

# Sondes Working Group: Ozonesonde Updates

**Ryan Stauffer (NASA/GSFC; 2025) and Roeland Van Malderen (RMI; 2024)**

**2023 NDACC Steering Committee Meeting**

**12 September 2023; Murnau a. Staffelsee, Germany**





# Quadrennial Ozone Symposium 2024 ☐

## Save the Date!

### Boulder, CO, USA 15-19 July 2024

NDACC News Item:  
<https://ndacc.larc.nasa.gov/news/2023/05/quadrennial-ozone-symposium-2024-save-date>

# QUADRENNIAL OZONE SYMPOSIUM

July 15-19, 2024  
Boulder, Colorado, USA or Hybrid



QOS conference website: coming soon



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The Quadrennial Ozone Symposium Organizing Committee is pleased to announce the dates and location of **QOS 2024**. The meeting will be held **in-person in Boulder, Colorado, USA from 15-19 July 2024**, and hosted by the University of Colorado Boulder **with a hybrid virtual option**. Stay tuned for updates from the Organizing Committee on abstract submission, registration, venue, travel, and other information. We look forward to seeing everyone working on everything ozone science in Boulder and online in July 2024!

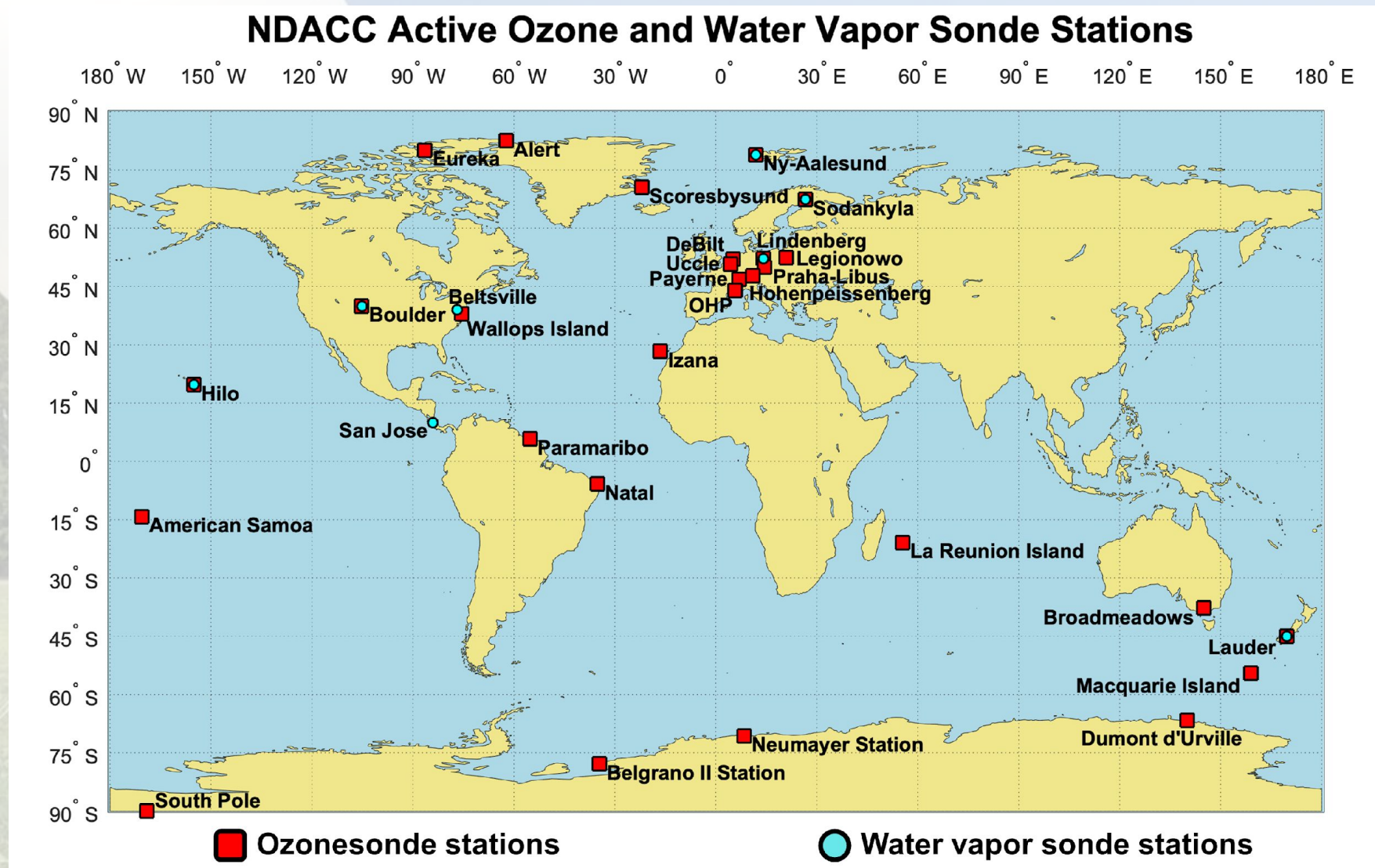
The 2024 QOS Organizing Committee

Photo credit: BeyondBoulder.com



# NDACC Ozonesonde Stations (28 Active)

- 18 in Northern Hemisphere, 10 in Southern Hemisphere
- NDACC O<sub>3</sub>sonde stations have archived 51,987 files at the NDACC DHF as of 05 Sep 2023 (49,691 from active stations)
- Data remains archived for inactive stations such as Thule and Summit



Map by D. Kollonige



# NDACC Ozonesonde Statistics (as of 05 Sep 2023)

SITE	Latitude	# Profiles	Archive Update	SITE	Latitude	# Profiles	Archive Update
Alert	82.5	48	Jun-23	Natal	-5.8	22	Aug-23
Eureka	80.0	58	Jun-23	American Samoa	-14.2	37	Jul-23
Ny-Aalesund	78.9	68	Aug-23	La Reunion	-20.9	32	Dec-21
Scoresbysund	70.4	43	Aug-23	Broadmeadows	-20.9	45	Aug-23
Sodankyla	67.3	33	Oct-19	Lauder	-45.0	55	Jun-23
Legionowo	52.4	52	Aug-22	Macquarie Island	-55.0	52	Aug-23
Lindenberg	52.2	54	Aug-23	Dumont d'Urville	-66.6	12	Dec-19
De Bilt	52.1	40	Dec-22	Neumayer	-70.6	63	Sep-23
Uccle	50.8	145	Jul-23	Belgrano	-77.8	16	Sep-23
Praha	50.0	47	Apr-23	South Pole	-90.0	53	Jul-23
Hohenpeissenberg	47.8	136	Aug-23				
Payerne	46.8	139	Jun-23	<b>Total Measurement Last 12 Months:</b>		<b>1515</b>	
OHP	43.9	40	Dec-22	Total Measurement Days 2022:		1455	
Boulder	39.9	53	Jul-23	Total Measurement Days 2021:		1546	
Wallops Island	37.9	51	Jun-22	Total Measurement Days 2020:		1485	
Izana	28.3	51	Aug-23	Total Measurement Days 2019:		1507	
Hilo	19.7	51	Jul-23	Total Measurement Days 2018:		1541	
Paramaribo	5.8	19	Dec-22	Total Measurement Days 2017:		1319	

