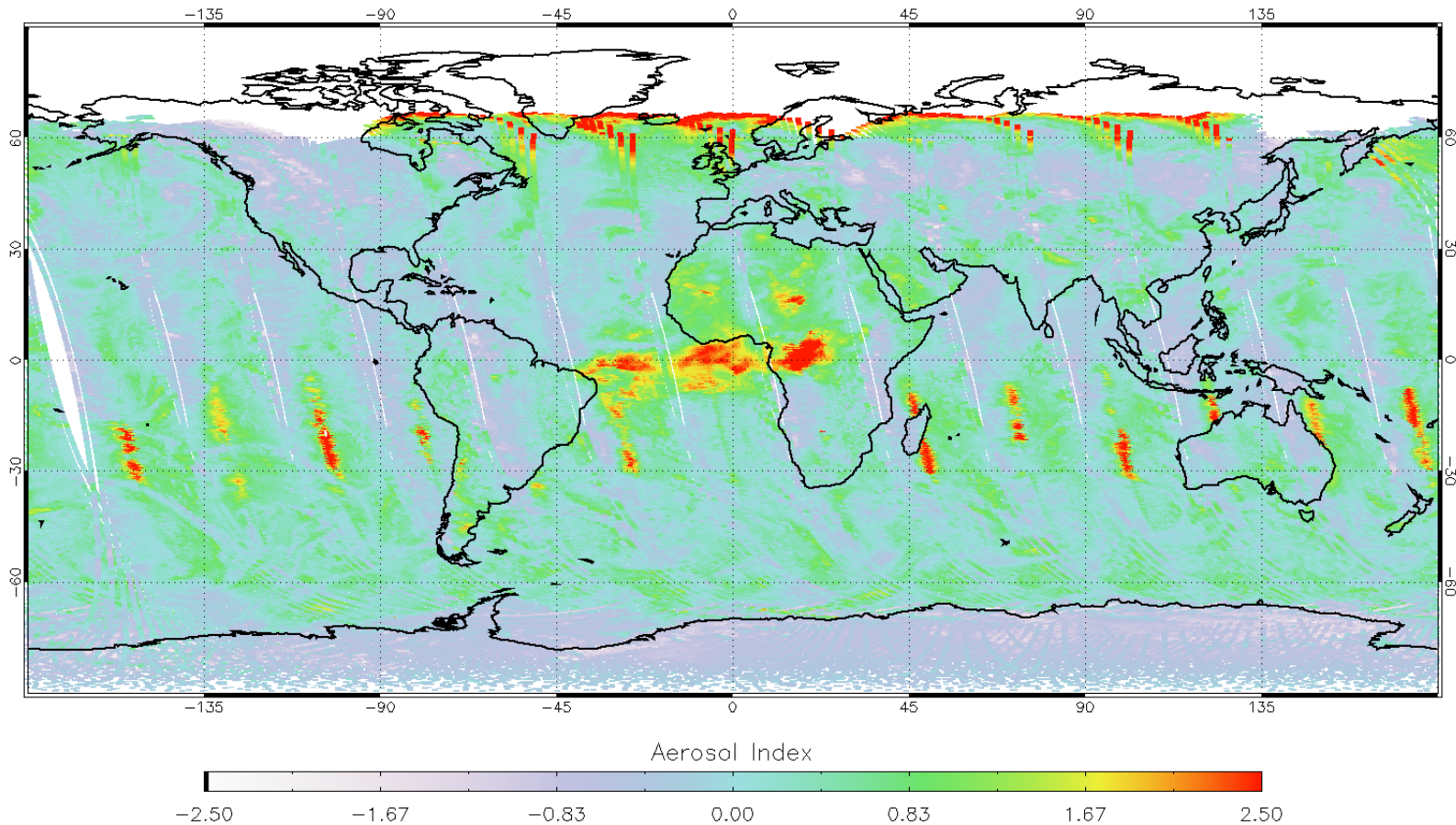
NDE, OMPS-V8toz Aerosol Index, 20160111



Daily Retrieved Aerosol Index from **NDE OMPS**

Products and Applications

PEATE, OMPS-V8toz Aerosol Index, 20160111



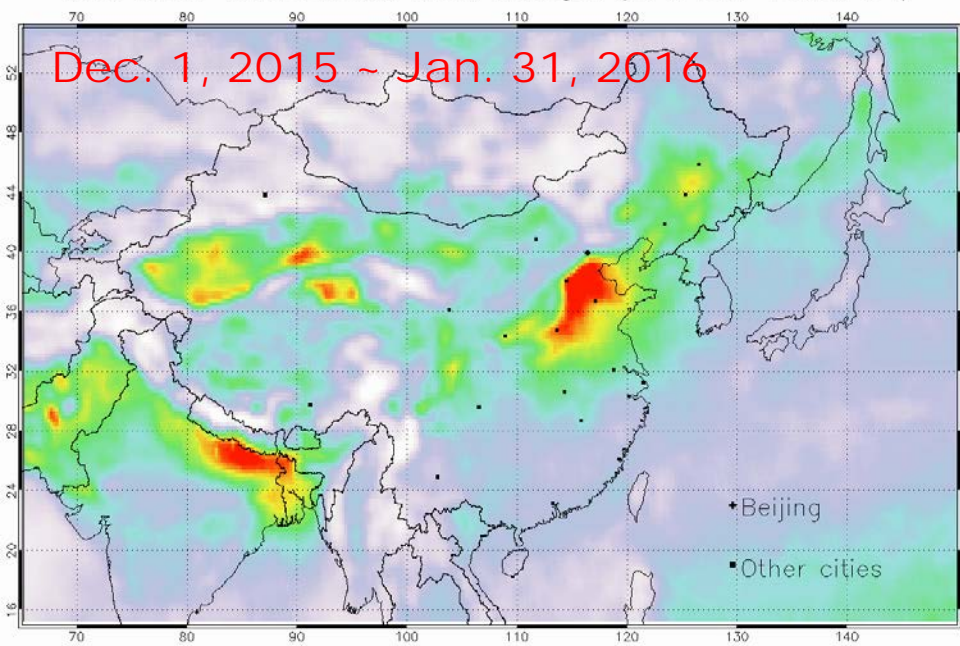
