Plan to Continue the Aerosol Index Product for NOAA 20/21

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Summary

❑ Current situation
  o LANCE contains (UV) Aerosol Index (AI) products (including imagery) for Aura OMI and S-NPP OMPS
  o OMPS Science Team provides no products for NOAA-20 (N20) OMPS
  o OMPS Science Team plans to provide no products for NOAA-21 (N21) OMPS
❑ Future
  o No AI products in LANCE
    o The S-NPP satellite will be decommissioned in 18 months or less
    o Aura OMI will also reach the end of its lifetime, plus it **DOES NOT** provide full global coverage due to the "row anomaly"
❑ Propose providing S-NPP / N20 / N21 AI products independent of the OMPS Science Team
  o Revert back to the heritage formulation, which has the advantage of linking to the AI of heritage UV sensors (TOMS) **as well as TROPOMI**

The AI was originally generated as a byproduct of the UV total ozone retrieval algorithm

❑ It's a comparison of the measured and calculated spectral contrast between 2 UV non ozone absorbing wavelengths
  o Heritage instruments are sometimes limited to one non ozone absorbing and one with a small amount of ozone absorption
❑ Sun-normalized radiance (S-NRs) measured from short wavelength used to characterize the scene
  o Reflectivity determined or, if clouds are present, an "effective cloud fraction" is determined
❑ S-NR is calculated for long wavelength using the characterization determined from first wavelength
  o Calculation compared to the actual S-NR measured from the second wavelength
  o A difference indicates something geophysical not accounted for in the calculation
    o Usually due to UV absorbing aerosols (smoke, dust, and ash) or other geophysical features (sun-glint in particular)
  o Log of this difference was called the Aerosol Index and became a new UV product

❑ The AI is not a physically quantitative measure of aerosol characteristics (like AOD, angstrom exponent, or extinction coefficient)
  o Magnitude depends not only on the amount of aerosol present but also on the type of aerosol, scene characterization (reflectivity), height of the aerosol, and other factors
❑ The AI cannot distinguish between types of UV absorbing aerosols (smoke, dust, or ash)

