

Sondes Working Group: Ozonesonde Updates

Ryan Stauffer (2022+) and Roeland Van Malderen (2024)

2022 NDACC Steering Committee Meeting

27 September 2022, Institut des Systèmes Complexes Paris Île-de-France



← Dale Hurst talk on
Water Vapor Sondes
is next!

NDACC Ozonesonde Stations (28 Active)

- 18 in Northern Hemisphere, 10 in Southern Hemisphere
- These 28 active stations have archived 47,780 files at the NDACC DHF as of 19 Sep 2022
- Data remains archived for inactive stations such as Thule and Summit



NDACC Ozonesonde Statistics (as of 19 Sep 2022)

SITE	Latitude	# Profiles	Archive Update	SITE	Latitude	# Profiles	Archive Update
Alert	82.5	0	Jun-19	Natal	-5.8	10	Mar-22
Eureka	80.0	0	Jun-19	American Samoa	-14.2	36	Aug-22
Ny-Aalesund	78.9	81	Sep-22	La Reunion	-20.9	36	Dec-20
Scoresbysund	70.4	55	Aug-22	Broadmeadows	-20.9	50	Aug-21
Sodankyla	67.3	28	Oct-19	Lauder	-45.0	47	Jun-22
Legionowo	52.4	52	Oct-21	Macquarie Island	-55.0	53	Aug-21
Lindenberg	52.2	61	Sep-22	Dumont d'Urville	-66.6	16	Dec-19
De Bilt	52.1	49	Oct-21	Neumayer	-70.6	62	Sep-22
Uccle	50.8	145	Jul-22	Belgrano	-77.8	22	Sep-22
Praha	50.0	48	Apr-22	South Pole	-90.0	53	Sep-22
Hohenpeissenberg	47.8	127	Aug-22				
Payerne	46.8	144	Dec-21	Total Measurement Last 12 Months:		1455	Missing Canada
OHP	43.9	43	Dec-21	Total Measurement Days 2021:		1546	
Boulder	39.9	57	Sep-22	Total Measurement Days 2020:		1485	
Wallops Island	37.9	48	May-21	Total Measurement Days 2019:		1507	
Izana	28.3	52	Jul-22	Total Measurement Days 2018:		1541	
Hilo	19.7	50	Sep-22	Total Measurement Days 2017:		1319	
Paramaribo	5.8	30	Sep-21	Total Measurement Days 2016:		1555	

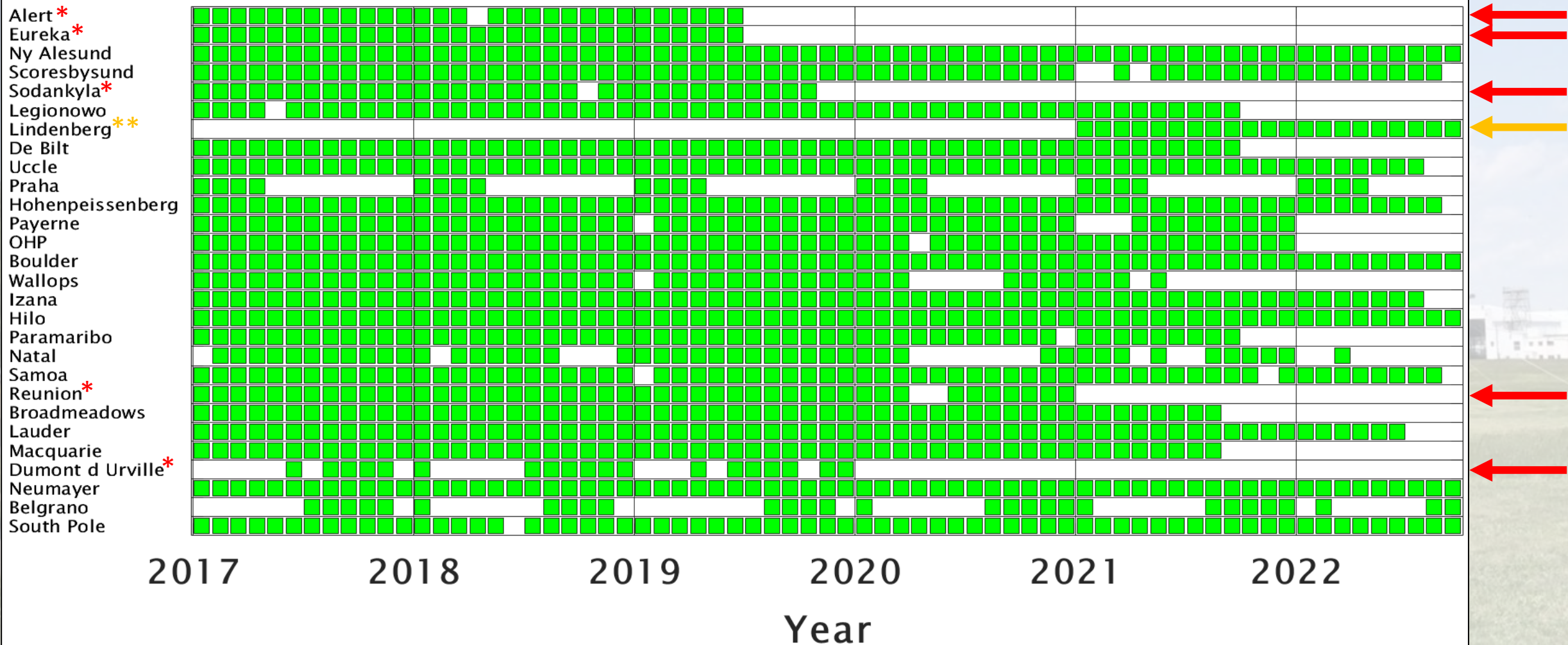
- 26 of 28 ozonesonde station reports received