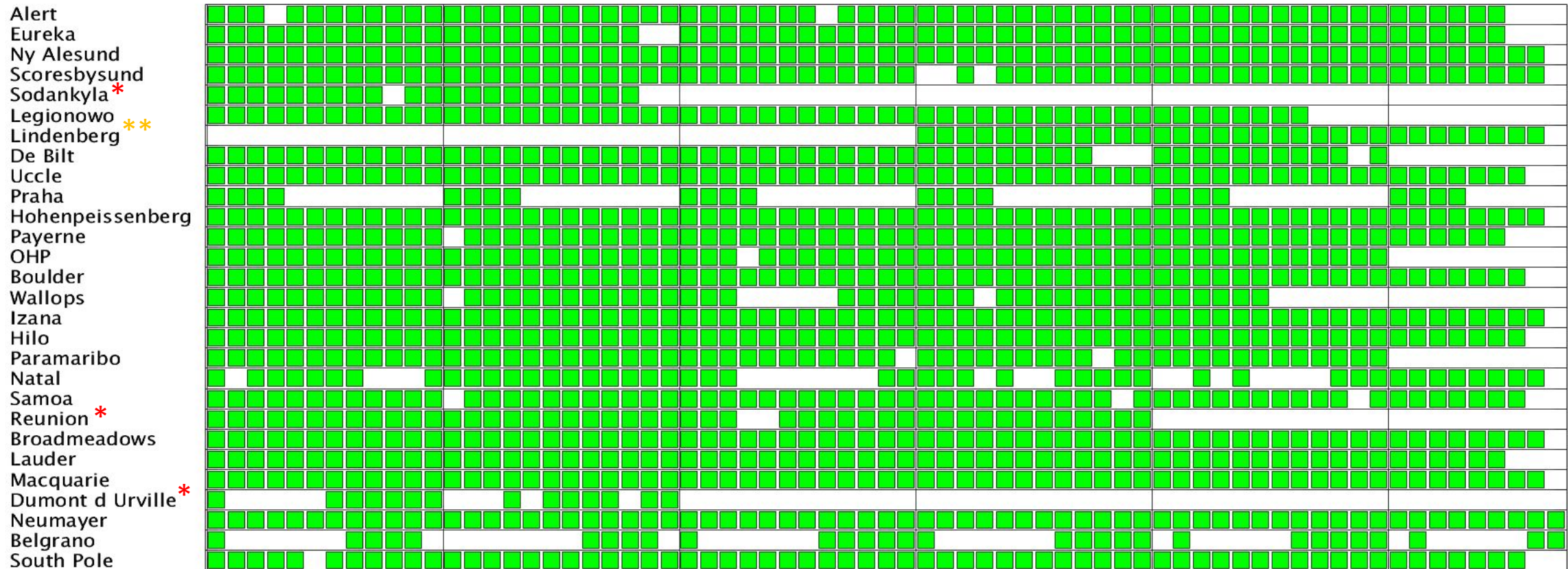
- All 28 ozonesonde station reports received!
- Three stations are considered **not up-to-date** on NDACC DHF (approaching 2 years old or more)

- 1515 total reported measurement days in this round of reporting. Near the recent yearly average
- Lindenberg awaiting guidance on data versioning/HDF option for pre-2021 data
- Will re-contact the necessary PIs to ensure upload of recent data



