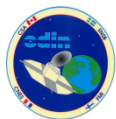


The OSIRIS Stratospheric Aerosol Record

Version 5, 6 and Merging with SAGE II

Adam Bourassa, Landon Rieger, Doug Degenstein
and the
OSIRIS Team at the University of Saskatchewan



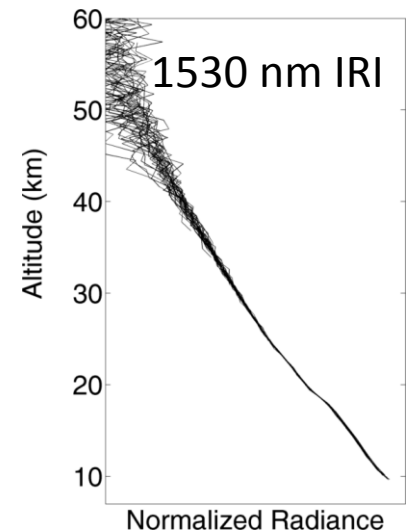
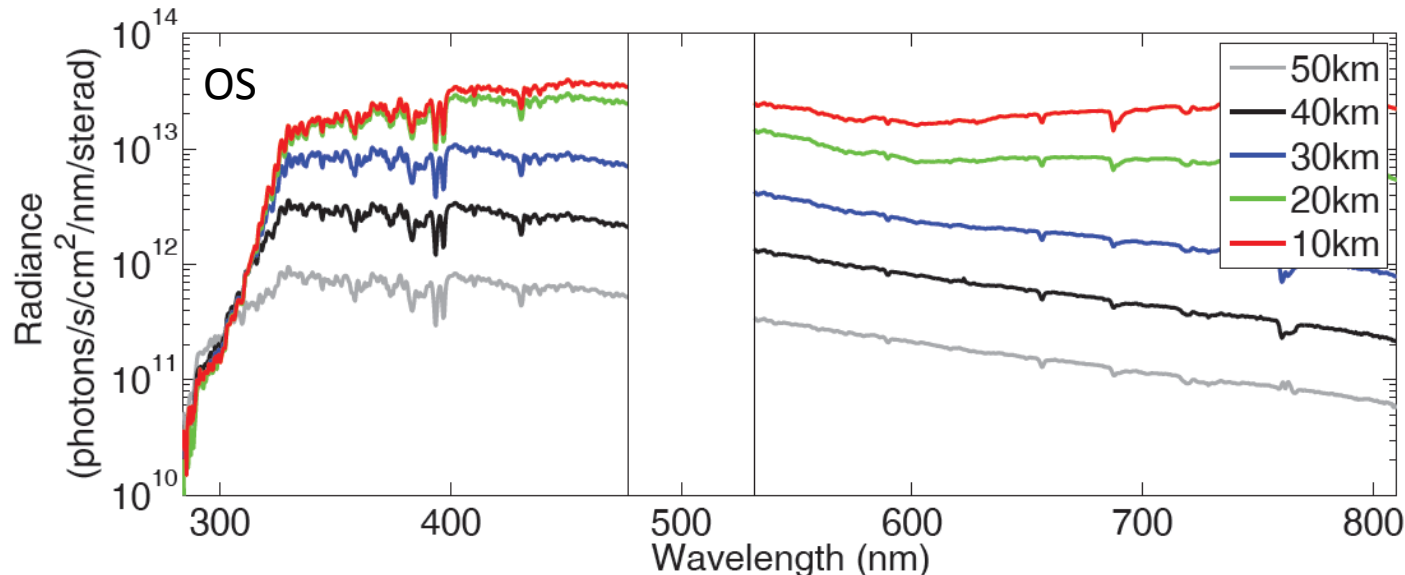
Overview

- OSIRIS on Odin
- Version 5 aerosol retrieval overview/analysis
- Version 6 aerosol retrieval overview/analysis
- Towards merging the OSIRIS and SAGE II datasets

OSIRIS - Overview

Optical Spectrograph and InfraRed Imaging System

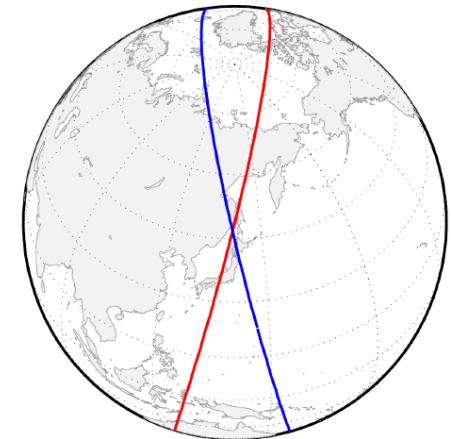
- Operational on Odin since late 2001 and continuing
- Measures limb scattered sunlight from 280 to 810 nm with approx. 1 nm resolution and 2 km vertical resolution
- 3 infrared channels at 1260, 1270 and 1530 nm



OSIRIS - Coverage

Optical Spectrograph and InfraRed Imaging System

- Odin orbit provides daily coverage at 1800/0600h
- Only sunlit hemisphere can be measured
- Vertical profile every 90 seconds, typically 200-400 profiles per day
- 'Matched pairs' of measurements on ascending and descending orbit tracks allow for two measurements of the same location separated by 12hrs



