



SHADOZ Notes

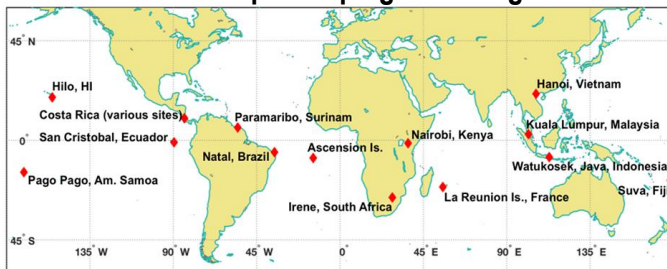
Southern Hemisphere Additional Ozonesondes

A NASA/Goddard Space Flight Center public archive of tropical and remote ozonesonde profile data

SHADOZ is a NASA project to augment and archive balloon-borne ozonesonde launches and to archive data from tropical and remote operational sites. The project was initiated in 1998 by NASA/Goddard Space Flight Center, the NOAA/Global Monitoring Division, and international co-investigators. There are currently fourteen stations launching ozonesondes in the SHADOZ network. The collective data set provides the first climatology of tropical ozone in the equatorial

region, enhances validation studies aimed at improving satellite remote sensing techniques for tropical ozone estimations, and serves as an educational tool to students, especially in participating countries.

SHADOZ Sites: <https://tropo.gsfc.nasa.gov/shadoz>



❖ NASA GSFC Visits Ascension Island Station in November 2023 ❖

During 6-22 November 2023, **Ryan Stauffer** (PI for SHADOZ; NASA/GSFC) and **Anne Thompson** (Founding SHADOZ PI; NASA/UMBC) traveled to **Ascension Island, UK.**, to visit the SHADOZ station and their colleagues: **Leroy Hudson** (Station operator; US Space Force/Yang Enterprises (YEI)), **Iona Yon** (Station operator; US Space Force/YEI), and **Patrick Benjamin** (Station operator; US Space Force/YEI), who was on leave at the time of the visit. During their 2 week-long trip, **Stauffer and Thompson:** 1) assisted with ozonesonde launches (4 in total) while observing their operations, 2) reviewed current Standard Operating Procedures (SOPs), 3) visited the AERONET site, and 4) met with the current station personnel and leadership at the US Space Force site. *(More on Visit Next Page).*



Photos: (left) [left-to-right] Anne Thompson (NASA/UMBC) and Ryan Stauffer (NASA/GSFC) assist with ozonesonde launch on 9 November 2023. (middle) Leroy Hudson (US Space Force / YEI) preps an ozonesonde in their lab space for a weekly launch. (right) Iona Yon assists with balloon prep prior to ozonesonde launch on 9 November 2023. **Photo credits:** Iona Yon and Anne Thompson.

❖ Ascension Island Visit (Cont'd) ❖

The Ascension Island trip included the teams launching 4 ozonesondes to test current SOPs and demonstrate a typical launch day for Major Christopher Nettles (US Space Force). The NASA GSFC team also visited the AERONET site while on the island with Terence Young (US Space Force / YEI) on behalf of the NASA GSFC AERONET Team. Overall, it was a successful site visit in ensuring high-quality ozone data since 1998.

Photos (clockwise from top right): 1) Major Christopher Nettles (US Space Force) launches ozonesonde on 16 November 2023 with Leroy Hudson (US Space Force/YEI). 2) Both GSFC and Ascension teams demonstrate the SOPs for Major Nettles on launch day. 3) Iona Yon (US Space Force/YEI) and Leroy Hudson prep the balloon on an ozonesonde launch day. 4) Terence Young (US Space Force / YEI) shows the AERONET instrument and site on the island.



Photo credits: Anne Thompson and Ryan Stauffer.

❖ SHADOZ Regional Stations Spotlight: Pacific Region ❖ ❖ Hilo, Hawaii ❖

The Hilo ozonesonde program is a part of the larger global network of NOAA Earth System Research Laboratories and the Global Monitoring Laboratory (ESRL/GML) ozonesonde stations (<https://gml.noaa.gov/ozwv/ozsondes/>) with **Bryan Johnson** (NOAA GML; *pictured here*) as the current PI and **Patrick Cullis** (NOAA/CIRES) as the current main technician. Continuous launches date back to 1984 for the Hilo station, which joined SHADOZ in 1998 at its inception. ECC Ozonesondes/radiosondes are launched once per week from the weather service facility at the airport in Hilo. The current station and launch operators include **David Nardini** (NOAA; *pictured here*) and **Marty Martinsen** (NOAA). **Darryl Kuniyuki** (NOAA; *pictured here*) recently retired, but also helped maintain the ozonesonde measurements at the station for several years.