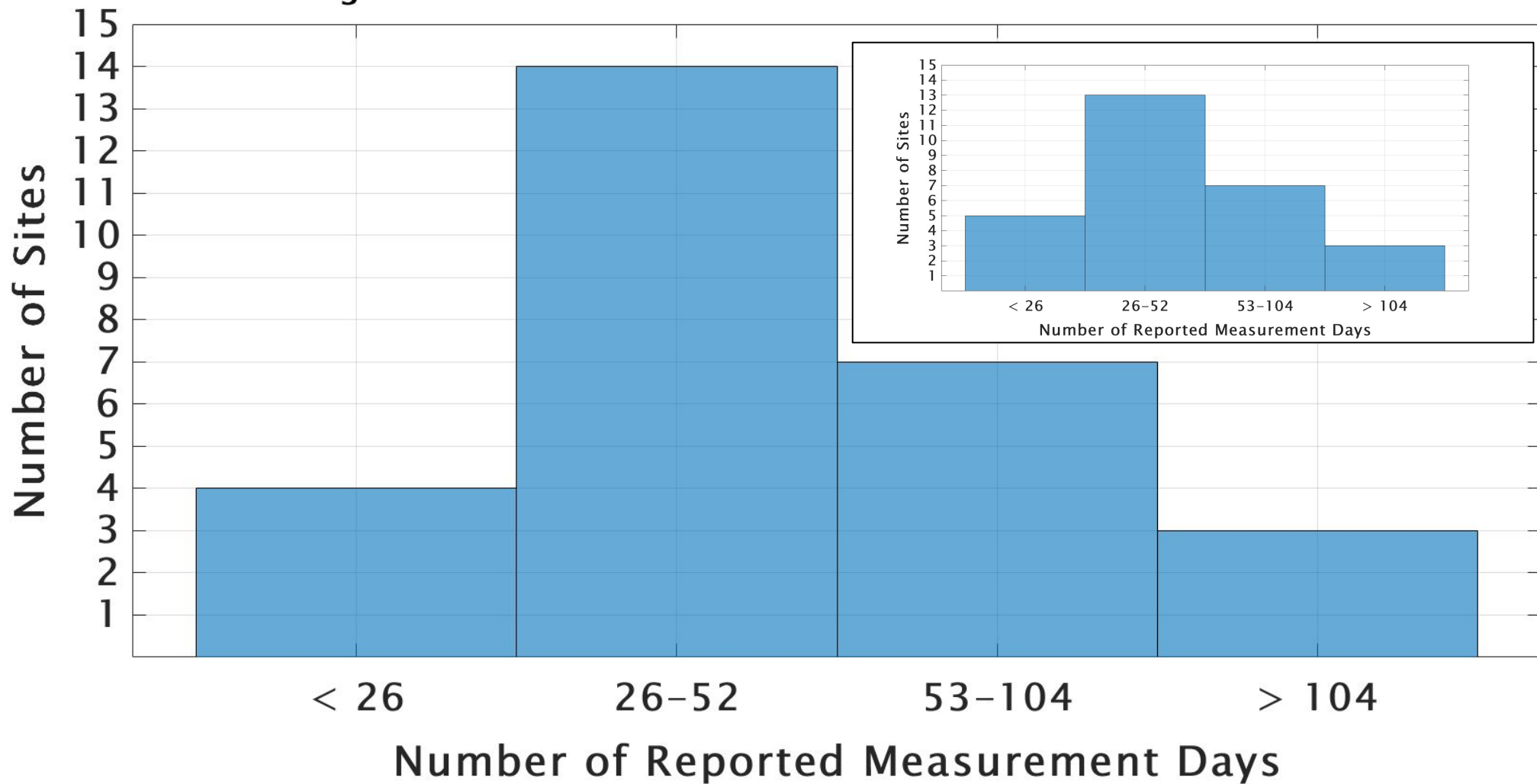
# O<sub>3</sub> Sonde Recent DHF Status

## NDACC Ozonesonde Archive Status (05 Sep 2023)



# 2022-2023 Reporting Period Ozonesonde Data

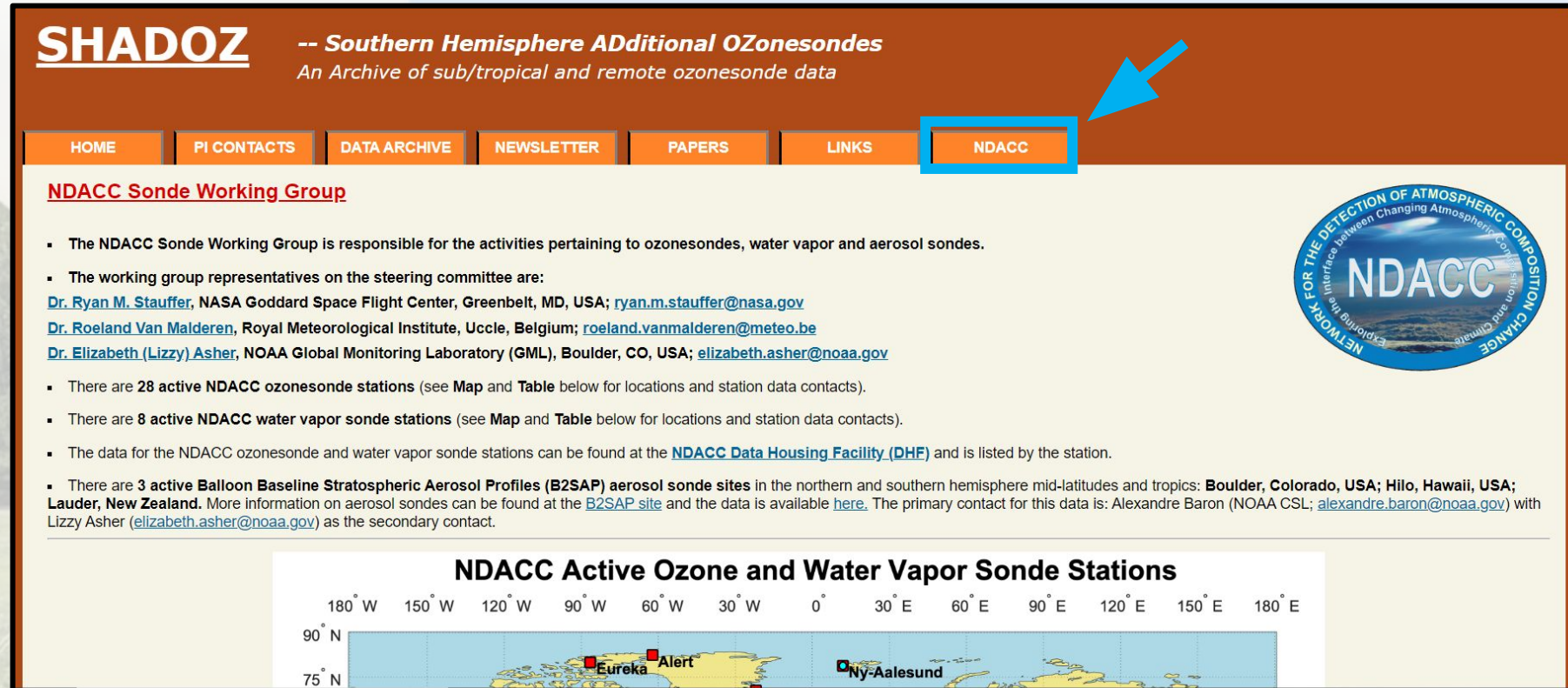
## O<sub>3</sub> Sonde # of Measurement Days, 2023 Reports





# New Working Group Webpage is Live! (S-6)

- Hosted within the SHADOZ ozonesonde network website
- Link from NDACC home page is live!
- To include information on potential Ames format changes, GEOMS HDF progress, DQA activities, etc.
- NDACC News Item: <https://ndacc.larc.nasa.gov/news/2023/08/new-sonde-working-group-webpage>



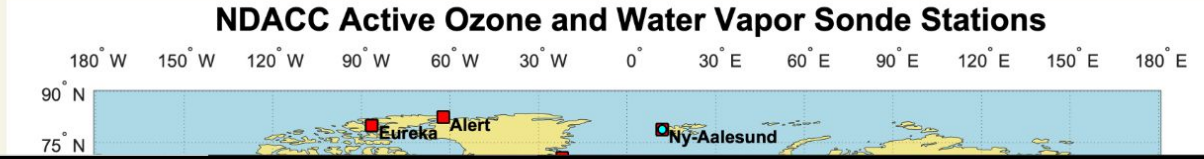
**SHADOZ** -- Southern Hemisphere Additional OZonesondes  
An Archive of sub/tropical and remote ozonesonde data

HOME | PI CONTACTS | DATA ARCHIVE | NEWSLETTER | PAPERS | LINKS | **NDACC**

[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](#), NASA Goddard Space Flight Center, Greenbelt, MD, USA; [ryan.m.stauffer@nasa.gov](mailto:ryan.m.stauffer@nasa.gov)  
[Dr. Roeland Van Malderen](#), Royal Meteorological Institute, Uccle, Belgium; [roeland.vanmalderen@meteo.be](mailto:roeland.vanmalderen@meteo.be)  
[Dr. Elizabeth \(Lizzy\) Asher](#), NOAA Global Monitoring Laboratory (GML), Boulder, CO, USA; [elizabeth.asher@noaa.gov](mailto:elizabeth.asher@noaa.gov)
- There are 28 active NDACC ozonesonde stations (see [Map](#) and [Table](#) below for locations and station data contacts).
- There are 8 active NDACC water vapor sonde stations (see [Map](#) and [Table](#) below for locations and station data contacts).
- The data for the NDACC ozonesonde and water vapor sonde stations can be found at the [NDACC Data Housing Facility \(DHF\)](#) and is listed by the station.
- There are 3 active Balloon Baseline Stratospheric Aerosol Profiles (B2SAP) aerosol sonde sites in the northern and southern hemisphere mid-latitudes and tropics: Boulder, Colorado, USA; Hilo, Hawaii, USA; Lauder, New Zealand. More information on aerosol sondes can be found at the [B2SAP site](#) and the data is available [here](#). The primary contact for this data is: Alexandre Baron (NOAA CSL; [alexandre.baron@noaa.gov](mailto:alexandre.baron@noaa.gov)) with Lizzy Asher ([elizabeth.asher@noaa.gov](mailto:elizabeth.asher@noaa.gov)) as the secondary contact.

