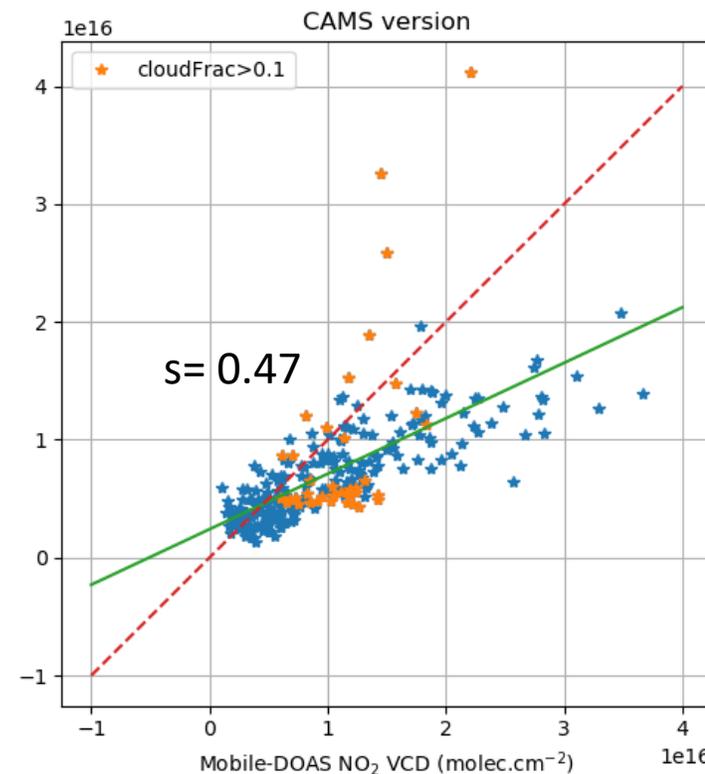
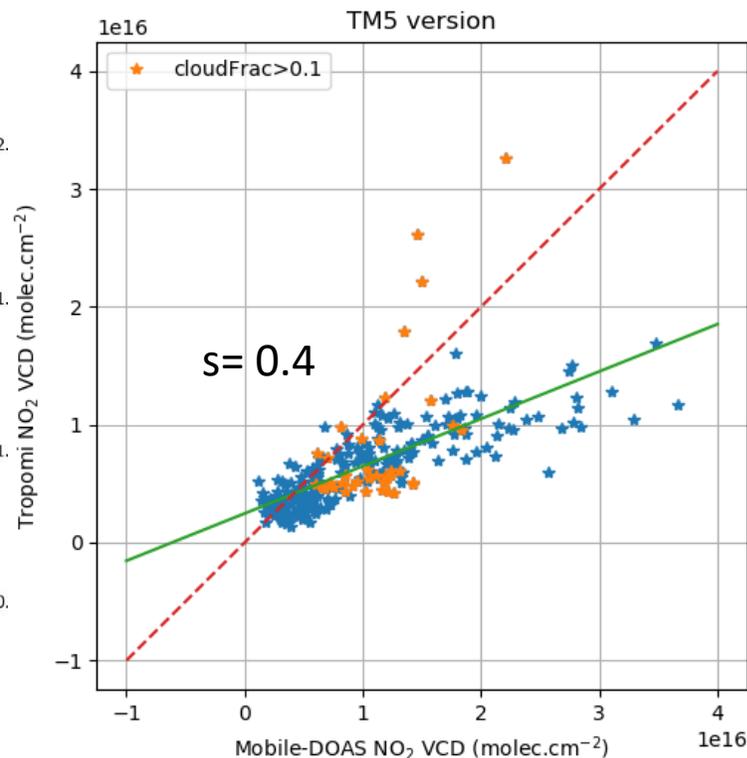
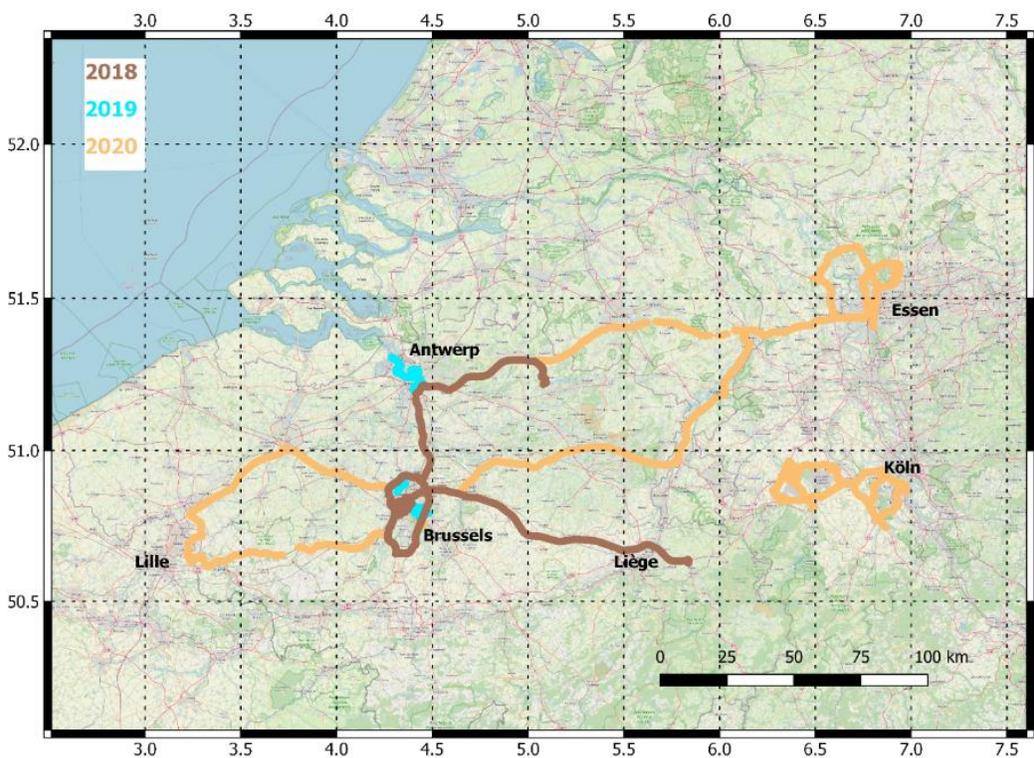