- Five stations are considered **not up-to-date** on NDACC DHF (approaching 2 years old or more)

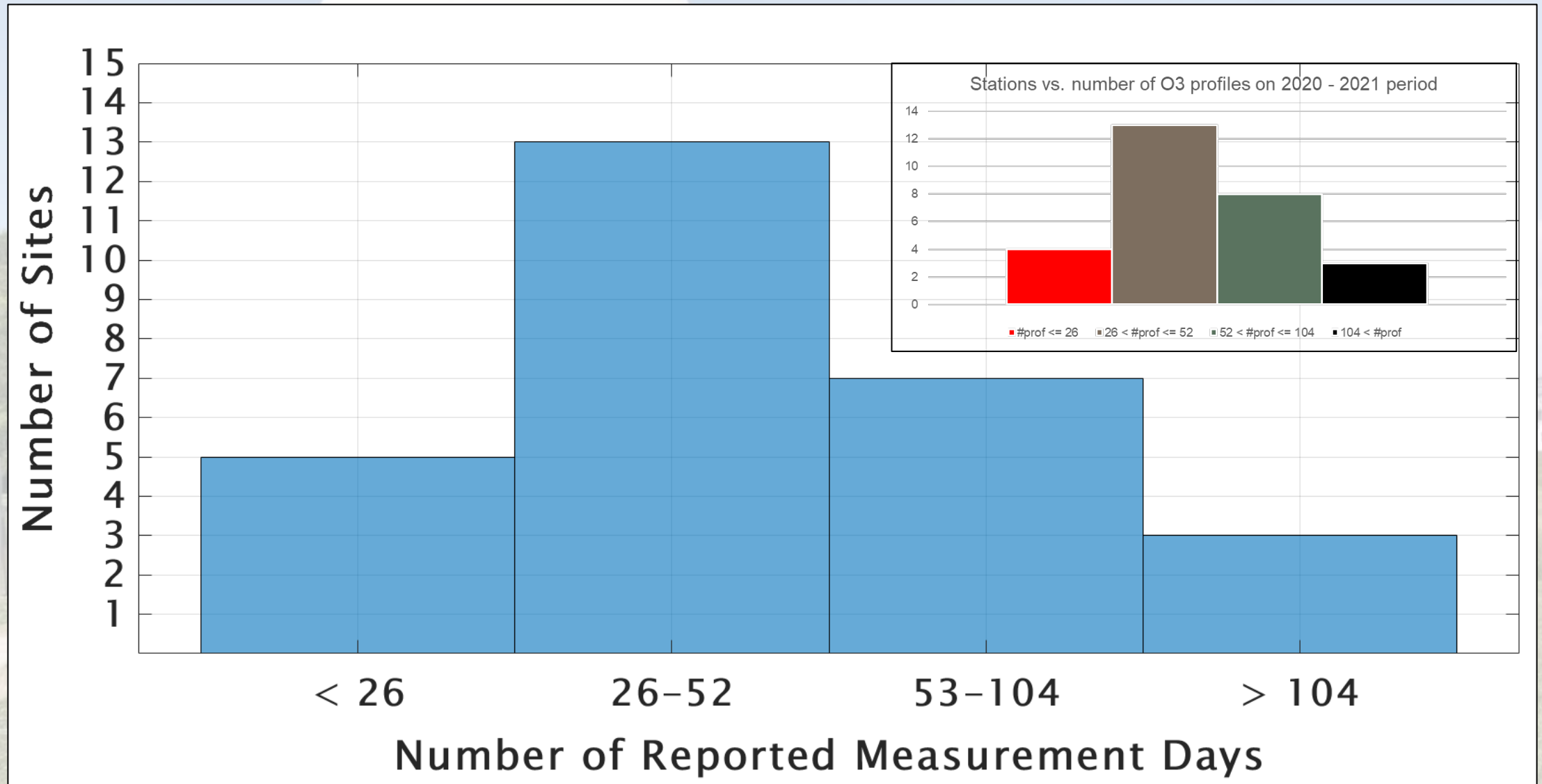
- 1455 total measurement days in this round of reporting, near the previous 5-year average (missing Canadian stations)
- Will contact the necessary PIs to ensure upload of recent data