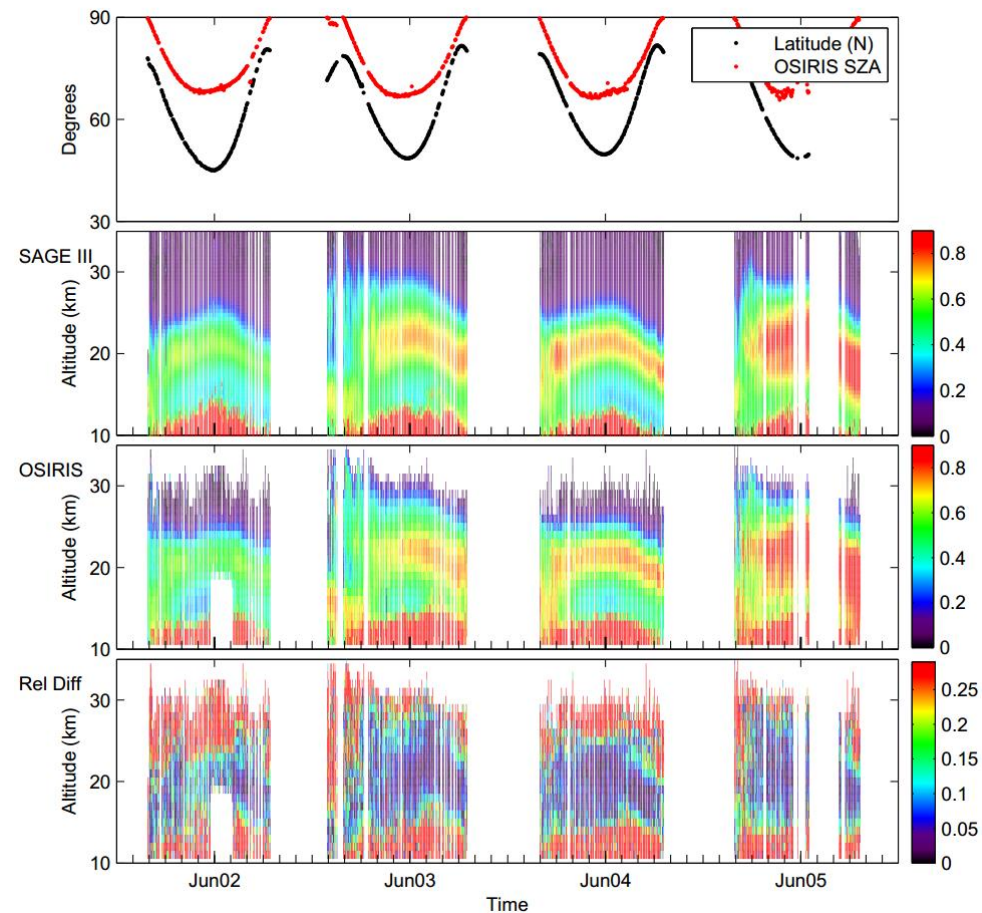
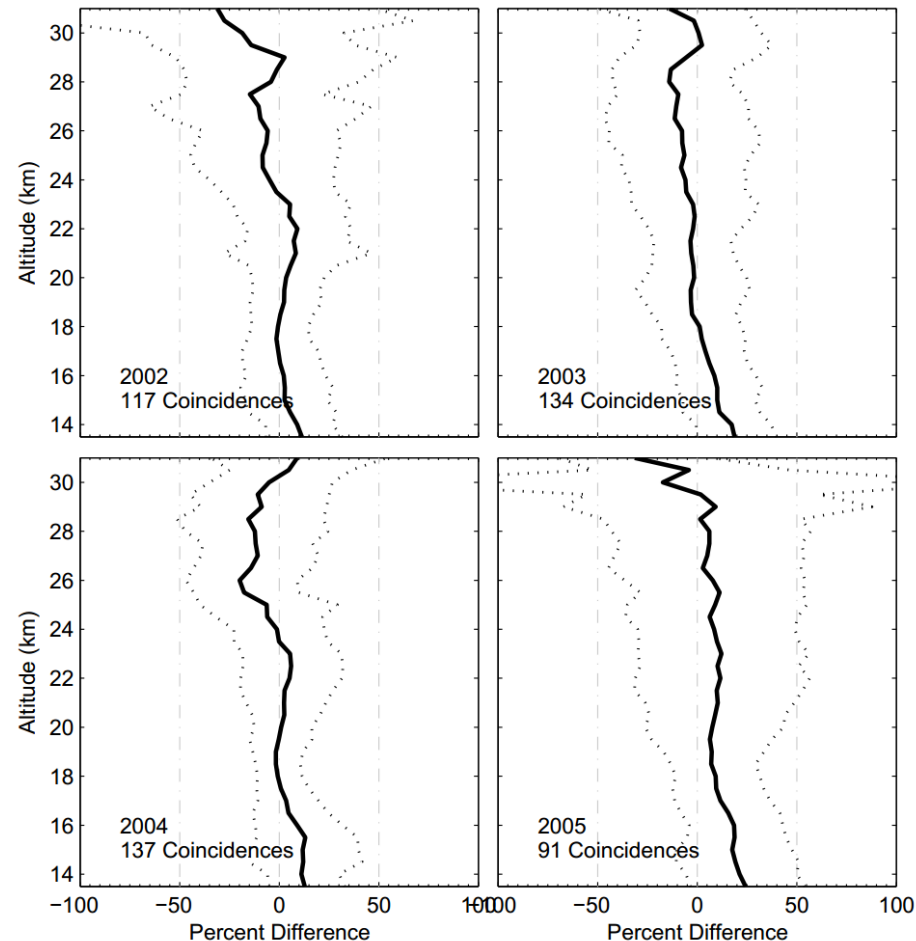
— Descending Track — Ascending Track

