Estimating Uncertainties in the Multi-Instrument SBUV Profile Ozone Merged Data Set

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- Measures back-scattered UV radiance in nadir, 14 orbits/day.

- Vertical resolution is ~6 km at 3 hPa, decreasing above and below.

- Profile ozone retrieved using common algorithm, optimized for long-term time series analysis.

- Measurements inter-calibrated at radiance level in V8.6

- Record continues with N19/OMPS
SBUV MOD Data Selection

- Drifting orbits affect data quality
- Use data taken when the orbit equator crossing time is between 8am and 4pm
- Do not use N9 profile data; extend use of N11 data to avoid coverage gap
- No offsets applied; run risk of inducing trends
- Average during overlap periods
SBUV Anomaly Time Series at 45-50N

Relative to 1979-1980 Seasonal Cycle
Monte Carlo Model Parameters

Offset %

Drift % per Yr

“Tier 1”

“Tier 2”
Example Monte Carlo Simulations

Sequential Calibration

SBUV Algorithm Calibration
SBUV MOD Monte Carlo Model Construction

Initial uncertainty simulations

Replicate V8.6 calibration to N11 and N17 references

Merge individual instrument simulations following MOD procedure.
Estimated 2-σ Uncertainty

Tier 1 Drift Variability

EESC (pre-1990)

Linear Trend 1979-1994

PWLT 1979-1996

EESC (post-2000)

Linear Trend 2001-2014

PWLT 1997-2014
EESC and Linear Segment Fits; 1979-1994 and 2001-2014

45-50S; 1979-1994

45-50S; 2001-2014

0-5N; 1979-1994

0-5N; 2001-2014

45-50N; 1979-1994

45-50N; 2001-2014
Summary and Remaining Issues

The MOD data set is uniquely qualified for use in long-term ozone analysis because of its long record, high spatial coverage, and consistent instrument design and algorithm.

The estimated MOD uncertainty term significantly increases the uncertainty over the statistical error alone. Trends in the post-2000 period are generally positive in the upper stratosphere, but only significant at 1-1.6 hPa.

Remaining uncertainties not yet included in the Monte Carlo model are:
- Smoothing Error (~ 1% from 10 to 1 hPa)
- Relative calibration uncertainty between N11 and N17
- Seasonal cycle differences between SBUV records