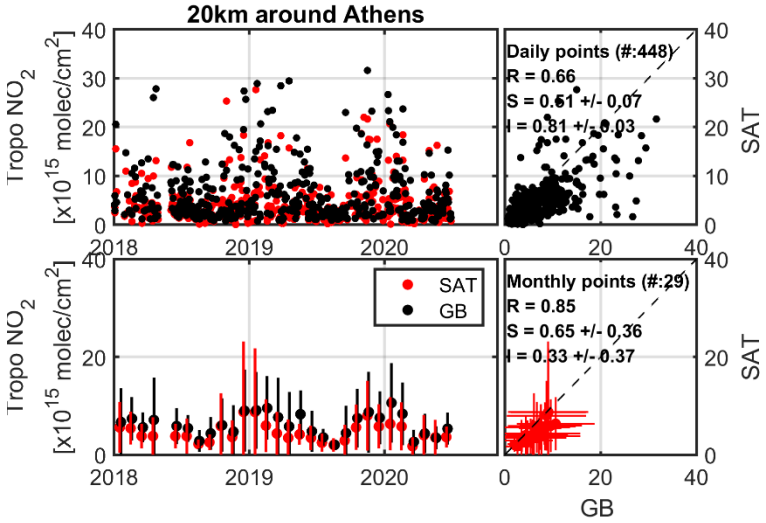
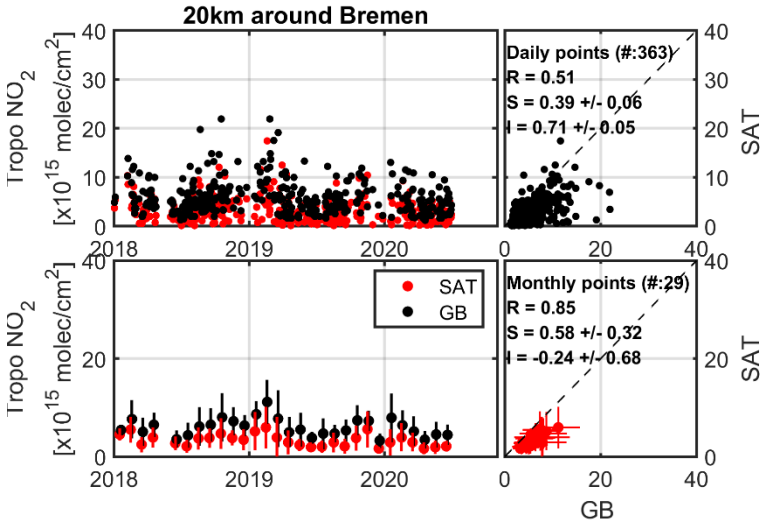
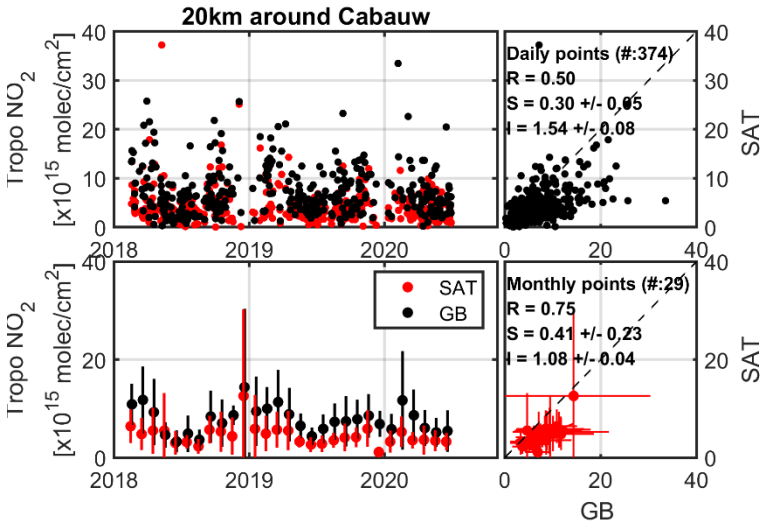
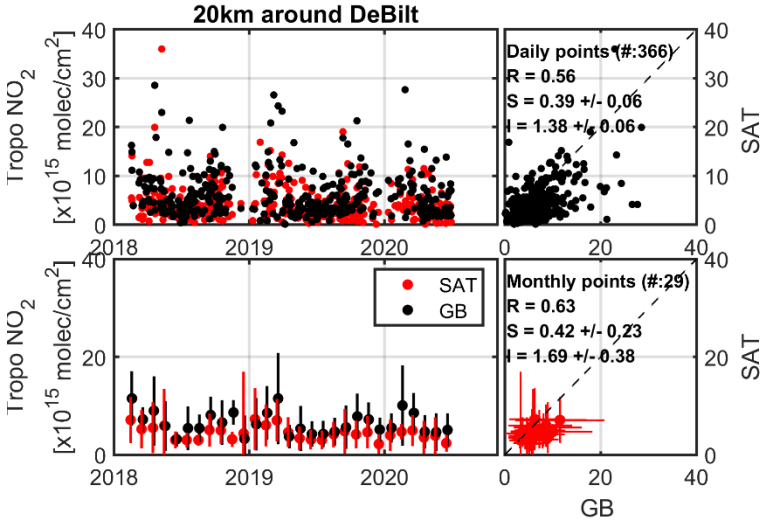
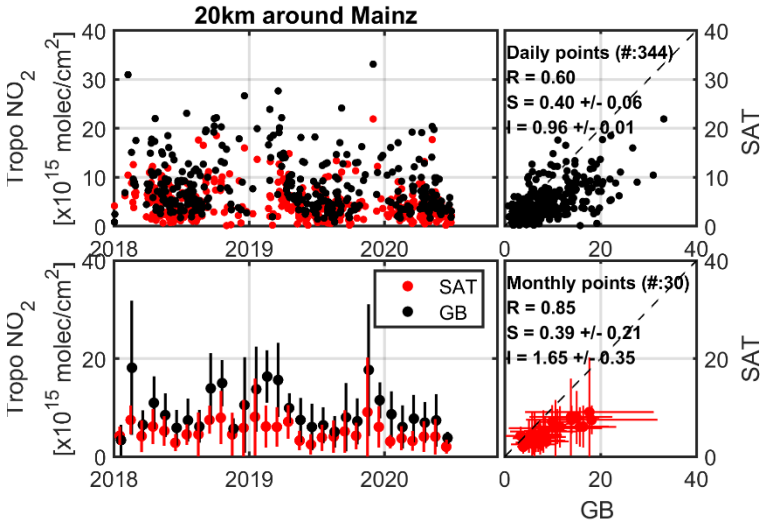
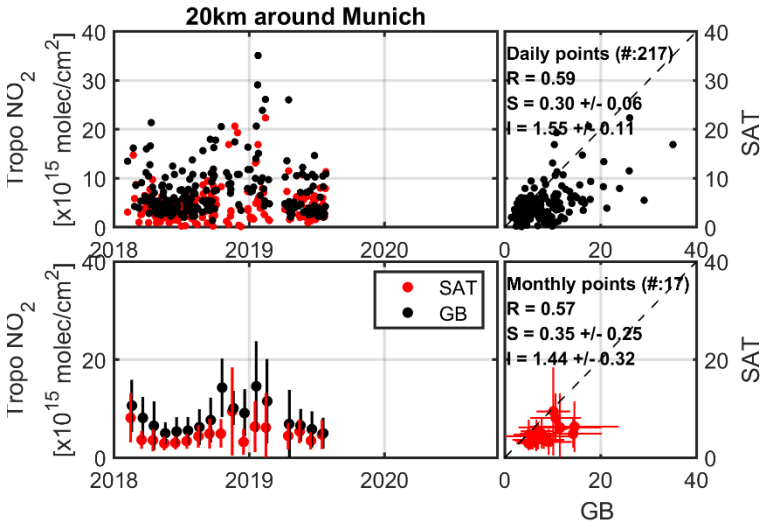

