



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 thirteen 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.

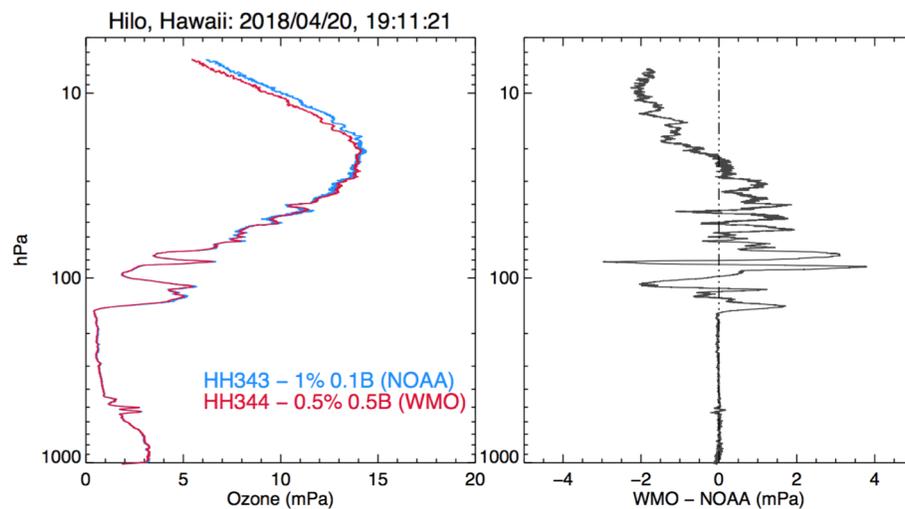
SHADOZ Sites: <https://tropo.gsfc.nasa.gov/shadoz>



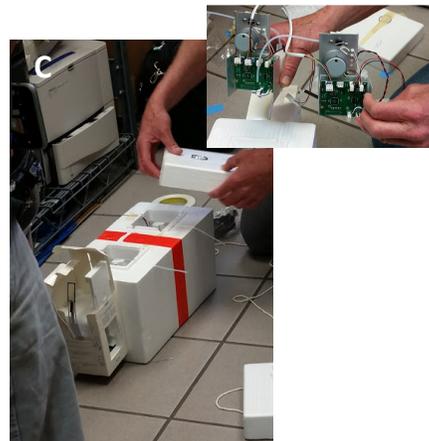
SHADOZ Site	Principal Investigator (PI), Station Chiefs and Operators
Ascension, U.K.	Anne Thompson (PI; anne.m.thompson@nasa.gov ; NASA/GSFC), Andrew Avery, Peter Crane & Patrick Benjamin (US Air Force AFSPC E-ROS/Wolf Creek)
Costa Rica (multiple sites)	Henry Selkirk (PI; henry.b.selkirk@nasa.gov ; NASA/USRA), Holger Vömel (NCAR), Jorge Andres Diaz & Ernesto Corrales (UCR)
Hanoi, Vietnam	Shin-Ya Ogino (PI; ogino-sy@jamstec.go.jp ; JAMSTEC), Masato Shiotani (Kyoto U.), T. H. Anh Nguyen (AMO)
Hilo, HI, USA	Bryan Johnson (PI; bryan.johnson@nasa.gov ; NOAA/GMD), David Nardini & Darryl Kuniyuki (NOAA/MLO)
Irene, South Africa	Gert J. R. Coetsee (PI; gerrie.coetsee@weathersa.co.za ; SAWS), Tshidi Machinini (SAWS)
Kuala Lumpur, Malaysia	Maznorizan Mohamad (PI; maz@met.gov.my), Zamuna Zainal, Nur Aleesha Abdullah, & Ab Rahman Buang (MMD)
La Réunion, France	Françoise Posny (PI; francoise.posny@univ-reunion.fr), Jean-Marc Metzger (U. Réunion)
Nairobi, Kenya	Christian Félix (PI; christian.felix@meteoswiss.ch), René Stübi & Gonzague Romanens (Meteoswiss), Kennedy Thiongo (KMD)
Natal, Brazil	Francisco R. da Silva & Tercio L. B. Penha (INPE)
Paramaribo, Surinam	Ankie PETERS (PI; ankie.peters@knmi.nl) & Marc Allart (KNMI), Sukarni Mitro & George Paiman (MDS)
Pago Pago, Am. Samoa	Bryan Johnson (PI; NOAA/GMD), LTJG Diane M. Perry (NOAA/ASO)
San Cristobal, Ecuador	Bryan Johnson (PI; NOAA/GMD), Manuel Carvajal & Jimmy Paredes (INAMHI)
Suva, Fiji	Bryan Johnson (PI; NOAA/GMD), Matakite Maata, Francis Mani, and Miriama Vuiyasawa (USP)