Ozonesonde Data Submission (as of 19 Sep 2022)

NDACC Ozonesonde Archive Status (19 Sep 2022)



2021-2022 Reporting Period Ozonesonde Data

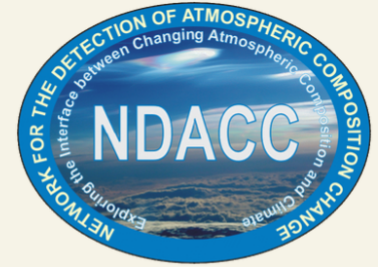


New Working Group Webpage Under Construction

- D. Kollonige (NASA/GSFC) working on new WG webpage
- To be hosted within the SHADOZ website. Need to update link from NDACC webpage
- To include information on potential Ames format changes, GEOMS HDF progress, DQA activities, etc.

NDACC Sonde Working Group

- The NDACC Sonde Working Group is responsible for the activities pertaining to ozonesondes, water vapor and aerosol sondes.
- The working group representatives on the steering committee are:
 - [Dr. Ryan M. Stauffer](mailto:ryan.m.stauffer@nasa.gov), NASA Goddard Space Flight Center, Greenbelt, MD, USA; ryan.m.stauffer@nasa.gov
 - [Dr. Roeland Van Malderen](mailto:roeland.vanmalderen@meteo.be), Royal Meteorological Institute, Uccle, Belgium; roeland.vanmalderen@meteo.be
 - [Dr. Dale F. Hurst](mailto:dale.hurst@noaa.gov), NOAA Global Monitoring Lab, Boulder, CO, USA; dale.hurst@noaa.gov
- There are 28 active NDACC ozonesonde stations (see Map and Table below for locations and station data contacts).
- The data for the NDACC ozonesonde stations can be found at the [NDACC Data Housing Facility \(DHF\)](#) and is listed by the station.



NDACC Active Ozonesonde Stations



https://tropo.gsfc.nasa.gov/shadoz/NDACC_SondeWorkingGroup.html

Issues Raised in Ozonesonde Station Reports

1. GEOMS HDF Format and Central Processing (added question to Report forms)
 - This will be discussed in later slides
2. Adoption of ASOPOS 2.0 Recommended Standard Operating Procedures
 - Virtual webinars are being planned by ASOPOS 2.0 to communicate the new WMO/GAW Report #268 and latest SOPs
3. Recent biases in total column ozone at Legionowo (and other stations)
 - More on network data quality issues in later slides, and also data homogenization in the 220pm Thursday ozonesonde science talk
4. Helium supply issues and switch to hydrogen lifting gas at some stations
 - Severely affected Natal operations in 2021-2022
5. Raw data archiving at NDACC: Mostly positive responses from stations

GEOMS HDF Progress

New WMO/GAW Report #268 (see later) sets a **new standard for (meta)data archiving** (→ re-processing!) including uncertainties, flagging, etc.

STEP 1: ascii Formats

- Current ascii formats (NASA-Ames, WOUDC, SHADOZ, GRUAN) need to update to be compliant, also with each other! → *streamlining ongoing*
- Survey in NDACC reports on modifying NASA-Ames format:
 - ✓ “YES”: 17 stations
 - ✓ “MAYBE”: 5 stations
 - ✓ “NO”: 2 stations (Dumont d’Urville and Legionowo)
 - ✓ no answer: 4 stations
- → Ryan & Roeland will propose new NASA-Ames ascii format template, in collaboration with WOUDC

GEOMS HDF Progress

STEP 2: GEOMS HDF format

- Operational ozonesonde data available in GEOMS-HDF at EVDC & AVDC
 - ✓ **meetings** with EVDC GEOMS team (e.g. Ian Boyd, Bavo Langerock) to make their GEOMS-HDF template for ozonesondes compliant with WMO/GAW #268
 - ✓ **exchange** of code and scripts to convert ozonesonde data in NASA-Ames, WOUDC, SHADOZ, etc. to GEOMS-HDF
- Different **versions** of ozonesonde site time series available (homogenized vs. operational), future reprocessing of data is envisioned.
 - ✓ test case for conversion to GEOMS-HDF: homogenized data at temporary HEGIFTOM ftp-server (→ archives, different version)
- Code and scripts will be made available to entire community and/or central processing

