Recent Advances in the SBUV Merged Ozone Dataset (MOD) for LOTUS Phase 2 Analysis of Stratospheric Ozone Trends and Uncertainties

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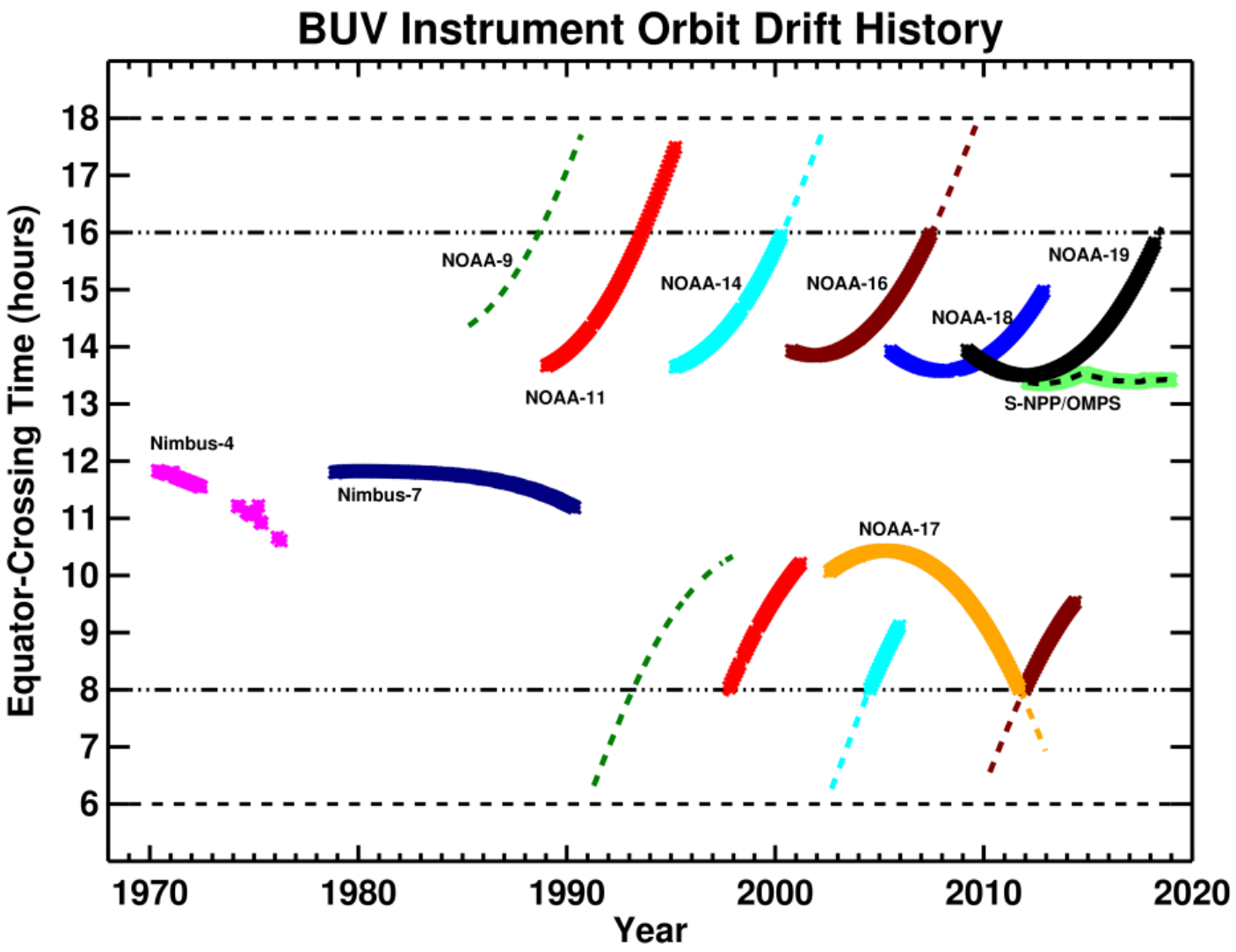
40+ Year Record of Backscatter UV Measurements, but in drifting orbits



