

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

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*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<sup>1</sup> using v5.2 data.

### JGR Atmospheres

#### RESEARCH ARTICLE

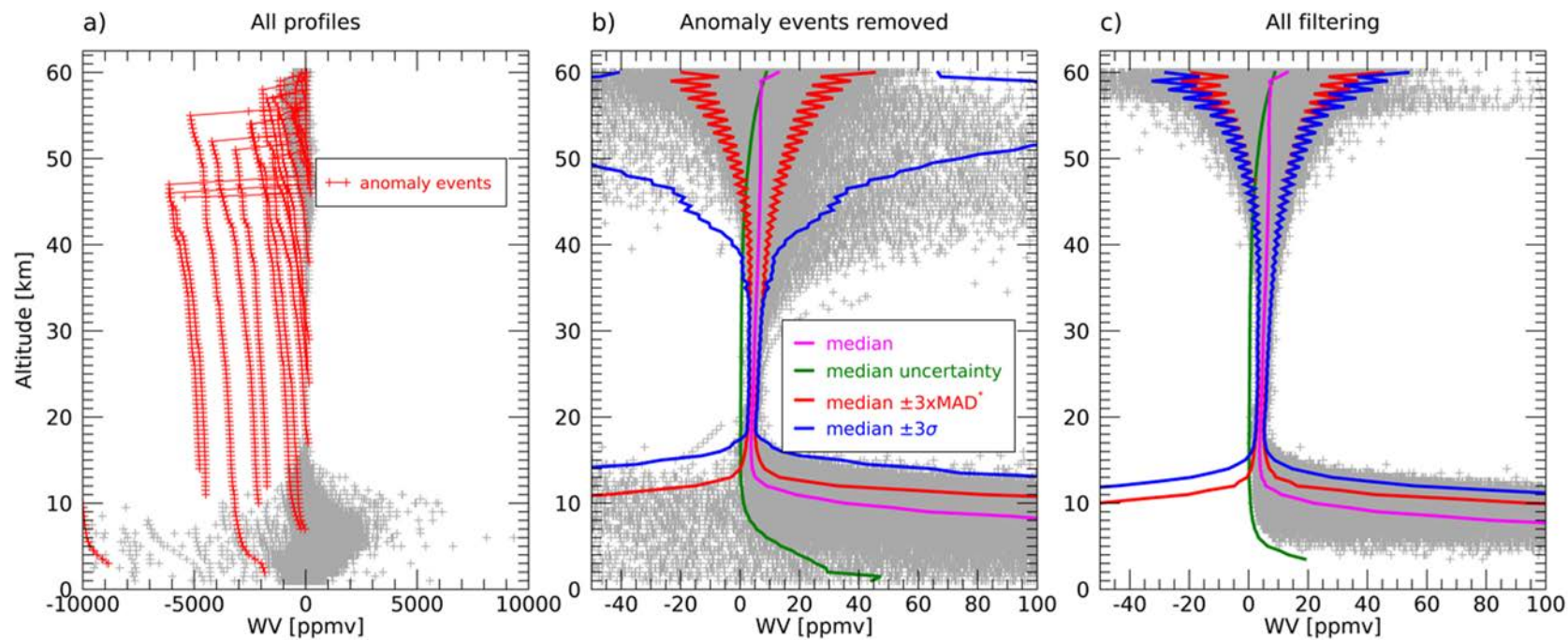
10.1029/2020JD033803

#### Validation of SAGE III/ISS Solar Water Vapor Data With Correlative Satellite and Balloon-Borne Measurements

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H. Selkirk<sup>10,11</sup> , G. Taha<sup>10,11</sup> , K. A. Walker<sup>12</sup>, and H. Vömel<sup>13</sup> 