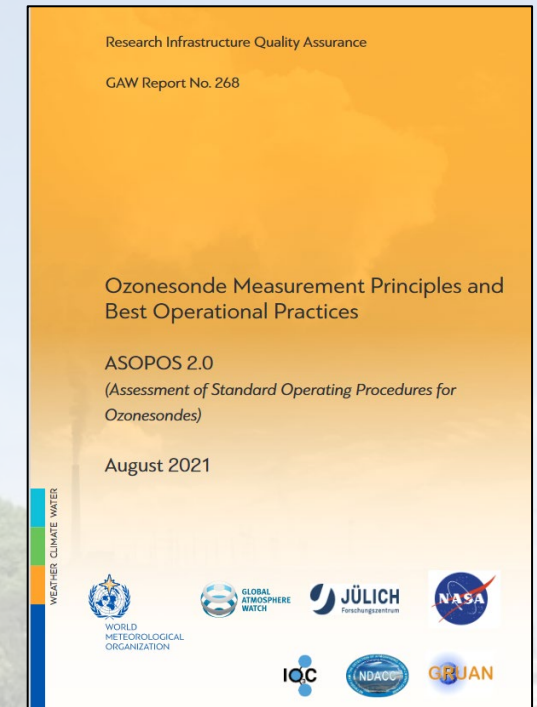
Raw Ozonesonde Data Archival Station Survey

- All but one station (Praha) that answered our request indicated a willingness to archive raw data at NDACC should it become available
- Data storage requirements are generally between ~100s of MB to ~GB/year for most stations
- Stations expressed ability to archive Level1 “raw” output from sonde software providers (Digicora binary, .dc3db, .mwx from Vaisala; no other formats were supplied in the questionnaire)
- *What about non-NDACC ozonesonde stations?* (Query from M. Tully for Davis station)

ASOPOS 2.0 (Sonde WG Meetings)

- Sonde WG meetings are essentially held within the Assessment of Standard Operating Procedures for OzoneSondes (ASOPOS) 2.0 Panel
- Ozonesonde WG Co-Chairs Van Malderen and Stauffer both members
- ASOPOS 2.0 published new WMO/GAW Report #268 August 2022 (Editors A. Thompson & H. Smit)
- Co-sponsorship by NDACC and IO₃C
- ***Coming Soon***: ASOPOS 2.0 virtual webinars and recorded presentations for global stations outlining GAW #268 material and ozonesonde best practices

WMO/GAW Report No. 268



ASOPOS 2.0 in Brussels, Sep 2019

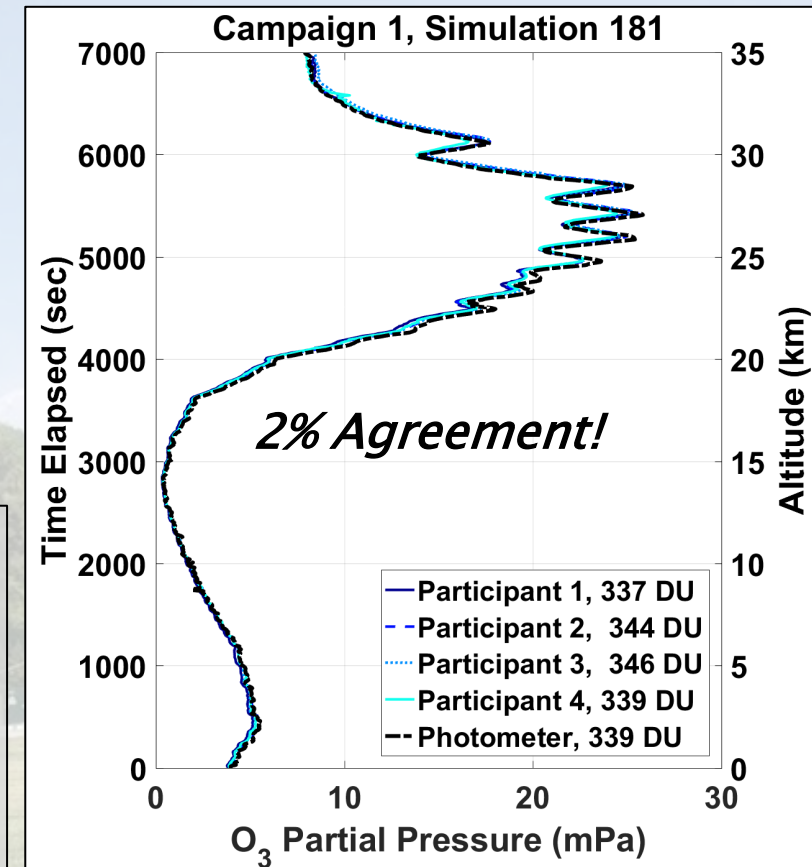
Role of WCCOS in ASOPOS 2.0: Traceability for O₃ sondes



WCCOS in Jülich, Germany



JOSIE-SHADOZ 2017 Campaign Participants



Example simulated profile from JOSIE-SHADOZ 2017 with four ozonesondes (Thompson et al., 2019; BAMS)

O₃ sondes have been intercompared at the World Calibration Center for Ozonesondes (WCCOS) in Jülich, Germany, since 1996. Focus only on ECC sondes post-2000

Data reprocessing and ASOPOS/GAW Report no. 201 are based on JOSIE and BESOS field experiments prior to 2009. New ASOPOS 2.0 GAW Report no. 268 is a handbook with SOPs and includes info from JOSIE-SHADOZ 2017 experiment

