Harmonization and Evaluation of Ground-based Instruments for Free-Tropospheric Ozone Measurements by TOAR-II Focus Working Group "HEGIFTOM"

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Key Objective:
Evaluation and harmonization of the different free tropospheric ozone profiling datasets of the established measuring platforms (in-service aircraft, ozonesondes, Brewer/Dobson Umkehr, FTIR, Lidar).

Major Deliverable:
Quality assessed ozone data sets, whereby each measurement gets also an ***uncertainty*** and a ***quality flag***. Thereby, ***representativeness*** and ***instrumental drifts*** will be characterized and evaluated.

Including:
Testing ozone retrievals from new remote sensing techniques (MAX-DOAS, Pandora) against the established techniques.

IAGOS


Ozonesondes

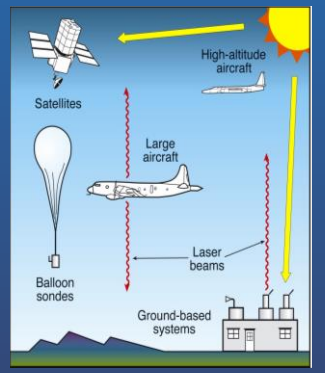

Brewer/Dobson Umkehr


FTIR


Lidar


MAX-DOAS & Pandora

http://hegiftom.meteo.be/datasets



Internal consistency within networks

Deliverable: Homogenized free tropospheric ozone profile data, described at HEGIFTOM website, with same template for each dataset:

Availability

location (ftp, data archive, website, doi, e-mail address contact person, etc.).

Data field description

Measured data fields (and their units), incl. auxiliary data fields, available metadata. Data format

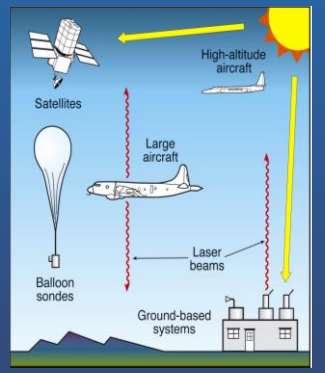
Description of homogenization procedure

short description of the steps taken to make the dataset (more) homogeneous within the network.

Data management

- *Flagging*
- *Uncertainties*
- *Traceability*
- *Internal consistency*
- *External consistency*
- *Data quality indicators*
- *List of homogenized sites (name, geographical location, period of observations)´*

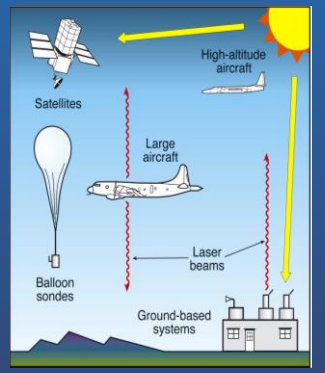
https://hegiftom.meteo.be/datasets



Internal consistency within networks

Achievements and updates:

- **ozonesondes**:
  - 10 more sites homogenized, e.g. OHP: Ancellet et al., https://doi.org/10.5194/amt-15-3105-2022 (±10/50 remaining),
  - WMO-GAW report on Ozonesonde Measurement Principles and Best Operational Practices (https://library.wmo.int/doc_num.php?explnum_id=10884)
- **IAGOS**:
  - internal consistency paper published in AMT (Blot et al., https://doi.org/10.5194/amt-14-3935-2021),
  - simulation chamber comparison of IAGOS-CORE UV-photometer and reference photometer for ozonesondes
- **Lidar**: TMF data has been updated with new data processor, OHP will follow
- **FTIR:** flagging applied to the NDACC data
- **Brewer/Dobson Umkehr**:
  - 5 Dobson Umkehr sites have been homogenized (Petropavlovskikh et al., https://doi.org/10.5194/amt-15-1849-2022), 1 to go.
  - Updated uncertainty estimation of the retrievals.

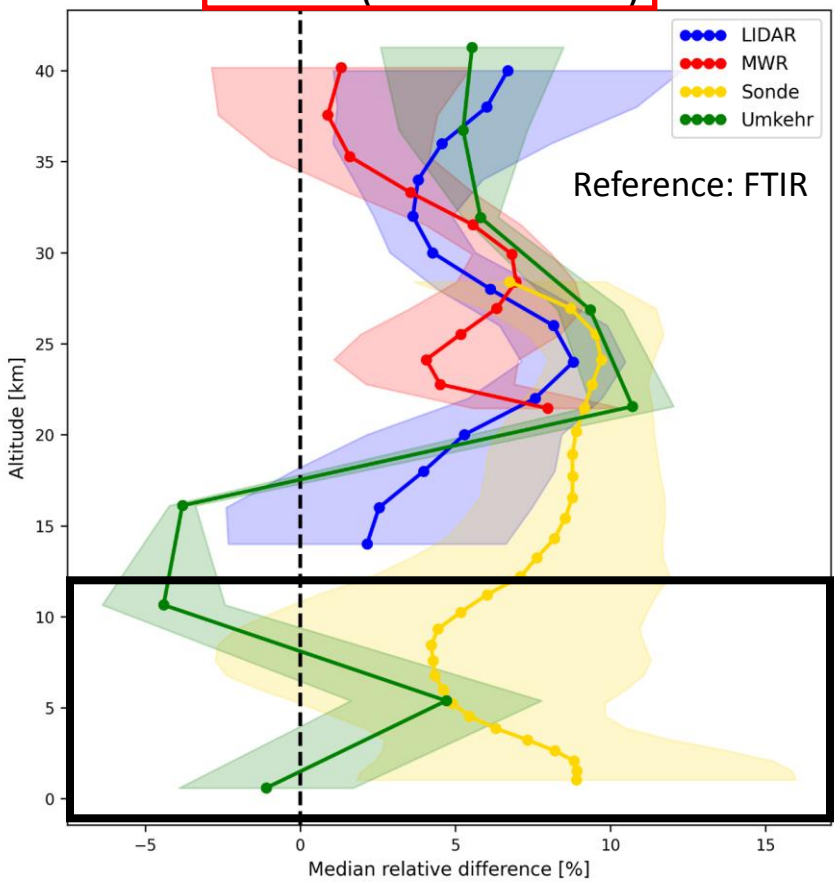


External consistency: Intercomparisons (On-going Year II: 2022)