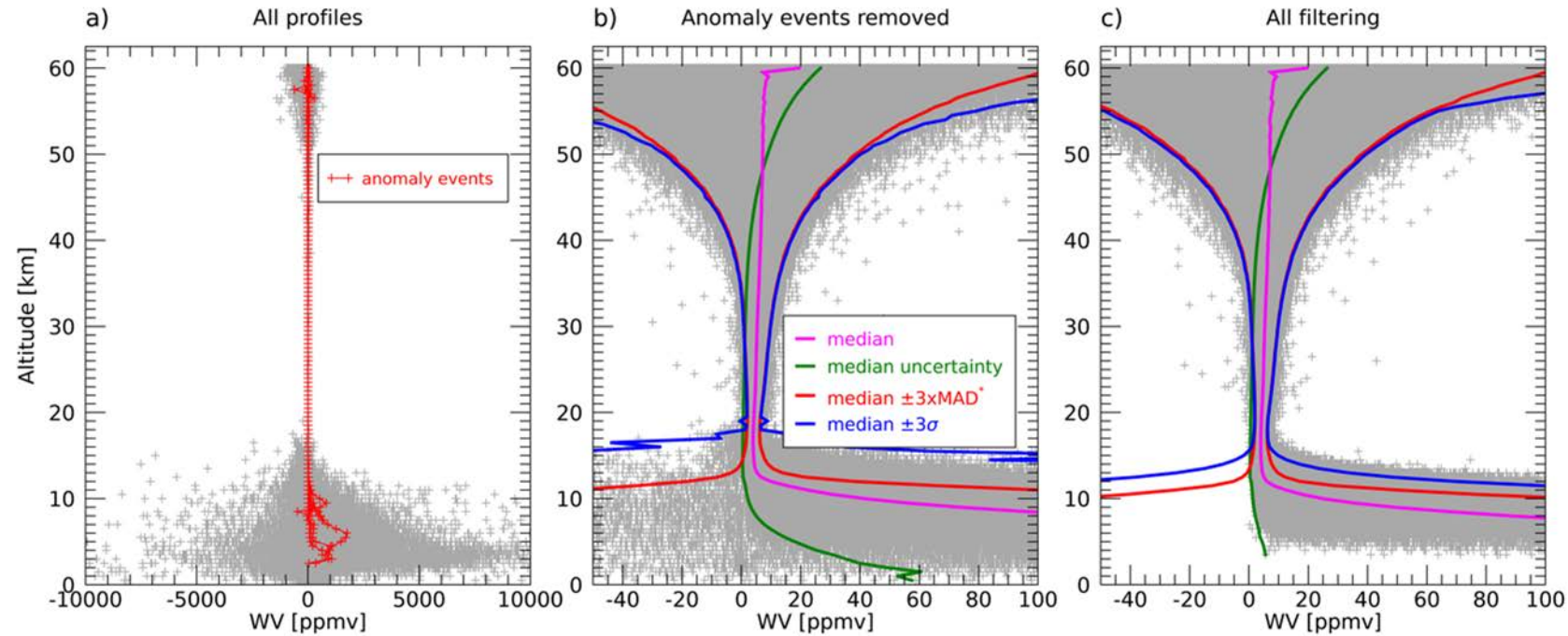
# 1) Look at anomaly events and filtering.