**NDACC Active Ozone and Water Vapor Sonde Stations**



180° W 150° W 120° W 90° W 60° W 30° W 0° 30° E 60° E 90° E 120° E 150° E 180° E

90° N  
75° N

Eureka Alert Ny-Aalesund

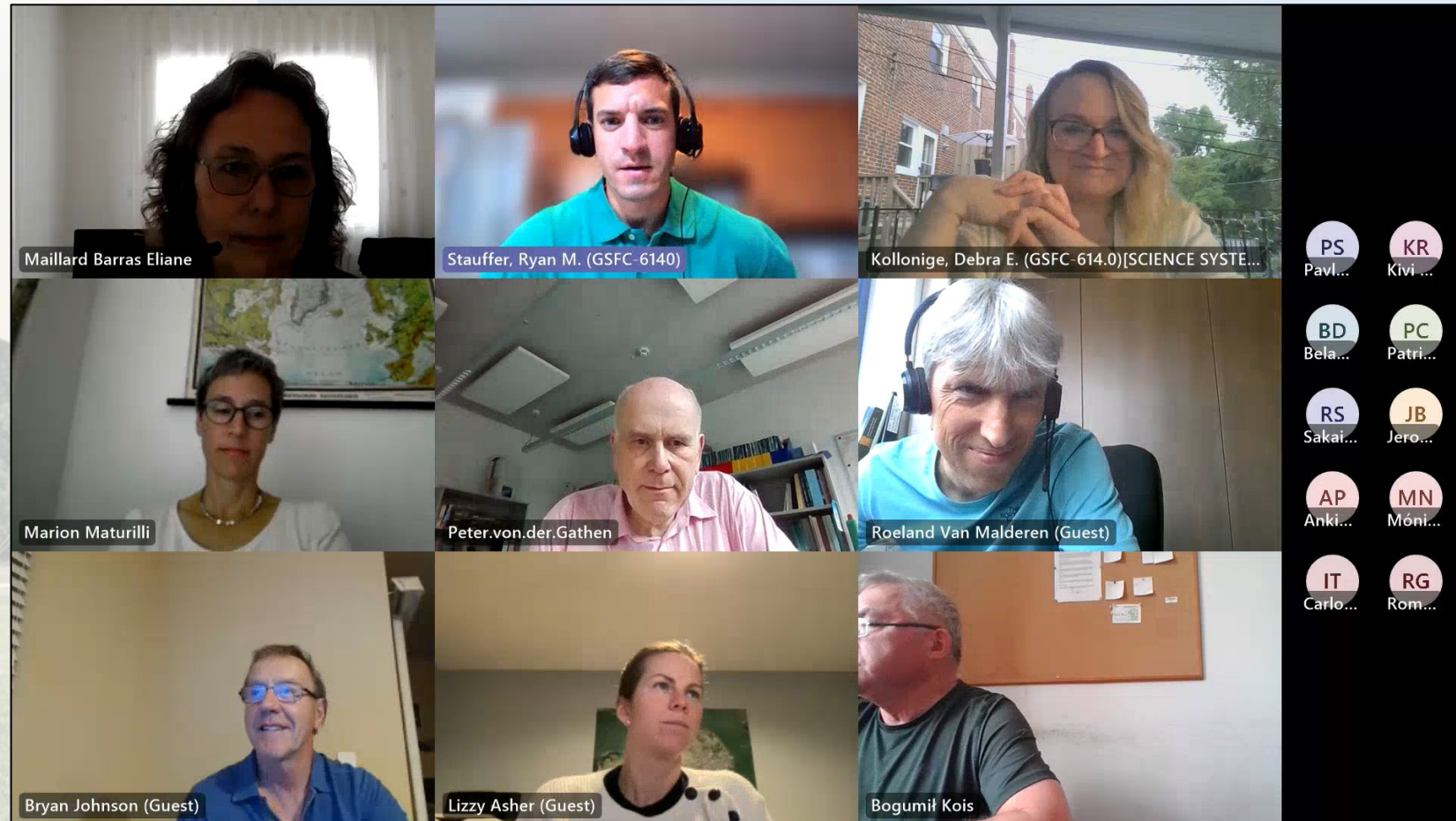
[https://tropo.gsfc.nasa.gov/shadoz/NDACC\\_SondeWorkingGroup.html](https://tropo.gsfc.nasa.gov/shadoz/NDACC_SondeWorkingGroup.html)

Thanks to D. Kollonige, NASA/GSFC



# June/July 2023 Virtual Sondes WG Meetings (**S-9**)

- First WG meeting(s) in several years! ~20 attendees
- 30 June (combined) and 6 July (separate O<sub>3</sub> and WV sonde) meetings
- General “Steering Committee Meeting” style presentations from WG co-chairs on Day 1
- More specific O<sub>3</sub> and WV topics for Day 2 + five station update/science presentations