Photos (clockwise from top right): 1) Darryl Kuniyuki (NOAA) attaches the ozonesonde payload to the balloon within a balloon shelter in preparation for launch. 2) Hilo station personnel, Darryl Kuniyuki (right) and David Nardini (NOAA; left), review the ozonesonde operations and SOPs with Bryan Johnson (middle) during a visit in April 2018. 3) Anne Thompson (NASA) assists David Nardini with the ozonesonde launch during their 2018 visit. **Photo credits:** Anne Thompson.

❖ SHADOZ Regional Stations Spotlight: Pacific Region ❖

❖ Suva, Fiji ❖

Ozonesonde launches in Suva, Fiji, started in 1997 as a part of the NOAA ESRL/GML ozone program and have been a part of the SHADOZ network from its start. The operations are located at the University of the South Pacific (USP) with **Dr. Matakite Maata** (USP; retired – *pictured here*) as the initial PI and **Dr. Francis Mani** (USP; *pictured here*) as the current PI for the ozonesonde measurement program. The current station operator is **Miriama Vuiyasawa** (USP; *pictured here*), who completes bi-weekly ECC ozonesonde/radiosonde launches as a part of the SHADOZ and NOAA networks. In April 2023, **Bryan Johnson** (NOAA GML) and **Patrick Cullis** (NOAA/CIRES) visited the station (pictures below) and helped move their operations to a new ozonesonde preparation lab and reviewed recommended SOPs with the Fiji station team. Dual and single ozonesondes were also successfully launched during their visit.



Photo: (left) NOAA and USP teams during February 2015 NOAA visit to Fiji. From left to right: Patrick Cullis (NOAA/CIRES), Francis Mani (USP), Matakite Maata (USP), and Bryan Johnson (NOAA). **(middle)** Miriama Vuiyasawa (USP; left) and Bryan Johnson (right) prepare balloon for ozonesonde launch during April 2023 visit by NOAA team. **(right)** Bryan Johnson (left) and Miriama Vuiyasawa (right) launch dual ozonesondes on 18 April 2023. **Photo credits:** Bryan Johnson and Patrick Cullis.

❖ Pago Pago, American Samoa ❖

The American Samoa station, about midway between Hawaii and New Zealand, is also a part of the NOAA ESRL/GML ozonesonde network, with near weekly launches beginning in 1986, and is a part of SHADOZ since 1998. The current Station Chief is **LTJG Skyler Jordan** (NOAA; *pictured here*), who took over operations in 2023 with an expedited training period and ensures consistent measurement operations at this NOAA Observatory in the South Pacific. This station has separate locations for its ozonesonde preparation/receiving station and the launch location, which makes for complicated weekly operations. Besides ozonesonde observations, the Samoa station personnel also maintain regular Dobson, halocarbon, greenhouse gas, aerosol, and flask sample measurements.

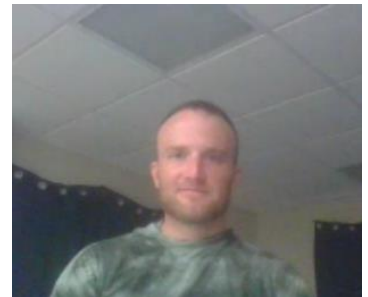


Photo: American Samoa Station Chief, LTJG Skyler Jordan (NOAA), attended the SHADOZ NOAA Pacific region Meet-up (virtual meeting) in May 2023. **Photo credit:** Debra Kollonige.

The long-term ozonesonde records from the NOAA Pacific region stations (Hilo, Fiji and American Samoa) are critical for understanding tropical and subtropical ozone trends, particularly in the South Pacific. Dedicated teams at each station, as well as the NOAA ESRL/GML team, have been crucial in maintaining these multi-decade datasets and we thank them!