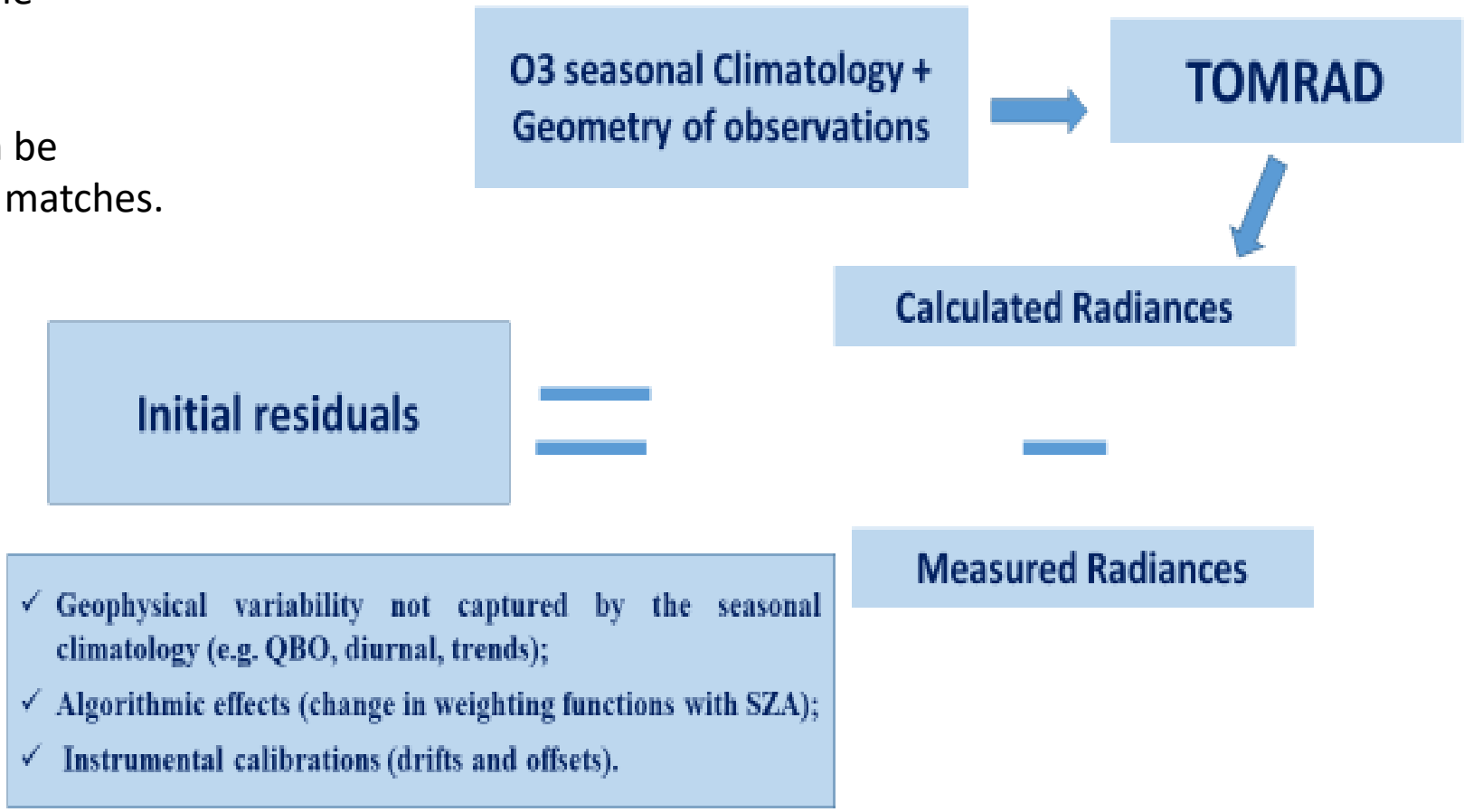
Measurements are explicitly inter-calibrated at the radiance level within the retrieval algorithm. **Still, offsets to 5% between instruments remain, can we reduce these offsets with improved calibration?**

V8.6 intercalibration relies on near-coincident profile matches in space and time to minimize real variability and isolate calibration differences. This approach significantly limits sampling of differences.

A New Approach to Determining Cross-Calibration: Initial Residuals

The initial residual is minimized when geophysical variability is captured in the Calculated Radiances.

Monthly Zonal Mean comparisons can be made, rather than very limited profile matches.