❖ Hilo, Hawaii, USA ❖

Anne Thompson (SHADOZ PI) and Bryan Johnson (NOAA/ESRL/GMD [Global Monitoring Division]; Hilo PI) visited the Mauna Loa Observatory (MLO) group of GMD on the Hawaii Big Island, 16-20 April, 2018. Hilo is one of two SHADOZ north subtropical stations. Among joint NASA-NOAA activities were: (1) tour of MLO on Mauna Loa (3.2 km ASL), an NDACC site; (2) MLO staff water vapor-ozonesonde launch at the Hilo Airport NWS site with lectures by Thompson and Johnson on SHADOZ and MLO Dobson-sonde-satellite data. (3) NDACC, AGAGE, HATS flask-filling at Pt Kumakahi Light, ozonesonde calibration; (4) Dual ozonesonde launch by Johnson and Thompson.



(photo, top left) Anne Thompson with David Nardini launching dual sondes. Both profiles are plotted on the top right. Solutions were tested: NOAA 1% 1.10th Buffer (blue) and the WMO 0.5% half buffer (red). Both were flown with ENSCI sondes of the type used at Hilo. Noise in the tropopause region is typical where it is challenging for sondes to respond quickly to steep ozone gradients (right profile panel). In this launch, the NOAA solution produces more ozone than the WMO recipe above 15 hPa. Further dual launches are required to gather more statistics on the observed biases.



A: Bryan Johnson (center) with operator David Nardini (L) and MLO station chief Darryl Kuniyuki (R).

B: Anne Thompson prepping one of the dual sondes.

C: Dual sondes placed inside the two styrofoam boxes and interfaced with an iMet radiosonde.

D: Aidan Colton preparing flask samples of greenhouse gases. Samples are analyzed at Scripps Institute of Oceanography and NOAA/GMD.

❖ Suva Fiji ❖

The Fiji site located on the University of the South Pacific (USP) campus in Suva has launched nearly 475 ozonesondes since 1997. The recent site visit (February 5-9, 2018) by Bryan Johnson (NOAA/GMD) involved the routine review of procedures, re-training, and equipment. Additional photos below are from a 2014 routine visit by Johnson and Patrick Cullis (also at NOAA).



(L) Bryan Johnson and Miriama Vuivyasa, (R) with Matakite Maata with ozonesonde #466 on 8 February, 2018.

Photo A (L-R): Bryan Johnson, Francis Mani, Matakite Maata, and Patrick Cullis during a 2014 site visit.

In addition to satellite validation, SHADOZ sites at Fiji, Hilo (Hawaii), and Ascension Is. have done coordinated balloon launches with the ATom (Atmospheric Tomography) NASA DC-8 aircraft mission. Ozonesondes measure high resolution ozone profiles that can be compared with the aircraft profiling from the near surface to 12 km. In the past 18 months there have been 3 matching flights at Fiji and 4 each from Hilo and Ascension. The recent profiles shown in Fig. 1 took place when the aircraft departed from Kona, Hawaii on 1 May 2018 arriving at Fiji, then flying out from Fiji on May 3rd. The Hilo flight (red) shows the ozonesonde passed through an SO₂ layer of volcanic outgassing from 2-5 kilometers. The ozonesonde sensor generates a negative response to high SO₂ making an artifact zero ozone layer.

