V8TOz and V8Pro Ozone Products at NOAA

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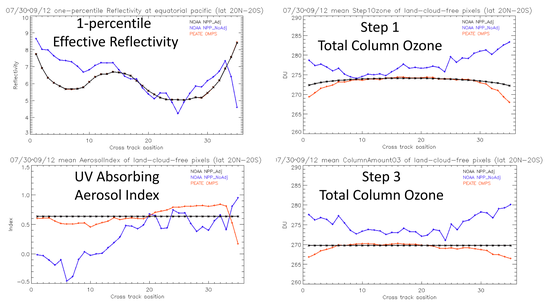
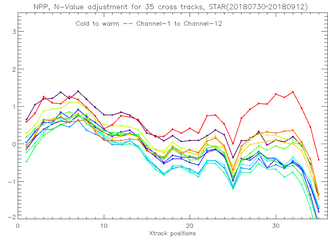
Introduction

V8TOz and V8Pro products from the S-NPP Ozone Mapping and Profiler Suite (OMPS) have been running on the NOAA NDE near-real-time system. However, due to a numbers of updates and changes to the Level 1 Sensor Data Records (SDRs), there are inconsistencies and biases in the operational products of daily global total ozone, nadir ozone profiles, UV reflectivity and aerosol indices. This poster will describe analysis to create soft-calibration adjustments of NOAA OMPS/S-NPP V8TOz and V8PRO products to remove internal inconsistencies, maintain stability over time, and to better agree with the NASA S-NPP OMPS products. The NASA products were adjusted to agree with the NOAA-18 SBUV/2 ozone products so the reprocessed products from V8TOz and V8Pro will provide users with a new, consistent component of the long-term climate data record extending from February 2012 to present. The adjustments will also be implemented in the forward processing on the operational NDE system.



OMPS V8TOz Soft-Calibration

NOAA OMPS/S-NPP V8TOz was adjusted to agree with NASA/V8TOz. The data used for this soft-calibration is from Jul/30, 2018 to Sep/12, 2018. The figures above show that, before soft-calibration, the one-percentile reflectivity, aerosol index and step1/step3 ozone vary significantly over 35 cross-track Fields of View. The natural "truth" ozone and aerosol patterns would be expected to show a flat averaged value dependence cross-track over a period time. So, this systematic cross-track bias has to be removed for high quality retrievals. The N-Value adjustments were calculated based on N-Value sensitivity to ozone and reflectivity(see figure below). The figure also shows that, after soft-calibration, the cross-track bias for the ozone and aerosol retrievals was mostly "leveled out", with reflectivity over equatorial Pacific showing sun-glint signals and high view angle effects.



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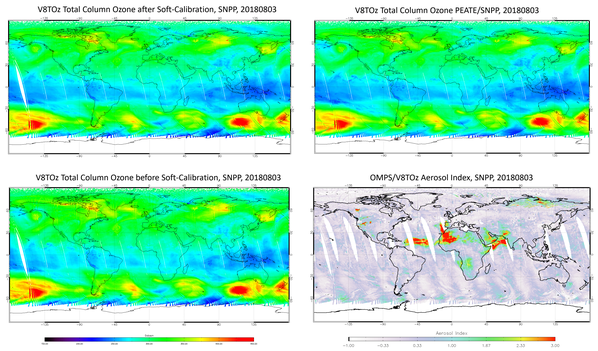
The figures below show OMPS V8TOz retrieved total column ozone and aerosol index values. There is apparent striping like structure in the global ozone retrieval before soft-calibration. This systematic cross-track related bias were completely gone in the retrievals when adjustments were put in the processing. The comparison between NASA processed OMPS ozone retrieval and NOAA processed OMPS ozone shows that the global total column ozone patterns are almost identical even though there are slightly difference in SDR and cross track positions.

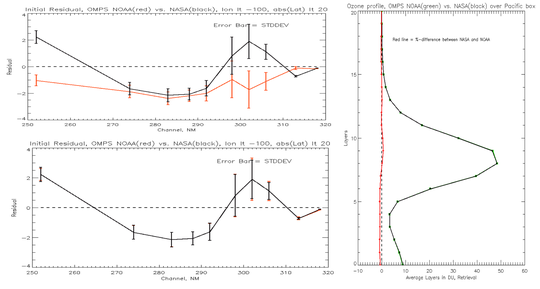


OMPS V8PRO Soft-Calibration

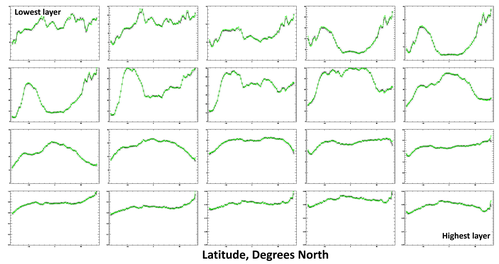
The NOAA OMPS/S-NPP NP V8Pro was adjusted to agree with the results for NASA Version2.6 OMPS/S-NPP NP V8Pro which had already been adjusted to NOAA-19 SBUV/2 and previous NOAA SBUV/2 series. 5 days' retrievals (03/18/2013- 03/22/2013) was selected to estimate calibration offsets and adjustments. The table below shows the averaged retrievals over Pacific box where we make statistical analysis before and after adjustments.