V5.1



# 1) Look at anomaly events and filtering.

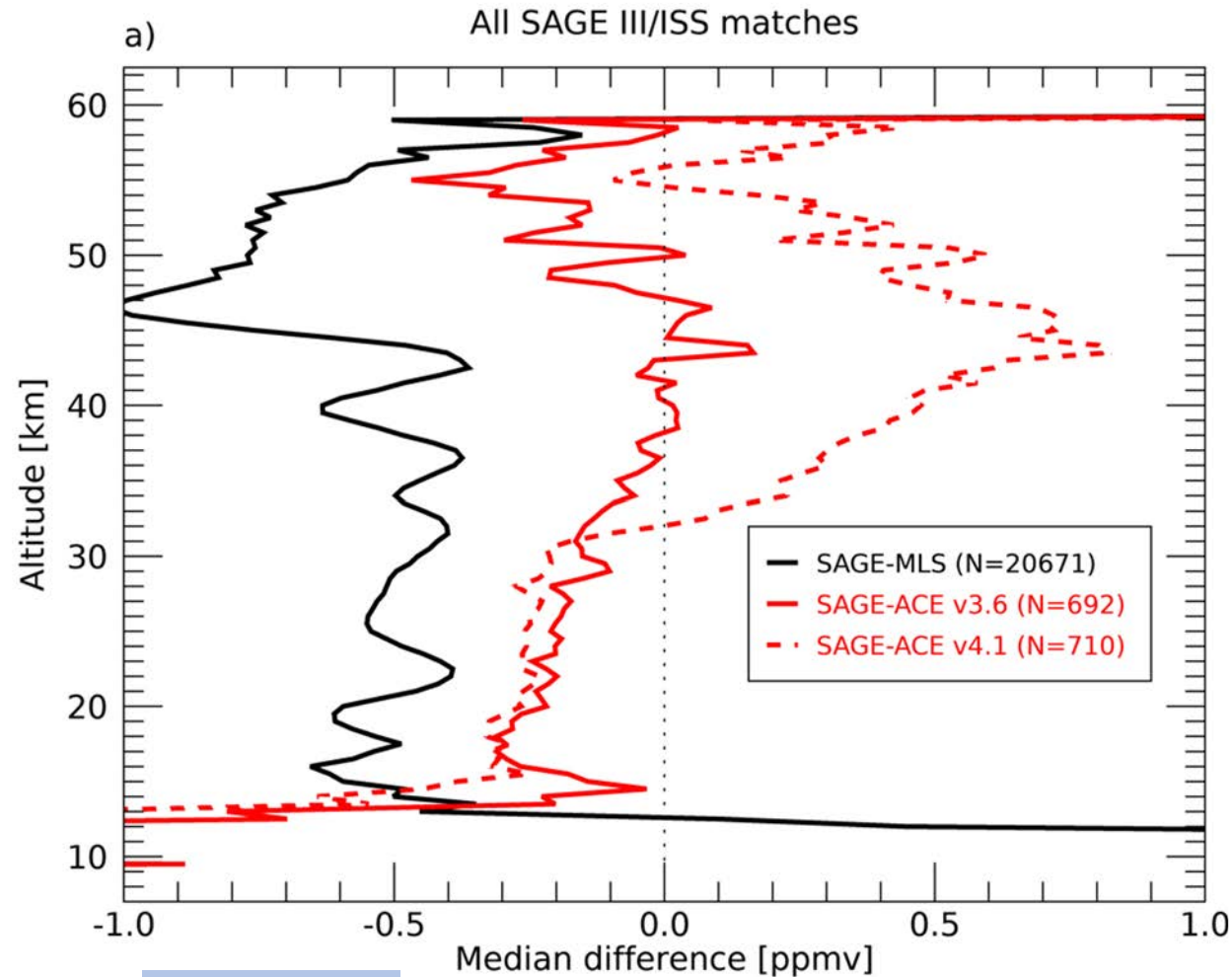
V5.2



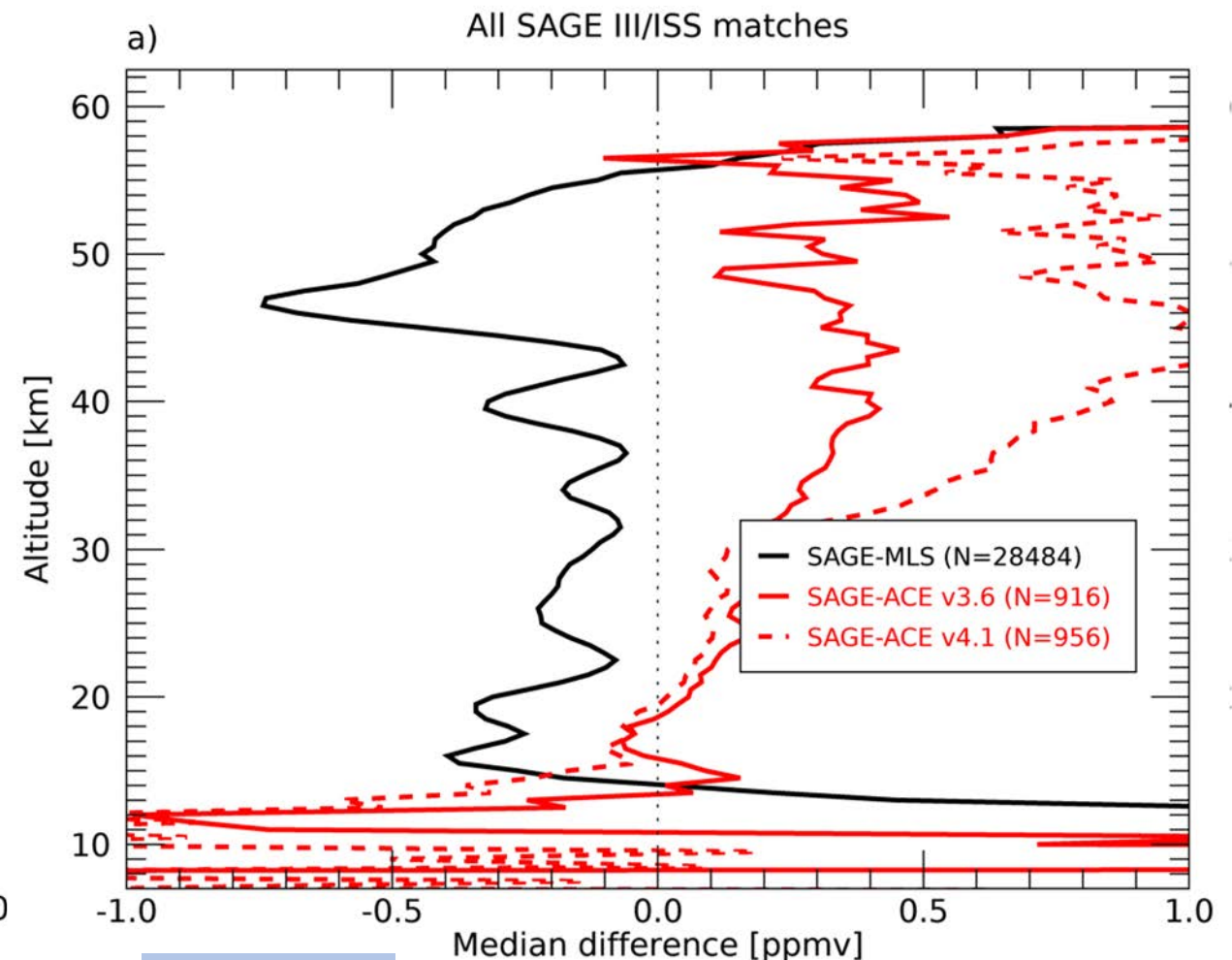
- Most “Anomaly events” identified in v5.1 WV not present in v5.2
- Significant spread (noise) above 30 km, upper level noise is normally distributed in 5.2, not in 5.1
- Cloud/aerosol filtering algorithm from v5.1 appears to work for v5.2