❑ The AI **CAN** be used over all types of land surfaces and clouds, making it ideal to detect and track smoke, dust, and ash from fires, dust storms, and volcanic eruptions
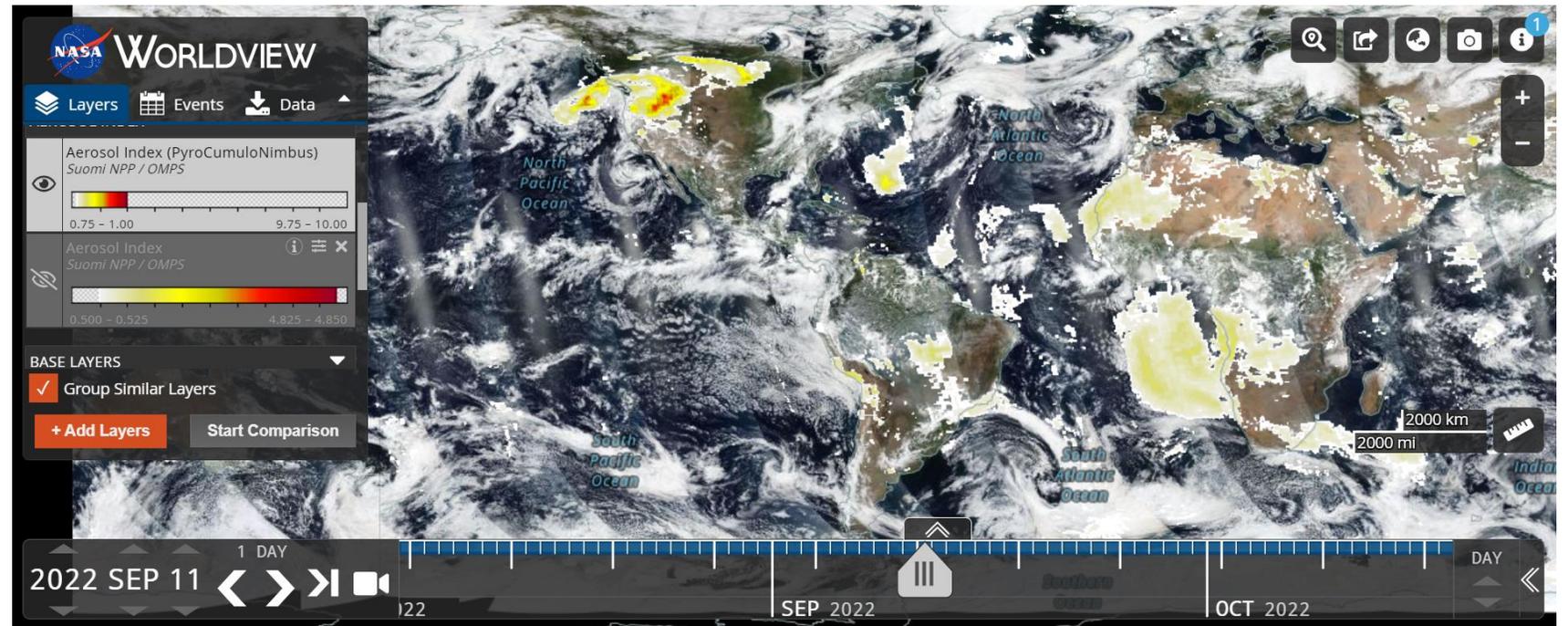
- ❑ AI can also be used to:
  - ○ Differentiate between ash and SO_2 clouds after a volcanic eruption, providing much needed information for entities such as the Volcanic Ash Advisory Centers (VAACs)
  - ○ Monitor and track dust from large-scale events providing input useful for air-quality forecasts
- ❑ The dependence of AI with aerosol altitude has turned into an advantage.
  - ○ It's ideal for detecting pyroCb events and tracking smoke from them
  - ○ AI values above 5 are routinely checked, often via Worldview, for smoke denoting the formation of a pyroCb event

"Dustzilla" event of 2020
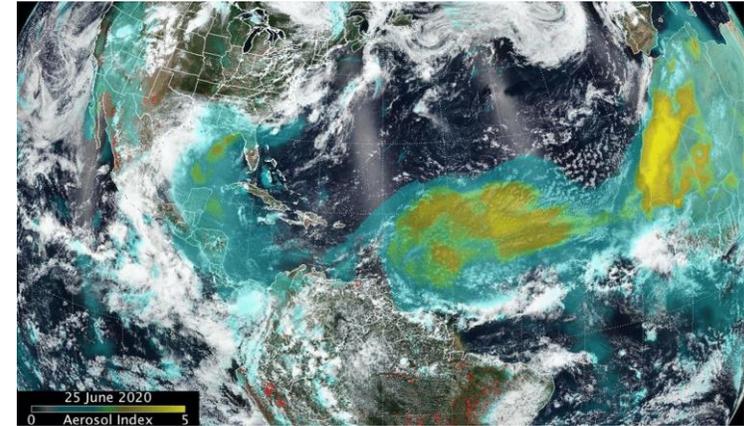
North American pyroCb event of 2017
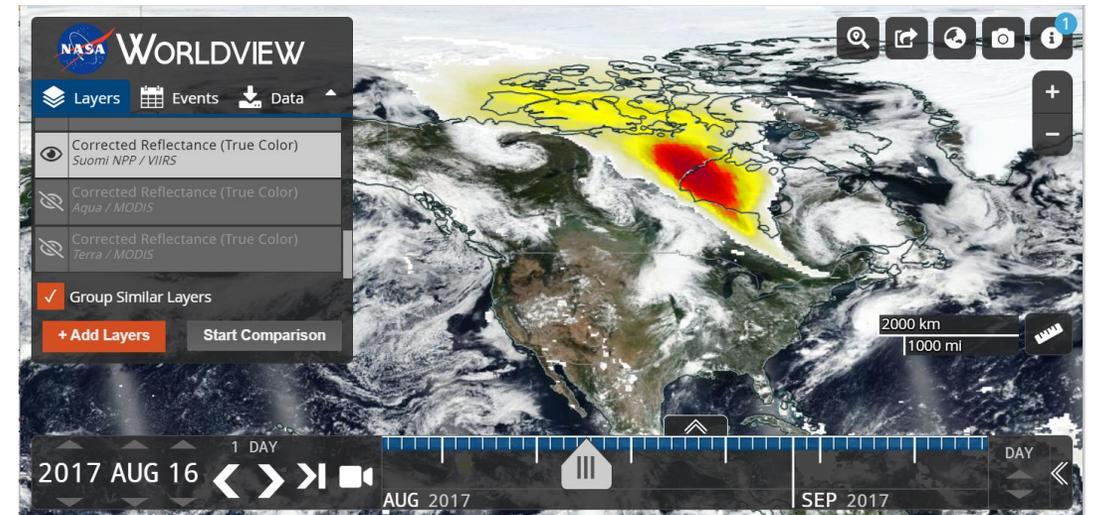
❑ The Atmospheric Chemistry and Dynamics Lab (Code 614) provides AI from Aura's OMI and S-NPP's OMPS sensors