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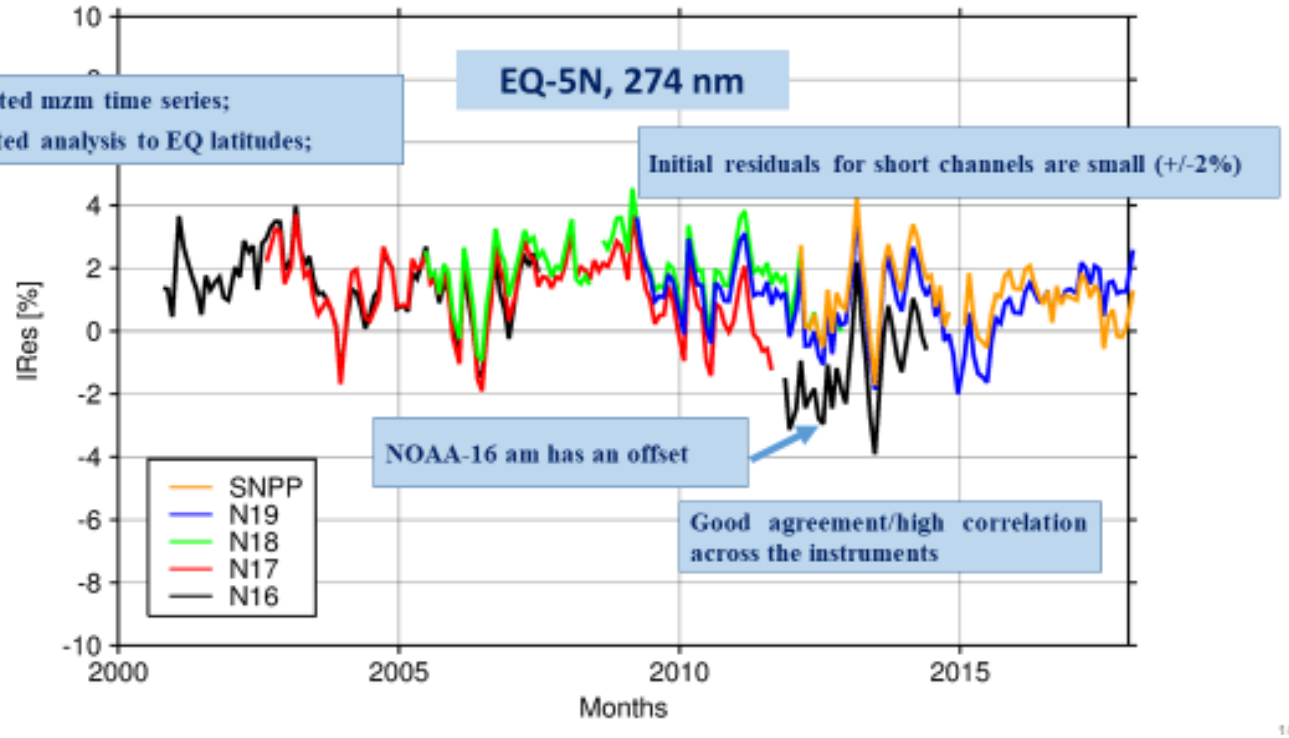
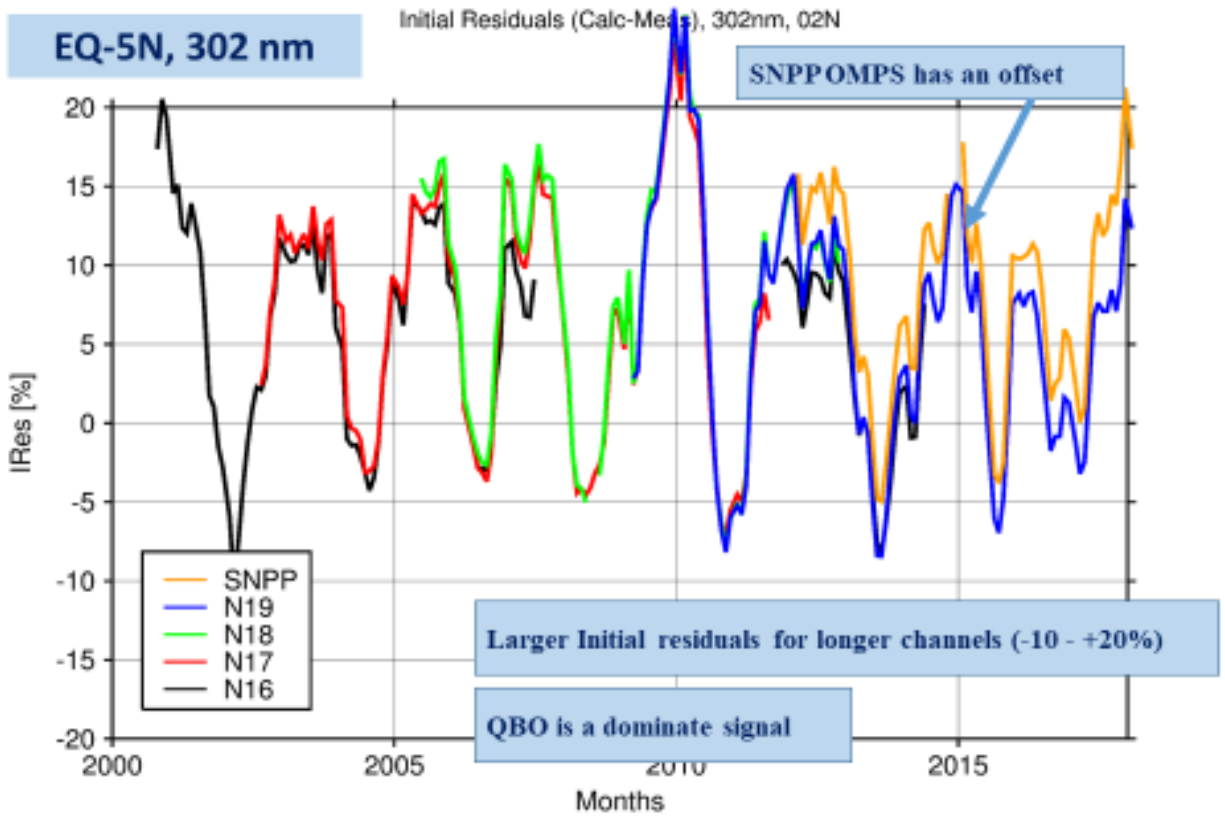