20km around Athens
Tropo NO2 [x10^15 molec/cm^2]
Daily points (#:448)
R = 0.66
S = 0.61 +/- 0.07
I = 0.81 +/- 0.03
SAT
GB
Monthly points (#:29)
R = 0.85
S = 0.65 +/- 0.36
I = 0.33 +/- 0.37
2018
2019
2020


20km around Bremen
Tropo NO2 [x10^15 molec/cm^2]
Daily points (#:363)
R = 0.51
S = 0.39 +/- 0.06
I = 0.71 +/- 0.05
SAT
GB
Monthly points (#:29)
R = 0.85
S = 0.58 +/- 0.32
I = -0.24 +/- 0.68
2018
2019
2020


20km around Cabauw
Tropo NO2 [x10^15 molec/cm^2]
Daily points (#:374)
R = 0.50
S = 0.30 +/- 0.05
I = 1.54 +/- 0.08
SAT
GB
Monthly points (#:29)
R = 0.75
S = 0.41 +/- 0.23
I = 1.08 +/- 0.04
2018
2019
2020


20km around DeBilt
Tropo NO2 [x10^15 molec/cm^2]
Daily points (#:366)
R = 0.56
S = 0.39 +/- 0.06
I = 1.38 +/- 0.06
SAT
GB
Monthly points (#:29)
R = 0.63
S = 0.42 +/- 0.23
I = 1.69 +/- 0.38
2018
2019
2020


20km around Mainz
Tropo NO2 [x10^15 molec/cm^2]
Daily points (#:344)
R = 0.60
S = 0.40 +/- 0.06
I = 0.96 +/- 0.01
SAT
GB
Monthly points (#:30)
R = 0.85
S = 0.39 +/- 0.21
I = 1.65 +/- 0.35
2018
2019
2020


20km around Munich
Tropo NO2 [x10^15 molec/cm^2]
Daily points (#:217)
R = 0.59
S = 0.30 +/- 0.06
I = 1.55 +/- 0.11
SAT
GB
Monthly points (#:17)
R = 0.57
S = 0.35 +/- 0.25
I = 1.44 +/- 0.32
2018
2019
2020