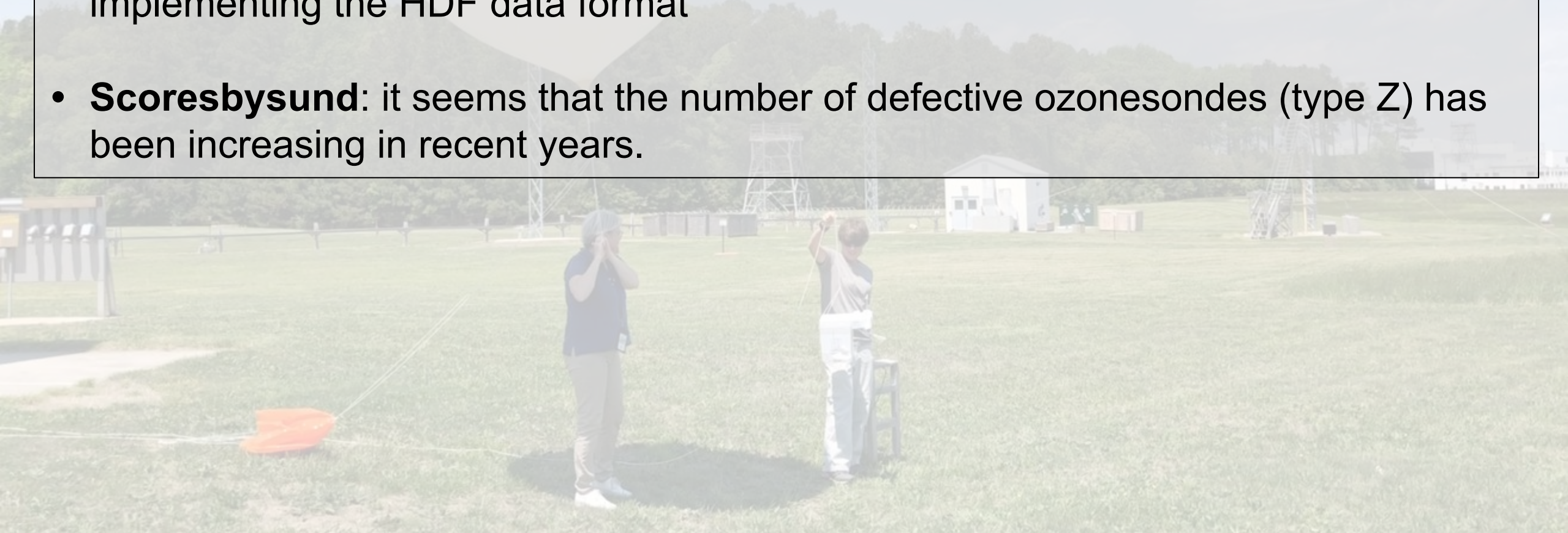
# Issues raised in 2023 Ozonesonde Station Reports

- **Australian stations:** stable funding with respect to consumables as a Bureau of Meteorology operational program, although human resources available for re-processing or analysis are very limited.
- **Belgrano station:** reduction in the number of operators due to COVID19 (one operator instead of three) in 2022. This led to a reduction in the number of ozone sondes launched.
- **Legionowo:** Format of data content of ozonesonde to be stored in the data archives
- **Sodankyla:** data quality control
- **OHP:** no sondes between 4/1/2023 to 14/3/2023 because of problems with He delivery at OHP □ Switch to Hydrogen for balloon inflation (**Boulder**)
- **Paramaribo:** Schedule was biweekly from April 2022 until June 2023 (instead of once a week) due to ozonesonde delivery problems.
- **Dumont d'Urville:** missed data delivery last year due to some people being away from the institute



# Issues raised in 2023 Ozonesonde Station Reports

- **Lauder:** GEOMS HDF format. Central processing. Homogenisation. Adoption of ASOPOS 2.0 recommended SOPs.
- **Lindenberg:** Plans to provide Lindenberg ozone data before 2021 are on hold for implementing the HDF data format
- **Scoresbysund:** it seems that the number of defective ozonesondes (type Z) has been increasing in recent years.





# HDF: decisions and steps (S-12)

- current situation: ozonesondes available in historical archives (NDACC, WOUDC, SHADOZ, NOAA) in different ascii formats, no consistency
  - ✓ not possible to store different versions (operational, homogenized, time response corrected)
  - ✓ available in netcdf in CDS, in HDF at EVDC, AVDC
- End of 2022: meeting with NDACC, WOUDC, SHADOZ, NOAA representatives, EVDC
- All archives (WOUDC, NDACC, SHADOZ) denoted **GEOMS-HDF as their new standard**, with same template for **all** archives!
- EVDC GEOMS team will **update** their **existing GEOMS-HDF template** for ozonesondes, to make it compliant with WMO/GAW #268



# HDF: decisions and steps (**S-12**)

- An explanatory file and conversion table (which NASA-Ames fields should feed into which GEOMS-HDF fields) will be made available (consistency in amount of data/metadata and meaning)
  - **exchange** of EVDC GEOMS code and scripts to convert ozonesonde data in NASA-Ames, WOUDC, SHADOZ, etc. to GEOMS-HDF
  - test these codes to make different **versions** of ozonesonde site time series (e.g. homogenized @ HEGIFTOM ftp-server vs. operational) available at the historical archives (NDACC, WOUDC, SHADOZ)
  - Code and scripts will be made available to entire community and/or central processing
- submission in NASA-Ames still possible, but discouraged.**



