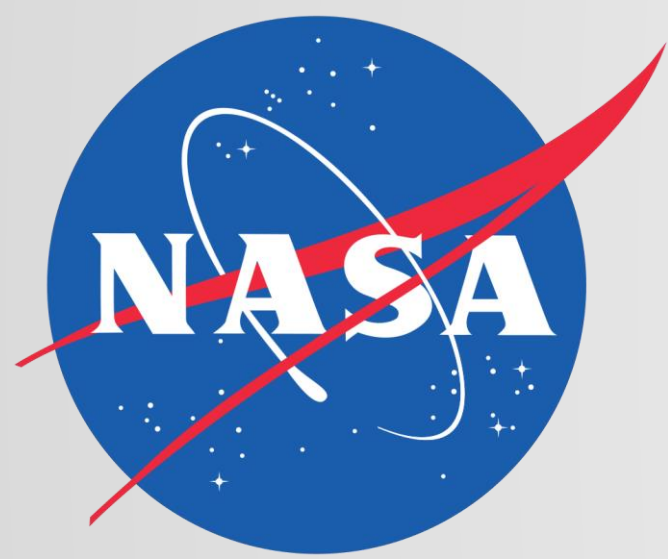
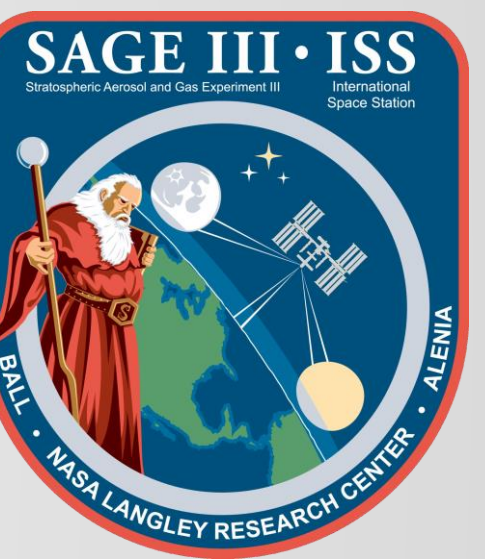