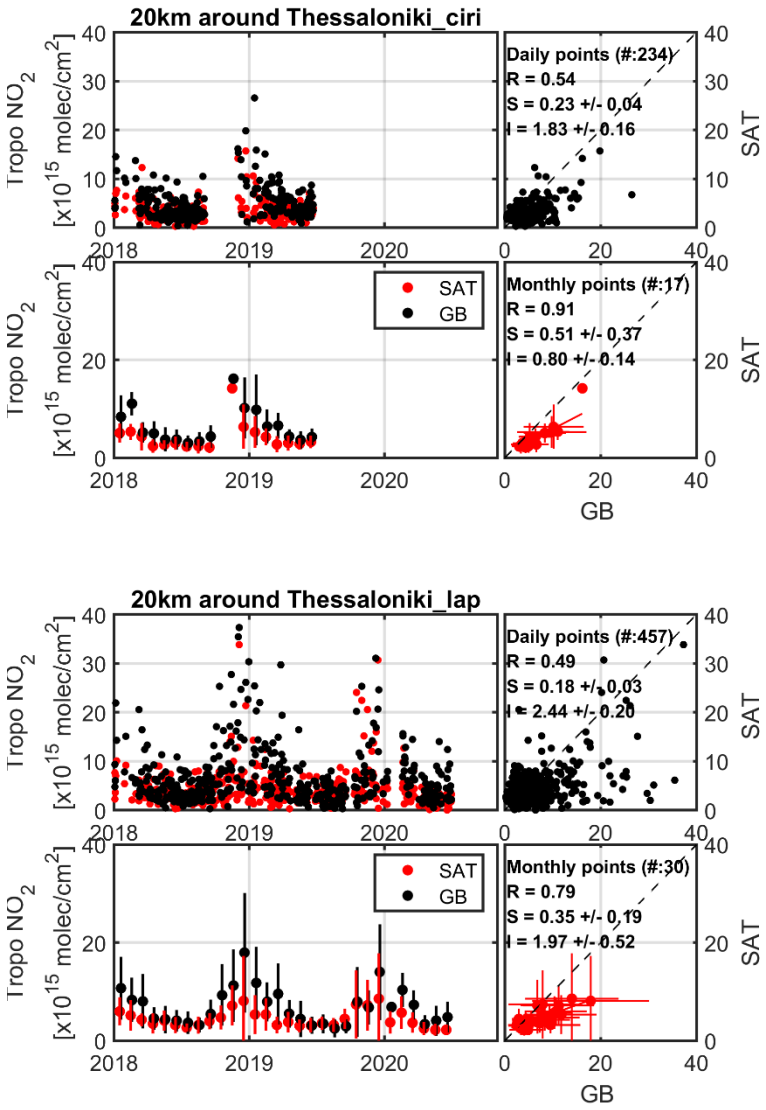
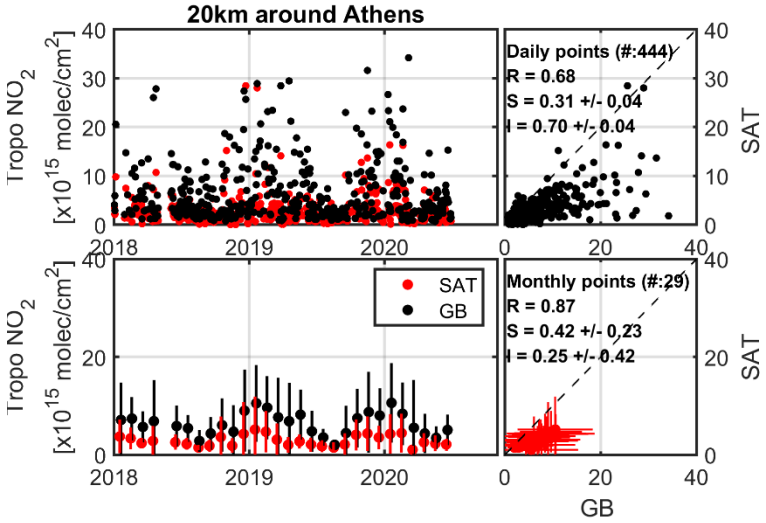
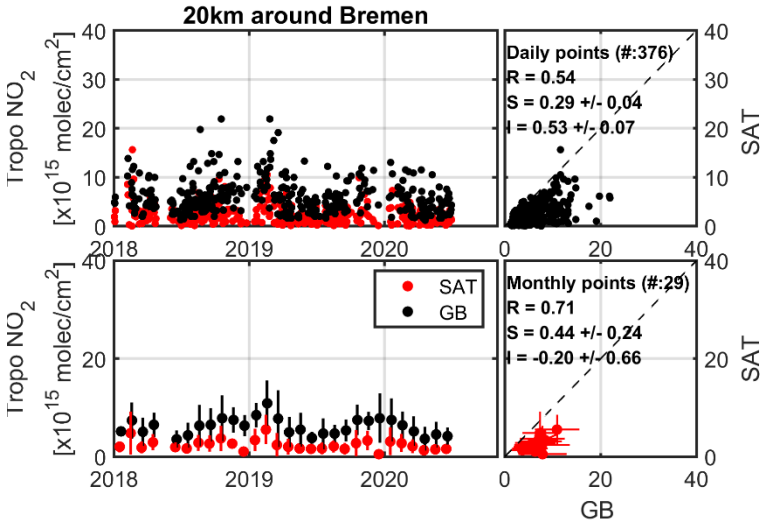
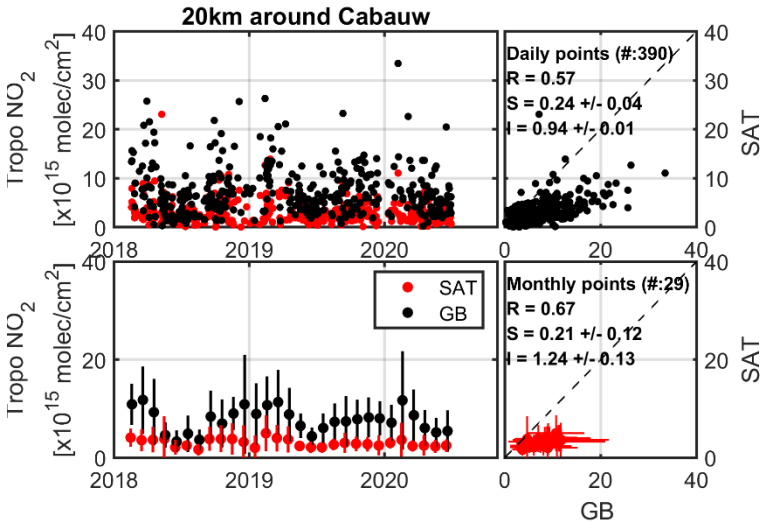
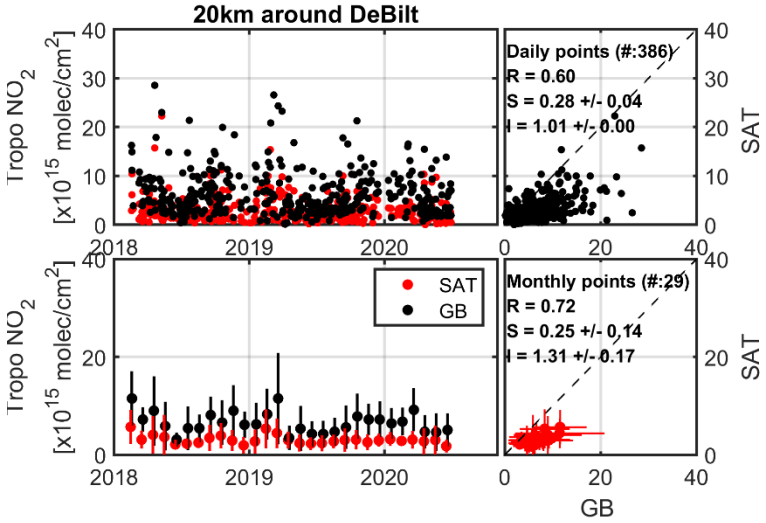