On the use of Mobile-DOAS measurements for air quality satellite validation

Alexis Merlaud, Frederik Tack, Michel Van Roozendael, Henk Eskes, John Douros



- NO₂ tropospheric VCD: Mobile-DOAS vs TROPOMI
- Northern Belgium and Ruhr
- 19 days between 27 June 2018 and 22 September 2020
- Coincidence criteria: +/- 1 h around overpass, QA>0.75
- 257 TROPOMI pixels in 21 orbits



BIRA Mobile-DOAS (a.k.a Aeromobil)

30° above horizon (forward) Zenith

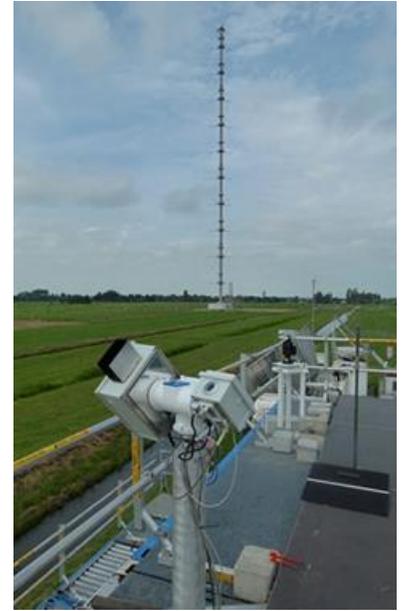
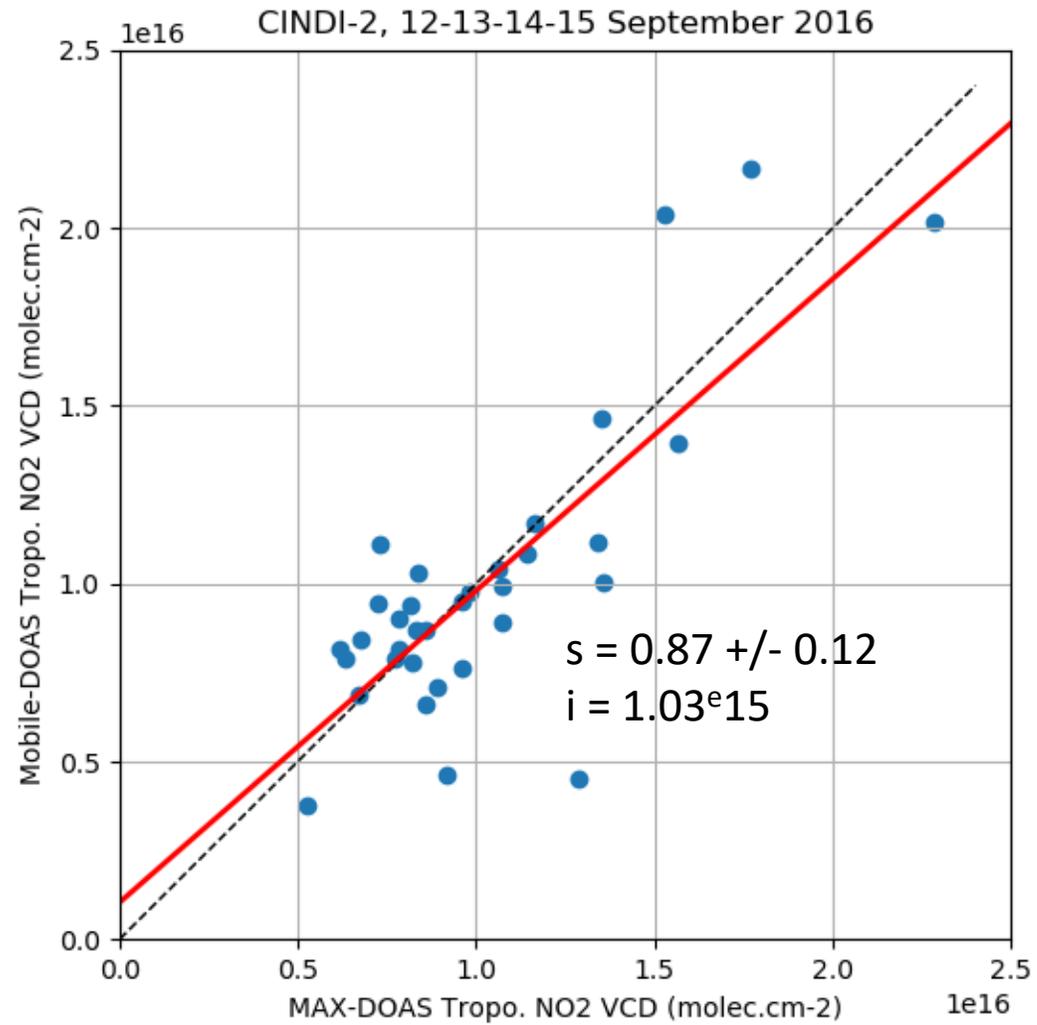


In the trunk: Avantes Double spectrometer (1.2 nm FWHM, 200-750 nm), Computer, UPS