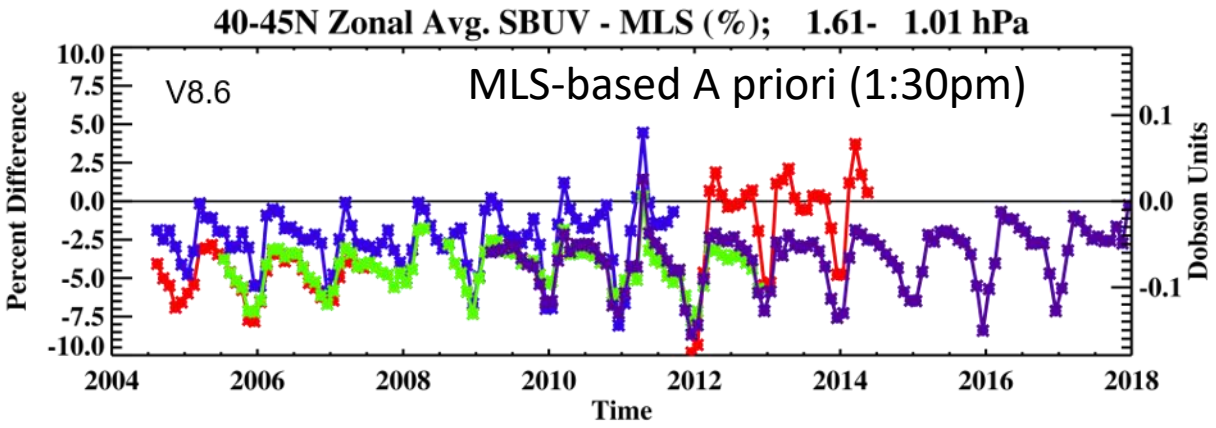


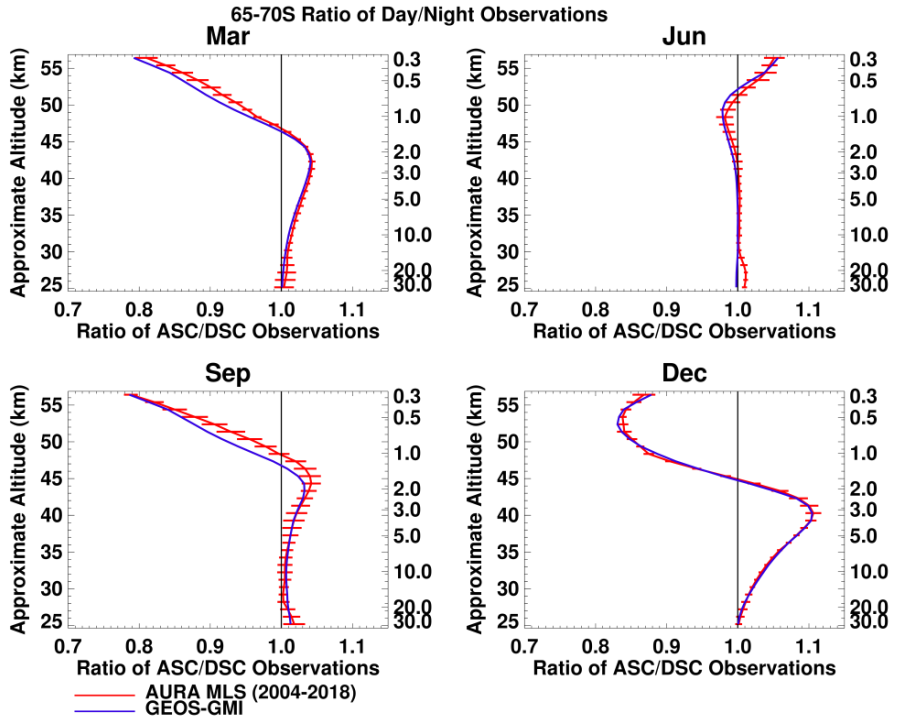
Differences on the order of a percent or less can cause the ozone differences of the order currently observed.

To isolate differences due to measurement error, those due to natural variability must be accounted for in the retrieval A Priori, which improves the calculated radiances.