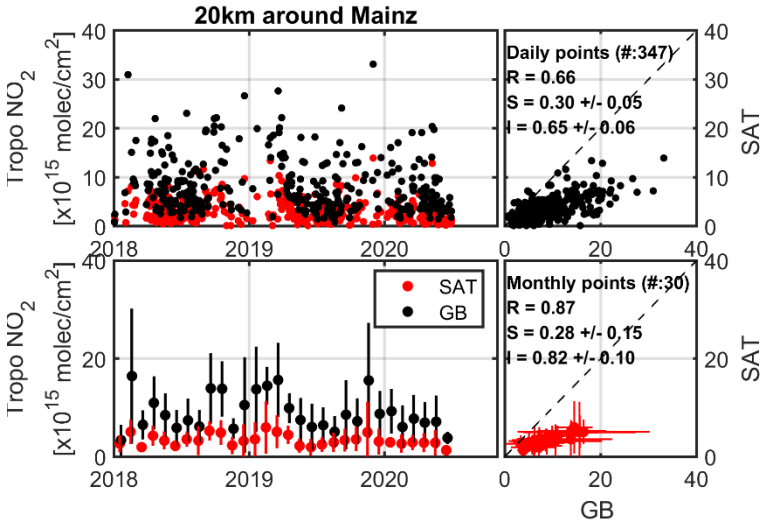
Figure S1. Daily and monthly mean time series and scatter plot of TROPOMI and MAXDOAS tropospheric NO_2 columns (closest valid pixel within 20 km) over Athens, Bremen, Cabauw, De Bilt, Mainz, Munich, Thessaloniki_ciri, and Thessaloniki_lap. Results are shown for the improved satellite retrieval algorithm.

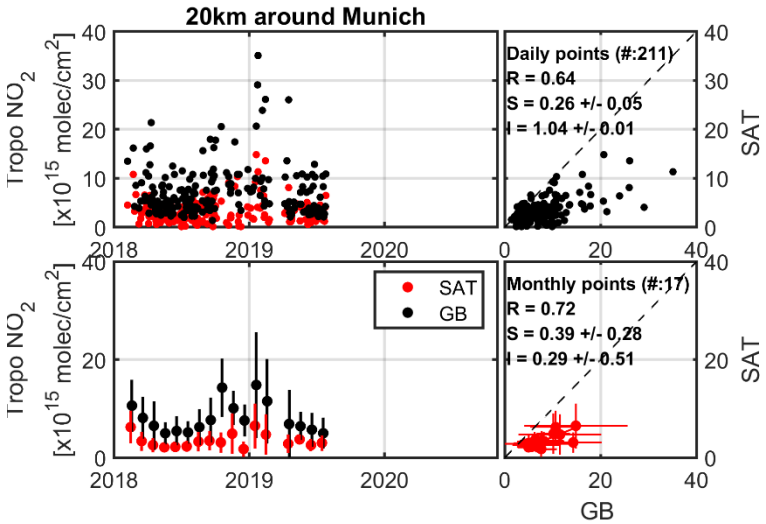

20km around Athens
Tropo NO2 [x10^15 molec/cm^2]
Daily points (#:444)
R = 0.68
S = 0.31 +/- 0.04
I = 0.70 +/- 0.04
SAT
GB
Monthly points (#:29)
R = 0.87
S = 0.42 +/- 0.23
I = 0.25 +/- 0.42
2018
2019
2020


20km around Bremen
Tropo NO2 [x10^15 molec/cm^2]
Daily points (#:376)
R = 0.54
S = 0.29 +/- 0.04
I = 0.53 +/- 0.07
SAT
GB
Monthly points (#:29)
R = 0.71
S = 0.44 +/- 0.24
I = -0.20 +/- 0.66
2018
2019
2020


20km around Cabauw
Tropo NO2 [x10^15 molec/cm^2]
Daily points (#:390)
R = 0.57
S = 0.24 +/- 0.04
I = 0.94 +/- 0.01
SAT
GB
Monthly points (#:29)
R = 0.67
S = 0.21 +/- 0.12
I = 1.24 +/- 0.13
2018
2019
2020


20km around DeBilt
Tropo NO2 [x10^15 molec/cm^2]
Daily points (#:386)
R = 0.60
S = 0.28 +/- 0.04
I = 1.01 +/- 0.00
SAT
GB
Monthly points (#:29)
R = 0.72
S = 0.25 +/- 0.14
I = 1.31 +/- 0.17
2018
2019
2020


20km around Mainz
Tropo NO2 [x10^15 molec/cm^2]
Daily points (#:347)
R = 0.66
S = 0.30 +/- 0.05
I = 0.65 +/- 0.06
SAT
GB
Monthly points (#:30)
R = 0.87
S = 0.28 +/- 0.15
I = 0.82 +/- 0.10
2018
2019
2020


20km around Munich
Tropo NO2 [x10^15 molec/cm^2]
Daily points (#:211)
R = 0.64
S = 0.26 +/- 0.05
I = 1.04 +/- 0.01
SAT
GB
Monthly points (#:17)
R = 0.72
S = 0.39 +/- 0.28
I = 0.29 +/- 0.51
2018
2019
2020

