ECC ozone sonde data product in GRUAN

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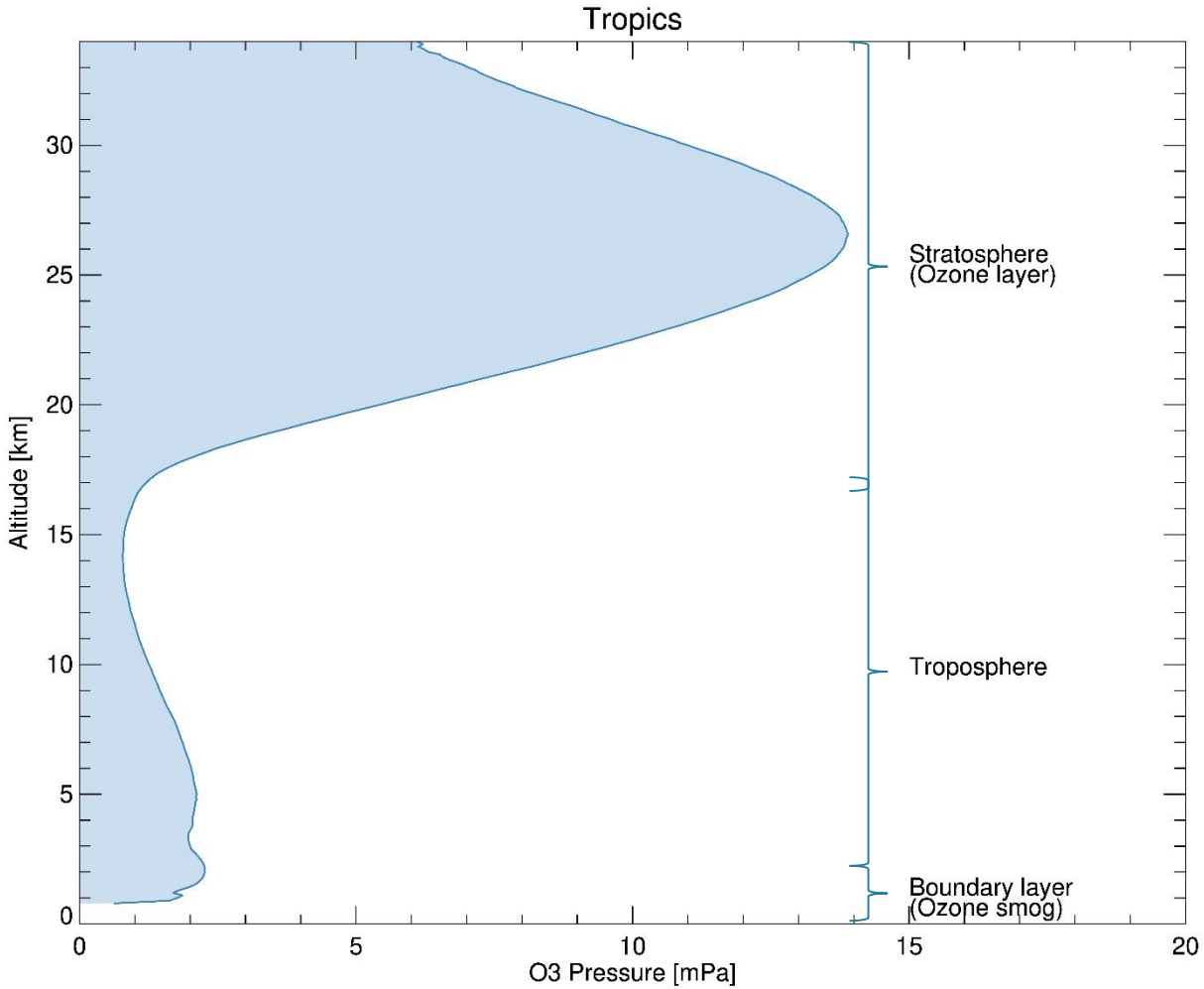
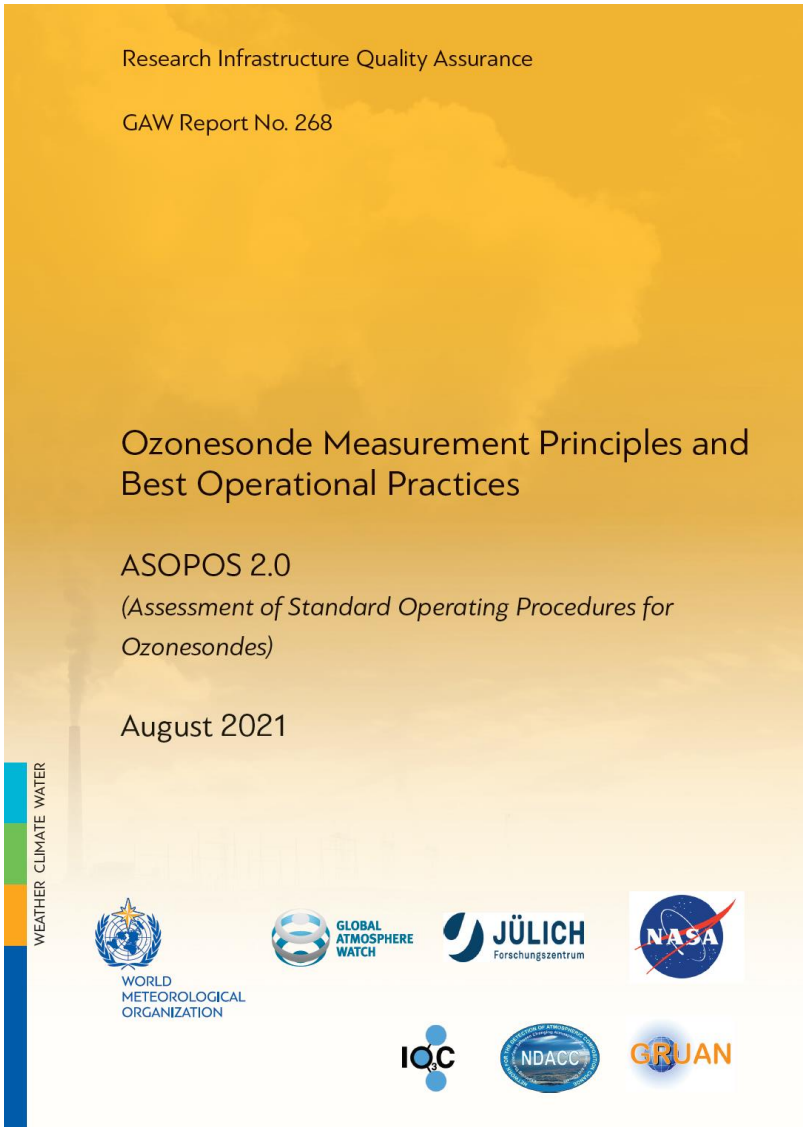
Ozone distribution in the atmosphere