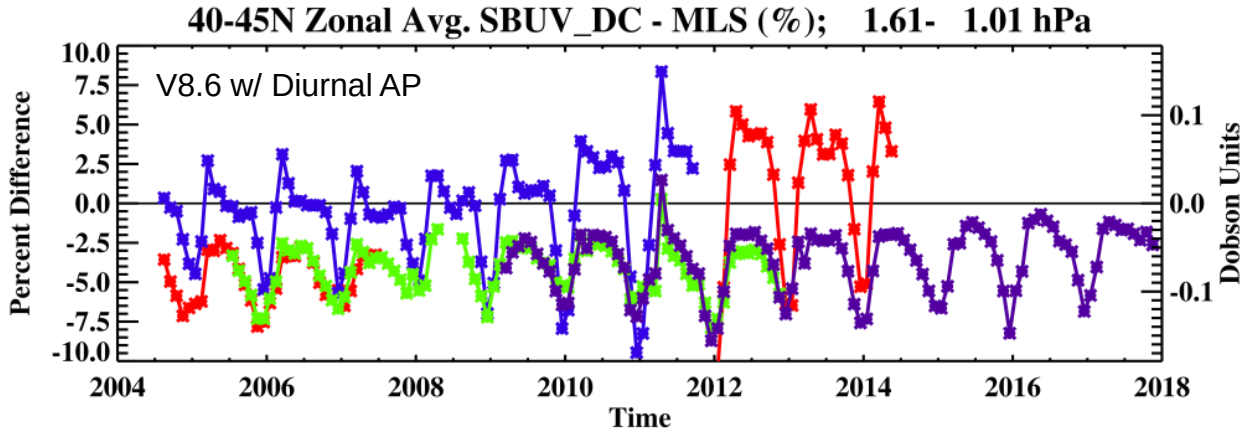
Improved A Priori: Diurnal Cycle

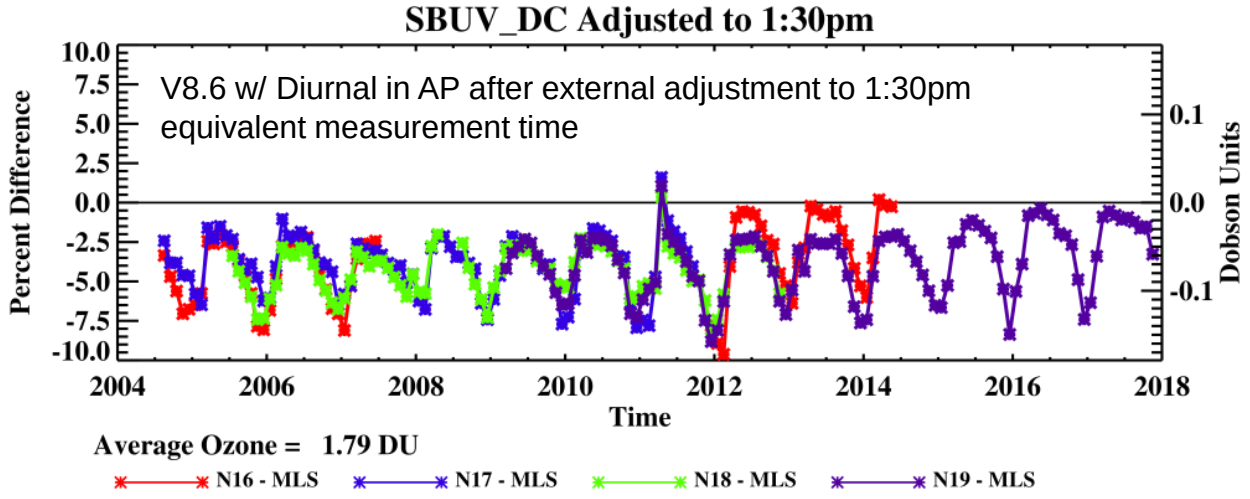
A Priori adjusted based on diurnal ozone climatology to actual measurement time. MLS-based A priori (1:30pm).