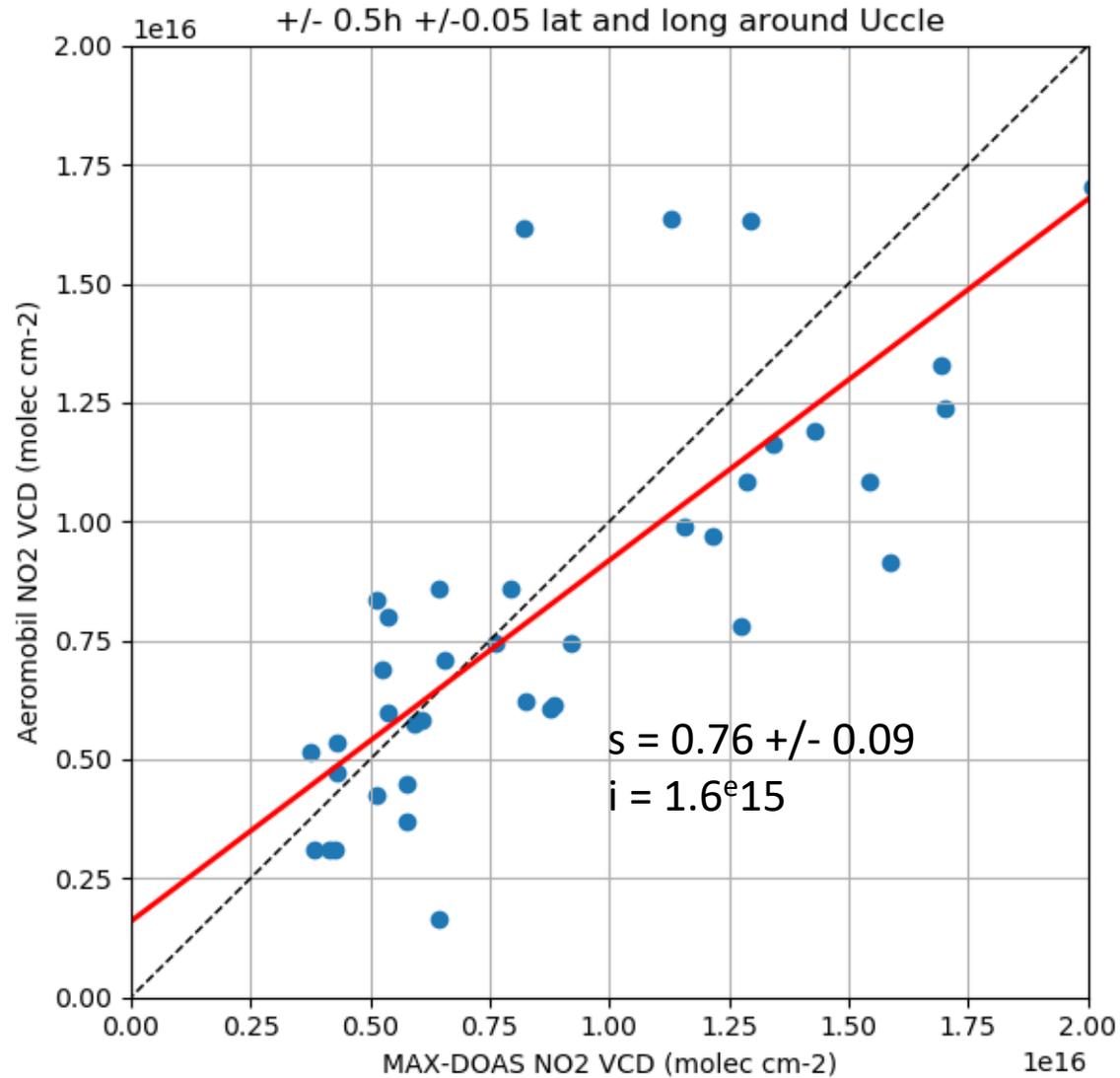
Validation of BIRA Mobile-DOAS (CINDI-2)