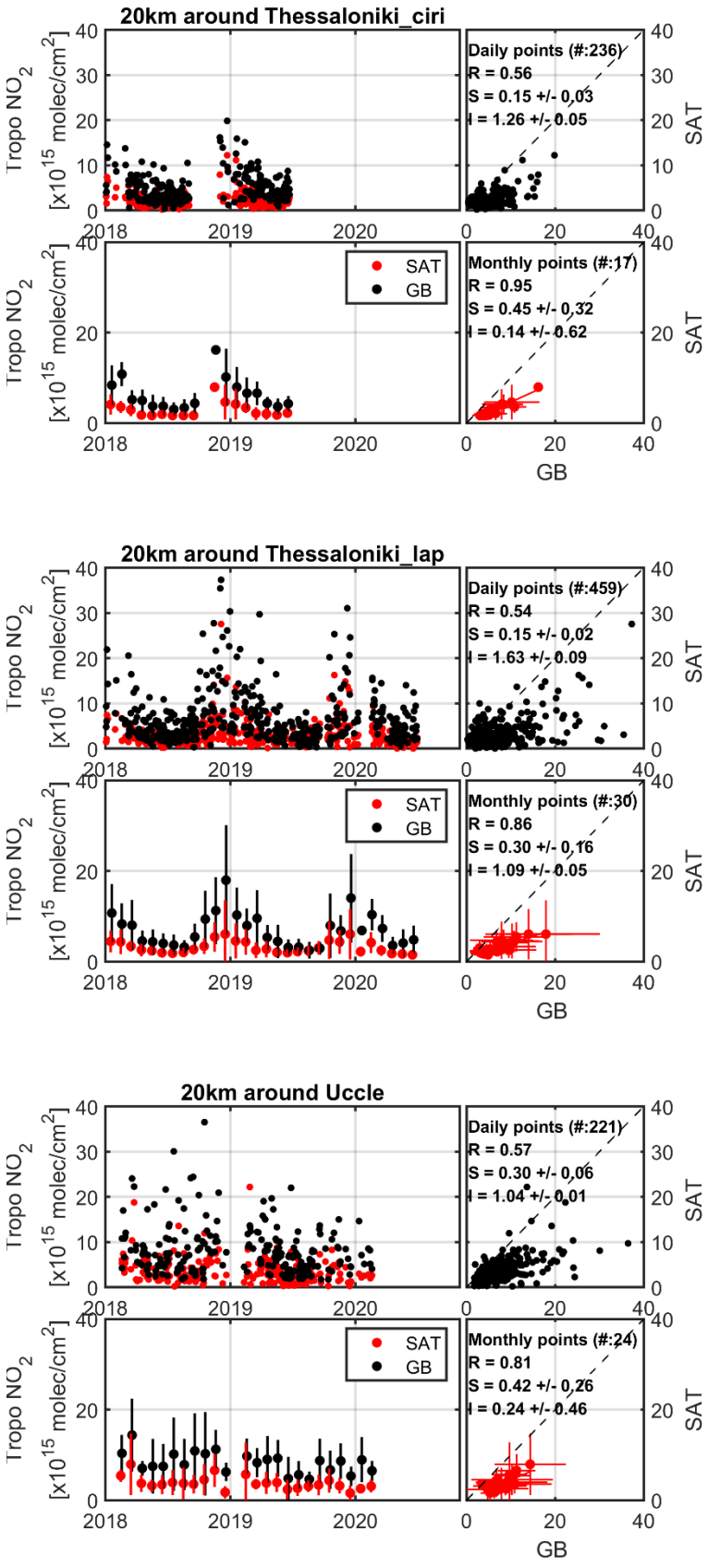
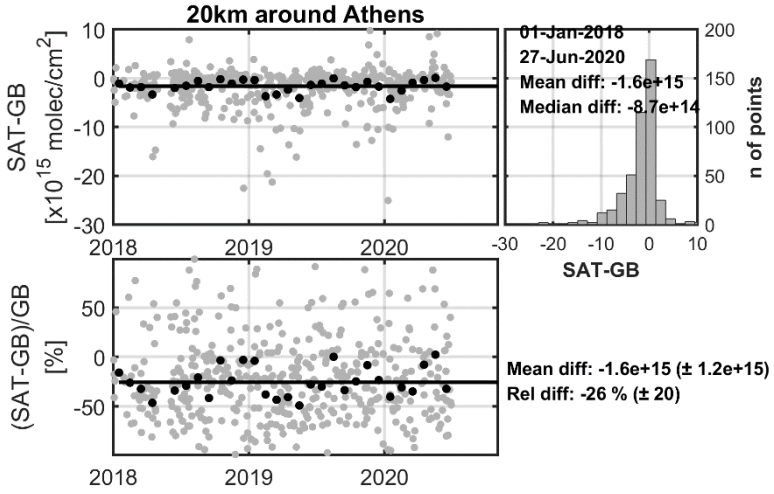
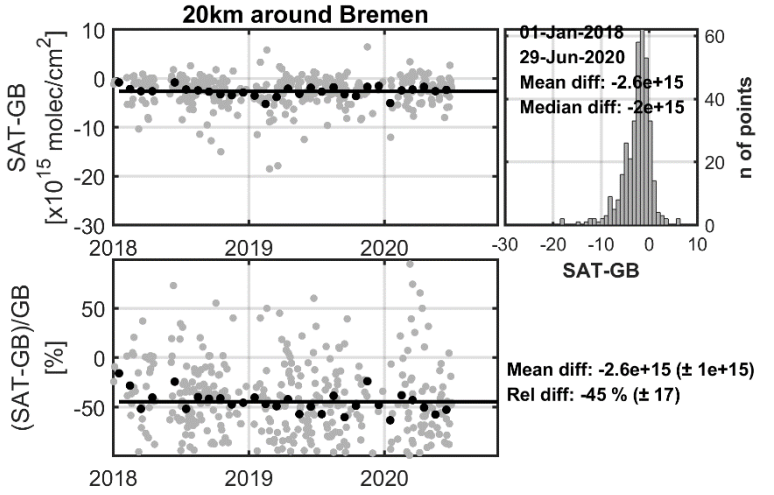
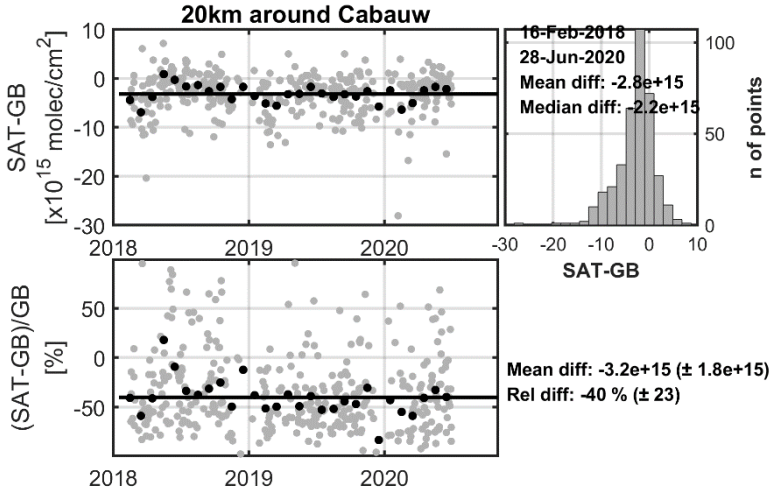
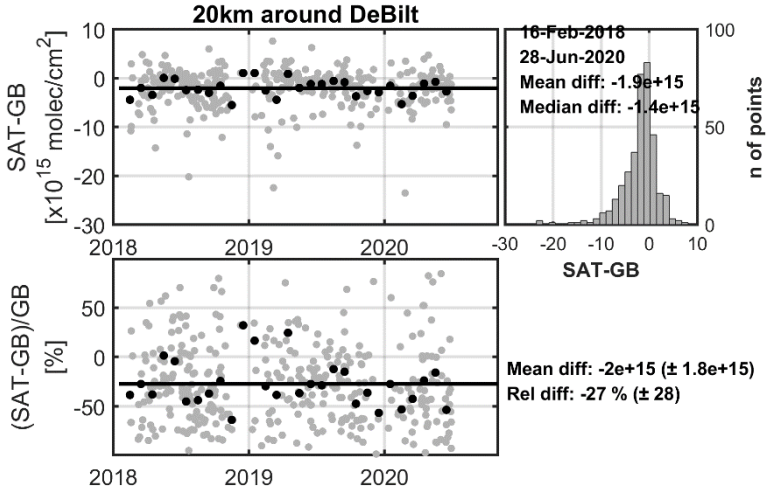