ASOPOS 2.0 recommends final data and reprocessing include traceability to WCCOS OPM (Ozone Photometer). **Must keep WCCOS running!**

WCCOS' Future

Recent activity

- Intercomparison campaign between WCCOS OPM (ozonesonde reference) to IAGOS/CARIBIC ozone monitoring instruments
- Goal: Both ozonesonde and IAGOS-ozone aircraft traceable to the same reference

Future of WCCOS

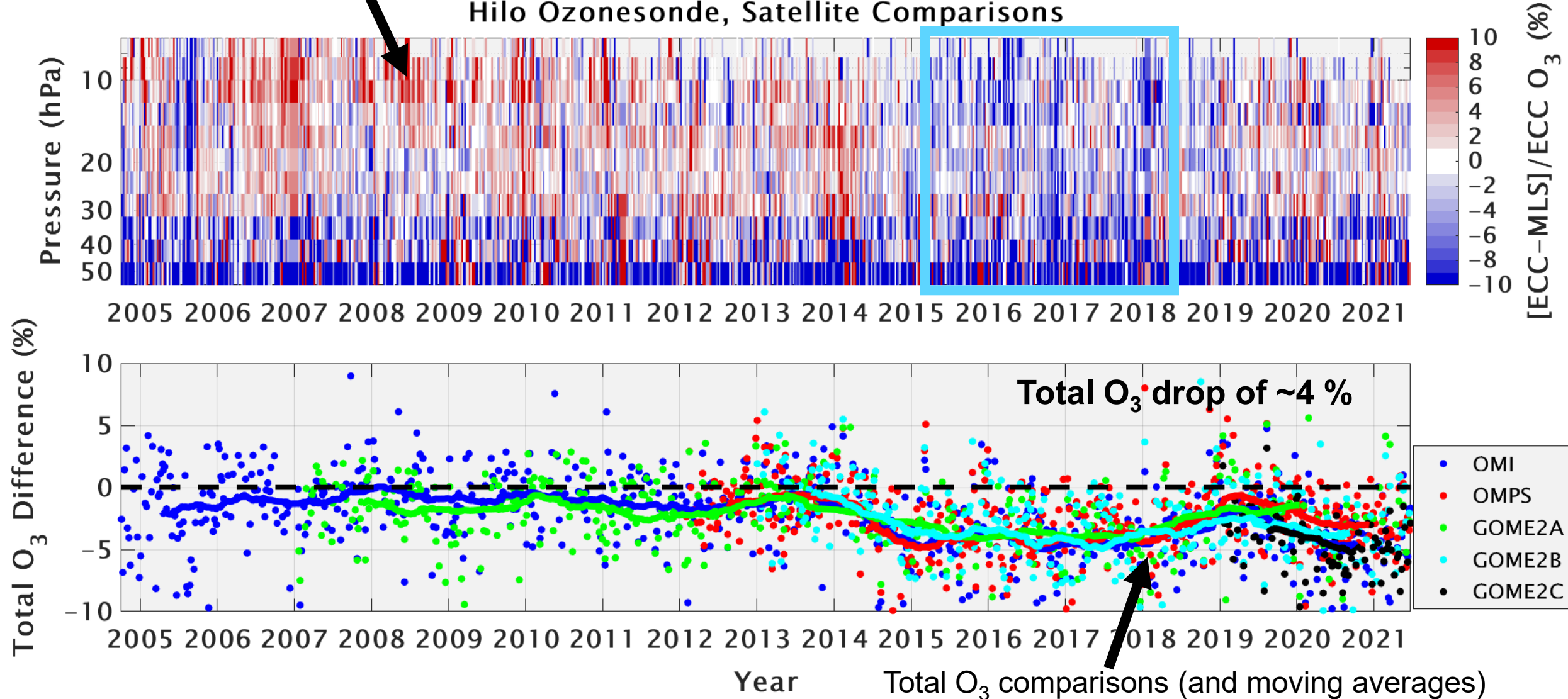
- Herman Smit, head of WCCOS, retired in 2021
- MoU between FZJ and RMI signed
(a couple of weeks ago)
 - ✓ FZJ hosts the WCCOS with the Central Calibration Laboratory (CCL) for ozonesondes (simulation chamber + OPM) + technical maintenance and operation
 - ✓ RMI hosts the Quality Assurance/Scientific Activity Centre (QA/SAC)
 - ✓ JOSIE: collaboration (technical + logistics + scientific)

Memorandum of Understanding
for an envisaged cooperation to perform JOSIE
(Jülich Ozone Sonde Intercomparison Experiment)
activities in the framework of the quality assurance plan of the
WMO-GAW

Data Quality Issues (Stratospheric O₃ Dropoff)

Comparisons with Aura MLS on MLS pressure levels. **Red** = sonde higher, **Blue** = sonde lower