Daily Retrieved Aerosol Index from **PEATE OMPS**

Products and Applications

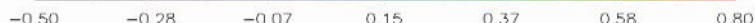
Haze in China



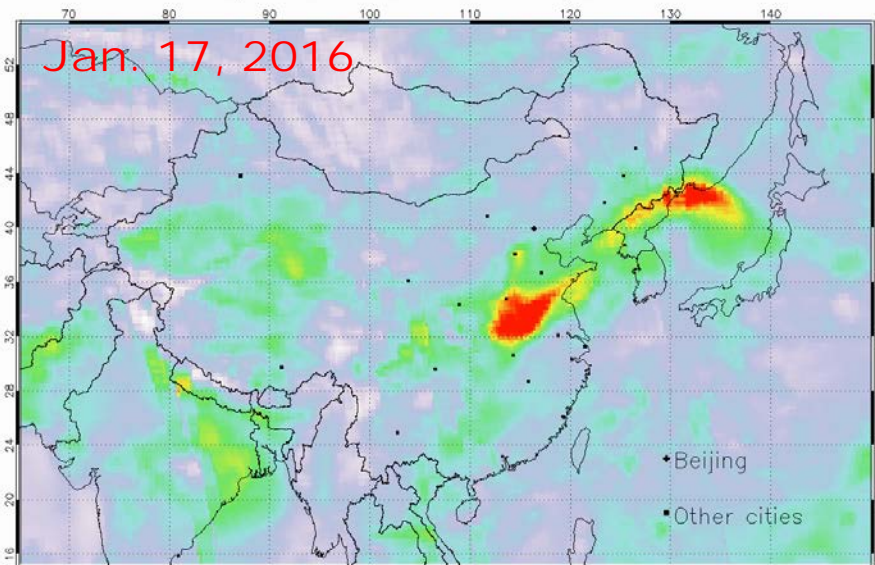
NDE, OMPS-V8toz Aerosol Index, averaged (20151201-20160131)



