Weekly Report

SCSB/CISESS
Cooperative Research Program Division (CoRP)
STAR/NESDIS
National Oceanic and Atmospheric Administration (NOAA)

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Products and Applications

Fixing Geolocation and Latitudinal Discrepancies in OMPS: CISESS Scientist Chunhui Pan (STAR/SMCD) recently made an important improvement to the Ozone Mapping and Profiler Suite (OMPS) Sensor Data Record (SDR) and resolved a long-standing problem with the NOAA-20 ozone product.

Significant improvement to the geolocation accuracy of the OMPS Nadir Mapper have been made, primarily in the sensor cross-track observations. Particularly, the sensor edge observations in the cross-track had 80-100 km error, which has been reduced to about 5 km (Figure 1).

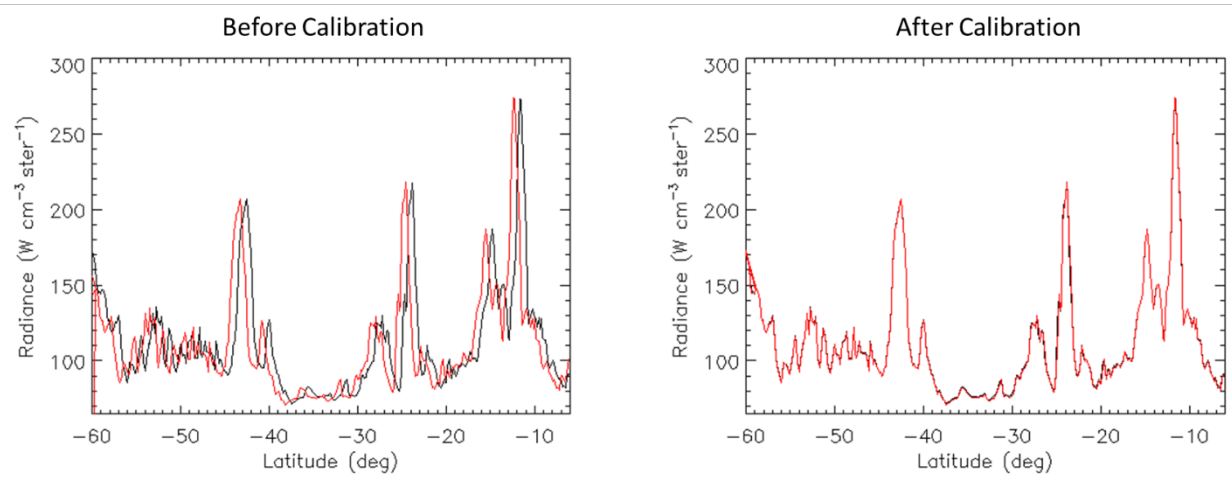

***Figure 1**: Study of Geolocation error via CCD spatial registration: Example of the Geolocation calibration results at N20 Nadir Mapper IFOV #35. Verification of the geolocation calibration is conducted via a comparison of radiance pattern between IDPS SDRs and NASA SDRs in satellite path along Earth view latitude (NASA date was verified by VIIRS data). Before calibration, there were 80 km error cross-track at the far observation footprint (left figure). After calibration, the*

error is reduced to < 5 km (right figure). Data is collected at orbit #16469 on Jan. 22, 2021. The calibration is made to CCD spatial registration for the N20 OMPS Nadir Mapper.

Another error identified was the root cause of the latitude discrepancy in OMPS Nadir Profiler ozone products between the S-NPP and the NOAA-20. This issue had been delaying the NOAA-20 Environmental Data Record (EDR) product from reaching its validation milestone for several months. She found that the primary cause was that the two Nadir Profiler sensors onboard the S-NPP and NOAA-20 are observing different Earth scenes (see Fig. 2). Her study results have been presented to the OMPS SDR related teams, including the EDR team, the NASA team, and JPSS Data Product Engineering and Services (DPES). The path forward is to collaborate with the EDR team to support their products' milestone assessment.