Deliverable: TOAR-II Intercomparison Guidelines for Observations of Tropospheric Column Ozone and Tropospheric Ozone Profiles (https://igacproject.org/sites/default/files/2022-03/TOAR-II_Guidelines_for_TCO_and_Profile_Intercomparisons.pdf)

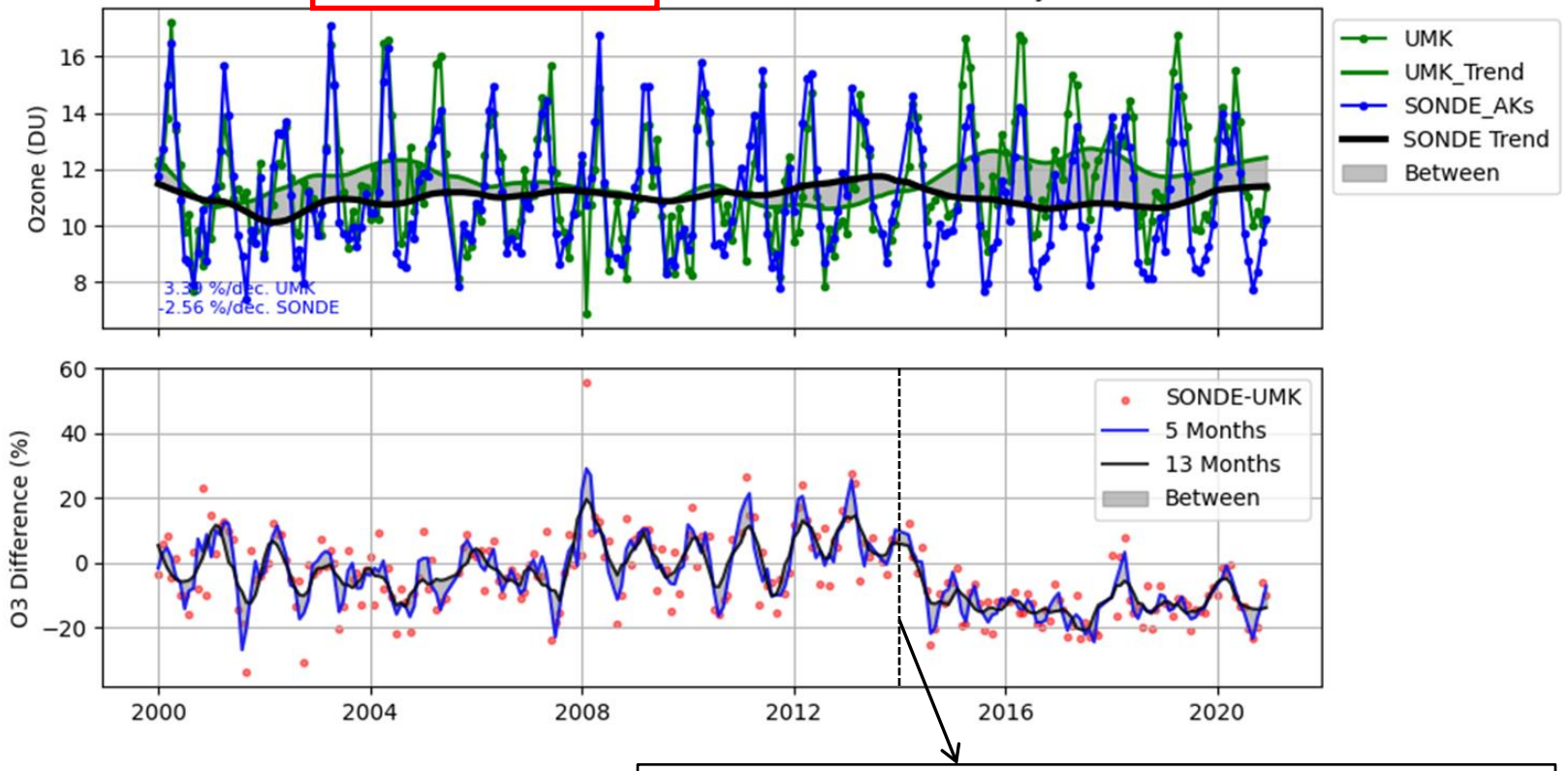
Intercomparison examples:

Lauder (New Zealand)



Mauna Loa (MLO) Hawaii (19.5 N, 155.6 W)

Layer 1 : 1000 – 250 hPa



drop in tropospheric ozone content in ozonesonde in 2014

Outlook (2022-2023)

- continue intercomparison studies
- study the **spatial and temporal representativeness** of ground-based free tropospheric measurements, in collaboration with TOAR-II satellite and reanalysis focus groups
- **development** of free-tropospheric ozone retrieval algorithm with MAX-DOAS & Pandora at and comparison with other ground-based free tropospheric ozone data
- support TOAR-II satellite ozone focus working group to determine drifts and biases between satellite ozone retrievals
- assessment of the tropospheric ozone distribution and trends of tropospheric ozone.
- more information: http://hegiftom.meteo.be