Averaged Retrievals over Pacific Box from OMPS-NPP V8PRO

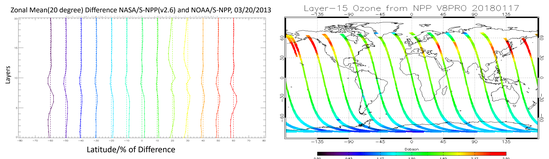
	NASA	NOAA/0-adj	NOAA/adj
Reflectivity	0.196	0.188	0.196
Step1-O3	250.60	254.62	250.60
Step2-O3	248.92	253.10	249.07
Step3-O3	246.99	251.58	247.17
Total-Profile	252.90	249.01	252.71
Aerosol-Index	0.71	0.55	0.71



The figures above compare the averaged initial residuals between NASA OMPS SNPP and NOAA OMPS SNPP over Pacific box before and after adjustments. The well-matched values of initial residual after adjustment make the retrieved ozone profiles agree well with each other as show in the plot on the right.



The figure above shows the averaged ozone profiles that confirms that the retrieved layer ozone values from NOAA OMPS are very close to those from NASA OMPS, with differences less than one percent for all the layers. The figure in the top of the next column shows the layer ozone amounts from the Version 8 Ozone Profile Retrieval Algorithm for both NASA and NOAA OMPS NP as a function of Latitude after applying the adjustments over a orbit. The very small differences in retrieved ozone indicate slight differences in SDR values as processed by the two systems.

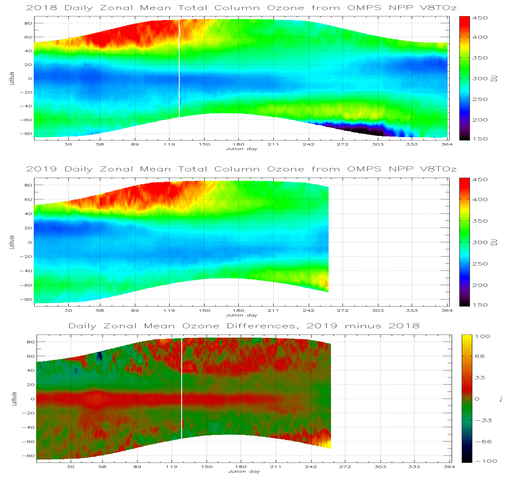


The plot on the left above shows the percent differences at 21 layers for 20-degree zonal mean between NOAA SNPP V8Pro retrievals and NASA retrievals after adjustments. The results indicates that the N-Value adjustments based on statistics over Pacific ocean are adequate to apply globally. Some relative large deviation (~5%) seen at some layers in higher latitude area imply small disagreement of SDR data between NASA OMPS and NOAA OMPS. The OMPS S-NPP V8Pro retrieved layer-15 ozone amounts (see plot on the right above) show the typical wintertime ozone pattern with apparent higher ozone density in the Northern Hemisphere then in the Southern Hemisphere.

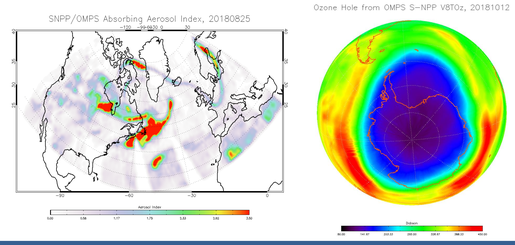
Products and Monitoring

NOAA/NESDIS/STAR has a well designed Integrated Cal/Val System(ICVS) to monitor the performance of instrument, to compare products from different instruments or algorithms, to alert the occurrence of natural disaster events, as well as to monitor the long-term environmental change.

The figures at the top of the next column show daily total column ozone latitudinal mean from NOAA OMPS S-NPP for the year 2018 and 2019. The spatial-temporal ozone pattern in the year shows apparent seasonal structures, which switch around the end of Spring and around the begin of Fall. The variation of timing for the switch and the strength of seasonal pattern should have strong association with global general circulation and weather patterns. The daily zonal mean ozone differences for the year 2019 and 2018 show a reduced ozone latitudinal gradient in the Northern Hemisphere for the winter and spring in 2019. The extremely enhanced ozone gradient in the Southern Hemisphere begins at the end of August suggests we will have a very unusual ozone hole season this year.



NOAA regularly monitors the Antarctic ozone hole variation, as well as global aerosol loading from wildfire, dust storm and anthropogenic air pollution. The figure (to the right) below shows the ozone hole on Oct. 12, 2018 from S-NPP at NOAA NDE, which is the 13th largest out of 40 years of satellite observations. The figure (to the left) shows that the S-NPP detected smoke plumes from wildfire occurred in the North America in August 2018. Apparently, this major wildfire influenced the aerosol loading for regions as far away as western Europe.



Conclusions

- The well calibrated retrievals from OMPS/S-NPP V8PRo and V8TOz can provide users with a consistent component of long-term climate data records.
- The OMPS/S-NPP has had stable performance in orbit, and is able to continue providing near-real time environment monitoring.

References

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Acknowledgment & Disclaimer

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