Version 5

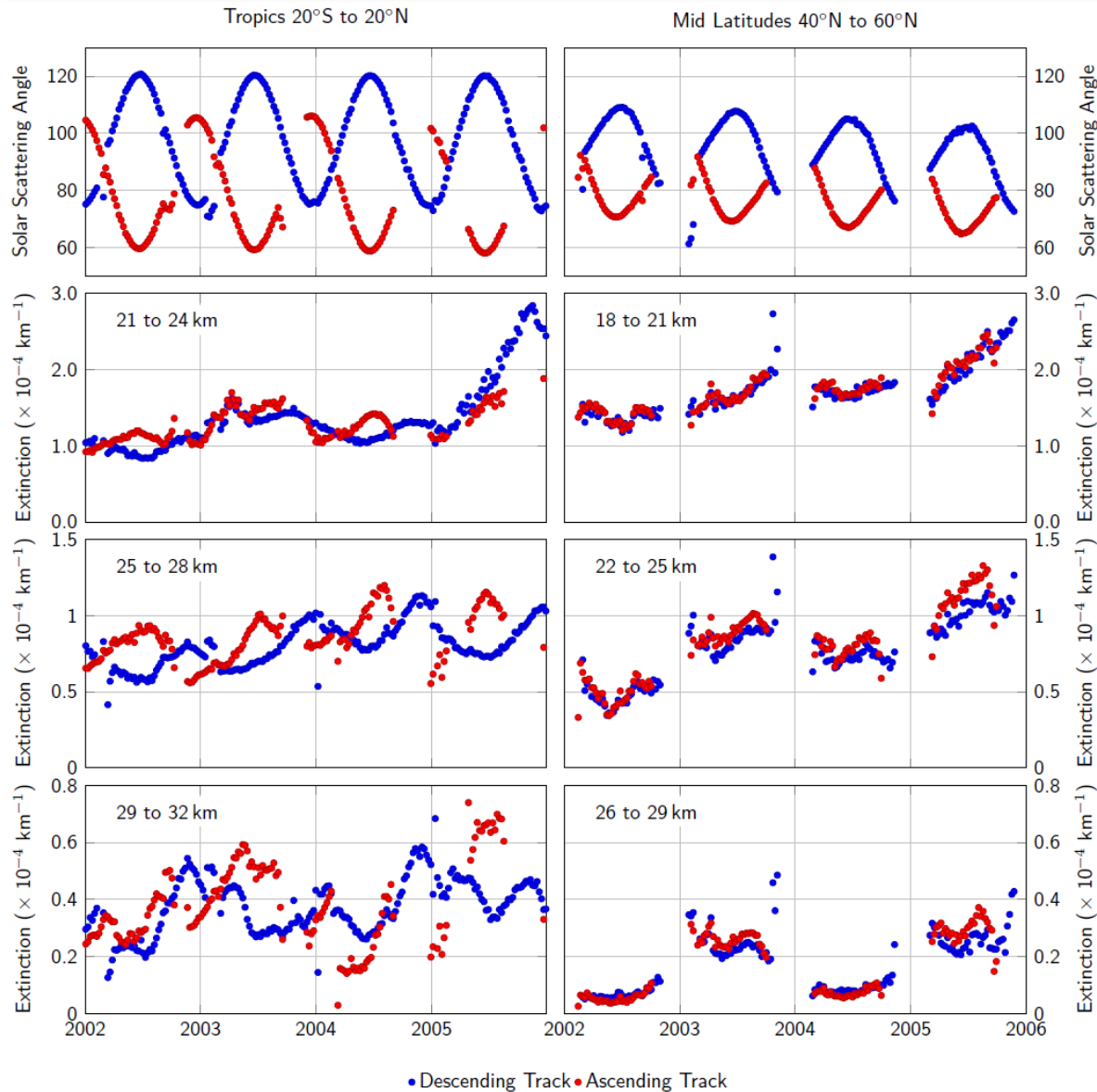
- Single measurement vector retrieval based on spectral ratio of 470 and 750 nm radiances
- Particle size is assumed to be single mode lognormal with mode radius of 80 nm, mode width of 1.6
 - Mie scattering phase functions and cross sections
- Extinction is retrieved at 750 nm using Multiplicative-Algebraic Reconstruction Technique (MART)

Version 5

- Good results in mid-to-high latitudes and low volcanic loading conditions (SAGE III comparisons at 750 nm over 4 years)