## 2) Look at matched profiles (with MLS 4.2 and ACE 3.6 & 4.1)



V5.1



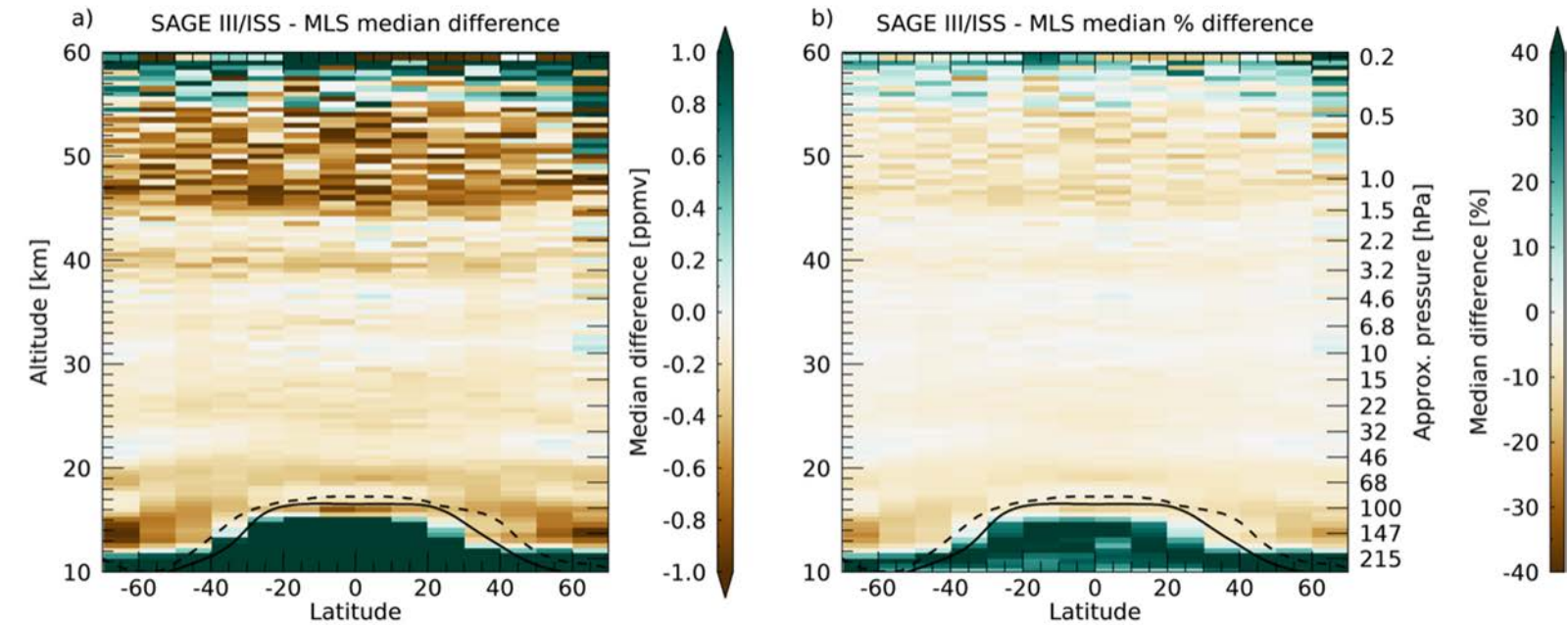
V5.2

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

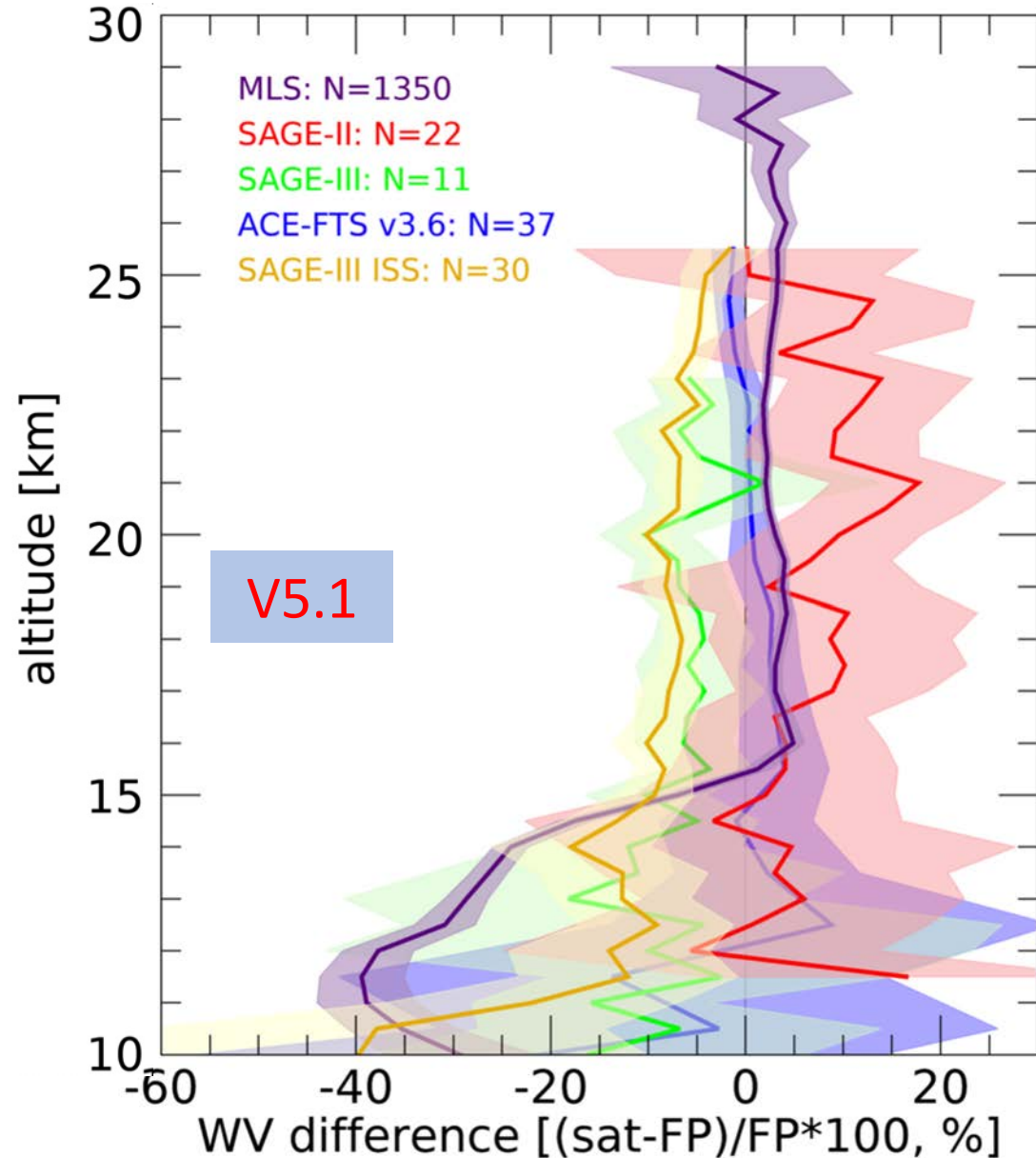
V5.1

V5.2

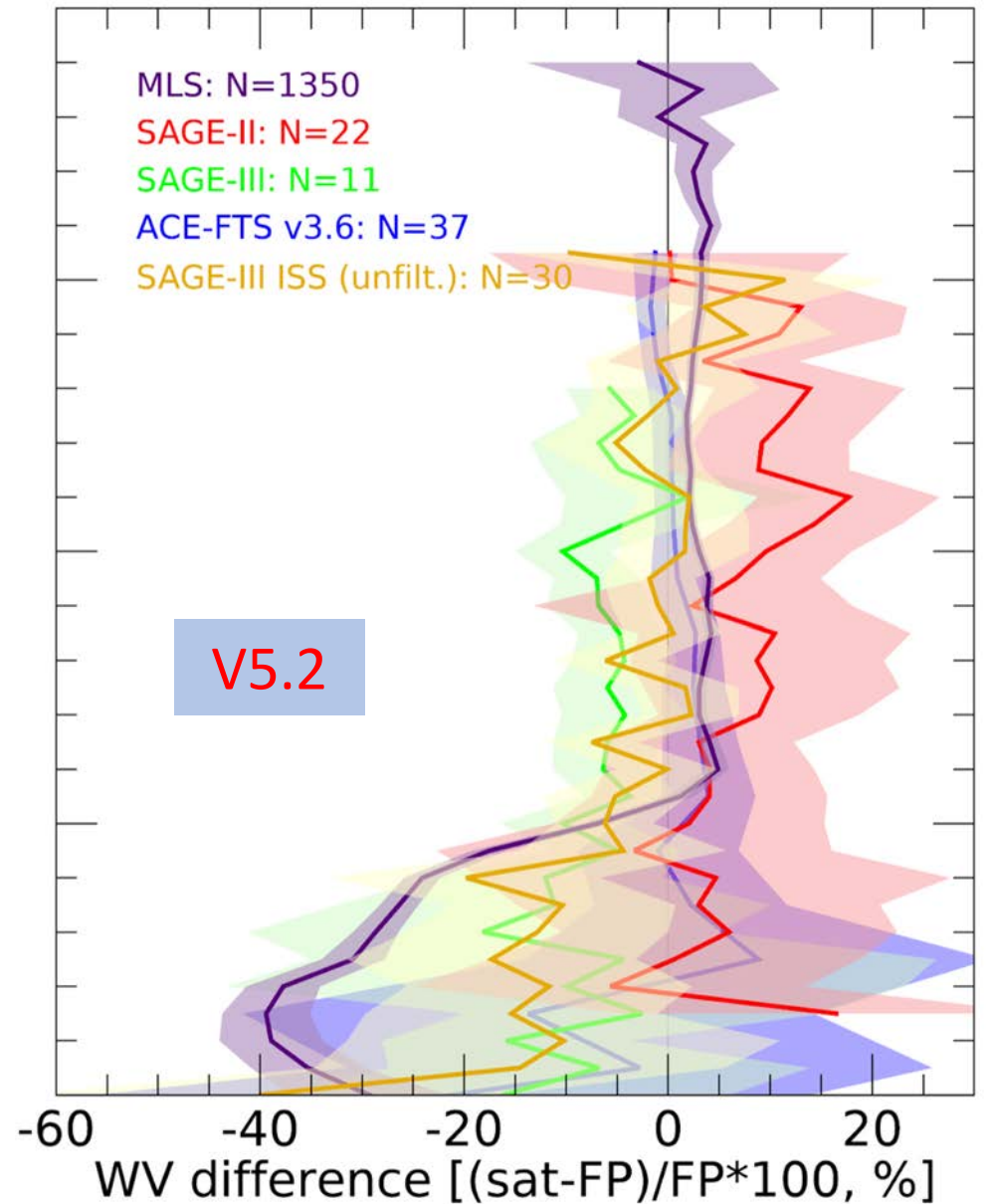


# Comparison with Frostpoint Hygrometers

Reduced bias with SAGE V5.2

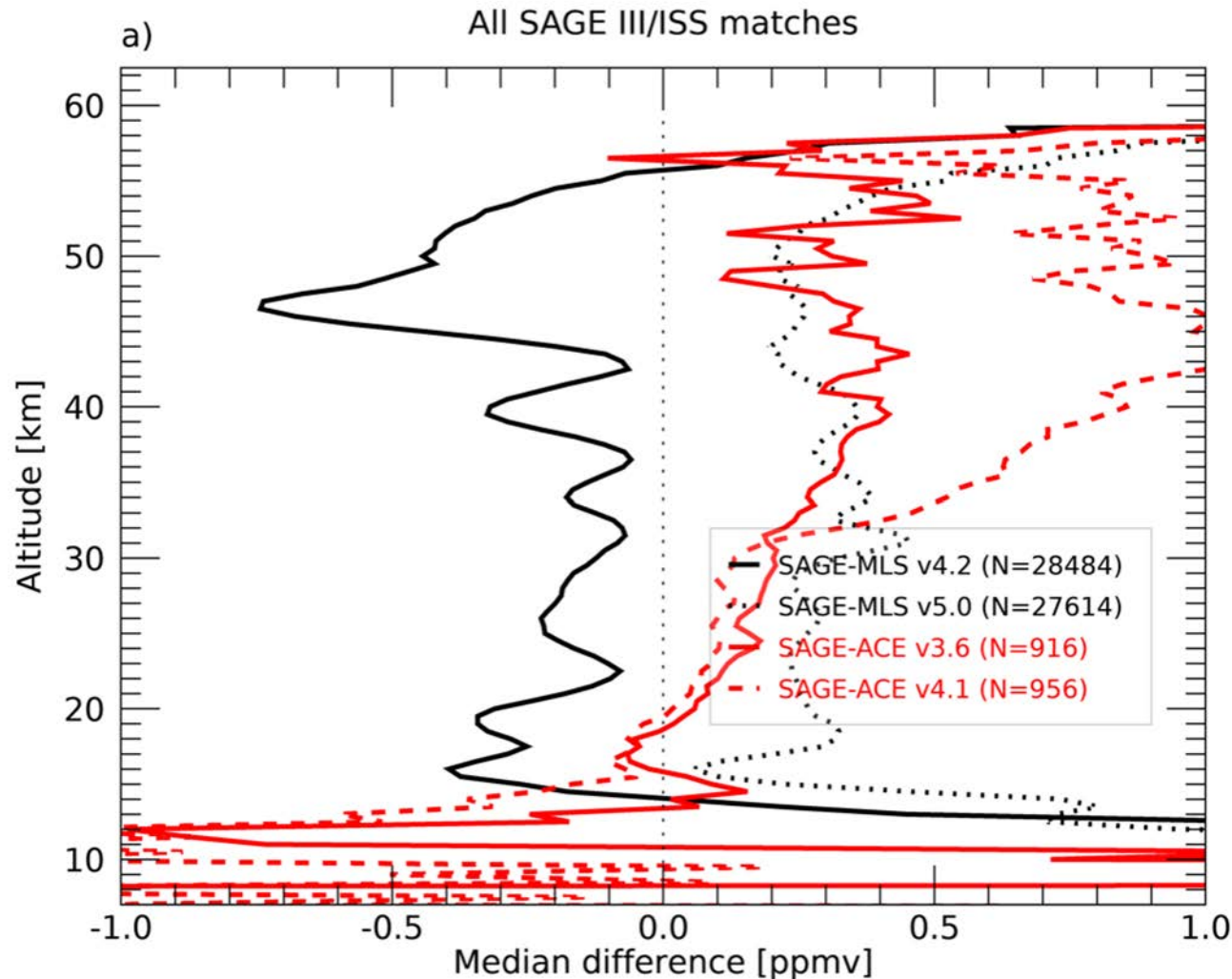


These use  
MLS V4.2





