Testing the SI²N Ozonesonde Data Quality Assessment for the nearby stations Uccle (BE) and De Bilt (NL)

1. INTRODUCTION AND MOTIVATION

Uccle & De Bilt

- Uccle and De Bilt are as close as 175 km from each other
- The ozonesonde stations Uccle and De Bilt are for the period 1997-2014
- Uccle and De Bilt trend estimates are closer
- De Bilt trend estimates are significantly different from Uccle

OZONE DATA QUALITY ASSESSMENT (O3S-DQA)

- talk by Smil et al., on Thursday, 8 Sept, 14h30
- only for ECC ozonesondes
- standard operation procedures
- guidelines for metadata collection
- two standards are set: ENSCI 0.5% SST & SPS 1% SST (ratio 1.0 with 1%)
- transfer functions to those standards, based on double soundings/simulation chamber experiments
- standard correction algorithms (based on simulation chamber experiments)
- uncertainty estimation for every data point (5o week for De Bilt, see Van Malderen et al., 2016)

(revised) worldwide, homogenous, consistent dataset to be used for satellite validation and trend analysis

MOTIVATION & AIM

The ozonesonde stations Uccle and De Bilt are for the period 1997-2014, a unique test bed for the O3S-DQA corrections!
- Impact of operating procedures and corrections (operational vs. O3S-DQA on the average ozone profiles)
- Impact of operating procedures and corrections on the vertical ozone trends

2. IMPACT ON AVERAGE O3 PROFILES

METHODOLOGY

1. for both stations: we calculate the average ozone profiles of the 1997-2014 datasets, corrected by different strategies (operational & O3S-DQA).
2. The average O3 profiles are calculated in altitudes relative to the tropopause.
3. Then, we calculate relative differences between the average profiles and one reference average ozone profile.

RESULTS

Uccle
- relative differences between operational (reference) and O3S-DQA correction [gray] are within ±2%
- closest to 0 at O3, max (10 km relative to tropopause)
- largest at lower troposphere and upper stratosphere

De Bilt
- relative differences between operational (red dotted) and O3S-DQA correction (magenta) between 2 to 4%
- largest deviation at UTLS
- due to differences in background current subtraction
- O3S-DQA average profile has lower ozone concentrations at all altitudes

Uccle vs. De Bilt
- relative differences seem dependent on the measured O3 concentrations: closest to 0 at the O3 max and most distinct from 0 at both upper troposphere (between -5 to -9%) and at upper range of the stratosphere (> 10%)
- pressure effect? [found for RS80-856, R580-R802 & R582-R592 Uccle-De Bilt comparison periods]
- differences in procedures/curves [for tropospheric O3, differences in background current measurement/subtraction]
- presence of NO effect? [Uccle, 7.5s, De Bilt: 6.6 m/s > O3measured at Uccle than at De Bilt]
- natural differences? [seasonality in the differences, also present in Aura MLS climatology, different temperature distribution at both sites]
- only in the lower stratosphere (layers below O3 max), the O3S-DQA corrections [gray and magenta] effectively reduce the relative differences between the Uccle and De Bilt ozone partial pressures

3. IMPACT ON THE VERTICAL O3 TRENDS

RESULTS

Uccle
- trend differences between operational (blue) and O3S-DQA correction [gray] are ±3%/dec

De Bilt
- trend differences between operational (red dotted) and O3S-DQA correction (magenta) are ±4%

Uccle vs. De Bilt
- only in the lower stratosphere and in the lower part of the free troposphere, the O3S-DQA corrections bring the Uccle and De Bilt trend estimates closer to one another (compare the [gray] and magenta lines)
- The trends at both stations are not significantly different from each other, independently of the used correction strategy.

OZONE RECOVERY?

- This 1997-2014 period starts with the maximum peak value in the EESC.
- Only in the troposphere are the ozone trends significantly different from 0.
- The sign of the O3 trend in the stratosphere depends on the station and on the applied data processing!
- caution is needed when using terminology like “the onset of ozone recovery”

4. CONCLUSIONS

- The close ozonesonde stations Uccle and De Bilt provide a unique test bed for the homogenisation activity O3S-DQA.
- SST, natural differences in the vertical distribution of ozone between Uccle and De Bilt cannot completely controlled out.
- Despite their impact on the average ozone profiles, the different correction strategies do not change the ozone trends significantly, usually only within their statistical uncertainty due to atmospheric noise.
- The O3S-DQA corrections do not give an overall better agreement of the average profiles and trends between both stations.
- Results for the same analysis for the periods 1969-1996 & 1969-2014 at Uccle: Van Malderen et al. (2016)

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