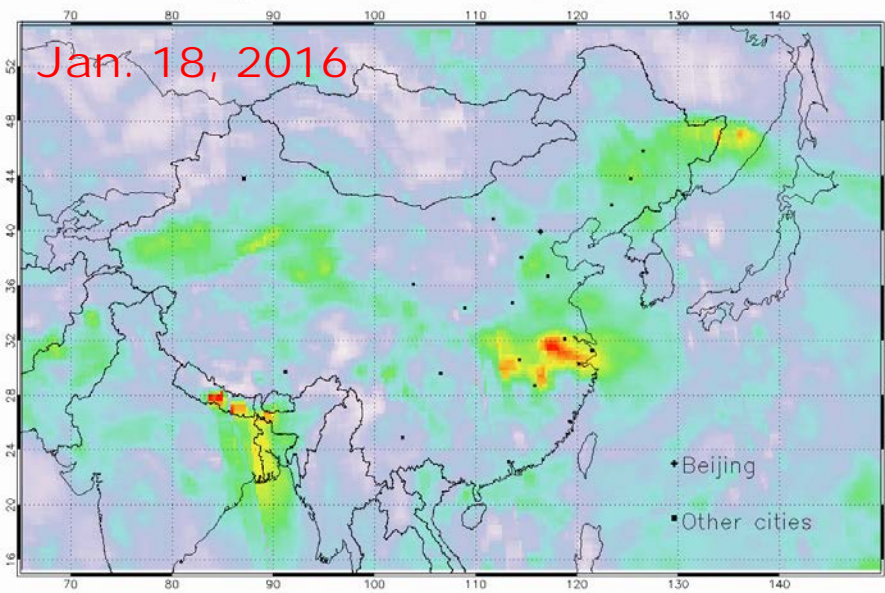
Aerosol Index



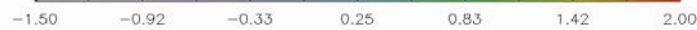
NDE, OMPS-V8toz Aerosol Index, 20160117



NDE, OMPS-V8toz Aerosol Index, 20160118

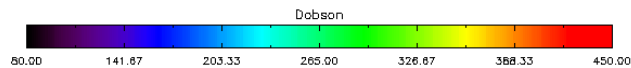
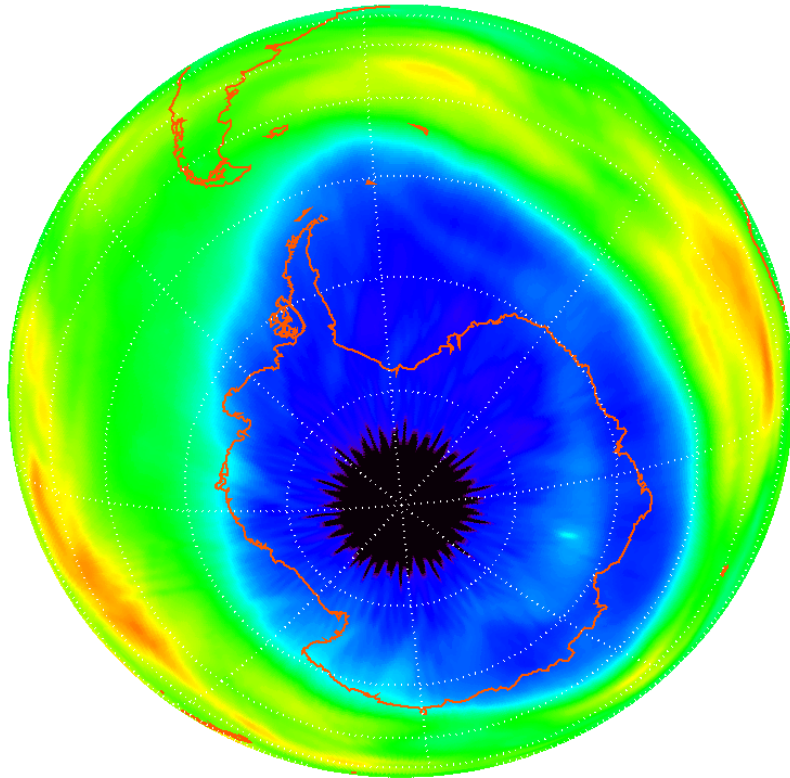