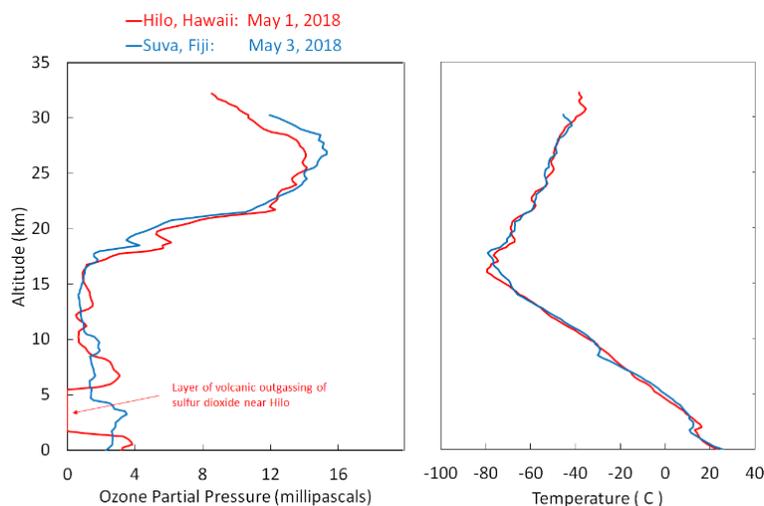


Fig. 1. Ozone and temperature profiles at Hilo and Fiji SHADOZ sites to match the ATom DC-8 mission flight. Volcanic outgassing was observed from the Hilo profiles (red) just two days before the major eruption of Mt. Kilauea volcano located only 50 km east of Hilo.

Meeting Announcements:

- **GMAC (Global Monitoring Annual Conference):** 22-23 May 2018; Boulder, CO, USA. Two presentations will be given on SHADOZ reprocessing and uncertainties and the JOSIE-SHADOZ Joint Campaign. Agenda: <https://www.esrl.noaa.gov/gmd/annualconference/agenda.php>
- **NDACC (Network for the Detection of Atmospheric Composition Change) - Steering Committee:** Held this year the week of 10 September 2018 at WMO in Geneva, Switzerland.
- **JOSIE Workshop:** WMO/NDACC sponsored workshop following the joint JOSIE-SHADOZ-2017 Campaign. Held during the week of 17 September 2018 in Switzerland.
- **IGAC (International Global Atmospheric Chemistry):** 25-29 September 2018; Kagawa, Japan. URL: <http://icacgp-igac2018.org/>
- **SPARC (Stratosphere-troposphere Processes And their Role in Climate) General Assembly:** 1-5 October 2018; Kyoto, Japan. URL: <http://www.sparc-climate.org/meetings/general-assembly-2018/>. Presentations will be given on JOSIE and SHADOZ led activities.
- **2018 Fall AGU Meeting:** 10-14 December, 2018, Washington D.C., USA. There will be a special session on "Atmospheric Trace Species Profiles from Long-term and Campaign Sampling: Observations from Ground, Balloons and Aircraft". As we celebrate 20 years of SHADOZ we welcome abstracts from SHADOZ participants. Financial support for participants from developing countries is available for registration relief and student travel. Visa letter support can be provided. Abstract deadline is 1 August, 2018. See URL: <https://fallmeeting.agu.org/2018/>
- **AMS (American Meteorological Society) 99th Annual Meeting:** 6-10 January 2019, Phoenix, Arizona, USA. There will be two notable conferences on the Middle Atmosphere and Atmospheric Chemistry. Abstract Deadline is 1 August, 2018. URL: <https://annual.ametsoc.org/2019/>

Recent noteworthy SHADOZ publications

Stauffer, R. M., Thompson, A. M. & Witte, J. C. (2018). Characterizing Global Ozone Profile Variability from Surface to the UT/LS with a Clustering Technique and MERRA-2 Reanalysis. *J. Geophys. Res.*, 123. <https://doi.org/10.1029/2018JD028465>.

Sterling, C. W., S. J. Oltmans, B. J. Johnson, H. G. J. Smit, A. Jordan, P. Cullis, E. Hall, J. Windell, A. M. Thompson, and J. C. Witte (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, H. G. J. Smit, H. Vömel, R. Stübi, and F. Posny (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., 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>.