Hilo Ozonesonde, Satellite Comparisons



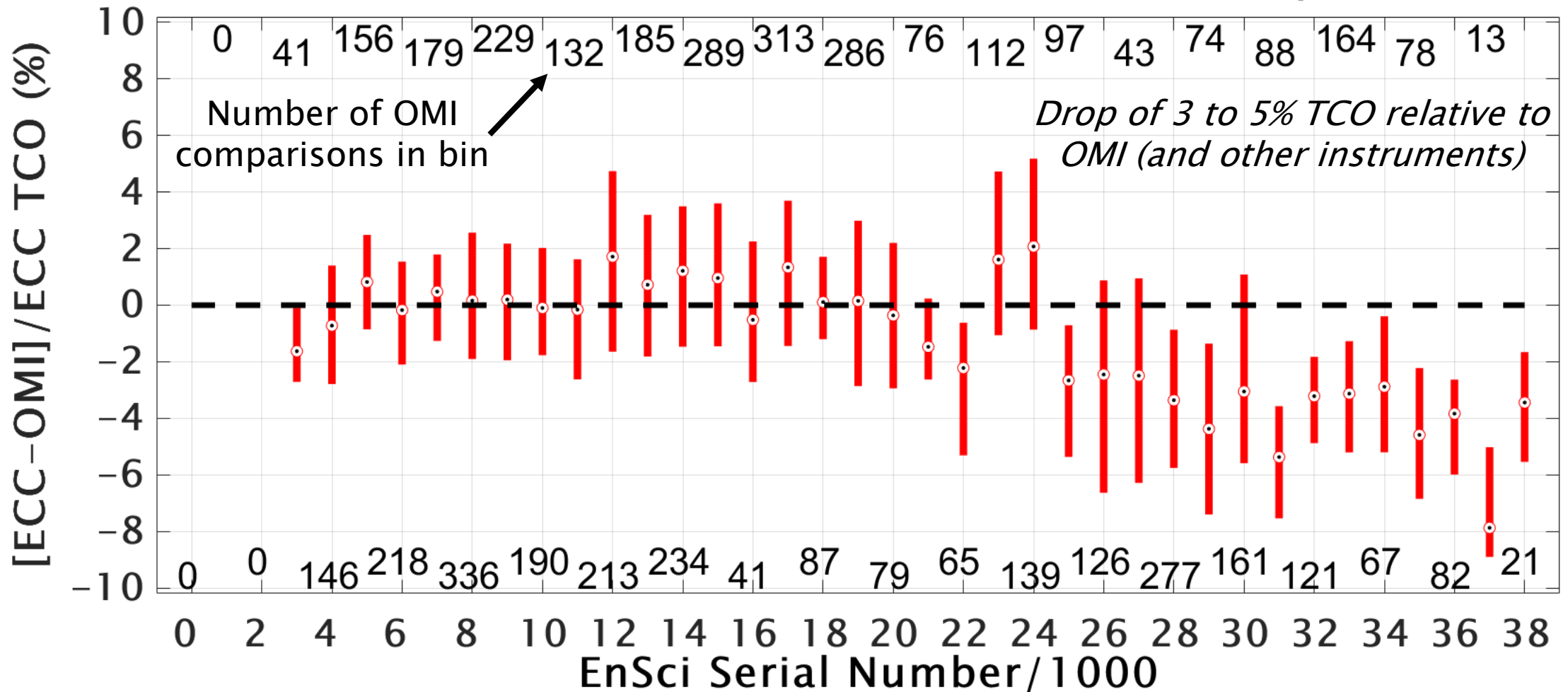
Updates to Solving the “Dropoff”

- The dropoff affects only the EnSci ozonesonde (not Science Pump; SPC), but each ozonesonde type is subject to variations in production and performance. Recent concerns with SPC performance and delays
- Dropoff occurs around EnSci serial number ~25250. Tropical stations are affected most. A changing EnSci ECC stratospheric pump performance may partially explain the dropoff
- **More information on global ozonesonde data quality in 220pm Thursday Science Talk: “Recent global ozonesonde network data quality underscores the success of homogenization efforts”**

