



# SHADOZ Notes

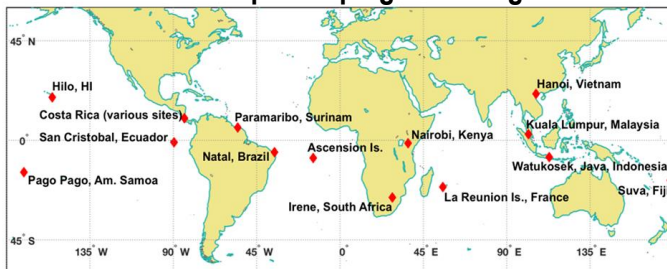
## Southern Hemisphere Additional OZonesondes

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>



### ❖ San Cristobal Station Restarts Launches in 2021 ❖

On 11 December 2021, Professor María Cazorla and her team (**Figure right**) at the University of San Francisco Quito (USFQ) in Ecuador launched their first ozonesonde at San Cristóbal campus in the Galapagos, after a nearly 6-year hiatus of operations (Figure top left). Early 2021, NASA Headquarters funded the reactivation of the San Cristobal station and inclusion of the Quito, Ecuador, station into SHADOZ through a new arrangement with Professor Carzola and USFQ. Training began in October 2021 at the USFQ Atmospheric Measurement Station (EMA) in Quito, where Cazorla's team has launched ozonesondes since 2014. On 12 December, Cazorla organized synchronized launches of the two Ecuador stations, starting a new era of valuable tropical ozonesonde profiles in SHADOZ.



**Figure: (top right)** Carlos Mena (Galapagos Science Center), Edgar Herrera (EMA Quito operator), María Cazorla (Station PI) and Ariel Pila (EMA San Cristobal operator) at the San Cristobal station before the balloon release on 12 December. **(bottom right)** María Cazorla and Ariel Pila preparing an ozonesonde in the lab on 11 December. **(bottom left)** Shelter / laboratory at USFQ San Cristobal campus. **(top left)** María Cazorla, Edgar Herrera and Ariel Pila prepare the balloon for the launch on 11 December (EMA; <https://www.usfq.edu.ec/en/institute/instituto-de-investigaciones-atmosfericas-usfq-ia-usfq>). **Photo credit:** María Cazorla.

## ❖ SHADOZ at 2021 QOS and AGU Meetings ❖

- In October 2021, the **Quadrennial Ozone Symposium (QOS)**; (<http://qos2021.yonsei.ac.kr>) was hosted entirely online by South Korea and SHADOZ had a strong presence with almost 30 talks and posters demonstrating the importance of the network's data for ozone science. The presentation topics ranged from recent SHADOZ ozone trends (Thompson *et al.*, 2021; published recently, **listed below**), satellite tropical ozone product evaluation (e.g. TROPOMI from Hubert *et al.*, 2021; **listed below**), SHADOZ station reports on their long-term measurements and ozonesonde data quality assurance efforts including: (1) a summary on the newly published WMO/ GAW Report No. 268 (**listed below**) on the Assessment of Standard Operating Procedures for OzoneSondes (ASOPOS 2.0) from D. Kollonige and (2) an update on the post-2013 ozonesonde total column drop-off from R. Stauffer.
- December 13-17, 2021, the **American Geophysical Union (AGU)** held a hybrid (online and in-person) version of the annual **Fall Meeting** located in New Orleans, LA, USA. The SHADOZ NASA Goddard Space Flight Center (GSFC) team participated both online only (A. Thompson and D. Kollonige) and in-person (R. Stauffer; pictured in **photo on right**). Their presentations as well as Holger Vömel's e-lightning poster provided summaries of results from recent publications (**below**).



**Figure:** Ryan Stauffer gives an in-person presentation on SHADOZ ozone trends at the hybrid 2021 AGU Fall Meeting in New Orleans, LA, USA on 15 December. **Photo credit:** Natasha Dacic.

## ❖ Recent noteworthy ozonesonde publications ❖

- Thompson, A. M., Stauffer, R. 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](https://library.wmo.int/index.php?lvl=notice_display&id=21986#.YaFNSbpOlc8)
  - Hubert, D., Heue, K.-P., Lambert, J.-C., Verhoelst, T., Allaart, M., Compennolle, S., Cullis, P. D., Dehn, A., Félix, C., Johnson, B. J., Keppens, A., Kollonige, D. E., Lerot, C., Loyola, D., Maata, M., Mitro, S., Mohamad, M., PETERS, A., Romahn, F., Selkirk, H. B., da Silva, F. R., Stauffer, R. M., Thompson, A. M., Veeckind, J. P., Vömel, H., Witte, J. C., and Zehner, C. (2021). TROPOMI tropospheric ozone column data: geophysical assessment and comparison to ozonesondes, GOME-2B and OMI, *AMT*, 14, 7405–7433, <https://doi.org/10.5194/amt-14-7405-2021>.
  - 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., Smit, H. G. J., Tarasick, D., Johnson, B., Oltmans, S. J., Selkirk, H., Thompson, A. M., Stauffer, R. M., Witte, J. C., Davies, J., van Malderen, R., Morris, G. A., Nakano, T., and Stübi, R. (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>.
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- 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, 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., 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:

### January 2021:

Tropospheric Ozone Assessment  
Report (TOAR-II) Meeting

### January 2021:

American Meteorological Society  
21<sup>st</sup> Conference on Middle Atmosphere

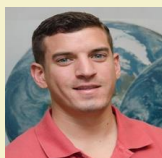
### May 2021:

NOAA GML Global Monitoring Annual Conference

### Attention Data Users:

- Questions about SHADOZ should be directed to PI, Ryan Stauffer. 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.

### ► SHADOZ GSFC Science Team ◀



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