❑ AI provided is an enhanced version of the heritage AI
  o Uses a better model to account for clouds (Mie scattering)
  o Incorporates Cox-Munk model over ocean
  o Uses longer wavelength to determine scene characteristics, shorter wavelength to determine AI

❑ No easy conversion / adjustment between current and heritage AI

❑ Heritage AI still available
  o Contained within V8 of the total column ozone retrieval product
  o No imagery provided by LANCE

OMPS AI now appears in FIRMS as an overlay
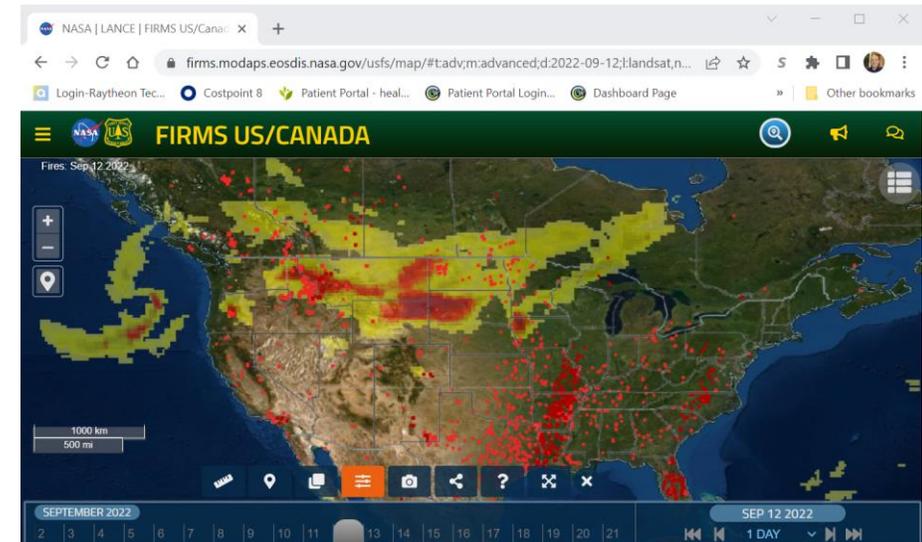
NOAA 20 OMPS AI Could Provide Higher Resolution AI Information to LANCE than S-NPP OMPS

NOAA 21 will provide even higher resolution than NOAA 20, although still not as high as TROPOMI