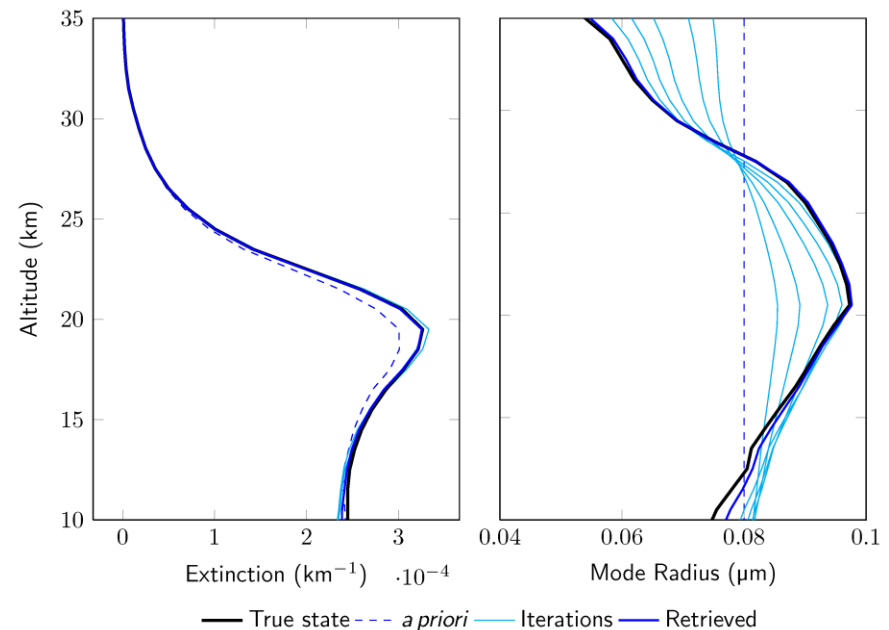
Version 5



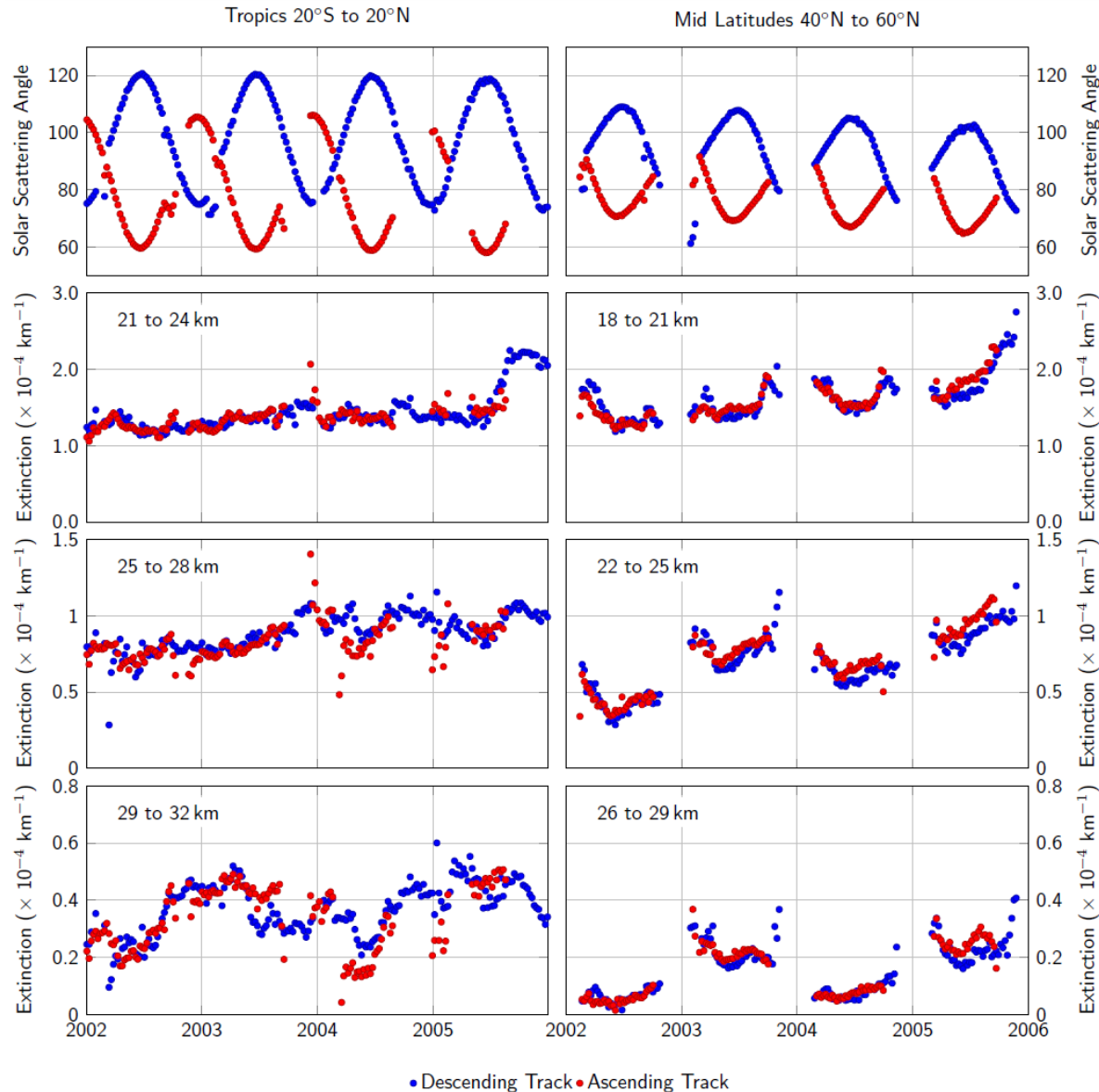
- Comparison of measurements at different viewing geometries shows systematic bias in the retrievals due to particle size assumptions

Version 6

- Version 6 incorporates 1530 nm infrared imager channel to retrieve particle size information as well as extinction
- Single mode lognormal distribution is still assumed with a fixed mode width of 1.6
- Mode radius and number density are adjusted in the model, with extinction and the Angstrom coefficient as the two retrieved parameters (these are more robust to model assumptions)



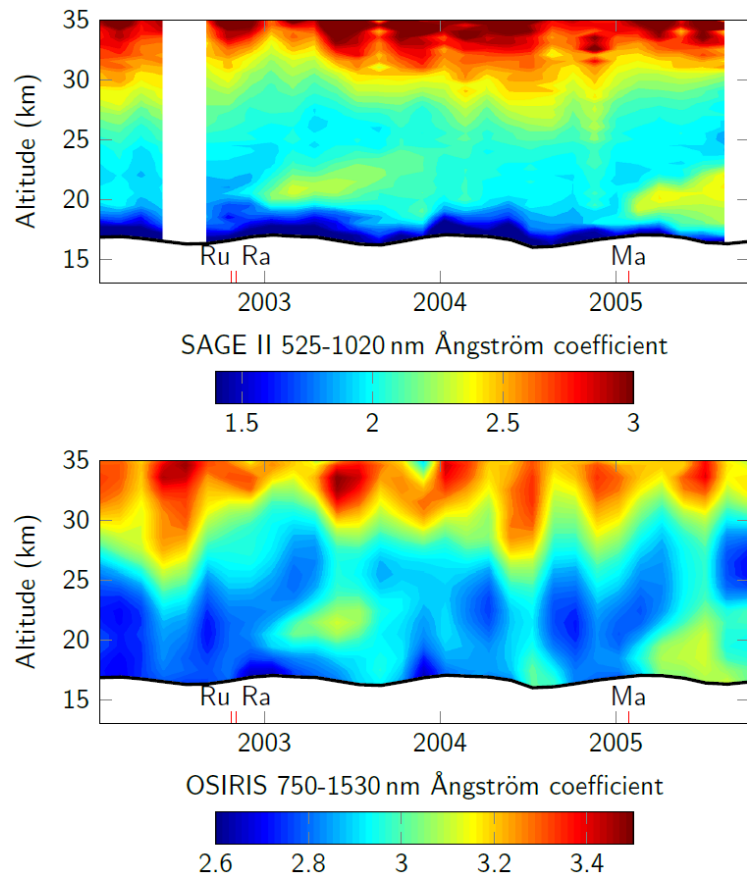
Version 6



- Comparison of ascending and descending track measurements is greatly improved, particularly in the tropics

Version 6

- Comparison of retrieved Angstrom coefficients shows good qualitative agreement with SAGE II, however some issues remain