Aerosol Index



Products and Applications

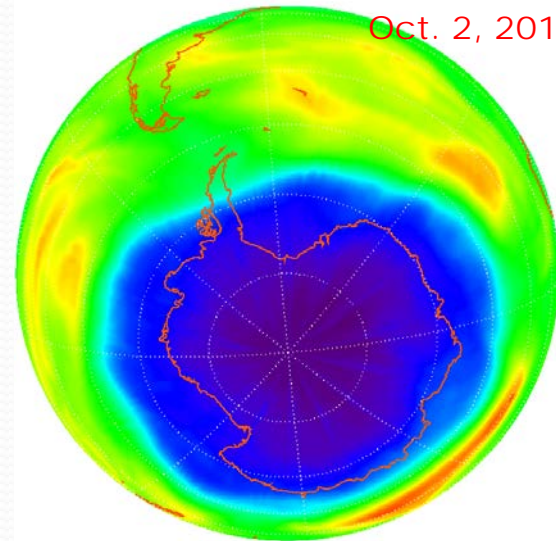
NDE, OMPS-V8TOZ OZONE 20150917



Daily Ozone Hole Changes in 2015

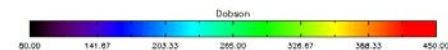
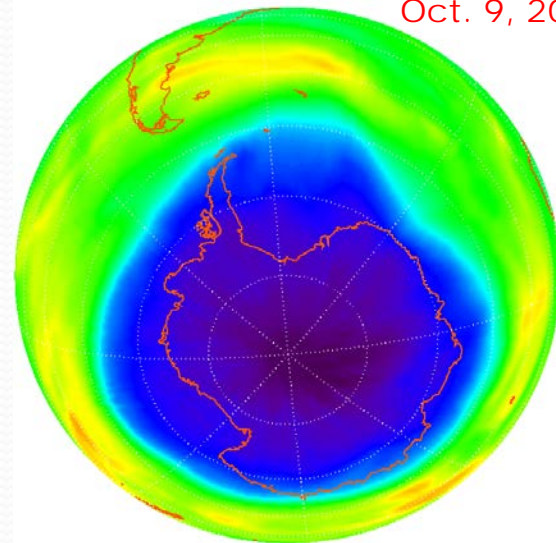
NDE, OMPS-V8TOZ OZONE 20151002

Oct. 2, 2015



NDE, OMPS-V8TOZ OZONE 20151009

Oct. 9, 2015





OMPS Product Monitoring at the ICVS

OMPS Product Demonstration Site

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Aug. 9, 2016

OMPS Product Demo Site URL:

<http://www.star.nesdis.noaa.gov/icvs/prodDemos/index.php>

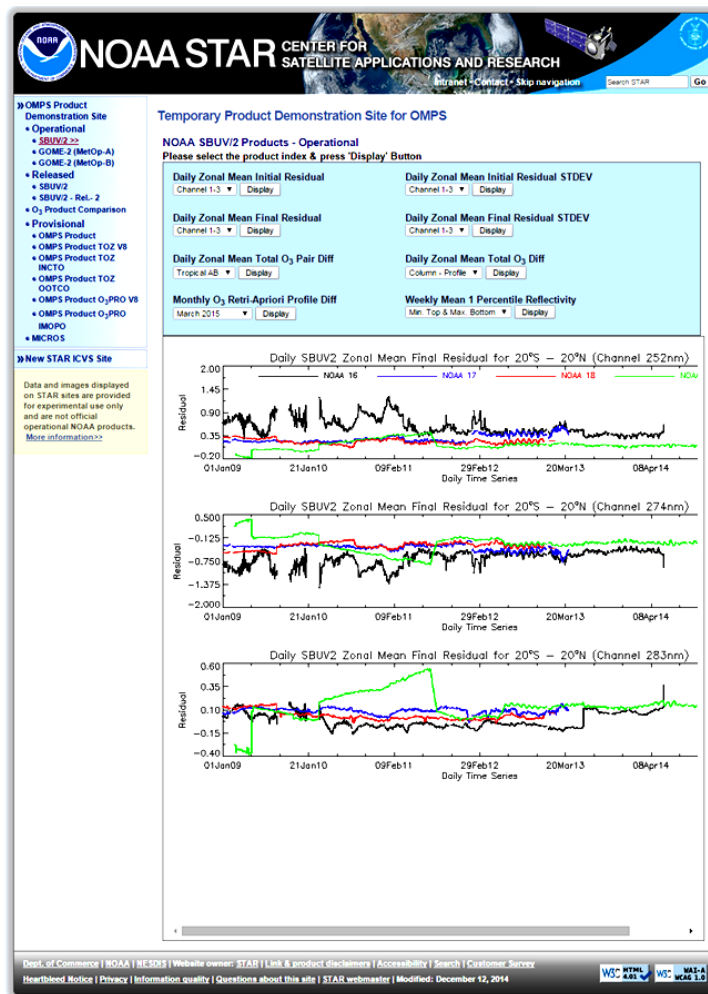
General Characteristics of site:

- Depicts performance of OMPS, GOME-2 and SBUV/2 instruments.
- Updated daily, weekly, or monthly depending upon the type of plot.
- Navigable via menu on left side of page. Pull down menus are available for most plot types to select previous time periods.
- Site is in process of being redesigned and relocated.

A screenshot of the NOAA STAR website. The header features the NOAA logo and the text "NOAA STAR CENTER FOR SATELLITE APPLICATIONS AND RESEARCH". Below the header is a navigation bar with links for "Intranet", "Contact", and "Skip navigation", along with a search bar. The main content area is titled "Temporary Product Demonstration Site for OMPS" and contains a message about the site's purpose and location. A left sidebar menu lists various product categories such as "Operational", "Released", "Provisional", and "New STAR ICVS Site". The footer contains a disclaimer and a list of links for "Dept. of Commerce", "NOAA", "NEOSIS", "Web site owner: STAR", "Link & product disclaimers", "Accessibility", "Search", "Customer Survey", "Heartbleed Notice", "Privacy", "Information quality", "Questions about this site", "STAR webmaster", and "Modified: September 24, 2013".

SBUV/2 V8 Operational Performance

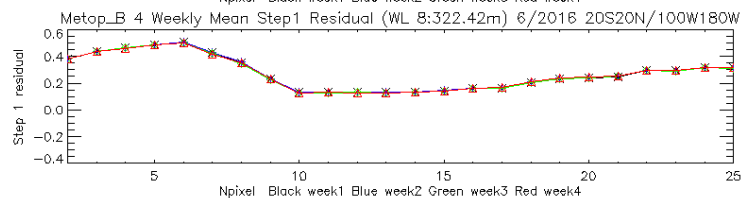
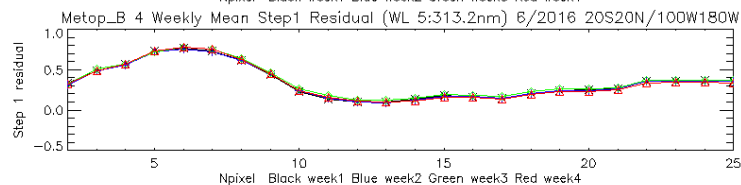
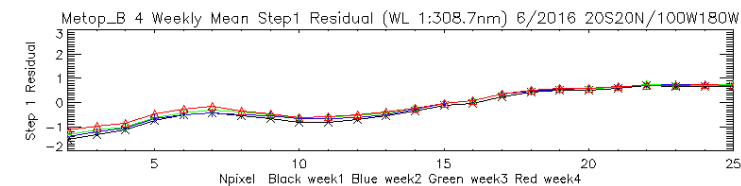
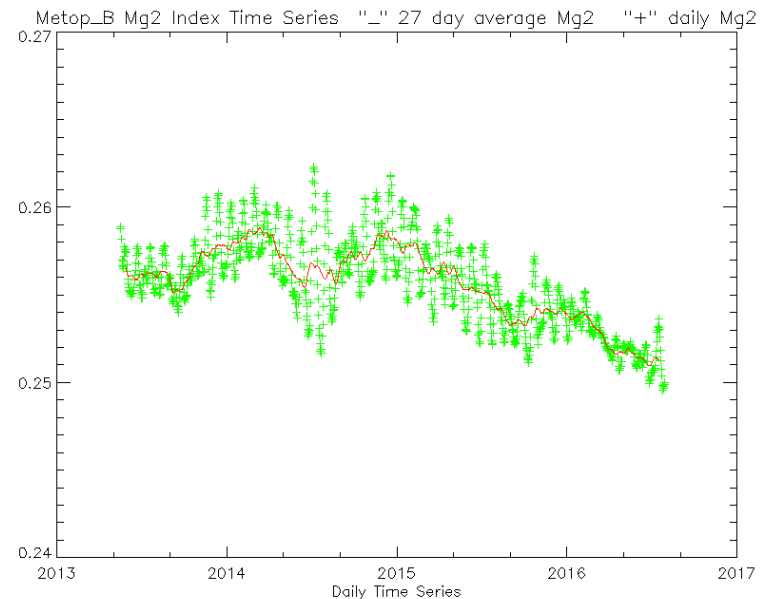
- SBUV/2 data products are monitored long term
- Parameters plotted include:
 - Daily zonal mean initial/final residual
 - Daily zonal mean initial/final residual standard deviation
 - Daily zonal mean total ozone pair difference
 - Monthly ozone retrieved a priori profile difference
 - Weekly mean 1-percentile reflectivity