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



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

SAGE is  $\sim 0.2$  ppmv drier than MLS V4.2  
SAGE is  $\sim 0.3$  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.



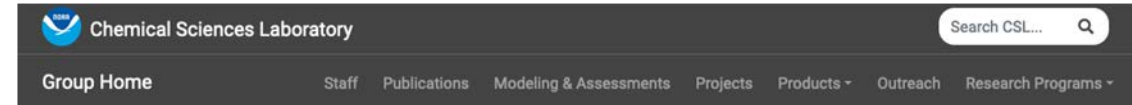
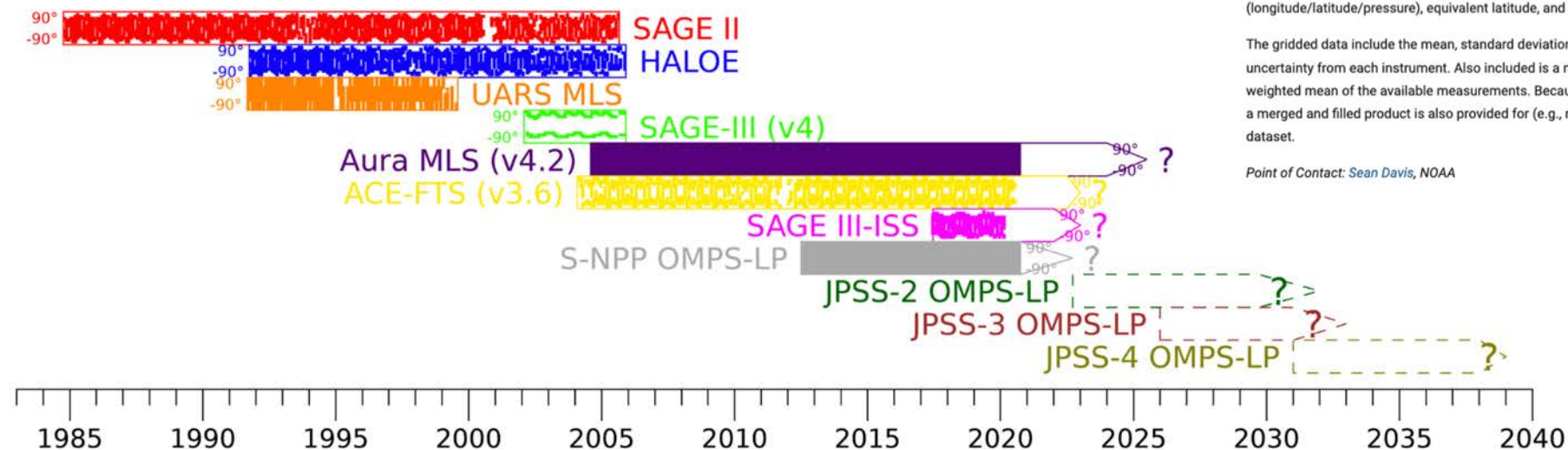
# SWOOSH product

- SWOOSH is a vertically-resolved monthly-mean zonal-mean data set of stratospheric WV and O<sub>3</sub> from multiple satellites

Available at

<https://csf.noaa.gov/groups/csf8/swoosh/>

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



Chemistry & Climate Processes: Products

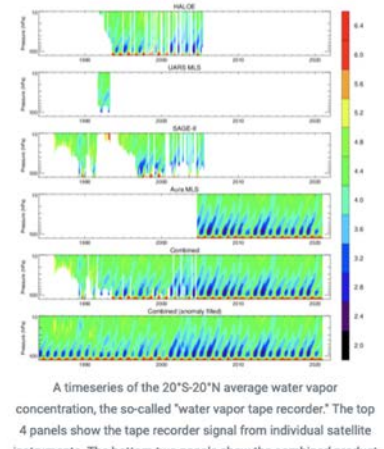
## SWOOSH: Stratospheric Water and OzOne Satellite Homogenized data set

The Stratospheric Water and OzOne Satellite Homogenized (SWOOSH) data set is a merged record of stratospheric ozone and water vapor measurements taken by a number of limb sounding and solar occultation satellites over the previous ~30 years. The SWOOSH record spans 1984 to present, and is comprised of data from the SAGE-II/III, UARS HALOE, UARS MLS, and Aura MLS instruments. The measurements are homogenized by applying corrections that are calculated from data taken during time periods of instrument overlap.