Pinpointing a Potential EnSci Manufacturing Change

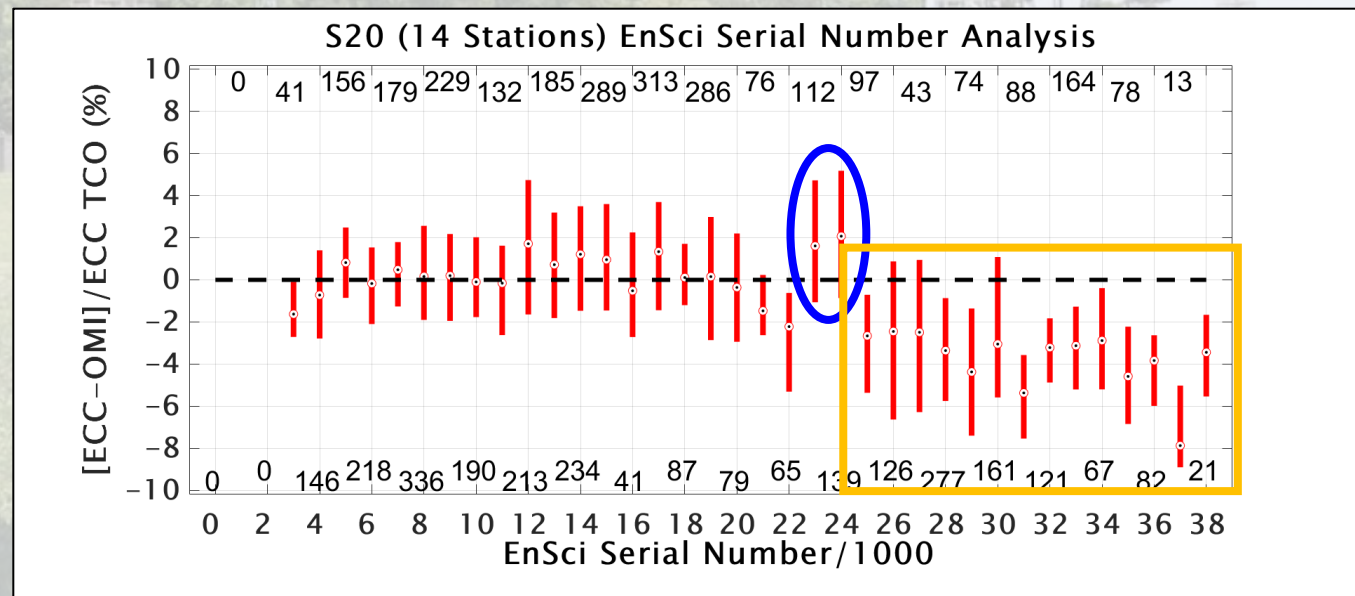
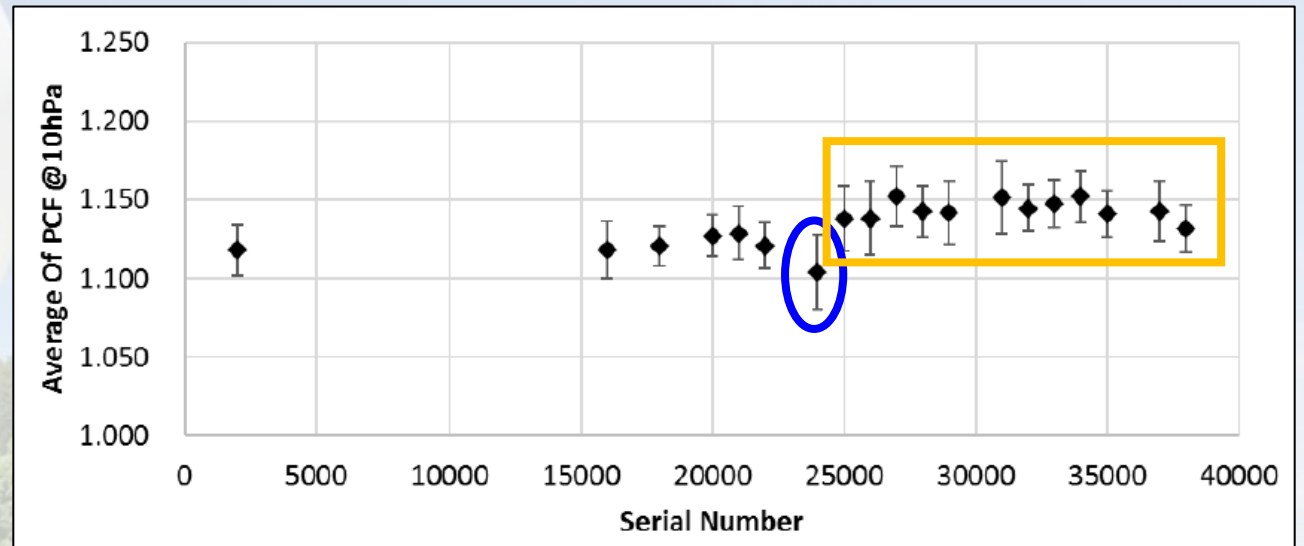
Serial numbers grouped in bins of 1000: (25 = S/N 25000s)

S20 (14 Stations) EnSci Serial Number Analysis



Changes to the EnSci Pump Efficiencies

- A new paper, Nakano and Morofuji (2022; AMTD) shows that there have been changes to the EnSci pump efficiency corrections that are coincident with the ozonesonde TCO dropoff, including a period of high-biased ozonesonde measurements
- Reprocessing ozonesonde data using this data set may resolve some of the magnitude of the TCO drop
- Accepted paper with “dropoff” updates: <https://www.essoar.org/doi/abs/10.1002/essoar.10511590.1> (Stauffer et al., 2022)



Action Item: Aura, Terra, Aqua end of life

- Request for Information on Aura/Terra/Aqua drifting orbits workshop. Deadline of 11 October. The Sonde Working Group and NDACC should submit responses, limited to 3 pages each, in support of continuing observations beyond summer 2023 (potentially to 2025):