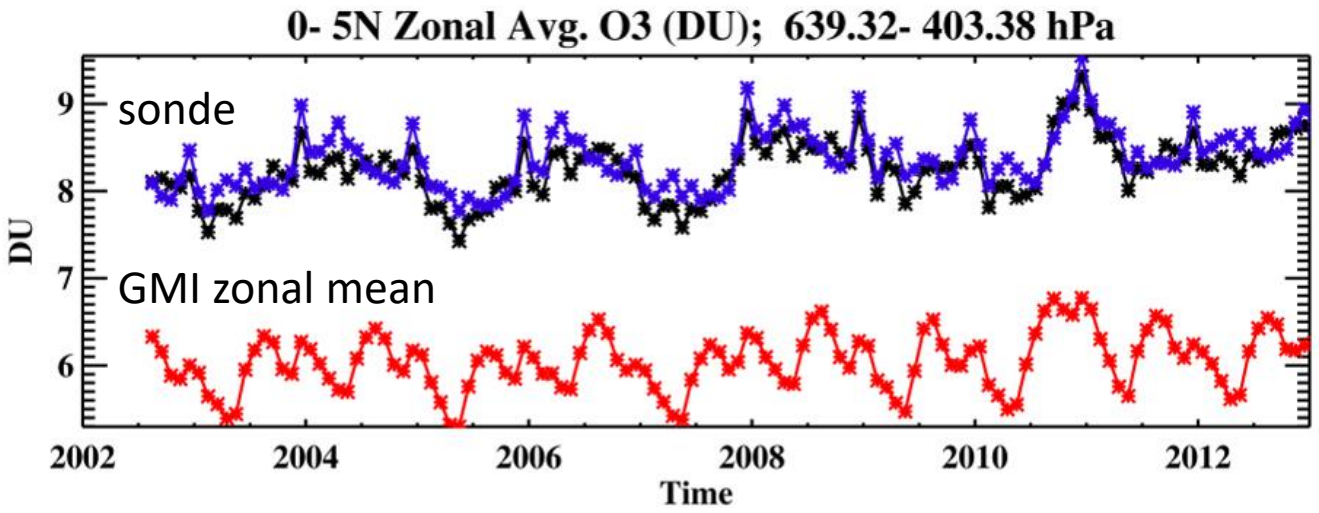


Diurnal variability represented by model-based climatology

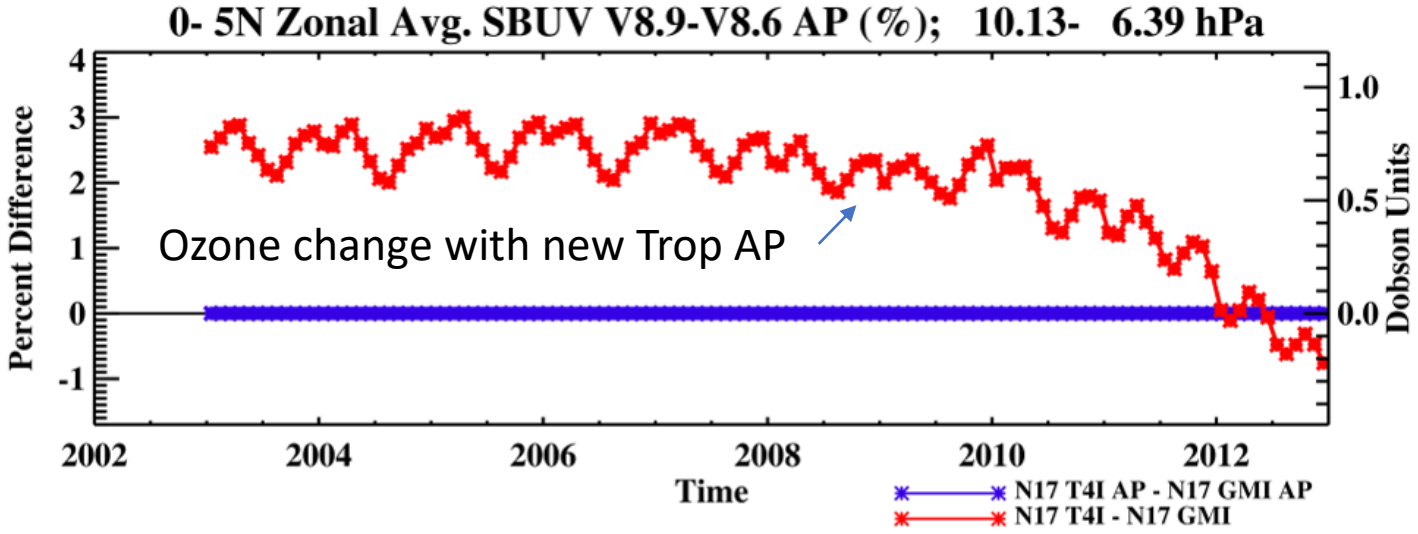


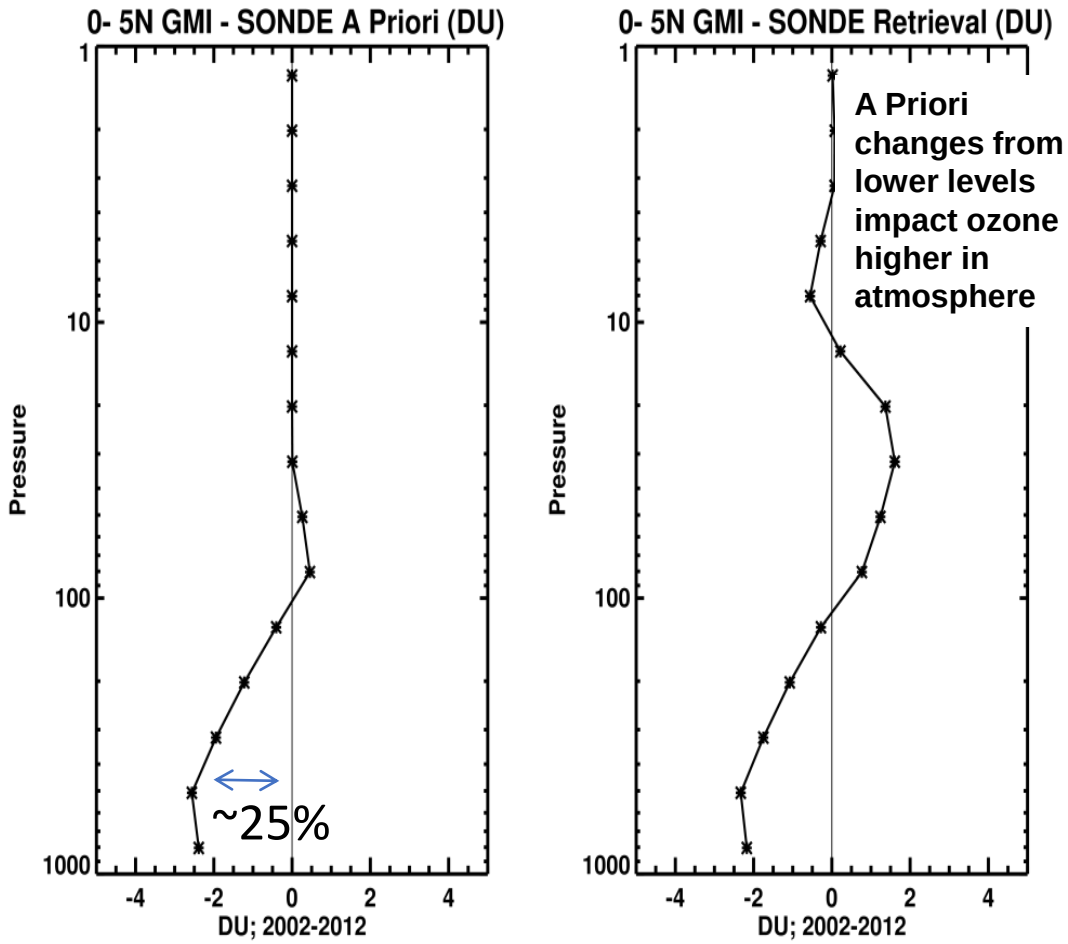


Improved A Priori: Tropospheric Climatology



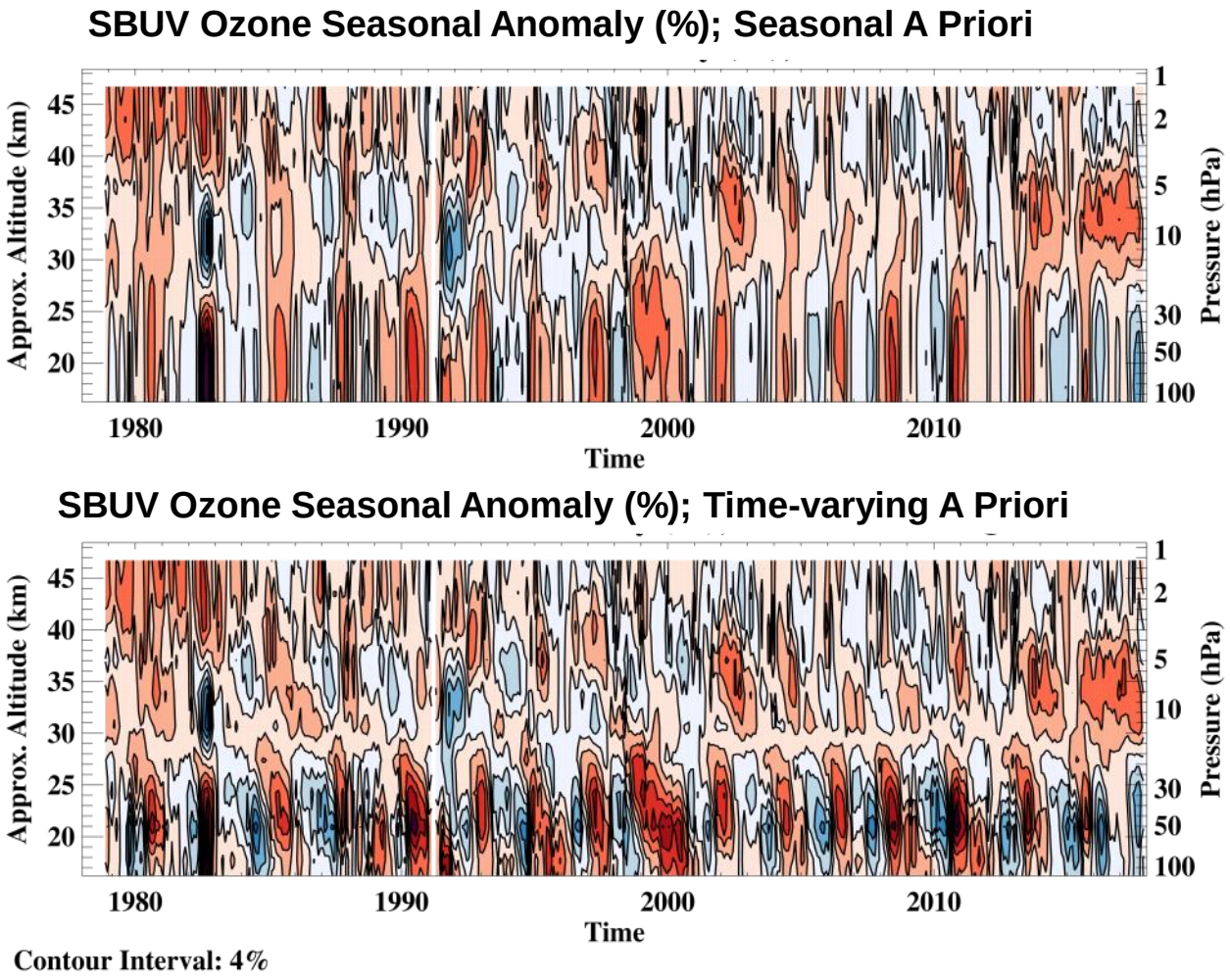