ASOPOS report

- Assessment of Standard Operating Procedures for Ozonesondes (ASOPOS) panel
- Just published by WMO/GAW GAW report 268
- Defines the best practices for the global ozone sonde network
- Was written with GRUAN in mind



GRUAN and GAW

- GRUAN ECC product will build on GAW report 268
- Establish best-possible traceability and lowest uncertainties
- GRUAN ECC product will become anchor observation
- Make sure that GRUAN stations provide homogeneous data set, despite heterogeneous instrumentation

GRUAN requirements

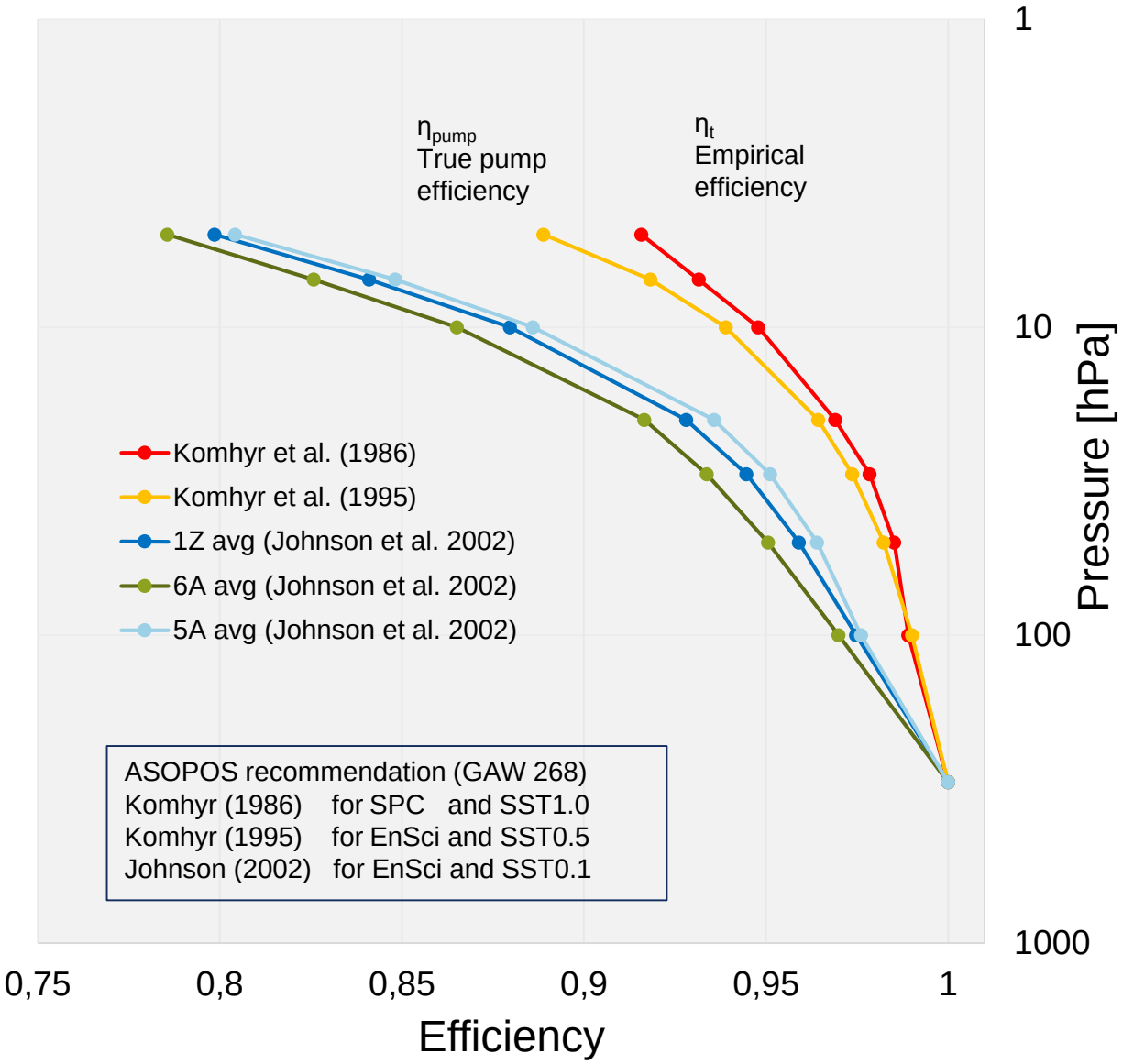
- All raw data, metadata, and products are archived centrally
- Transparent measurement and central processing
- Traceability to accepted or community standard
- All systematic errors removed to the extent possible
- Complete uncertainty budget