❖ SHADOZ at 2023 IAGOS Data Users Workshop ❖

- 14-16 November, **Debra Kollonige (NASA/SSAI)** attended the IAGOS Workshop in-person and presented 3 talks on behalf of the **NASA GSFC SHADOZ team**:
 - **Stauffer et al.**: “Dynamical Drivers of Free-Tropospheric Ozone Increases Over Southeast Asia”.
 - **Kollonige et al.**: “SHADOZ 2023 Project and Data Archive Updates”.
 - **Thompson et al.**: “Tropical Tropospheric Ozone Trends (1990-2022): Integrating Satellite, Sonde & Aircraft Perspectives”.
- Other **relevant SHADOZ presentations** from ozonesonde colleagues include: “Trends in tropo. ozone derived from homogenized ground-based and in-situ datasets within TOAR-II” from **Van Malderen et al.**, “First Ozone Intercomparison Campaign of IAGOS (CORE & CARIBIC) versus WCCOS” from **Smit et al.**, and “Quantitative consistency of tropo. ozone from ozonesonde and aircraft (IAGOS) observations: vertical distribution, ozonesonde types and station distance” from **Tarasick et al.**

❖ SHADOZ at 2023 AGU Fall Meeting ❖

- 11-15 December, the **NASA GSFC SHADOZ team** presented **1 talk and two posters**:
 - **Stauffer et al. (poster)**: “Dynamical Drivers of Free-Tropospheric Ozone Increases Over Southeast Asia”.
 - **Kollonige et al. (poster)**: “Tropical Tropospheric Ozone Trends (1990 to 2020) from SHADOZ Profiles and Satellite Data”.
 - **Thompson et al. (talk)**: “Homogenized ground-based and profile ozone datasets from the TOAR-II/HEGIFTOM project: Methods and station trends”.

❖ Recent noteworthy ozonesonde publications ❖

- Smit, H. G. J., Poyraz, D., Van Malderen, R., Thompson, A. M., Tarasick, D. W., Stauffer, R. M., Johnson, B. J., and Kollonige, D. E. (2024). New insights from the Jülich Ozone Sonde Intercomparison Experiment: calibration functions traceable to one ozone reference instrument, *Atmos. Meas. Tech.*, 17, 73–112, <https://doi.org/10.5194/amt-17-73-2024>.
- Stauffer, R. M., Thompson, A. M., Kollonige, D. E., Komala, N., Al-Ghazali, H. K., Risdianto, D. Y., Dindang, A., Fairudz bin Jamaluddin, A., Sammathuria, M. K., Zakaria, N. B., Johnson, B. J., and Cullis, P. D. (2023). Dynamical drivers of free-tropospheric ozone increases over equatorial Southeast Asia, *EGU sphere* [preprint], <https://doi.org/10.5194/egusphere-2023-2618>.
- Evan, S., J. Brioude, K. H. Rosenlof, R.-S. Gao, R. W. Portmann, Y. Zhu, R. Volkamer, C. F. Lee, J.-M. Metzger, K. Lamy, P. Walter, S. L. Alvarez, J. H. Flynn, E. Asher, M. Todt, S. M. Davis, T. Thornberry, H. Vömel, F. G. Wienhold, R. M. Stauffer, et al. (2023). Rapid ozone depletion after humidification of the stratosphere by the Hunga Tonga Eruption, *Science*, 382 (6668), <https://doi.org/10.1126/science.adg2551>.
- Stauffer, R. M., Thompson, A. M., Kollonige, D. E., Tarasick, D. W., Van Malderen, R., Smit, H. G. J., et al. (2022). An examination of the recent stability of ozonesonde global network data. *Earth and Space Science*, 9, e2022EA002459. <https://doi.org/10.1029/2022EA002459>.
- Thompson, A. M., Smit, H. G. J., Kollonige, D. E., Stauffer, R. M. (2022). Chapter 4: “Ozonesondes”, in *Field measurements for Passive Environmental Remote Sensing: Instrumentation, Intensive Campaigns and Satellite Applications*, ed. N. R. Nalli, Elsevier. <https://www.sciencedirect.com/science/article/abs/pii/B9780128239537000113>.
- Thompson, A. M., Wargan, K., Witte, J. C., Kollonige, D. E., & Ziemke, J. R. (2021). Regional and seasonal trends in tropical ozone from SHADOZ profiles: Reference for models and satellite products. *Journal of Geophysical Research: Atmospheres*, 126, e2021JD034691, <https://doi.org/10.1029/2021JD034691>.
- WMO/GAW Report No. 268, 2021: Smit, H. G. J., Thompson, A. M., and ASOPOS panel, *Ozonesonde Measurement Principles and Best Operational Practices*, ASOPOS (Assessment of Standard Operating Procedures for Ozonesondes) 2.0, WMO Global Atmosphere Watch report series, No. 268, World Meteorological Organization, Geneva. https://library.wmo.int/index.php?lvl=notice_display&id=21986#_YaFNSbpOlc8
- Tarasick, D. W., Smit, H. G. J., Thompson, A. M., Morris, G. A., Witte, J. C., Davies, J., et al. (2021). Improving ECC Ozonesonde Data Quality: Assessment of Current Methods and Outstanding Issues. *Earth and Space Science*, 8, e2019EA000914, <https://doi.org/10.1029/2019EA000914>.
- Vömel, H., et al. (2020). A new method to correct the ECC ozone sonde time response and its implications for “background current” and pump efficiency, *AMT*, 13, 5667–5680, <https://doi.org/10.5194/amt-13-5667-2020>.
- Stauffer, R. M., Thompson, A. M., Kollonige, D. E., Witte, J. C., Tarasick, D. W., Davies, J., et al. (2020). A post-2013 dropoff in total ozone at a third of global ozonesonde stations: Electrochemical concentration cell instrument artifacts? *Geophys. Res. Lett.*, 47, e2019GL086791, <https://doi.org/10.1029/2019GL086791>.