# Action Items Progress

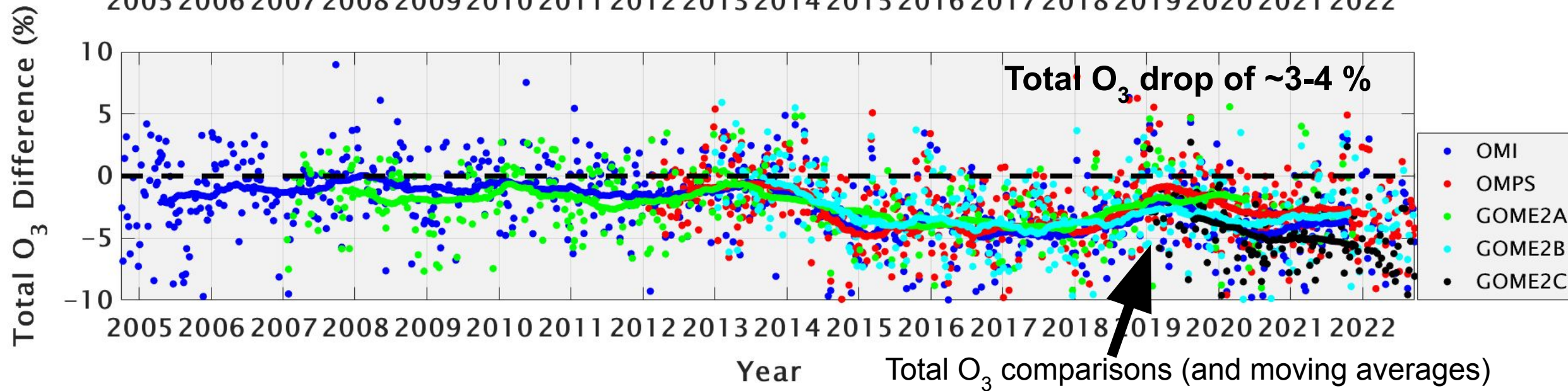
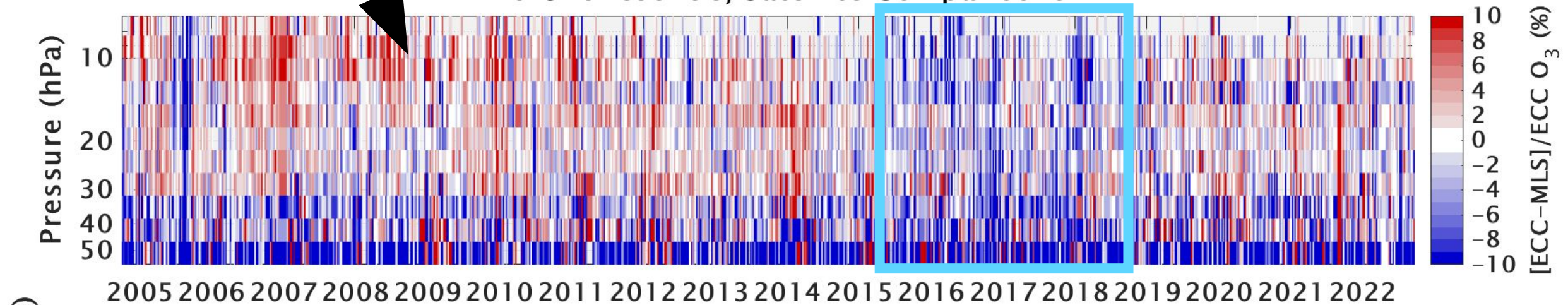
1. **GEOMS HDF and AMES data formats. Progress continuing (S-12)**
2. **Refine new Working Group Webpage and make available to community (S-6)**
3. **ASOPOS 2.0 Report Webinars (and other) News Items (soon!) (S-7)**
4. **Ensure all stations have chosen a license type for their data:** Belgrano, Broadmeadows, Dumont d'Urville, Lauder, Lindenberg, Macquarie Island, Mc Murdo (inactive), Neumayer, Ny Alesund, OHP, Scoresbysund, Sodankyla, La Reunion, Thule (inactive) **(S-8)**
5. **Have a "true" O3Sonde Working Group meeting in ~first half of 2023 (S-9)**
6. Working Group Reps: R. Stauffer to seek WG concurrence for a second term. **Ryan's second term confirmed (S-3)**
7. **Determine what future role aerosol sondes will have in NDACC (E. Asher lead) (S-10)**



# Data Quality Issues (Stratospheric O<sub>3</sub> Dropoff)

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

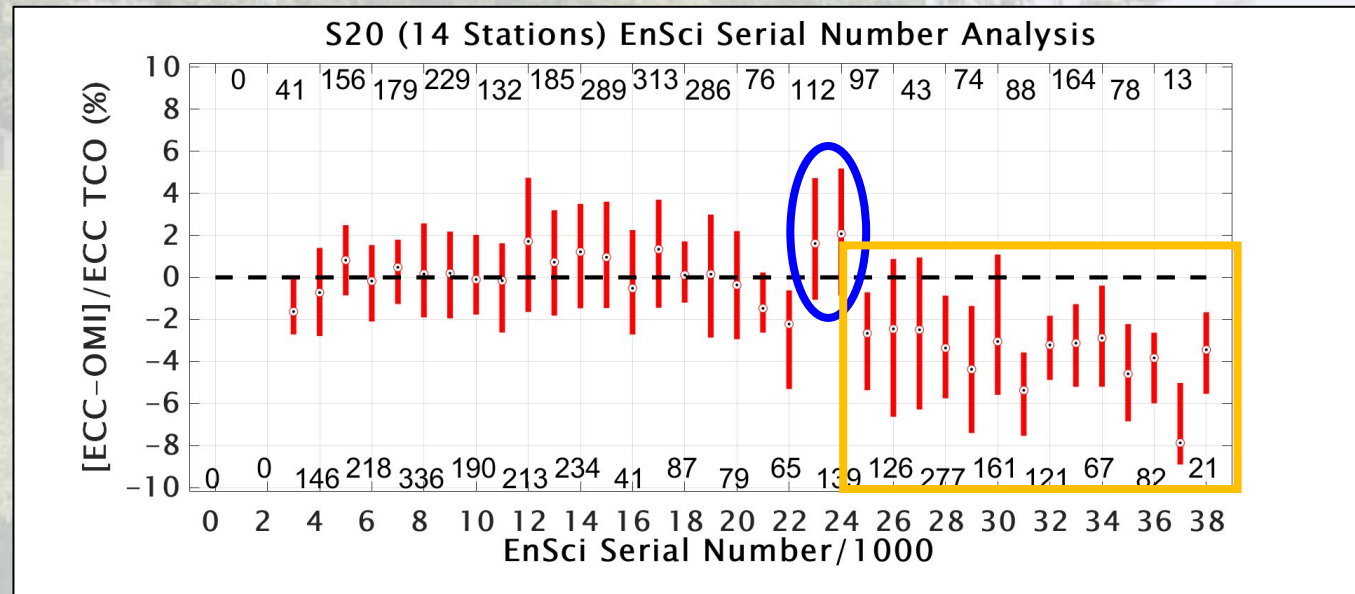
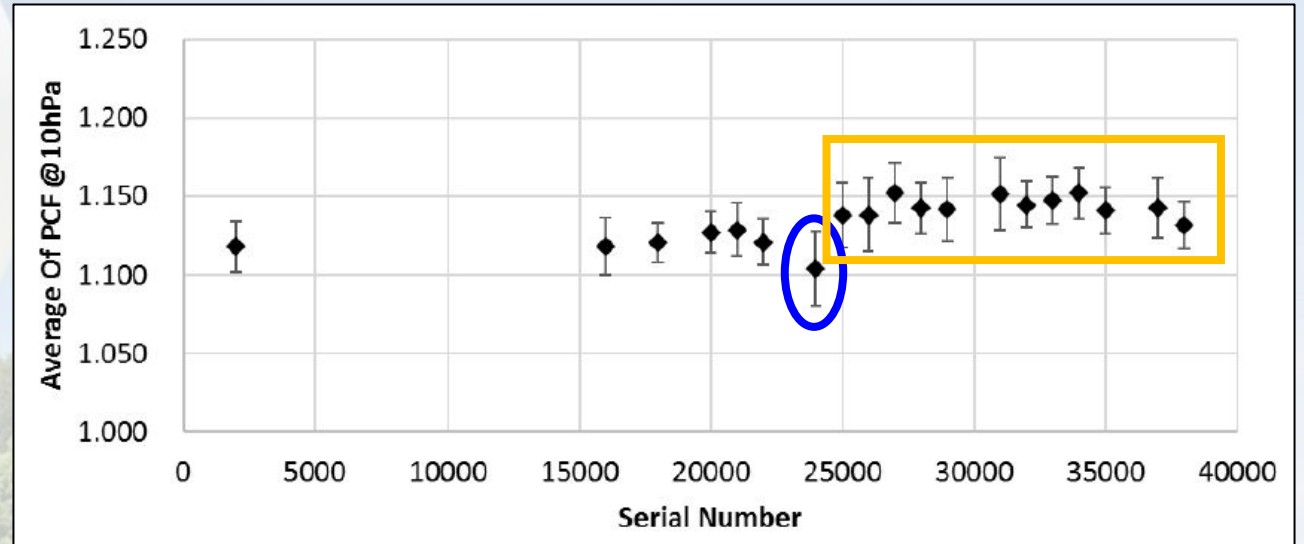
### Hilo Ozonesonde, Satellite Comparisons