Brief roadmap for updated GRUAN ECC data product

- Existing and new stations will follow GAW 268 recommendations for ozonesondes and continue their best practices
- Stations participating in GRUAN ozonesondes must collect all required, essential, and desired metadata specified in metadata appendix of GAW 268
- Stations participating in GRUAN must use manufacturer independent ground check for ECC ozone sondes, which is suggested in GAW 268
- High quality ozone destruction filter (or “zero” air) during preparation
- Centralized processing will be done in parallel to processing at stations
- Empirical (“pump”) efficiencies will be separated into
  - True pump efficiency
  - Stoichiometry factor
  - Time response correction
  - “Background current” will be deprecated
  - Pre-launch data are used in processing
- Uncertainty budget in processing will be worked out following GAW 268, Tarasick (2021), and new processing steps

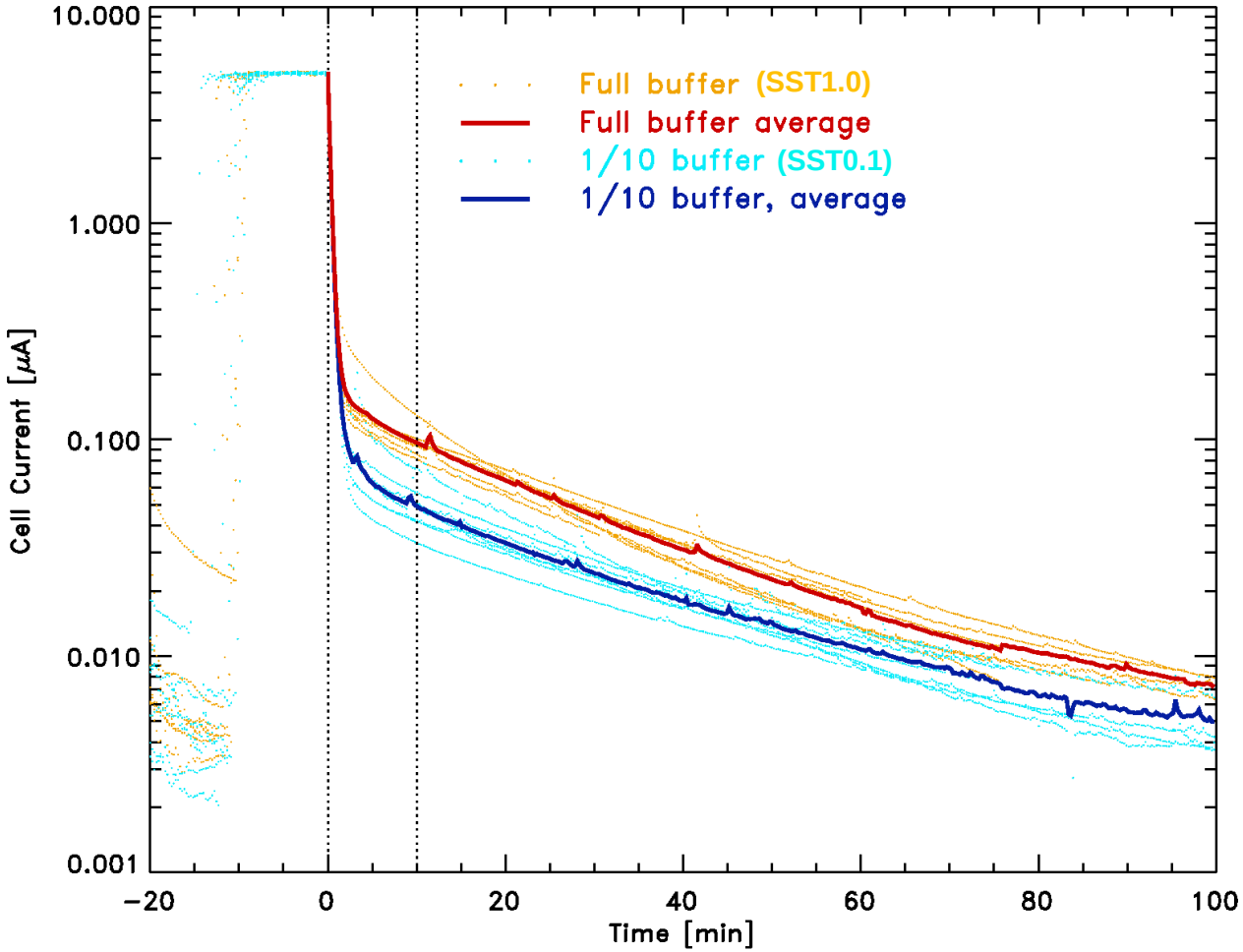
Efficiencies

- Current processing:
  Mix physical and chemical efficiency corrections in one single “empirical” efficiency, depending on manufacturer and solution
- Need to use pump efficiency to correct behavior of pump (well understood)
- Chemical stoichiometry is considered separately



“Background current” during sonde preparation

- Concept of constant “background” is not supported by measurements
- “Background” current is not well defined and does not describe an instrument property.



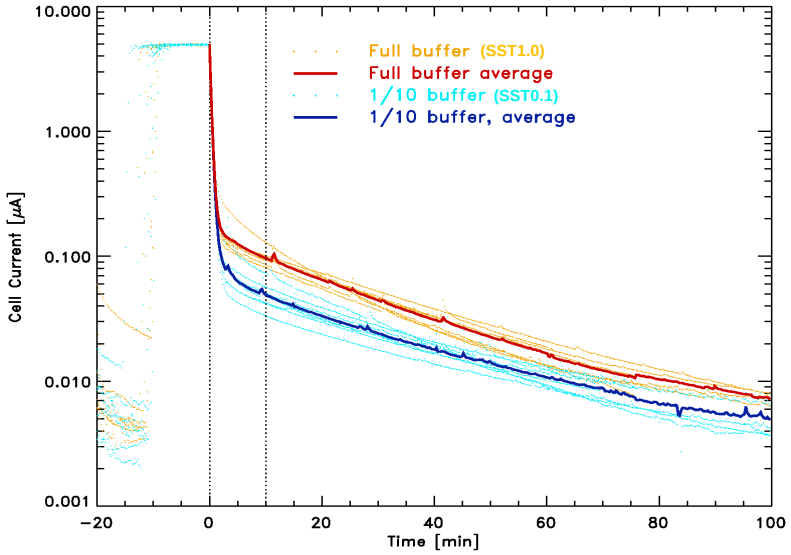
Vömel, H and K. Diaz (2010), Atmos. Meas. Tech., 3, 495-505, doi:10.5194/amt-3-495-2010.