+/- 30 min, +/- 0.015° in Lat/Long



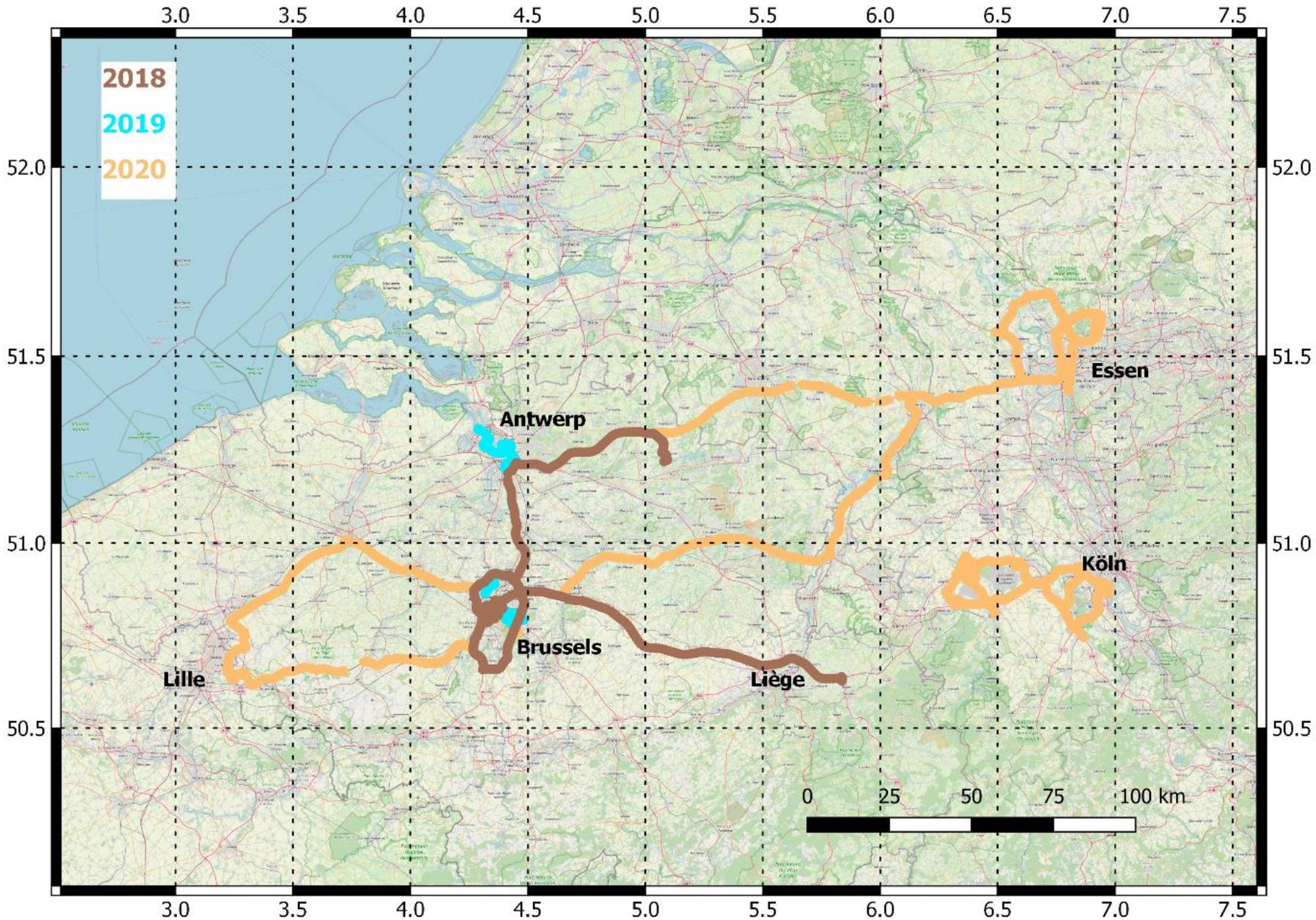
Validation of BIRA Mobile-DOAS (Uccle, 2018-2019)

18 Sept 2018
8-9-10 Oct 2018
26-27-28 Jun 2019



Note that the MAX-DOAS points toward the city which may explain part of the low bias of the mobile