Smoke from Alberta fires, 20 May 2019

NOAA20 OMPS Aerosol Index
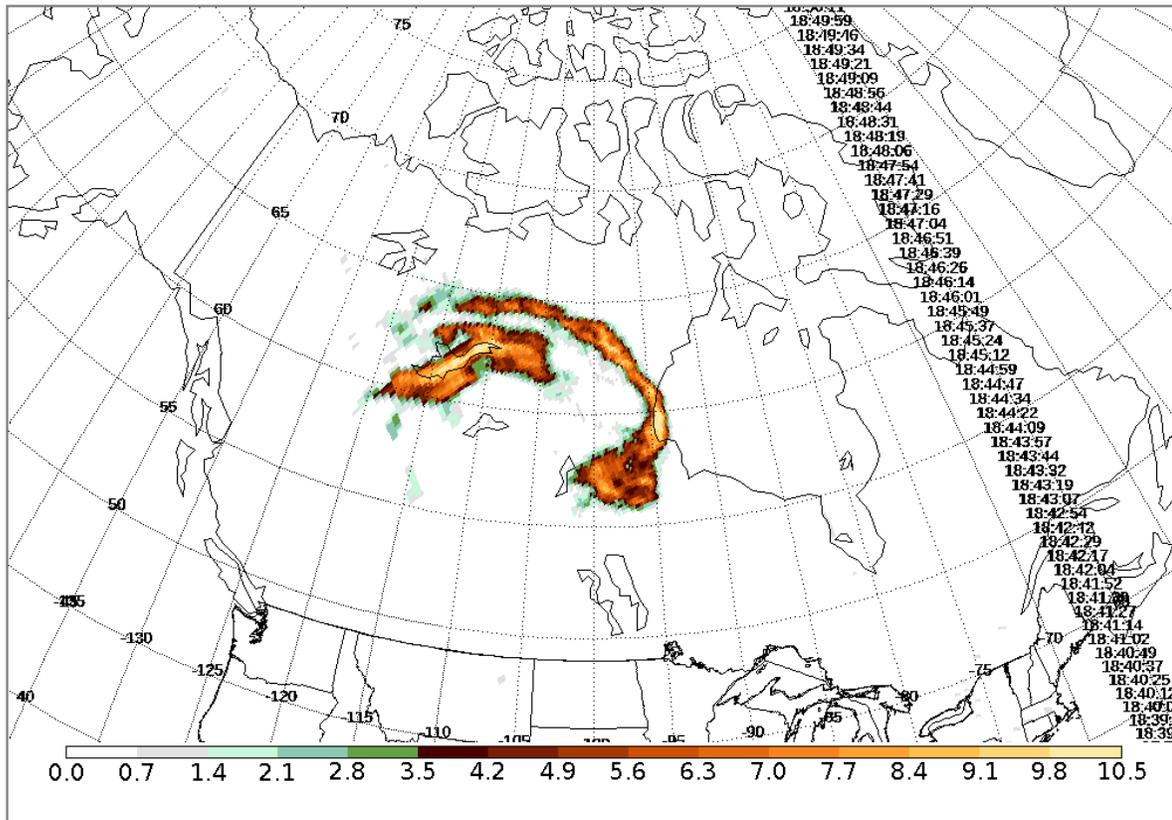
SNPP OMPS Aerosol Index
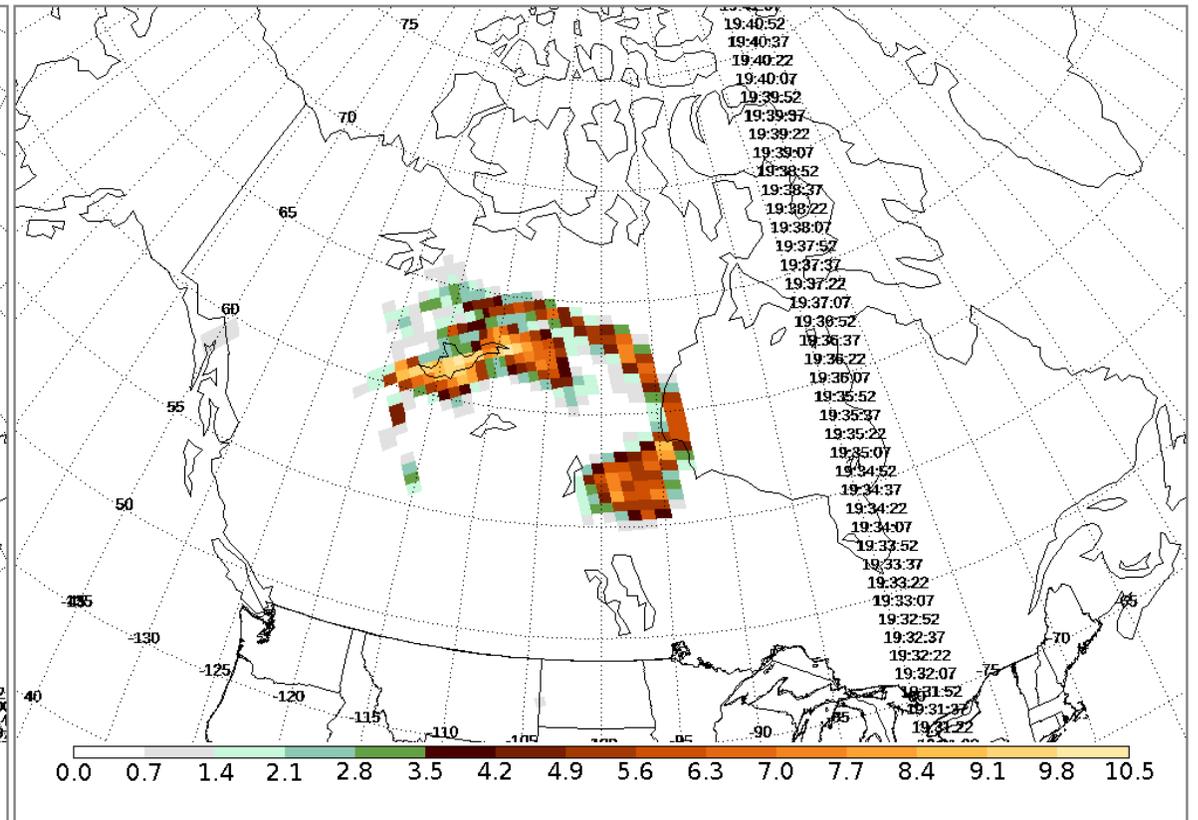
❑ The Atmospheric Chemistry and Dynamics Lab (Code 614) **will not** provide nadir aerosol products for current and future JPSS missions, including N20 and N21