The primary SWOOSH data product consists of monthly-mean zonal-mean values on a pressure grid. In addition to the primary (zonal-mean) grid, SWOOSH data are also available on 3D (longitude/latitude/pressure), equivalent latitude, and isentropic grids.

The gridded data include the mean, standard deviation, number of observations, and mean uncertainty from each instrument. Also included is a merged (multi-instrument) product based on a weighted mean of the available measurements. Because the merged product contains missing data, a merged and filled product is also provided for (e.g., modeling) studies requiring a continuous dataset.

Point of Contact: [Sean Davis](#), NOAA



# SWOOSH updates for v2.7

New data sources in 2.7:

SAGE III/ISS v5.2 O<sub>3</sub> and WV (SAGE III/ISS was not in 2.6)

OMPS-LP O<sub>3</sub> v2.5

Updated data versions/processing in 2.7:

MLS v5 (v4.2 previously)

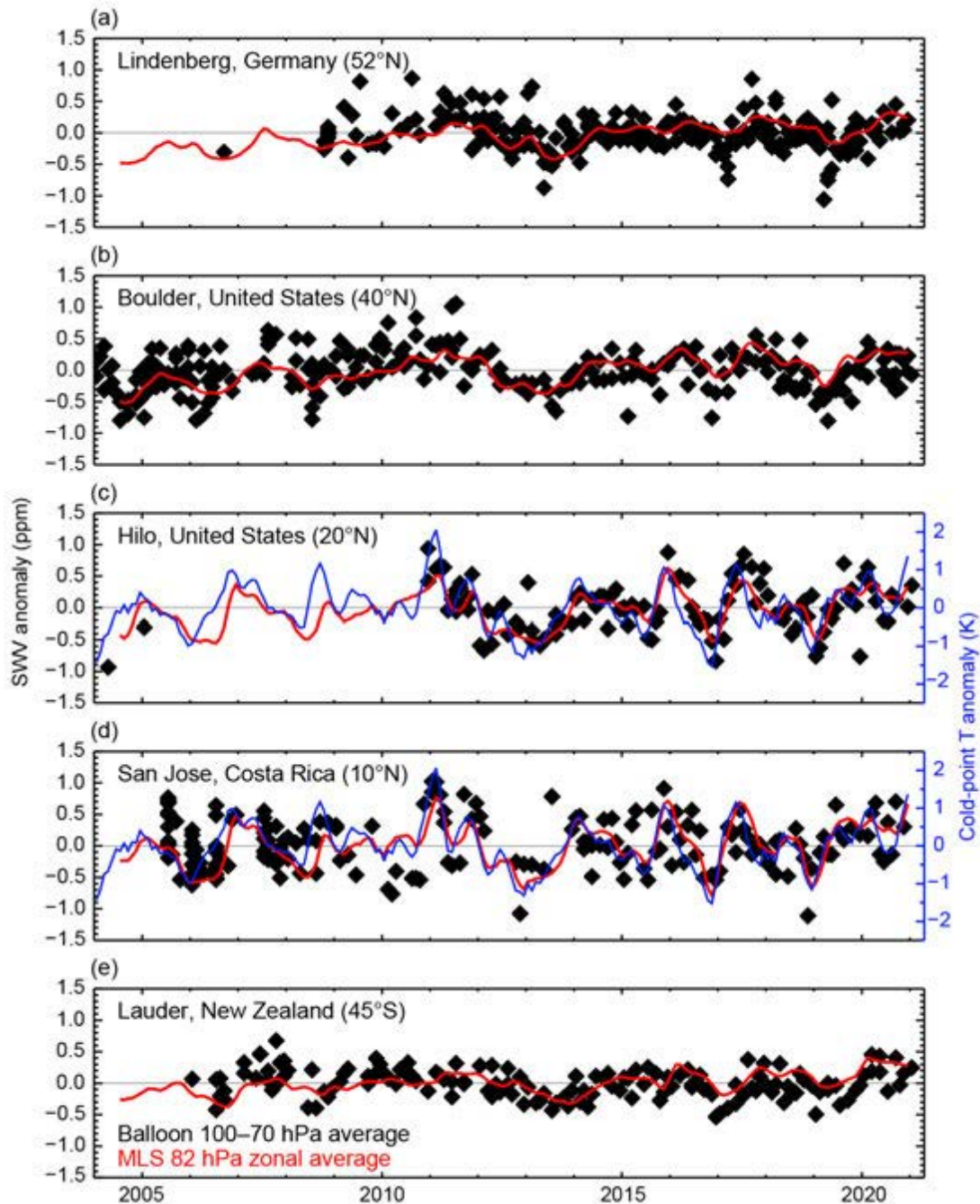
ACE-FTS WV and O<sub>3</sub> v4.1 (was 3.6 previously)

SAGE II O<sub>3</sub> 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.