“Background current” during sonde preparation

→ Use two different superimposed time constants to describe sonde response

$$I(t) = I_0 e^{-\frac{t-t_0}{\tau}} + I_0^{'} e^{-\frac{t-t_0}{\tau^{'}}}$$

fast ≈ 20 s, slow ≈ 25 min



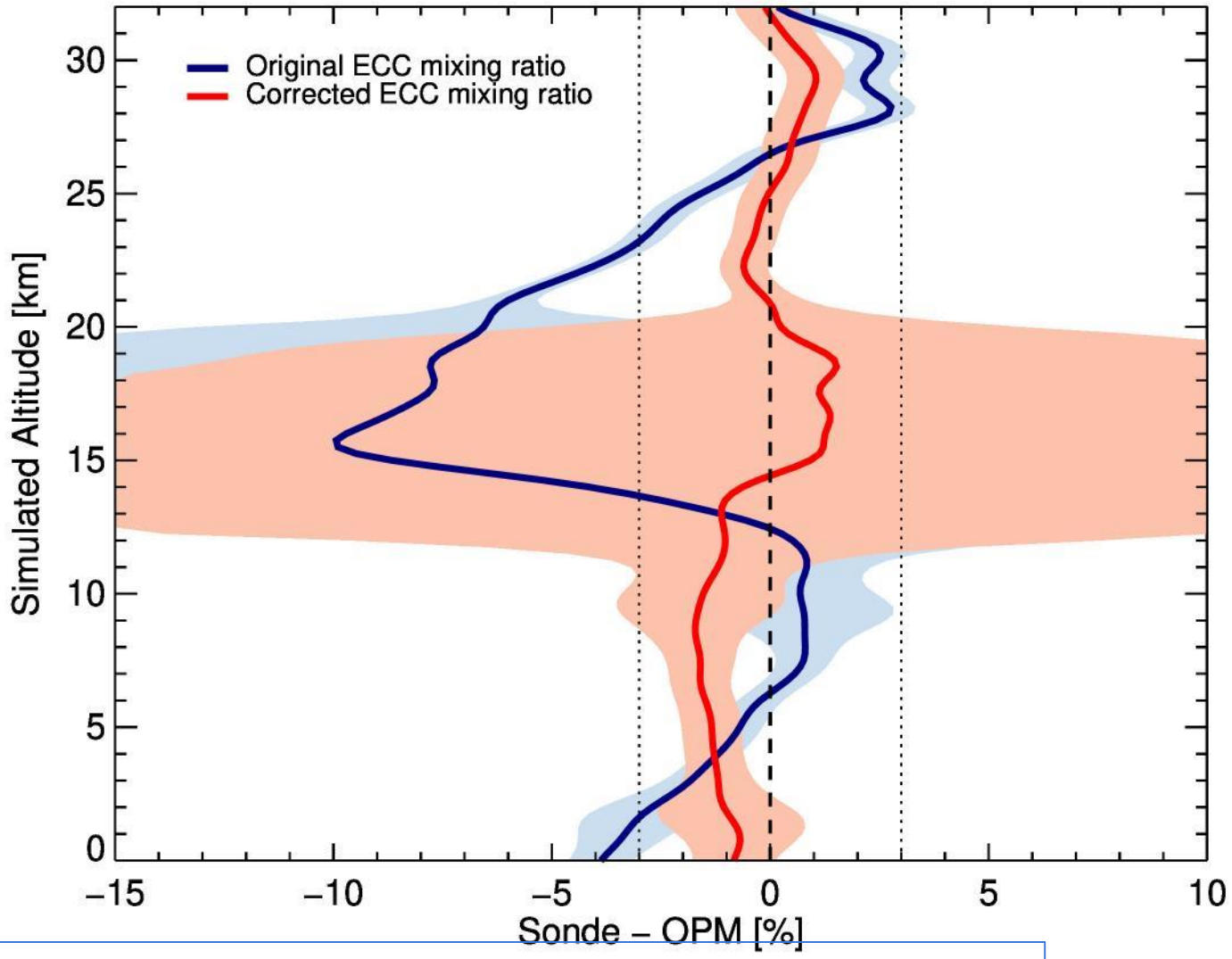
Solve iteratively to correct both fast and slow response simultaneously

Vömel, H., et al (2020): Atmos. Meas. Tech., 13, 5667–5680, https://doi.org/10.5194/amt-13-5667-2020