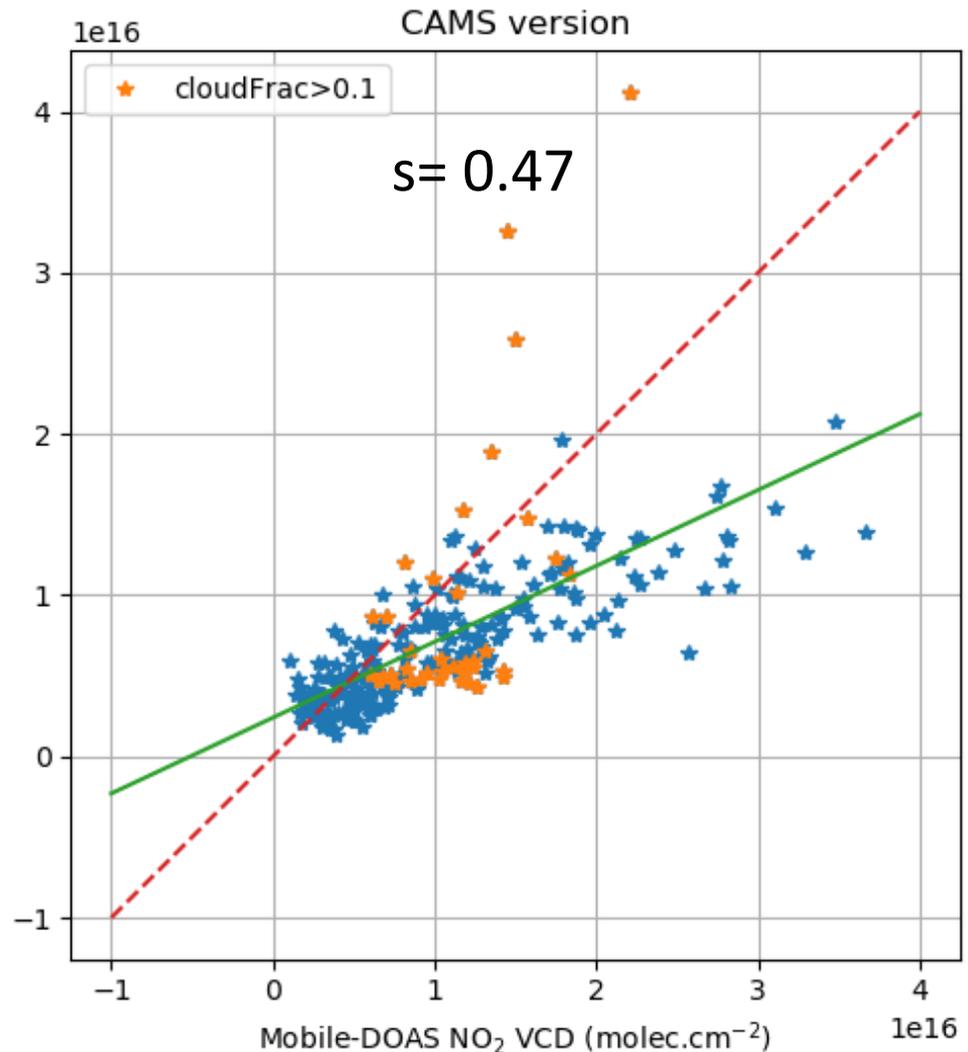