SAGE III/ISS Data Product Improvements

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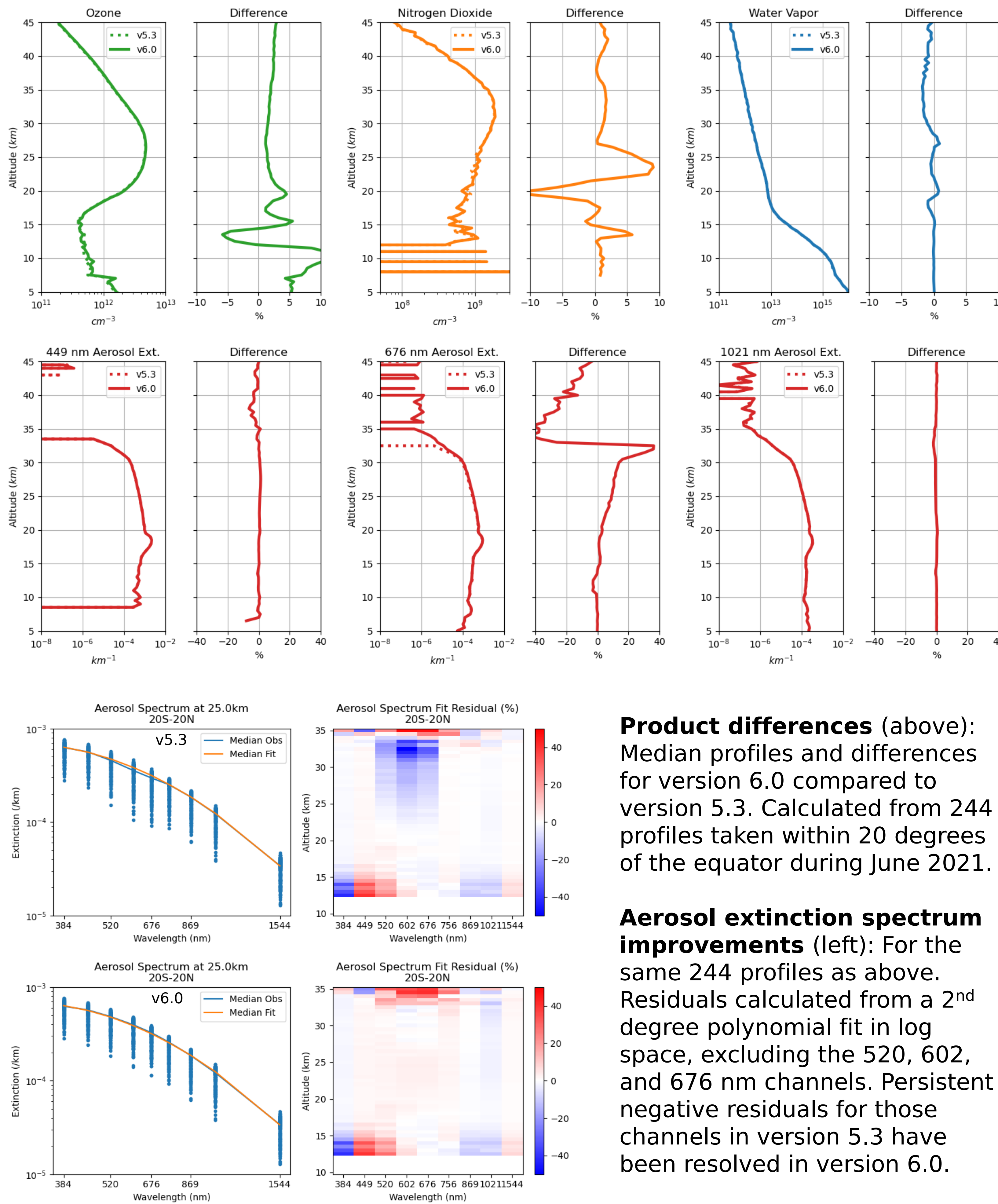


Abstract

In 2024 the Stratospheric Aerosol and Gas Experiment on the International Space Station (SAGE III/ISS) entered its eighth year of operations. Using a CCD spectrometer to observe solar and lunar occultations through Earth's limb, the mission has retrieved tens of thousands of vertical profiles for ozone, aerosol, water vapor, and nitrogen dioxide. Retrieval algorithms are constantly under development to enhance these products. Product version **6.0** improves upon previous versions by addressing problems with the aerosol extinction spectrum and recovering hundreds of profiles impeded by the recent proliferation of sunspots. Users of SAGE III/ISS data can also expect improvements to uncertainty estimates and a continued expansion of ancillary products.