GOME-2 V8 (Metop A/B)

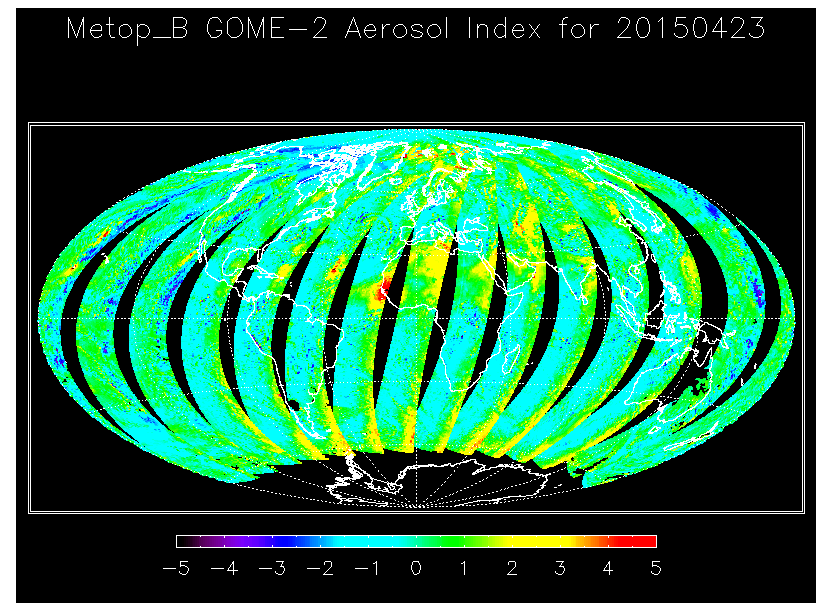
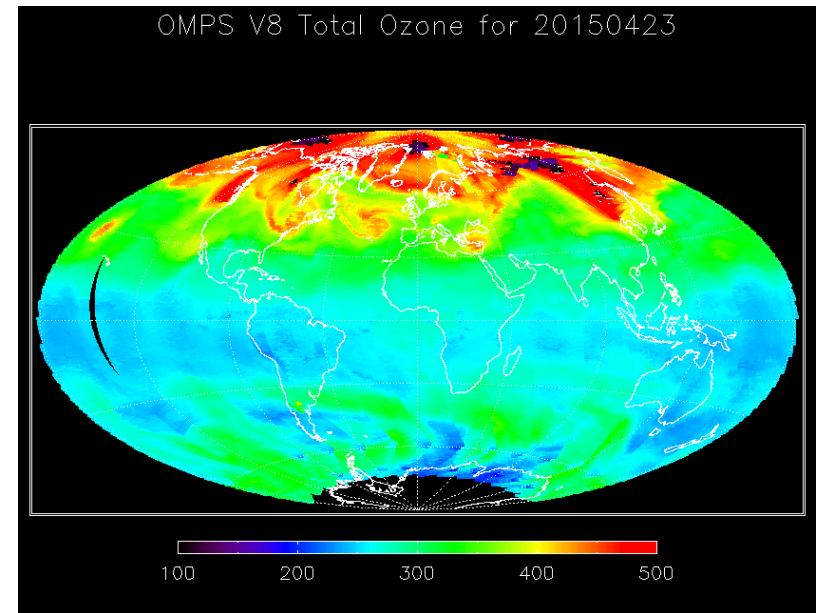
Parameters plotted include:

- Mg-II index
- Daily zonal mean total ozone, aerosol index, reflectivity, step 1 residual
- 4-Weekly mean total ozone, reflectivity, aerosol index, step 1 residual

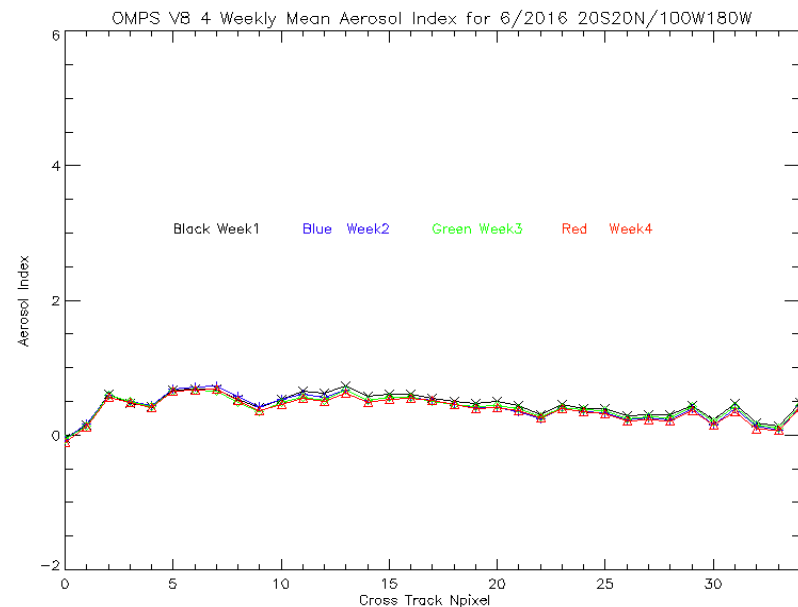
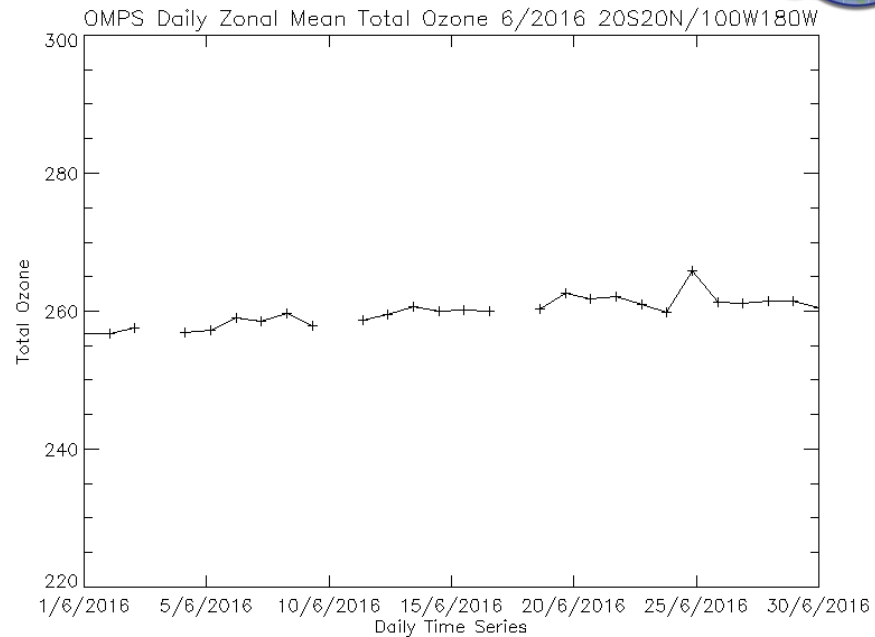


V8 OMPS, GOME-2, and OMI Maps

- Daily “postage stamp” images depicting total ozone, reflectivity, and aerosol index
- OMPS V8, INCTO, OOTCO, METOP A/B GOME-2, and OMI products are available