    o Focus of work on nadir aerosol products is TROPOMI (NASA does not obtain TROPOMI data within the LANCE latency requirement) and future geostationary platforms (GEMS, TEMPO)

❑ Code 614 will "shortly" implement V9 of the total ozone algorithm, which does not calculate the heritage AI as a byproduct

❑ Once S-NPP is decommissioned, there will be no OMPS AI products / imagery available via LANCE (time frame for decommissioning is no longer than 18 months, when it runs out of fuel)

❑ Aura OMI is probably nearing the end of its lifetime (plus the row anomaly prevents full global coverage)

❑ **We will reach a time when no AI will be available in LANCE**

    o **Also, no real-time AI products / imagery will be available through GSFC's Direct Readout Lab**

❑ Provide AI products for all current and future OMPS sensors
❑ Take responsibility to validate and maintain them as well
❑ Will revert the S-NPP product back to the heritage definition of the AI
   o Since heritage AI is compatible with the products from TOMS **and TROPOMI** sensors comparisons between current and historical events will become easier, particularly for communities like the pyroCb group

Next Steps

❑ I will finalize the S-NPP software and perform the necessary modifications to handle N20 and N21 datasets and, when ready, go through the LANCE working group approval process
❑ If approved, I hope to have products available by sometime in mid 2023