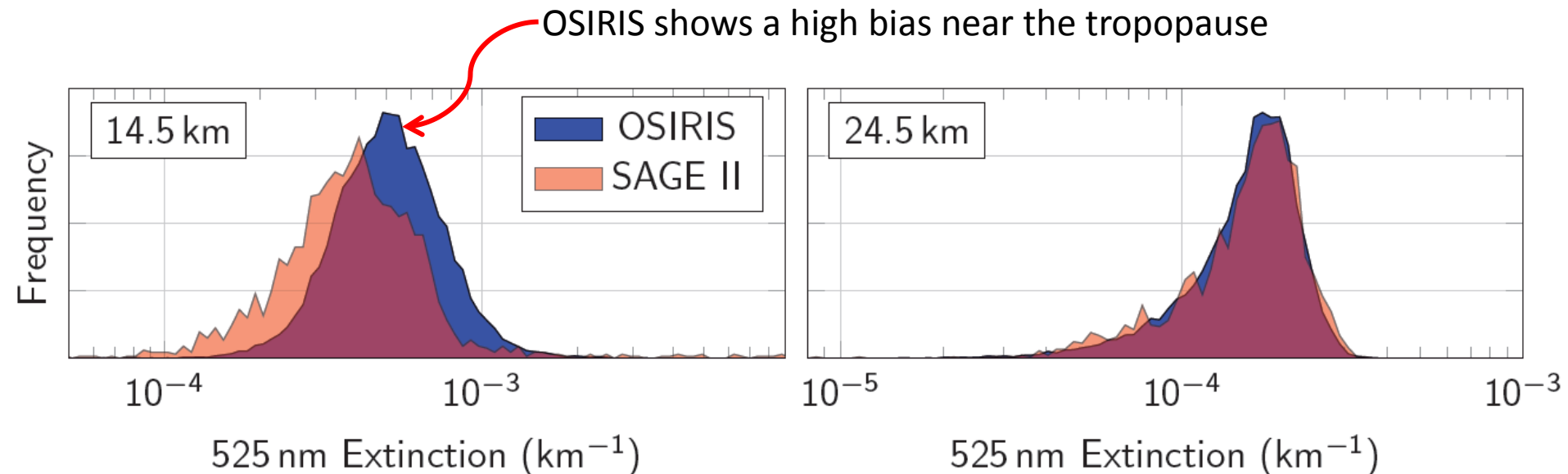
- Lack of 1530 nm albedo measurements leads to systematic biases
- Assumption of single mode lognormal with fixed mode width not perfect
- IR detector saturates under high aerosol loading at low altitudes

Merging SAGE II/OSIRIS Datasets

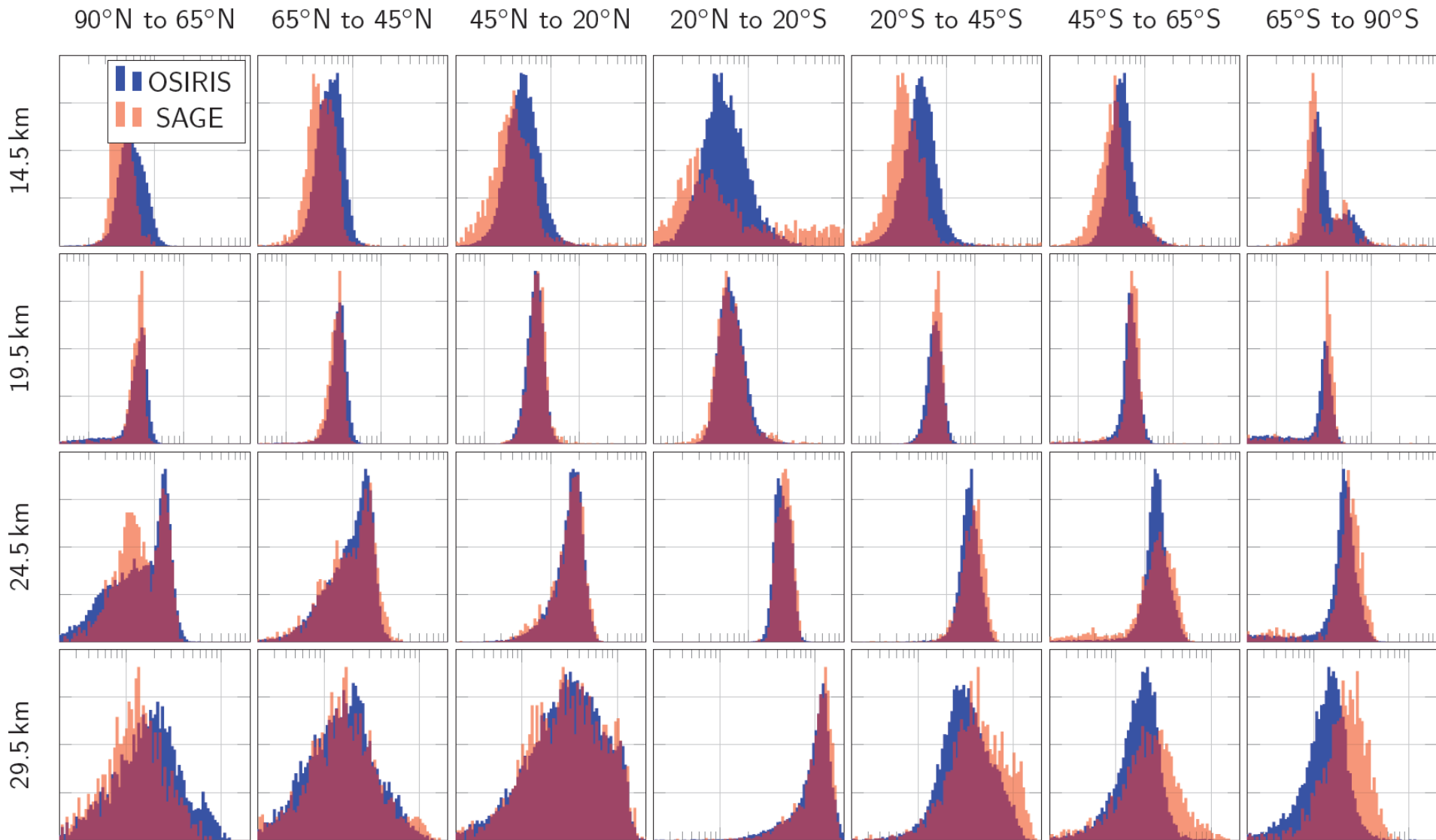
- Work has begun on a merged 525nm stratospheric aerosol extinction data set spanning from 1984 to present
- High quality and long overlap (~3.5 years) of the data sets makes for (relatively) easy merging with a few exceptions
 - Coverage is sparse in the winter polar regions for both instruments, limiting coincidences
 - OSIRIS must be extrapolated to 525nm using the retrieved Angstrom coefficient