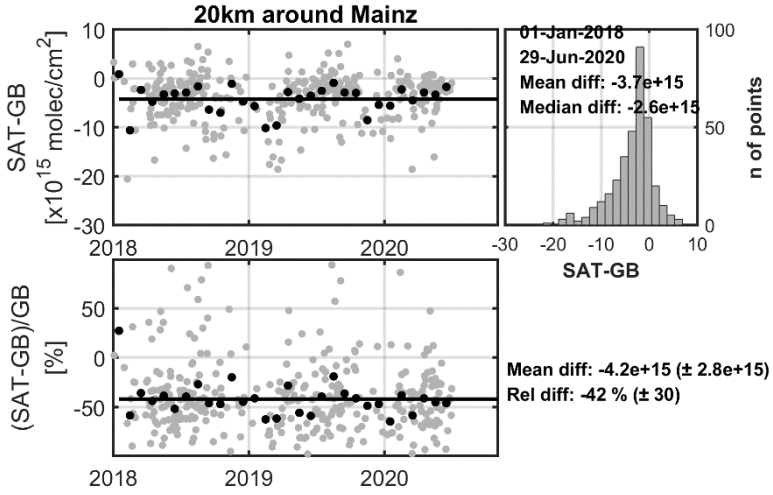
Figure S2. Similar as Fig. S1 but for the reference satellite retrieval algorithm over Athens, Bremen, Cabauw, De Bilt, Mainz, Munich, Thessaloniki_ciri, Thessaloniki_lap, and Uccle.

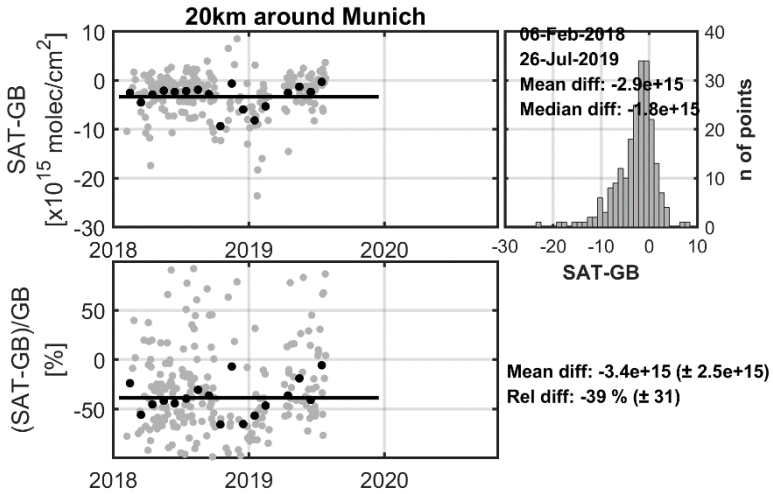

20km around Athens
SAT-GB [x10^15 molec/cm^2]
01-Jan-2018
27-Jun-2020
Mean diff: -1.6e+15
Median diff: -8.7e+14
n of points
SAT-GB
(SAT-GB)/GB [%]
Mean diff: -1.6e+15 (± 1.2e+15)
Rel diff: -26 % (± 20)