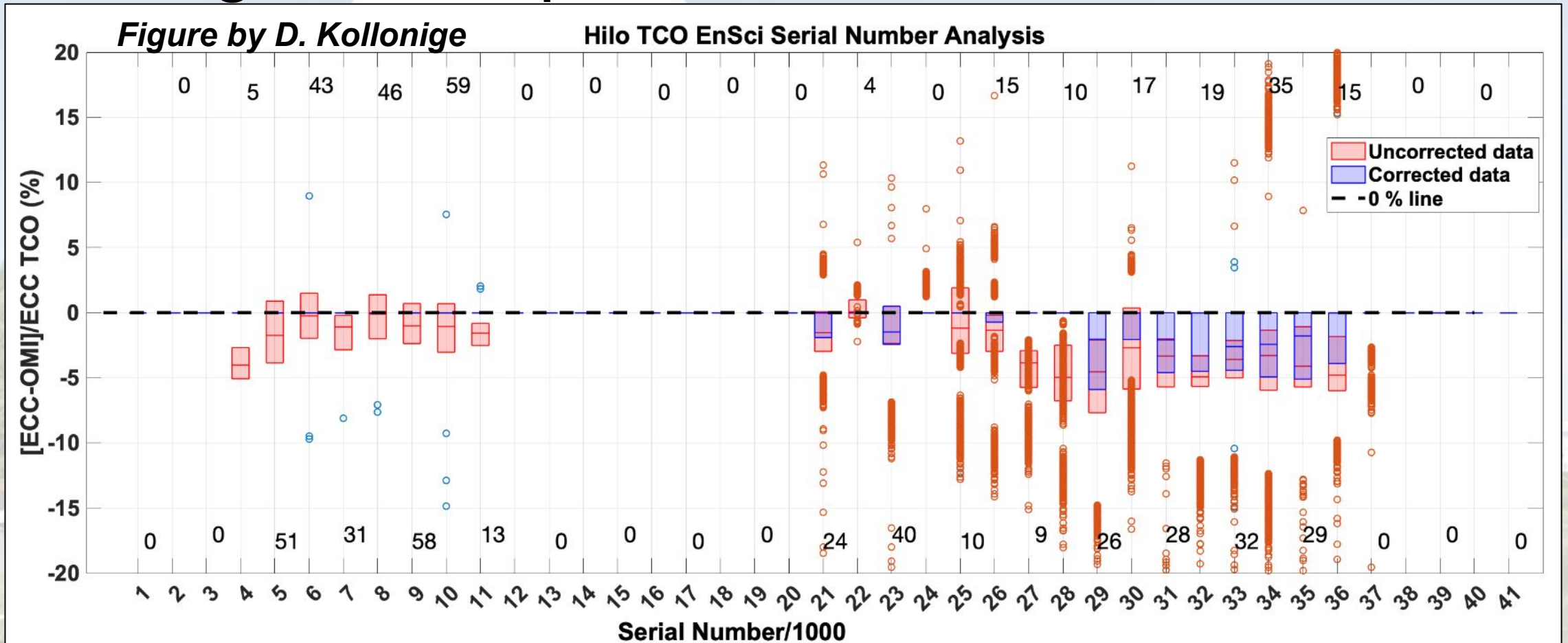
# Changes to the EnSci Pump Efficiencies

- Nakano and Morofuji (2023; <https://doi.org/10.5194/amt-16-1583-2023>) shows that 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 has resolved the “dropoff” at least at some stations
- Paper with “dropoff” updates: <https://doi.org/10.1029/2022EA002459> (Stauffer et al., 2022)