Merging SAGE II/OSIRIS Datasets

- SAGE II and OSIRIS measurements show good agreement, both in mean and standard deviations over most altitude and latitudes
- Measurements from 20 to 45°N for 2002-2005 are shown in the histograms below

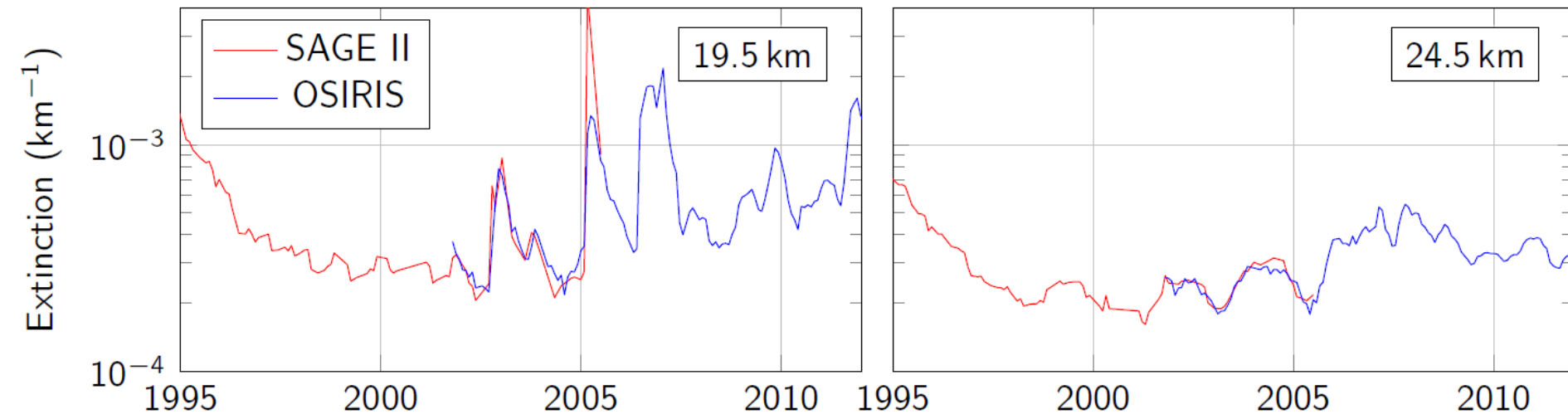


Merging SAGE II/OSIRIS Datasets

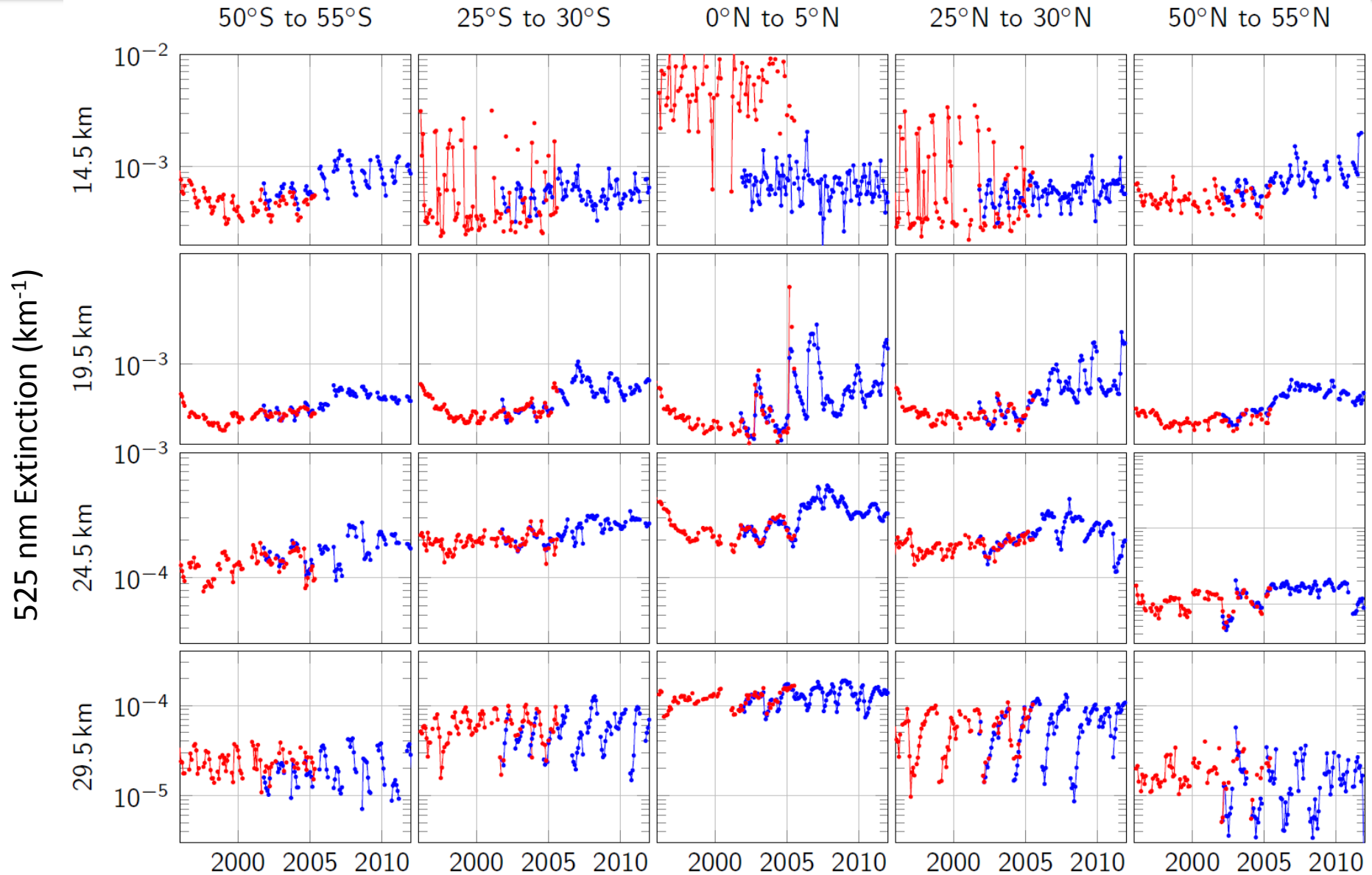


Merging SAGE II/OSIRIS Datasets

- 525 nm extinction time series at various altitude and latitude bins shows excellent agreement
- Figure shows two altitudes at 0-5N before OSIRIS data has been corrected