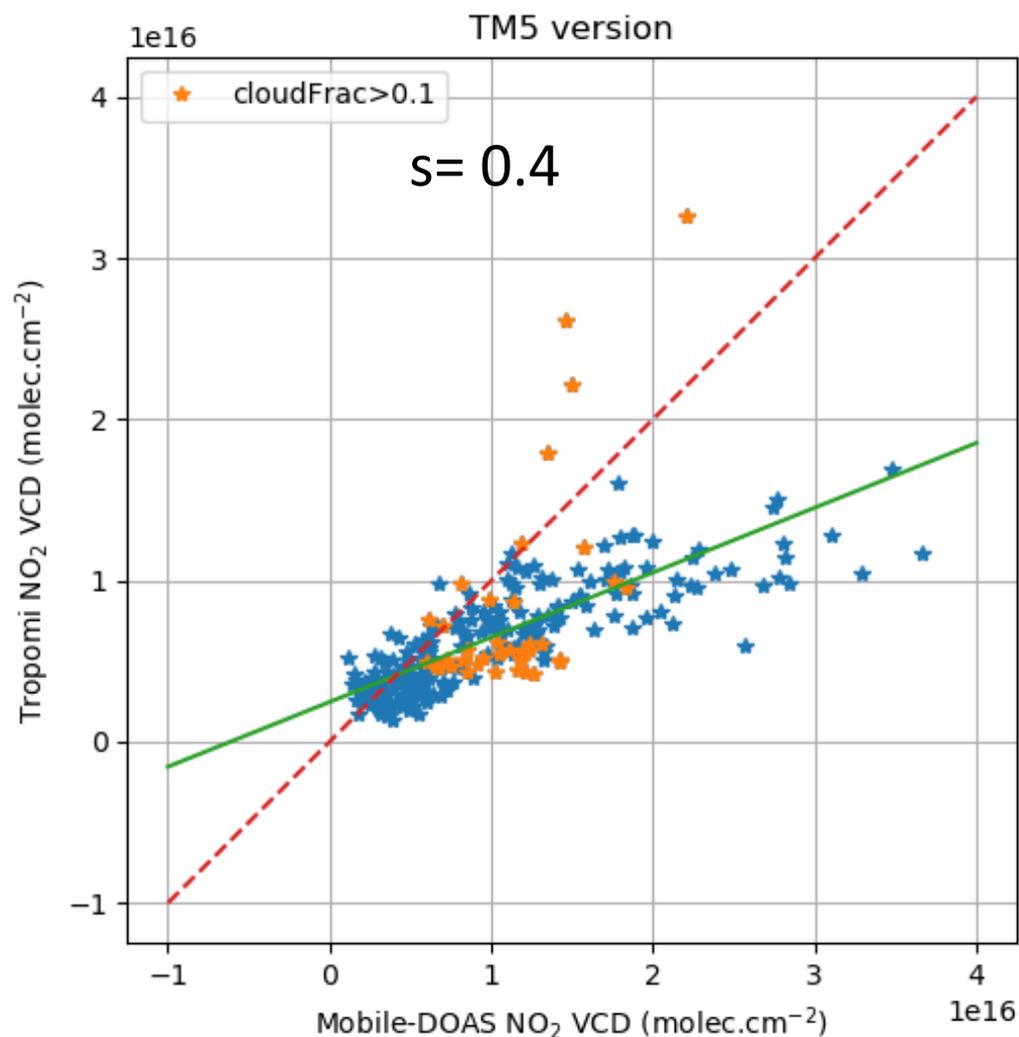