Time response correction for Jülich Ozone Sonde Intercomparison Experiment

Average of 77 simulation experiments in the Jülich Environmental Chamber, 2017

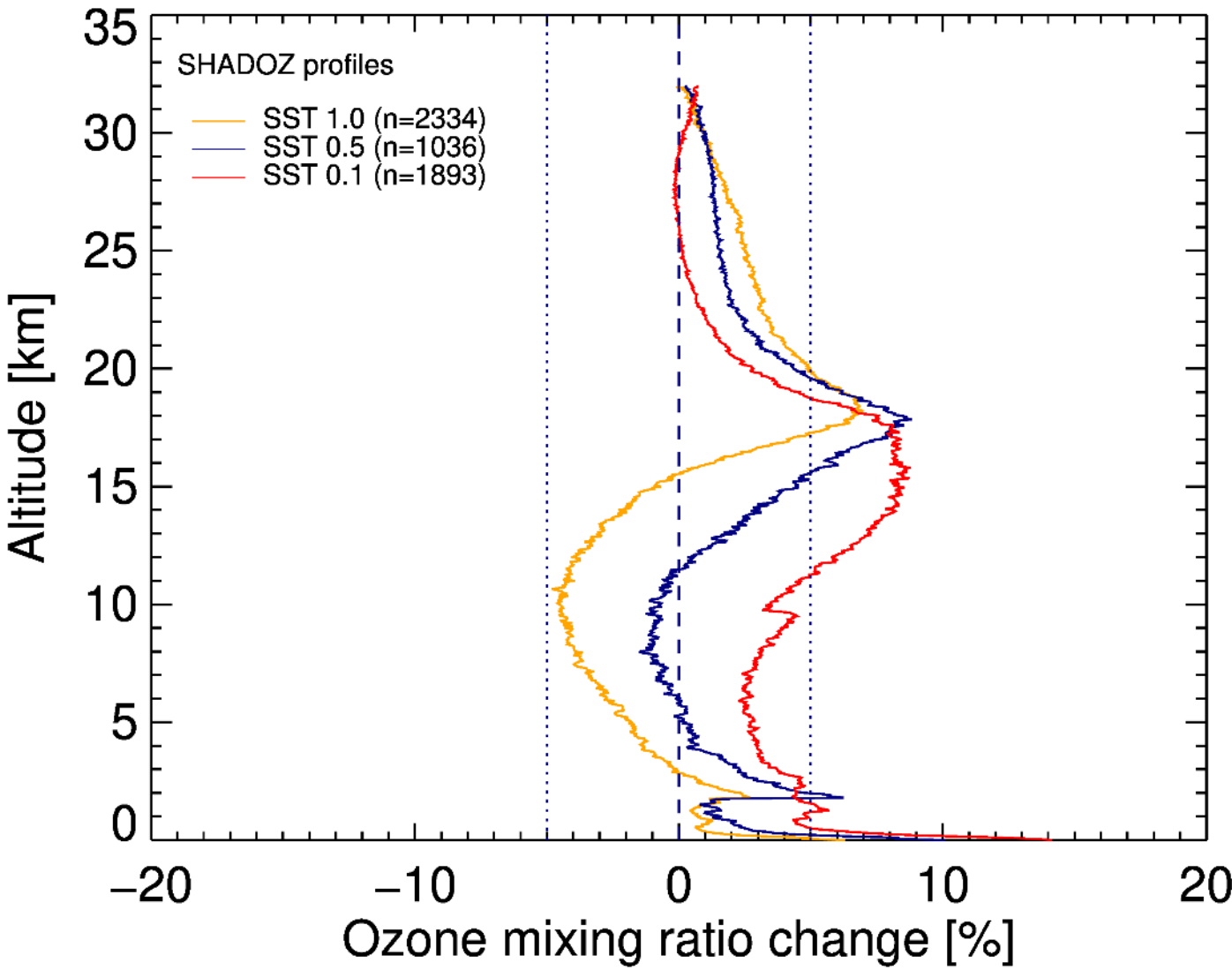
- Time response correction removes systematic bias observed during JOSIE
- Essential for GRUAN



Vömel, H., et al (2020): Atmos. Meas. Tech., 13, 5667–5680, https://doi.org/10.5194/amt-13-5667-2020

Average time response correction in SHADOZ

- Time response changes shape of the profile compared to normal processing, depending on the solution type



Next steps

- Rewrite draft of GRUAN Ozonesonde Technical Document
- Define GRUAN processing algorithms based on GAW 268 with updated time response correction
- Define ground check (ozone calibrator, e.g. Boulder, Lauder, Payerne, Wallops Island)
- Define necessary data files/formats based on guidance from GAW 268