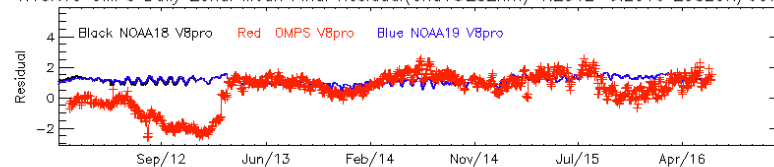


- Monitor the performance of the V8 ozone, reflectivity, and aerosol products
- Daily zonal mean and 4 weekly mean plots are available for each product

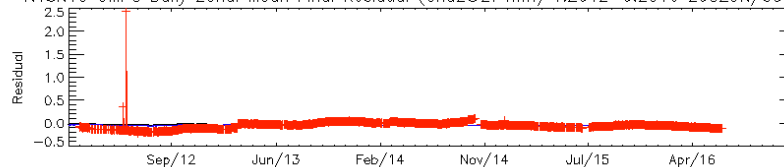


- Monitor the performance of the V8 profile product
- Plots produced:
 - Daily zonal mean initial/final residual
 - Zonal mean total column O₃ – profile O₃
 - Retrieved – A priori plots

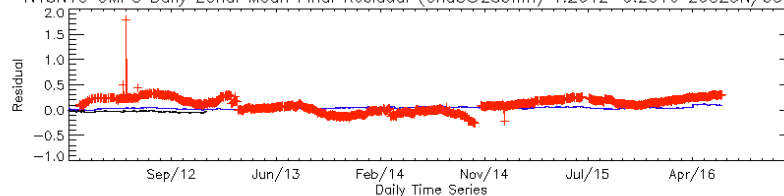
N18N19 OMPS Daily Zonal Mean Final Residual(Cha1@252nm) 1.2012–6.2016 20S20N/90W180W



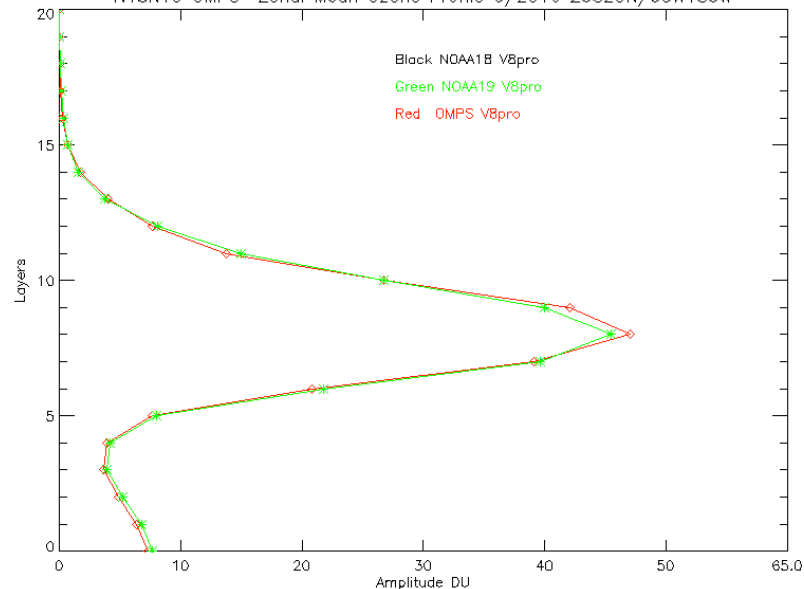
N18N19 OMPS Daily Zonal Mean Final Residual (Cha2@274nm) 1.2012–6.2016 20S20N/90W180W



N18N19 OMPS Daily Zonal Mean Final Residual (Cha3@283nm) 1.2012–6.2016 20S20N/90W180W



N18N19 OMPS Zonal Mean Ozone Profile 6/2016 20S20N/90W180W



New OMPS EDR Site Features

- Plots and images will have consistent projections, labels, fonts, and sizes
- Navigation improvements will include:
 - Parameters selected via pull down menu
 - Selectable dates or products via forward or reverse buttons. Also enable date selection via a calendar interface
 - For daily image products, animations can be produced

Conclusion

- V8TOz is a trusted algorithm for J1 instrument
- The delivery of V8TOz to NDE for J1 was successful
- V8TOz products have great value in environmental monitoring and research
- ICVS is a useful tool to monitor our ozone instruments and products



Thanks!