19 (mostly) clear-sky days
27 Jun 2018 - 22 Sept 2020

Including:
-APEX campaign (June 2019)
-QA4EO-DE campaign (Sept 2020)

Coincidence criteria: +/- 1 h around overpass, QA>0.75



CAMS version of Tropomi NO₂ VCD improves the slope by 18%

Filtering on **cloud fraction < 0.1** improves the correlation but reduces the slope

Filtering on **larger nMobileDOAS** within a pixel improves the correlation but has little effect on slope

Comparisons with some previous studies: effect of replacing TM5 by CAMS profiles

- Ialongo et al. (2020) improvement of the slope **0.45 → 0.52 (16%)**
(Helsinki, Ground-based Pandora)
- Tack et al. (2021) improvement of the slope **0.82-→0.93 (13%)**
(Brussels and Antwerp, Airborne, Apex)

-> We report 18% improvement with the Mobile-DOAS in Belgium and Germany

Comparisons with some previous studies: slope (wrt TM5 product)

- Verhoelst et al, 2021, Uccle, MAX-DOAS **0.47**
- Judd et al, 2020, New York, GeoTASO, GCAS **0.68**
- Judd et al, 2020, New York, PANDORA, **0.8**
- Tack et al, 2021, Brussels and Antwerp, APEX, **0.82**
- Iolongo et al, 2020, Helsinki, PANDORA, **0.42**
- See also K. Lange presentation **EGU21-10637** on airborne measurements simultaneous to some of these Mobile-DOAS measurements

-> We report 0.4 wrt the TM5 product

Preliminary conclusions

- We made Mobile-DOAS NO₂ VCD measurements in Belgium and Germany in 2018, 2019, and 2020
- The slope we report is around 0.4 for these polluted areas, 0.47 when replacing TM5 with CAMS
- These regression slopes are low but consistent with other measurements, such as the improvement with CAMS
- Mobile-DOAS measurements are useful to validate TROPOMI and further satellite at finer spatial resolution