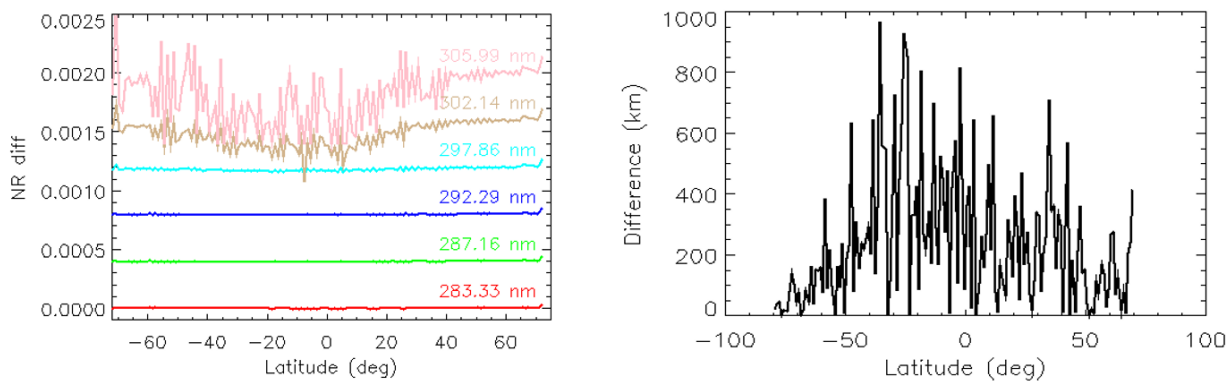

***Figure 2**: Study of latitude dependency in ozone measurements for SNPP Nadir Profiler and N20 Nadir Profiler: Left: Absolute difference of normalized radiance between N20 NP and SNPP NP vs. latitude for N20 NP 6 wavelengths channels. The y direction is values of normalized radiance plus 0.0004*# of channels, which is intend to fit into the OMPS EDR team's observation frame. Noticeable latitude dependency is observed in dichroic spectral region of 300 – 310 nm. The primary cause of such latitude dependency is that the two Nadir Profiler sensors are making different observation on the different Earth scenes. The right figure shows the geolocation difference between the two Nadir Profiler sensors. The study used 32 days data from JPSS IDPS SDRs.*

(POC: Chunhui Pan, chunhui.pan@noaa.gov, Funding: JSTAR)

<u>Publications</u>

Air Quality Modeling of Wildfires and Dust Storms: Youhua Tang and other air quality researchers (NASA and NOAA/NCEP) compared the influence of chemical lateral boundary conditions (CLBCs) on regional air quality modeling during the major intrusion events, such as wildfires or dust storms. Without a proper LBCs, the regional model missed these incursions of pollutants. This study tested dynamic CLBCs from the NASA Goddard Earth Observing System Model, version 5 (GEOS) and NOAA/NCEP Environmental Modeling System (NEMS) Global Forecast System (GFS) Aerosol Component (NGAC) on the National Air Quality Forecasting

Capability (NAQFC). Two case studies from summer 2015–Saharan dust and Canadian wildfire intrusion events–were selected as case studies to examine the CLBCs' influence. This paper also tested deriving the CLBCs using ***satellite-retrieved aerosol optical thickness (AOT)***, and showed that the new method could improve the model performance for the wildfire intrusion events as an alternative method to capture the air quality effects of intrusions when the CLBCs of global models are not available.