- Thompson, A. M., et al. (2019). Ozonesonde Quality Assurance: The JOSIE-SHADOZ (2017) Experience. *Bull. Amer. Meteor. Soc.* <https://doi.org/10.1175/BAMS-D-17-0311.1>
- Sterling, C. W., et al. (2018). Homogenizing and estimating the uncertainty in NOAA’s long term vertical ozone profile records measured with the electrochemical concentration cell ozonesonde. *Atmos. Meas. Tech.* <https://doi.org/10.5194/amt-2017-397>
- Witte, J. C., A. M. Thompson, et al. (2018). First Reprocessing of Southern Hemisphere Additional Ozonesondes (SHADOZ) Profile Records. 3. Uncertainty in Ozone Profile and Total Column. *J. Geophys. Res.*, 123. <https://doi.org/10.1002/2017JD027791>
- Thompson, A. M. et al. (2017). First Reprocessing of Southern Hemisphere Additional Ozonesondes (SHADOZ) Ozone Profiles (1998-2016). 2. Comparisons with Satellites and Ground-based Instruments. *J. Geophys. Res.*, 122. <https://doi.org/10.1002/2017JD027406>
- Witte, J. C., A. M. Thompson, et al. (2017). First reprocessing of Southern Hemisphere Additional Ozonesondes (SHADOZ) profile records (1998-2015) 1: Methodology and evaluation. *J. Geophys. Res.*, 122. <https://doi.org/10.1002/2016JD026403>

❖ Upcoming Relevant Meetings ❖

SHADOZ will be represented at the following:

29 Jan – 2 Feb 2024:

American Meteorological Society (AMS) Meeting –
Baltimore, MD., USA

15-19 July 2024:

Quadrennial Ozone Symposium - Boulder, CO., USA

*Abstract Submissions now OPEN through 14 February:

<https://qos2024.colorado.edu/abstract-submission> *

7-15 September 2024:

International Global Atmospheric Chemistry (IGAC)
Conference - Kuala Lumpur, Malaysia

Attention Data Users:

- Questions about SHADOZ should be directed to PI, Ryan Stauffer, ryan.m.stauffer@nasa.gov. SHADOZ data sets are products of evolving research by the site Co-Investigators (Co-Is) and ongoing community collaboration.
- The SHADOZ homepage gives technical and contact information for each station and their Co-Is responsible for the original data processing. Co-Is should be consulted for details of their methods & appropriate references to their work.
- Questions about the final data and any news updates should be directed to the Archiver: Debra Kollonige, debra.e.kollonige@nasa.gov.

► SHADOZ GSFC Science Team ◀



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