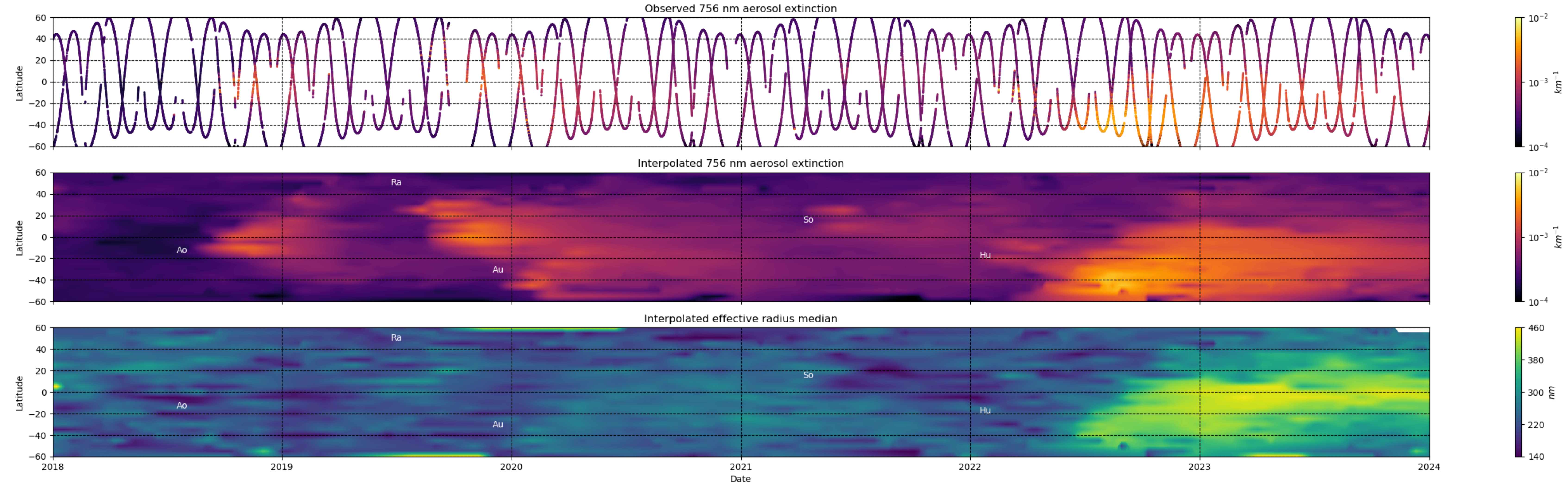
Ozone Cross Section Change

For version 6.0, *Serdyuchenko 2014* high resolution ozone absorption cross sections are used in the inversion calculation. These replace the SCIAMACHY 3.0 source used in previous versions. The change diminishes the “dip” in some aerosol channels noted by *Wang, et al. 2020*. Retrieved Ozone concentrations see an increase of 1% to 3%.