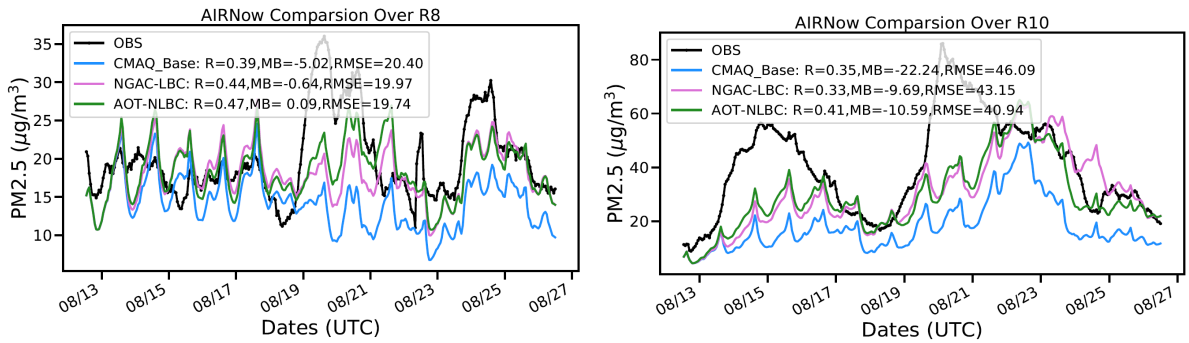

***Figure**: AIRNow surface $PM_{2.5}$ time-series comparisons for the three CMAQ LBCs runs: CMAQ_base (clean LBC), NGAC_LBC (NGAC global model LBC) and AOT-NLBC (VIIRS AOT derived northern LBC), over EPA Region 8 (R8, states of MT, ND, SD, WY, CO and UT), Region 10 (R10, states of WA, ID and OR) during the Canadian wildfire fire intrusion events in August 2018.*

Tang, Y., Bian, H., Tao, Z., Oman, L. D., **Tong, D**., Lee, P., **Campbell, P. C., Baker, B**., Lu, C.-H., Pan, L., Wang, J., McQueen, J., and Stajner, I., 2021: Comparison of chemical lateral boundary conditions for air quality predictions over the contiguous United States during pollutant intrusion events, *Atmos. Chem. Phys*., **21**, 2527–2550, https://doi.org/10.5194/acp-21-2527-2021.

(POC: Youhua Tang, youhua.tang@noaa.gov, Funding: ARL)

The 40th Anniversary of AVHRR: Tom Smith coauthored an article with Jeff Key and Andy Heidinger on NOAA's Advanced Very High Resolution Radiometers (AVHRR). The satellite was launched in 1978 and provides the longest global record of Earth observations from a visible – infrared imager. The article highlights the AVHRR contributions to terrestrial, cloud, aerosol, polar region, and oceanography studies.

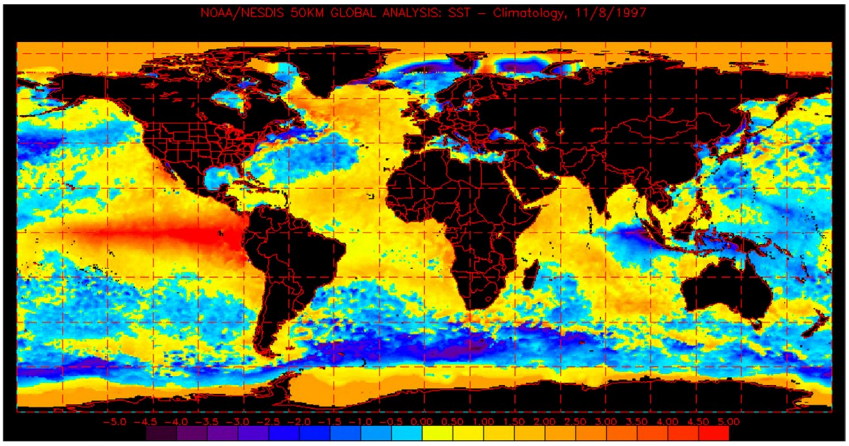

***Figure**: AVHRR SST anomaly (deviation from climatology) along the equatorial Pacific on 8 Nov 1997 indicating El Niño–Southern Oscillation (NOAA Coral Reef Watch; https://coralreefwatch.noaa.gov/product/50km/).*

Kalluri, S., C. Cao, A. Heidinger, A. Ignatov, J. Key, and T. Smith, 2021: The Advanced Very High Resolution Radiometer, Contributing to Earth Observations for over 40 Years. *Bull. Amer. Meteor. Soc*., https://doi.org/10.1175/BAMS-D-20-0088.1.

(POC: T. Smith , tom.smith@noaa.gov, Funding: PDRA)