20km around Bremen
SAT-GB [x10^15 molec/cm^2]
01-Jan-2018
29-Jun-2020
Mean diff: -2.6e+15
Median diff: -2e+15
n of points
SAT-GB
(SAT-GB)/GB [%]
Mean diff: -2.6e+15 (± 1e+15)
Rel diff: -45 % (± 17)


20km around Cabauw
SAT-GB [x10^15 molec/cm^2]
16-Feb-2018
28-Jun-2020
Mean diff: -2.8e+15
Median diff: -2.2e+15
n of points
SAT-GB
(SAT-GB)/GB [%]
Mean diff: -3.2e+15 (± 1.8e+15)
Rel diff: -40 % (± 23)


20km around DeBilt
SAT-GB [x10^15 molec/cm^2]
16-Feb-2018
28-Jun-2020
Mean diff: -1.9e+15
Median diff: -1.4e+15
n of points
SAT-GB
(SAT-GB)/GB [%]
Mean diff: -2e+15 (± 1.8e+15)
Rel diff: -27 % (± 28)


20km around Mainz
SAT-GB [x10^15 molec/cm^2]
01-Jan-2018
29-Jun-2020
Mean diff: -3.7e+15
Median diff: -2.6e+15
n of points
SAT-GB
(SAT-GB)/GB [%]
Mean diff: -4.2e+15 (± 2.8e+15)
Rel diff: -42 % (± 30)


20km around Munich
SAT-GB [x10^15 molec/cm^2]
06-Feb-2018
26-Jul-2019
Mean diff: -2.9e+15
Median diff: -1.8e+15
n of points
SAT-GB
(SAT-GB)/GB [%]
Mean diff: -3.4e+15 (± 2.5e+15)
Rel diff: -39 % (± 31)