<https://nspires.nasaprs.com/external/solicitations/summary!init.do?sollid={19F4296E-5280-3996-3149-42CB166328DC}&path=open>

Request for Information: NASA's Terra, Aqua, and Aura Drifting Orbits Workshop

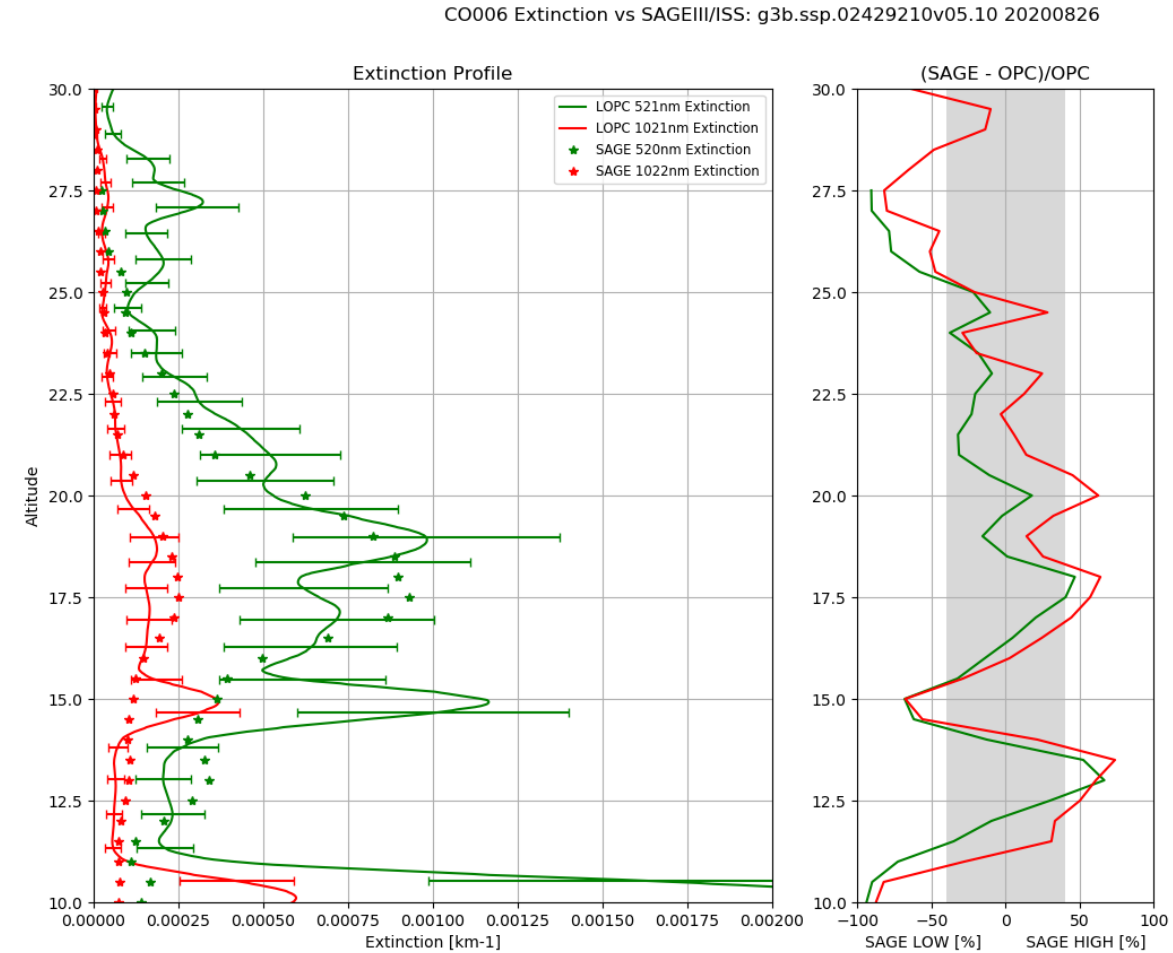
Number: **NNH22ZDA018L** | Directorate: **Science Mission Directorate** | Type: **RFI**

▼ Dates

Label	↑↓ Date	↓ Option	↑↓
Release	Sep 08, 2022		
Close	Oct 11, 2022		
TAADOW22 RFI Responses Due	Oct 11, 2022	Create	

Aerosol Sondes??

- Sonde working group is seeking suggestions for re-invigoration of aerosol sondes into NDACC (current co-chairs lack necessary expertise)
- *What stations are potential candidates?*
- *Who are potential co-chair candidates for aerosol sondes that would be willing to join the Steering Committee?*



LOPC sonde and SAGE-III/ISS aerosol extinction in the stratosphere (left) and percent differences (right)

Thank You

Sonde Working Group Co-Chair Contact Info:

- Ryan Stauffer (O₃): ryan.m.stauffer@nasa.gov
- Roeland Van Malderen (O₃): roeland@meteo.be
- Dale Hurst (WV, next talk): dale.hurst@noaa.gov