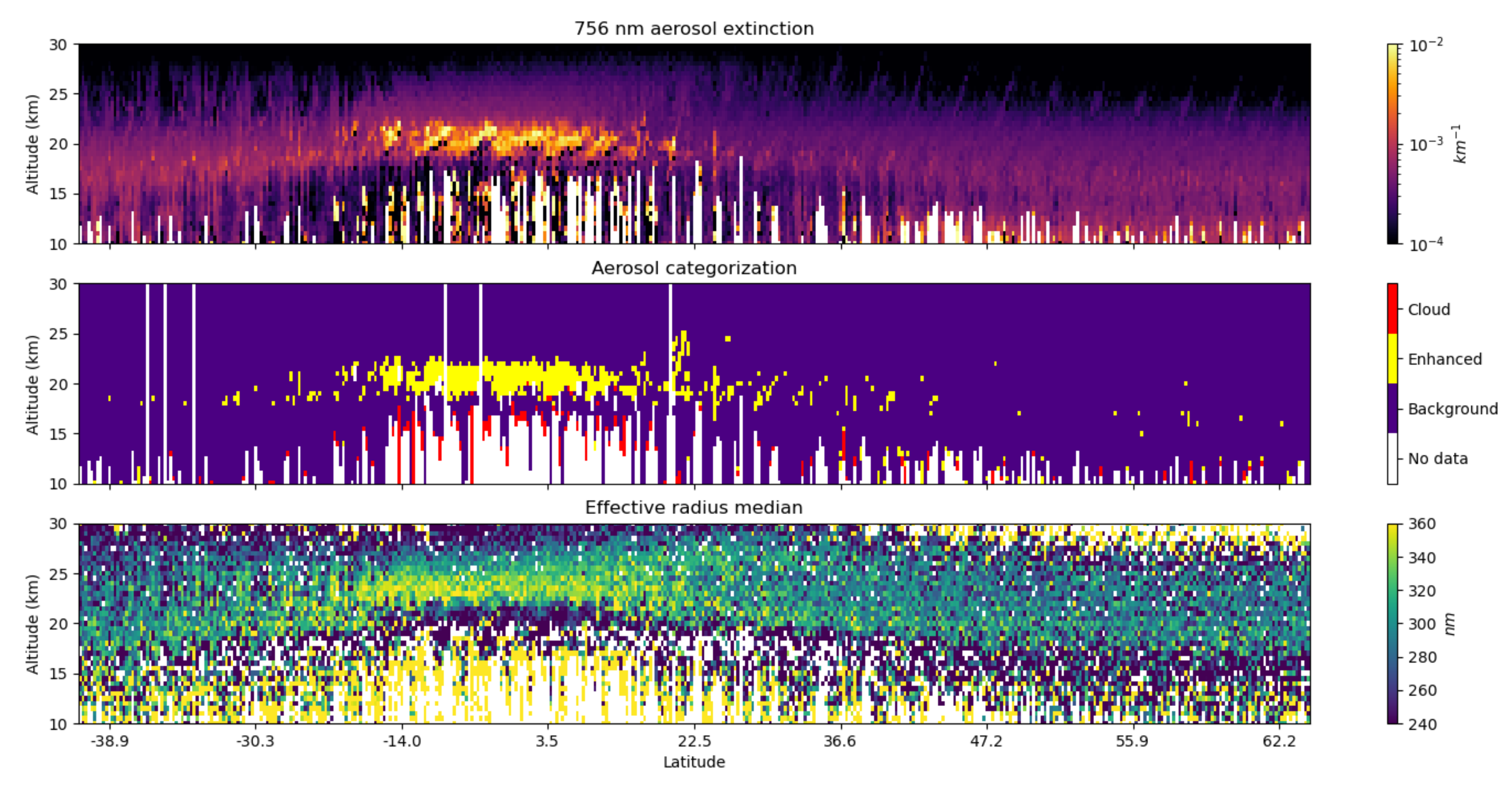


Product differences (above): Median profiles and differences for version 6.0 compared to version 5.3. Calculated from 244 profiles taken within 20 degrees of the equator during June 2021.

Aerosol extinction spectrum improvements (left): For the same 244 profiles as above. Residuals calculated from a 2nd degree polynomial fit in log space, excluding the 520, 602, and 676 nm channels. Persistent negative residuals for those channels in version 5.3 have been resolved in version 6.0.



A growing aerosol record (above): Aerosol extinction and effective radius median at 20 km altitude over six calendar years of data collection. Topmost plot reflects the location and time of solar occultation events observed from the International Space Station's orbit. Bottom two plots show an interpolation of that sampling. Approximate latitudes and dates of aerosol injection events are annotated on the interpolated plots (Ao: Aoba, Ra: Raikoke, Au: Australian fires, So: La Soufriere, Hu: Hunga Tonga-Hunga Ha'apai).