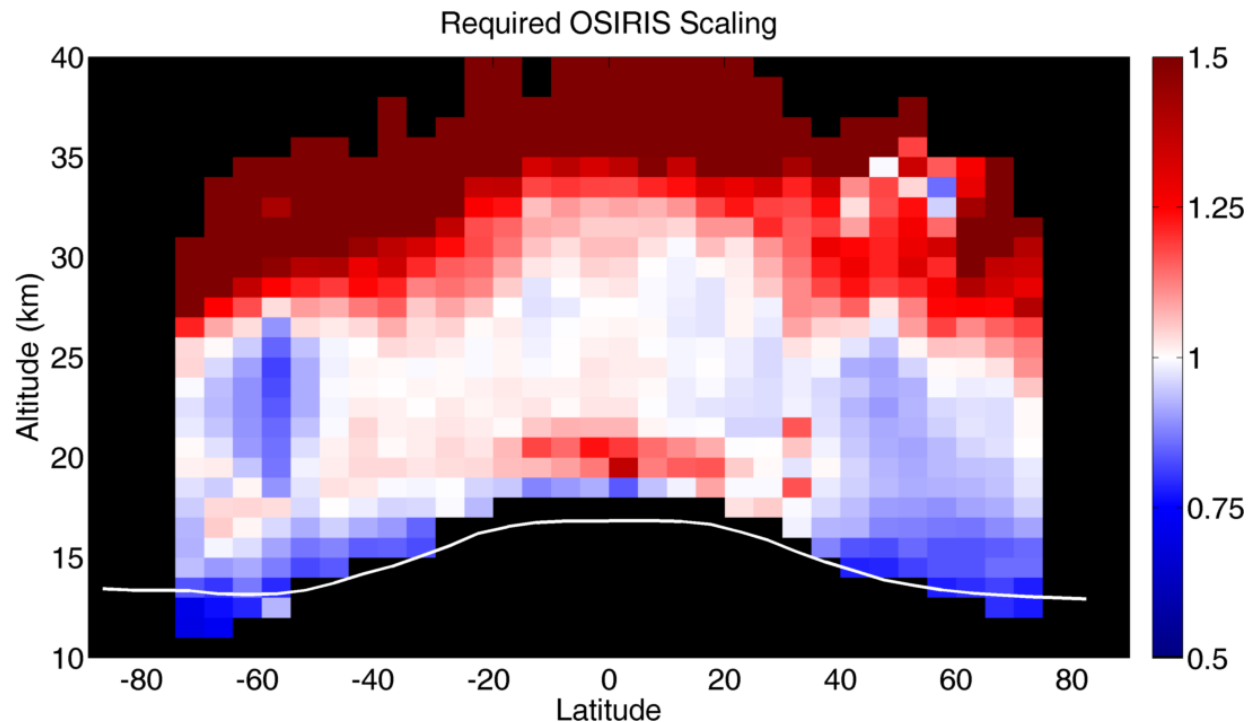


Merging SAGE II/OSIRIS Datasets



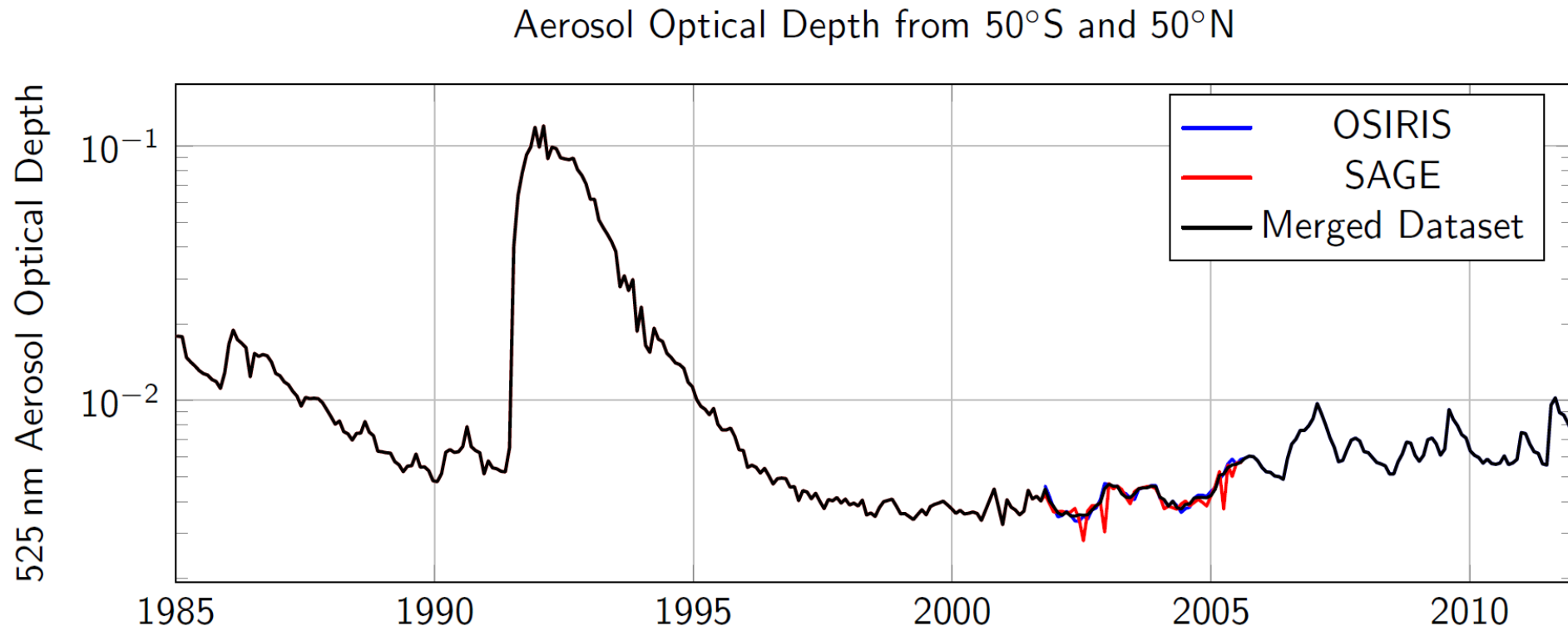
Merging SAGE II/OSIRIS Datasets

- For merging OSIRIS data was scaled to the SAGE II extinction so that the mean extinction value in each 5 degree latitude bin and 1km altitude bin are equal
- For the bulk of the stratosphere OSIRIS is within 10% of SAGE II with a couple exceptions

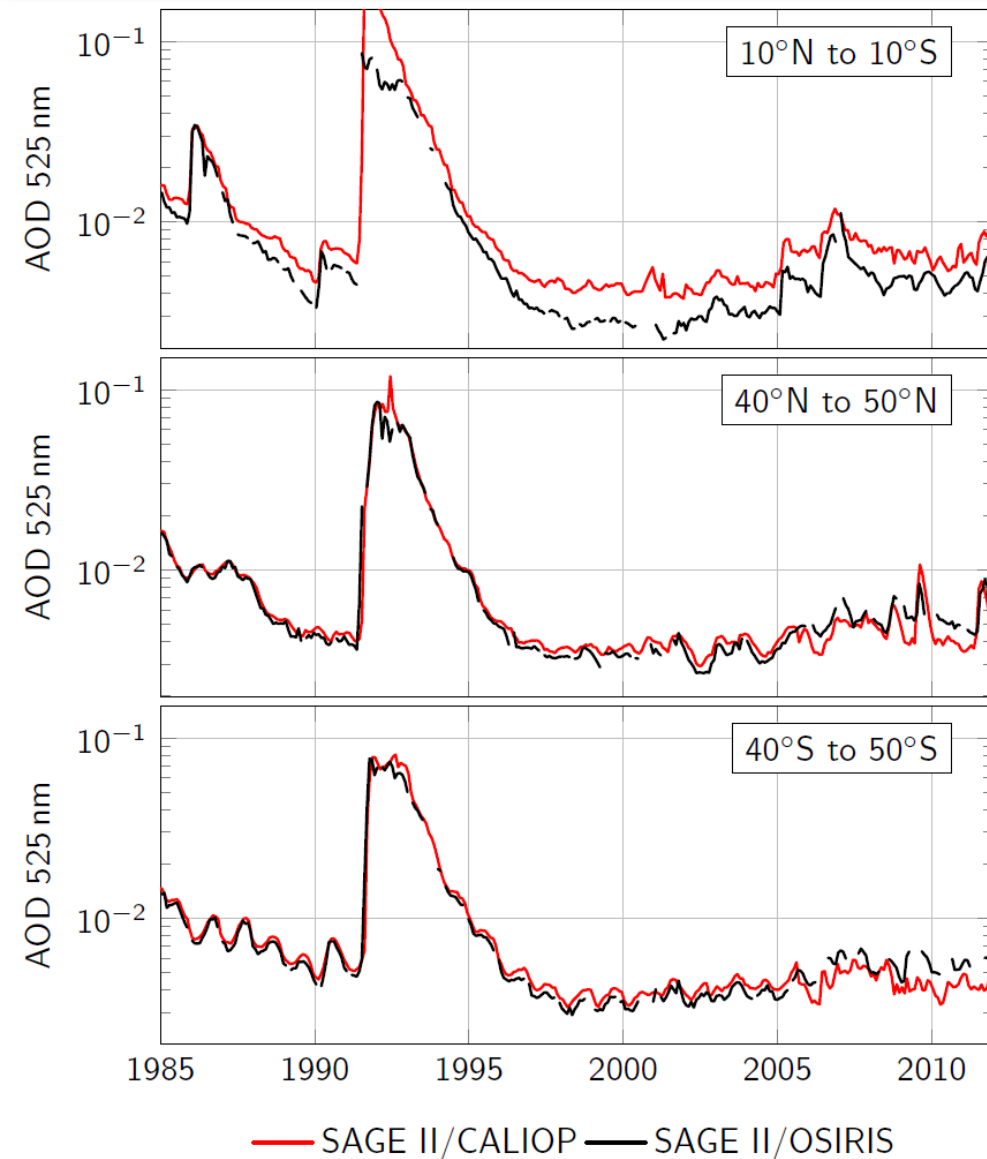


Merging SAGE II/OSIRIS Datasets

- To avoid low altitude biases only data above the tropopause is used in the merge



Merging SAGE II/OSIRIS Datasets



- Comparisons with the merged SAGE II/CALIOP AOD from 15-40 km show good agreement
- SAGE II/CALIOP generally higher due to AOD calculated from 15km and up, rather than from tropopause - particularly in the tropics

Conclusions

- Version 6 OSIRIS aerosol provides improved extinction measurements over the bulk of the mission as well as qualitative Angstrom measurements
- Work continues on the version 6 data set to improve measurements where the IR channel saturates
- Merging the SAGE II and OSIRIS datasets provides a nice long term aerosol record, provided only values above the tropopause are used.