Limited sonde sampling leads to large offset relative to GMI ozone



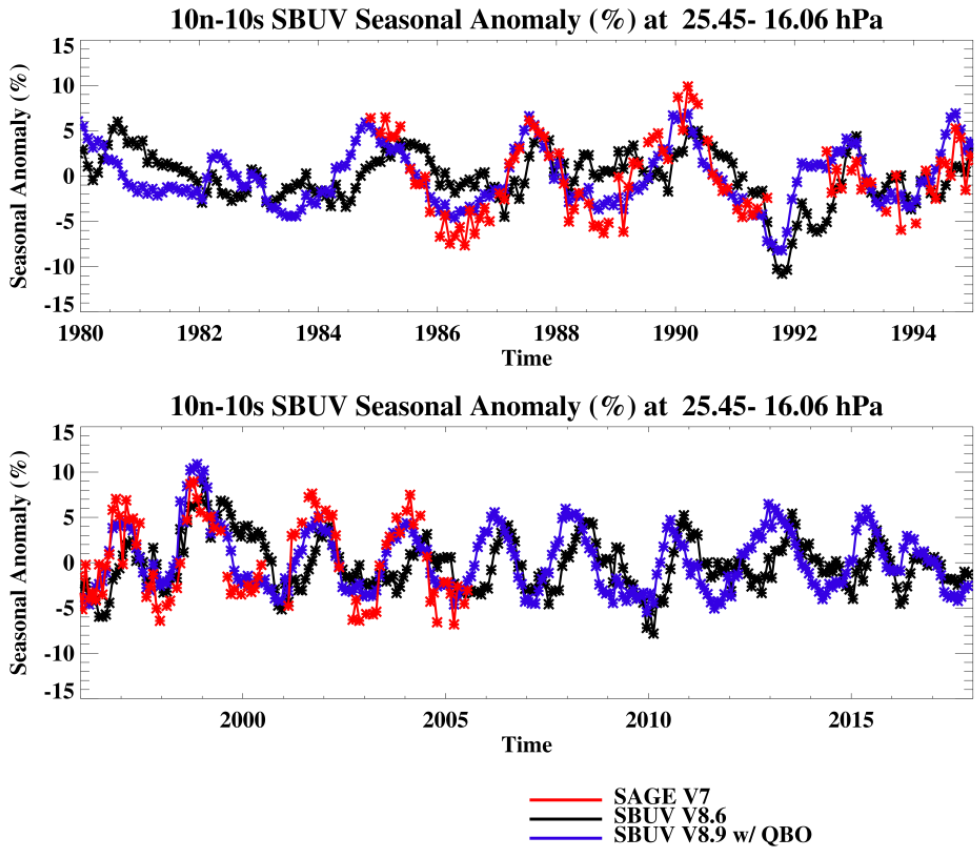


As N17 SBUV's orbit drifts and SZA increases, sensitivity to the tropospheric AP is reduced, imparting a trend in the retrieved ozone.

