ASOPOS (Assessment of Standard Operating Procedures (SOPs) for OzoneSondes) 2.0: Ozonesonde Measurement Principles and Best Operational Practices

Poster #E-198

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Assessment of Standard Operating Procedures for OzoneSondes (ASOPOS) 2.0 Report:

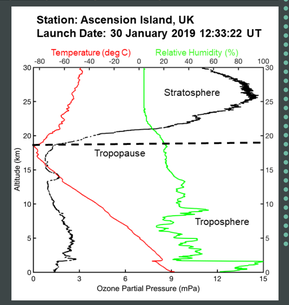
- Serves as an update of WMO/GAW Report 201 (Smit and ASOPOS, 2014), the first ASOPOS Guidebook with "best practices" for quality assurance criteria and standard operating procedures (SOPs).
- Describes: 1) measurement principles of ozonesonde instrument, 2) uncertainty chain of parameters affecting measurement, 3) new recommendations on sonde preparation steps and 4) revised data processing protocols.
- Provides expanded guidelines on data quality indicators and rationale for good metadata.

Ozonesonde and its Measurement

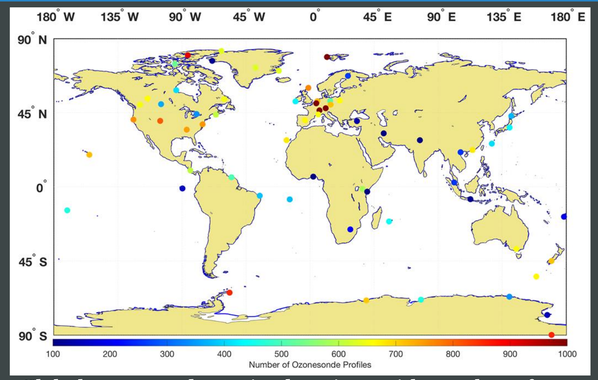
- An **electrochemical concentration cell (ECC) ozonesonde** (Top photo) is a small balloon-borne instrument attached to radiosonde to measure ozone profiles from surface to 35 km with 100m vertical resolution (Bottom figure).
- **Challenge!** Two instruments (**SPC & EN-SCI**) & 3 KI "sensing solution" (SST) types used globally.
- Sondes w/ different instrument-SST combinations launched together give systematically varying O3 readings throughout profile.
- Since 2015, satellite & trends assessment communities request 5% or better accuracy and precision of sonde data.

Science Pump Corp. (SPC)

Environmental Science (EN-SCI)



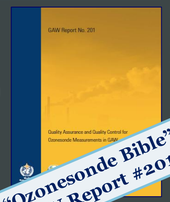
Global Ozonesonde Network



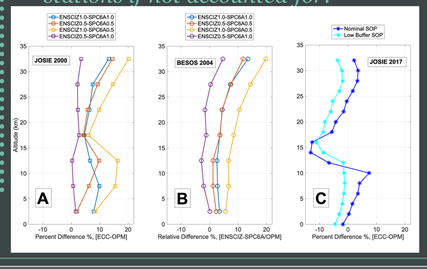
- Global ozonesonde station locations with number of ozonesonde profiles from 2005-2019 indicated.
- Sonde network has supported > 20 satellite O3 instruments & calibrated O3 lidars and IAGOS aircraft O3 profiles.

ASOPOS 1.0 (2001-2014) & JOSIE

- Jülich OzoneSonde Intercomparison Experiment (JOSIE; *Smit et al., 2007*) and Balloon Experiment on Standards for OzoneSondes (BESOS; *Deshler et al., 2008*) showed importance of SOPs and consistent instrumentation to maintain accuracy of long-term records.
- From JOSIE, BESOS, and JOSIE 2017: Profile sets in test chamber with different SSTs diverge ➔ *leads to bias among stations if not accounted for.*

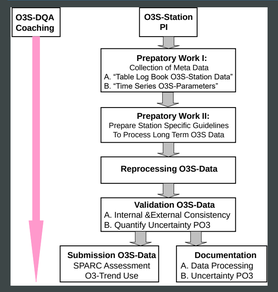


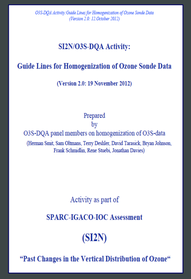
"Ozonesonde Bible" GAW Report #201



Nominal SOP 6% higher than low buffer SOP at left.

ASOPOS 2.0 & Capacity-Building





O3S-DQA OzoneSonde-Data Quality Assessment

Started in 2011- Now more than 30 Stations Re-processed

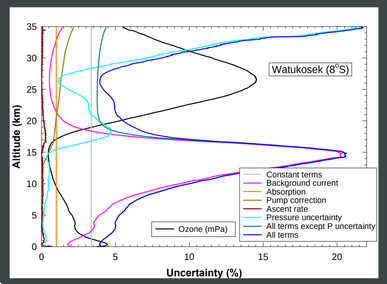
JOSIE-SHADOZ 2017: 20 Tropical Simulations

8 SHADOZ Operators

ASOPOS 2.0 Timeline:
Sept. 2019: Outline
Mar. 2020: First Draft
Aug. 2020: Draft-> Review
Dec. 2020: Final Au Edits
July 2021: Final Edits -> WMO

2021 ASOPOS 2.0 Report

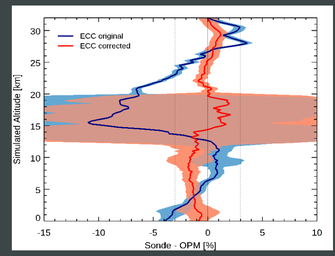
Quantifiable Uncertainties In Each Profile



Uncertainties for Watukosek, Java, Indonesia (*Witte et al., 2018*) show influence of different terms. -> Because of very low O3 in tropical UT, uncertainty due to background current without correction dominates.

ASOPOS 2.0 Chapters: What's New?

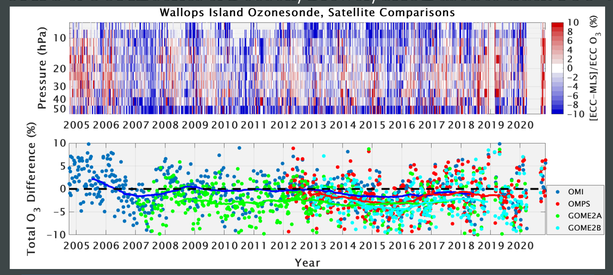
- "Empirical" correction factors for stratospheric data that compensate for decreasing pump motor efficiency (Ch. 3).
- Specification of uncertainties in each sonde profile *and* referencing final data to OPM (Ch. 3) – *Tarasick et al. (2021).*
- Data handling that accounts for two-reaction pathways of chemicals in sensing solution (Ch. 3) – *Vömel et al. (2020).*
- Updated guidelines for preparation steps (Ch. 4).
- Quality assessment monitoring: frequent comparison to satellite and ground-based total column (TCO) ozone amounts (Ch. 5).
- Specification of extensive metadata for every sonde launched to facilitate re-processing of data in future (Ch. 5).



Comparison between ECC/OPM in 77 simulations during JOSIE 2017. Originally reported difference is shown in blue; difference calculated using corrected data is shown in red. Shaded areas indicate standard error (*Vömel et al., 2020*).

Data Quality Assurance

Aura MLS checks for stratospheric profile drift. Aura OMI, SNPP OMPS & GOME series & Dobson/Brewer/SAOZ used to track TCO*.



References

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*** See *Stauffer et al. (2021)* QOS talk for more on Ozonesonde Data Quality Assurance Updates as a part of ASOPOS activities!**