The uncertainty in stratospheric ozone trends

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Trend production process(es)

- O3 profile data
- Averaged O3 profile data
- Trend analysis
- Combined trend result

- O3 profile data
- Averaged O3 profile data
- Combined data record
- Trend analysis
- Combined trend result
Uncertainty of ozone profile measurements

Limb sounders versus ground

Hubert et al., AMT 2016
... and in the reference data as well

Nadir sounders versus ground

Kramarova et al., ACP 2013
Uncertainties in merged data records

GOZCARDS v1.01

Froidevaux et al., ACP 2015
Uncertainties for averaged data records

To bin ... or not to bin?

SAGE II v7.0 (1998-2005)

Damadeo et al., ACP 2014; poster 34 (today)
Uncertainties from regression model & parameters

SAGE II v7.0 – GOMOS v6.01 (34km, 0S-10S)

GOZCARDS v1.01 (35N-60N)

1997-2012
1998-2012
1999-2012
2000-2012
2001-2012
2002-2012

Harris et al., ACP 2015

Laine et al., ACP 2014; poster 44 (today)
An ensemble of data sets with perturbed offsets + long-term drift

Frith et al., JGR 2014; poster 40 (today)

SBUV (10-16 hPa)
Random error from regression...

Frith et al., JGR 2014; poster 40 (today)
... plus uncertainty due to unknown bias and drift
Identify input data used for trend analysis & regression set-up
(satellite/stations, profile representation, abs or rel, binning, regression model, period, ...)

Baseline (merged) record

Alternative regression set-ups

Perturbed (merged) anomaly records

From SAT-GND or SAT-SAT

“Central” trend estimate

Uncertainty due to observations & regression model

Uncertainty due to regression model

Uncertainty due to observations
... plus uncertainty due to unknown bias and drift

Frith et al., JGR 2014; poster 40 (today)
... next step? adding uncertainty from regression model/parameters.

Frith et al., JGR 2014; poster 40 (today)
Current estimates of systematic uncertainty (1σ) of recent upper stratospheric ozone trends range between 0.4 and 3% per decade.

Quantification of uncertainty, even at Level 2, is a daunting task due to a myriad of methodologies, data records and expressions of results.

Establish a standardised “best” practice for each step in the trend production chain & exhaustive sensitivity studies for alternative plausible methodologies.

We need more realistic propagation of the uncertainties; the ensemble approach may be helpful.

All of this will require a concerted action between all groups involved.