Improved A Priori: Interannual Variability/QBO



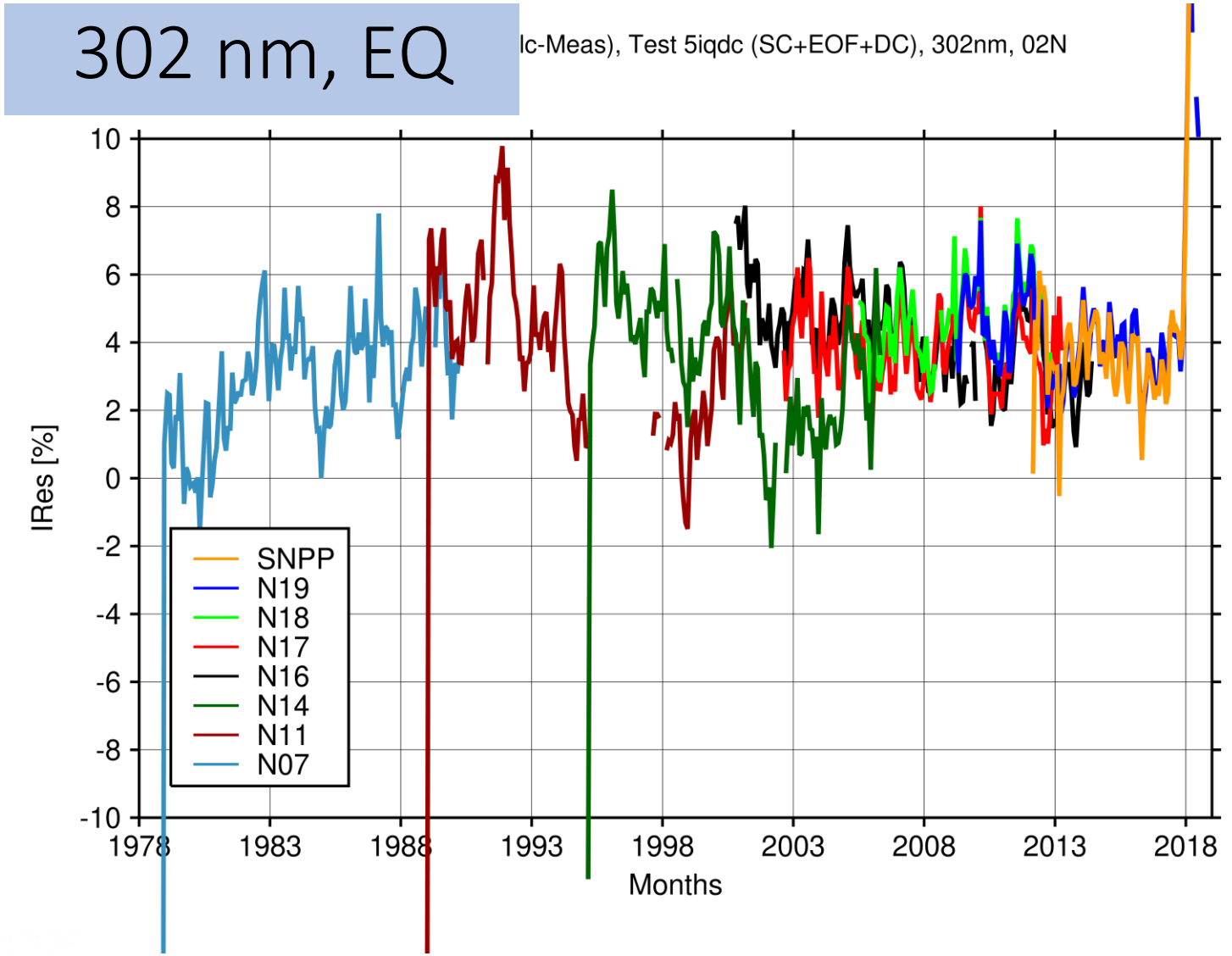
Interannual Variability is added to the A Priori based on a rotational EOF analysis of AURA MLS seasonal anomalies as a function of latitude and altitude.



SBUV sees QBO-scale variability, but the phase is incorrect due to vertical smoothing within the algorithm. SAGE II data agree better with retrieved ozone using the A Priori with interannual variability (here QBO) included.

A New Approach to Determining Cross-Calibration: Initial Residuals

- QBO Variability is largely reduced
- Expanded Analysis to earlier SBUV instruments
- Use results to estimate new calibration adjustments



Current Results and Status

Reduced offsets, particularly near 10 hPa, lead to a reduction in the drift of the MOD data set relative to Aura MLS.

All AP improvements except the Inter-annual variability/QBO will be included in the next version of MOD.

Finishing up some final refinements, but release expected in summer 2020.