Evaluation of SAGE III/ISS v5.2 water vapor, and updates to the SWOOSH database

Sean Davis, PI
Karen Rosenlof and Melody Avery, Co-PIs
Robert Damadeo, Collaborator

Proposal: Constraining multi-scale processes that impact upper tropospheric and stratospheric water vapor and ozone using SAGE III/ISS and complementary satellite data sets

This presentation: Update of “Validation of SAGE III/ISS Solar Water Vapor Data With Correlative Satellite and Balloon-Borne Measurements”, JGR, 2020, 10.1029/2020JD033803
Primary tasks for our proposal

1) Assess SAGE III/ISS version 5.2 and add to SWOOSH (satellite stratospheric ozone and water vapor merged dataset)
2) Extend the analysis of Avery et al (2017) looking at anomalous convective ice transport into the stratosphere. (and related events)

Completed since the start of funding for the current proposal

Updates of the comparison plots from Davis et al. 2021\textsuperscript{1} using v5.2 data.
1) Look at anomaly events and filtering.
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- Most “Anomaly events” identified in v5.1 WV not present in v5.2
- Significant spread (noise) above 30 km, upper level noise is normally distributed in 5.2, not in 5.1
- Cloud/aerosol filtering algorithm from v5.1 appears to work for v5.2
2) Look at matched profiles (with MLS 4.2 and ACE 3.6 & 4.1)

V5.2 SAGE III/ISS is vertically smoothed (2 km triangle)

- V5.2 data lie in between MLS v4.2 and ACE-FTS. Data are in better agreement with MLS v4.2
3) Lat/Alt comparison between SAGE III/ISS and MLS 4.2

V5.1

V5.2
Comparison with Frostpoint Hygrometers

Reduced bias with SAGE V5.2

These use MLS V4.2

V5.1

V5.2
Comparisons of SAGE V5.2 with MLS V4.2 and V5.0

- Solid black line: SAGE, MLS V4.2 comparison
- Dotted black line: SAGE, MLS V5.0 comparison

SAGE is ~0.2 ppmv drier than MLS V4.2
SAGE is ~0.3 ppmv wetter than MLS V5.0

If one considers the FP comparisons, this means that MLS V5.0 will not agree as well with FP as MLS 4.2 did.
SWOOSH product

- SWOOSH is a vertically-resolved monthly-mean zonal-mean data set of stratospheric WV and O$_3$ from multiple satellites

Available at https://csl.noaa.gov/groups/csl8/swoosh/

Beta V2.7 includes SAGE III/ISS data, it will be finalized at the end of 2021.
SWOOSH updates for v2.7

New data sources in 2.7:
SAGE III/ISS v5.2 $O_3$ and WV (SAGE III/ISS was not in 2.6)
OMPS-LP $O_3$ v2.5

Updated data versions/processing in 2.7:
MLS v5 (v4.2 previously)
ACE-FTS WV and O3 v4.1 (was 3.6 previously)
SAGE II $O_3$ screening as detailed in Kremser et al., ESSD 2020

Methodological changes:
Instruments included in the merged arrays may change.
Additional information (mean position and time) will be augmented relative to V2.6
From **BAMS State of the Climate** report for 2020: Red lines are SWOOSH at 82 mb, symbols are 100-70mb FP average

**Work in Progress or planned this year:**
We are currently investigating the SH increase in water vapor in 2020, possibly related to the Australian New Year fires.

A research scientist (Yue Jia) just started with us, and will be working on WV trajectory runs to extend the analysis of Avery et al (2017) to look for incidents where cloud ice impacts stratospheric water vapor.

Comparisons with Strateole-2 flights (currently ongoing) are also planned.