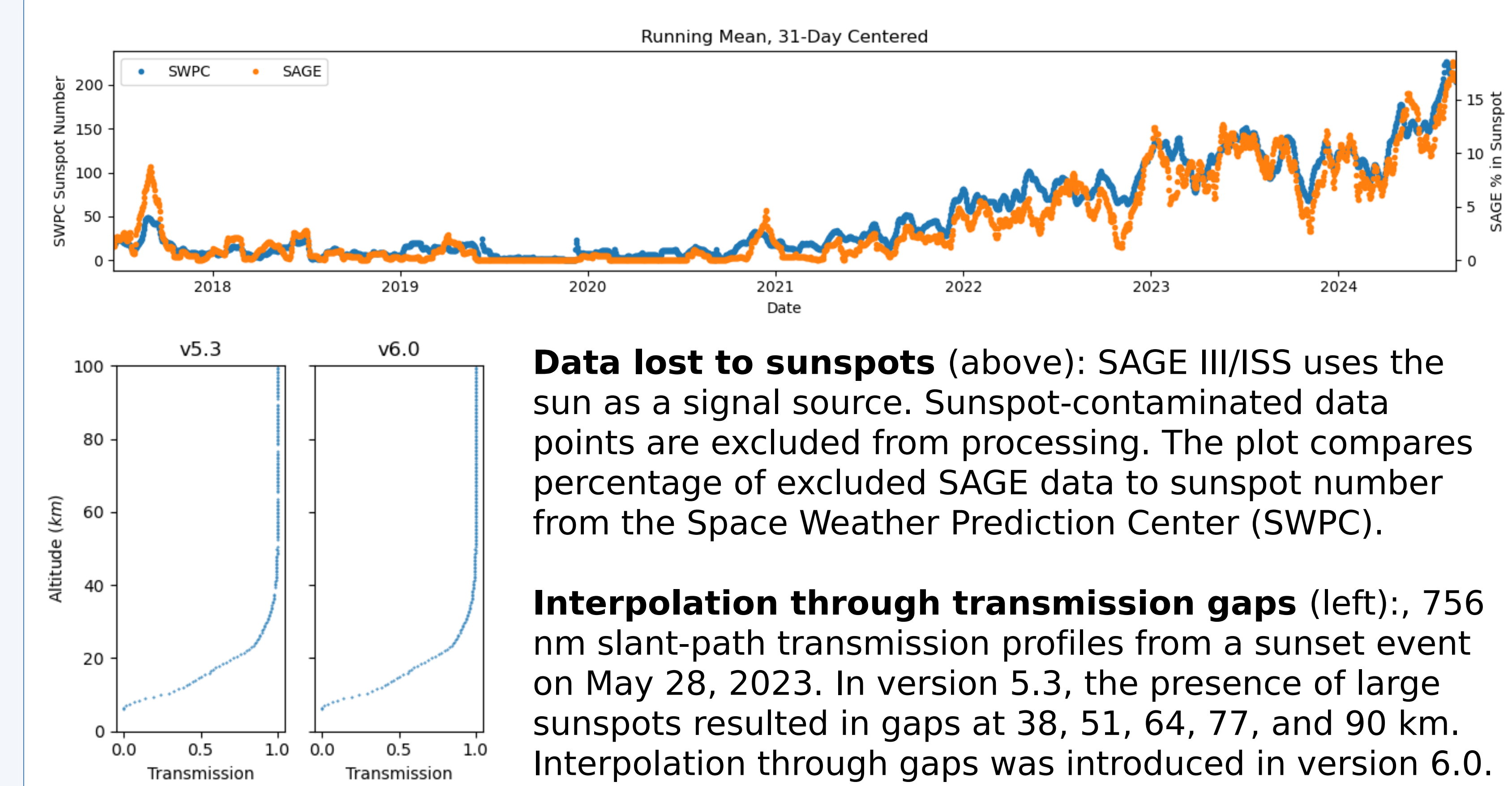


New aerosol products (above): 421 profiles from June 2024 sunrise events plotted as an altitude-latitude curtain. Aerosols at tropical latitudes are enhanced by the recent eruption of Ruang (2.3°N). Aerosol categorization product is based on the work of *Kovilakam, et al. 2023*. Particle size products are based on the work of *Knepp, et al. 2024*.



Data availability

SAGE III/ISS version 6.0 data products will be released in early 2025 and distributed through the Atmospheric Science Data Center (<https://asdc.larc.nasa.gov/>). More information on SAGE III/ISS can be found at <https://sage.nasa.gov/> (QR code provided).



Data lost to sunspots (above): SAGE III/ISS uses the sun as a signal source. Sunspot-contaminated data points are excluded from processing. The plot compares percentage of excluded SAGE data to sunspot number from the Space Weather Prediction Center (SWPC).

Interpolation through transmission gaps (left): 756 nm slant-path transmission profiles from a sunset event on May 28, 2023. In version 5.3, the presence of large sunspots resulted in gaps at 38, 51, 64, 77, and 90 km. Interpolation through gaps was introduced in version 6.0.

References & Acknowledgements

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