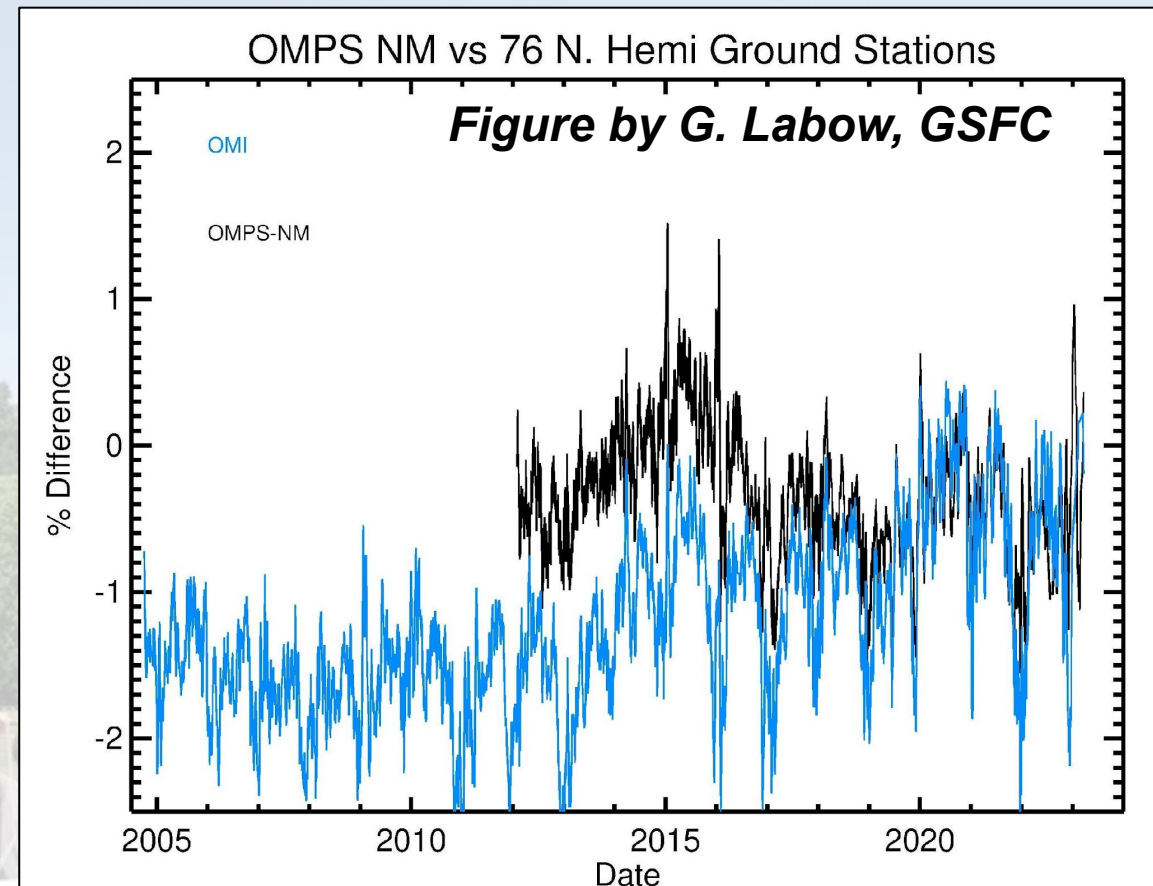
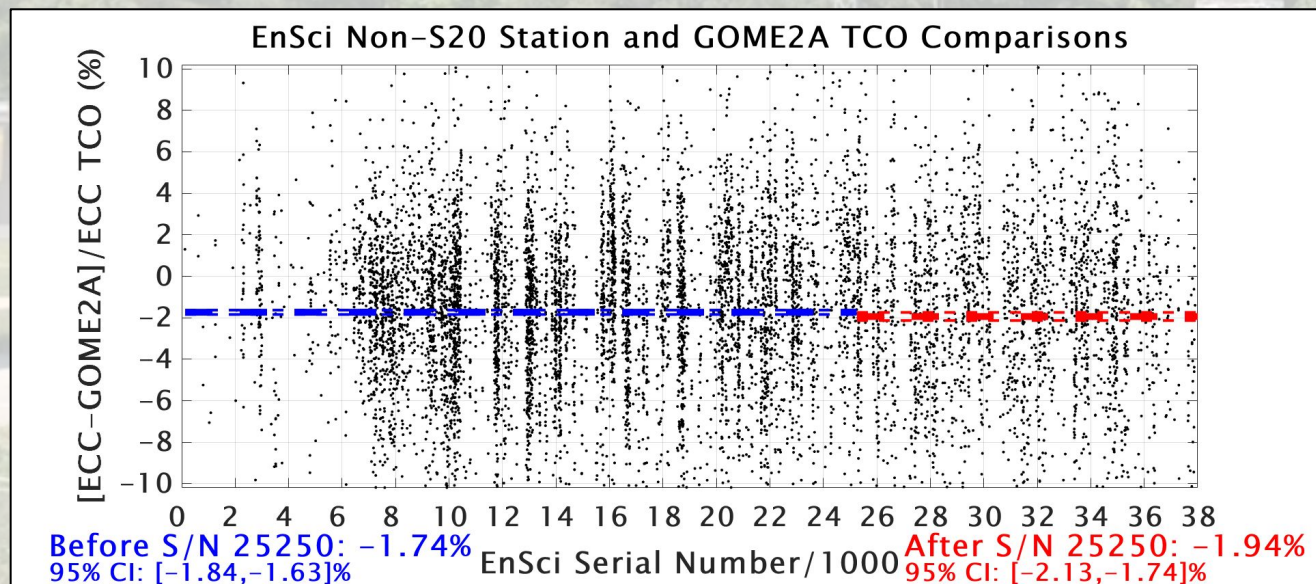
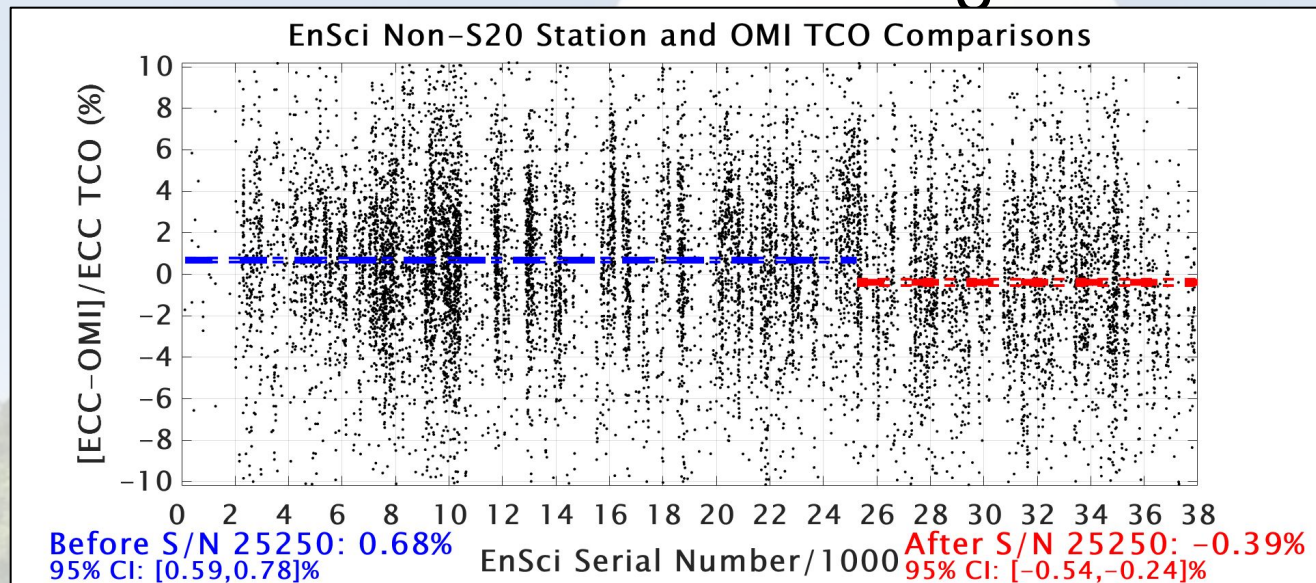
# Correcting the “Dropoff” at Hilo, HI, USA



- Application of JMA pump efficiency data set **reduces low bias by ~1.5%** total column ozone
- \*And\* we are tracking a drift toward higher OMI total column ozone (next slides)...



# OMI Total Column O<sub>3</sub> is Drifting Higher...



- **Sondes and ground-based total column ozone confirm OMI has drifted higher by >1% over its lifetime. More in SHADOZ update Wednesday**



# Thank You

## Sonde Working Group Co-Chair Contact Info:

- Ryan Stauffer (O<sub>3</sub>): [ryan.m.stauffer@nasa.gov](mailto:ryan.m.stauffer@nasa.gov)
- Roeland Van Malderen (O<sub>3</sub>): [roeland@meteo.be](mailto:roeland@meteo.be)
- Elizabeth Asher (WV, next talk): [elizabeth.asher@noaa.gov](mailto:elizabeth.asher@noaa.gov)