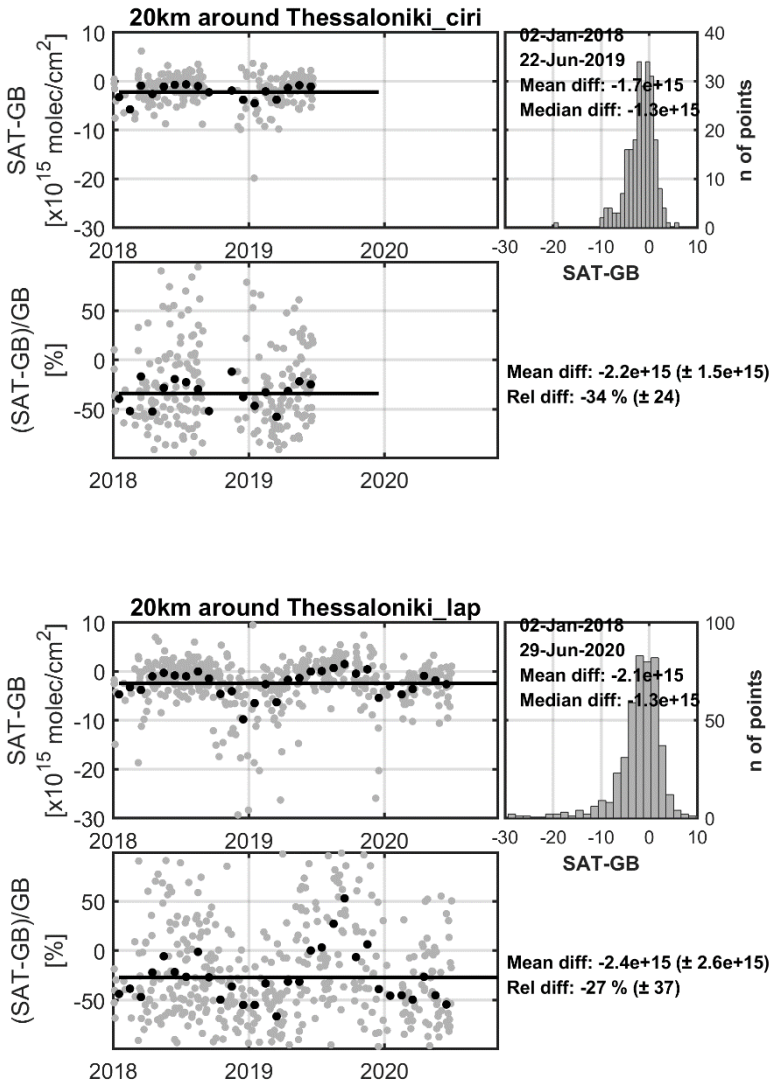
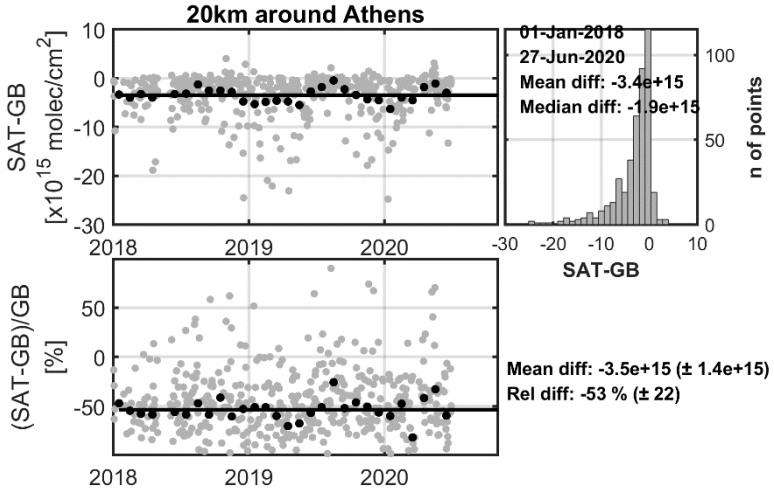
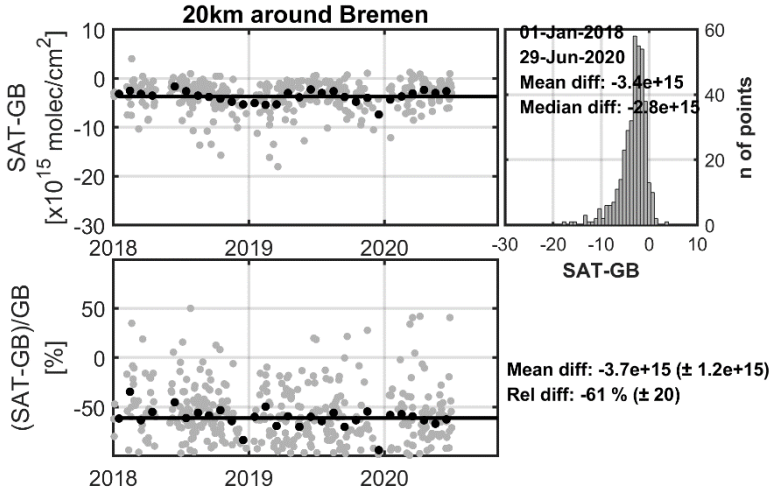
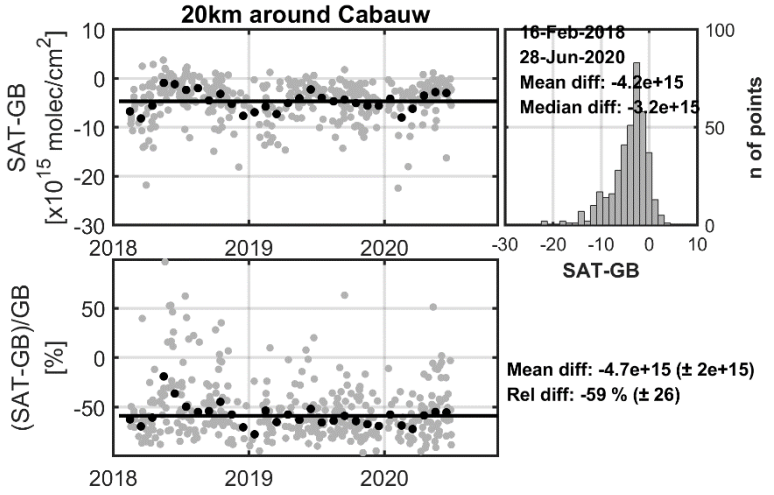
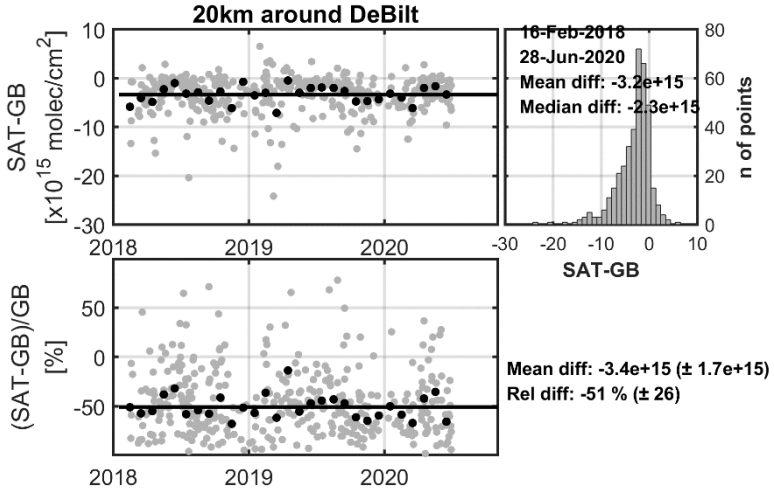


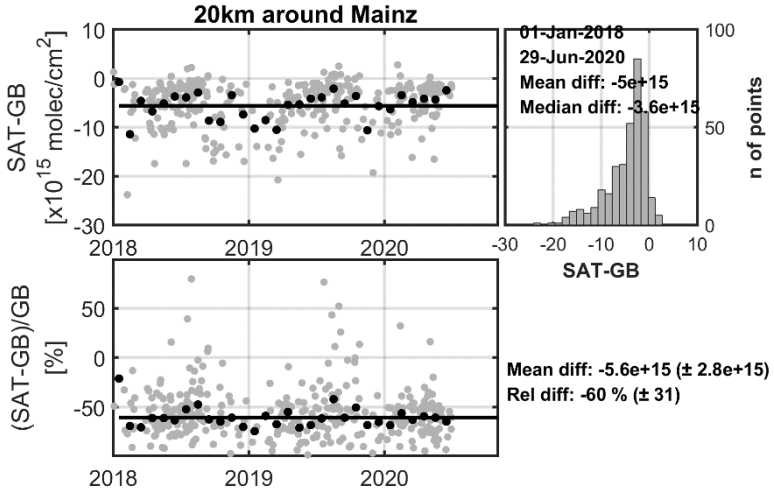
Figure S3. Daily (grey dots) and monthly mean (black dots) absolute and relative TROPOMI (SAT) and MAXDOAS (GB) time series differences over Athens, Bremen, Cabauw, De Bilt, Mainz, Munich, Thessaloniki_ciri, and Thessaloniki_lap. Results are shown for the improved satellite retrieval algorithm. The histogram of the daily differences is also given, showing the mean and median difference. The total mean values of absolute and relative monthly differences are given in the bottom-right panel.

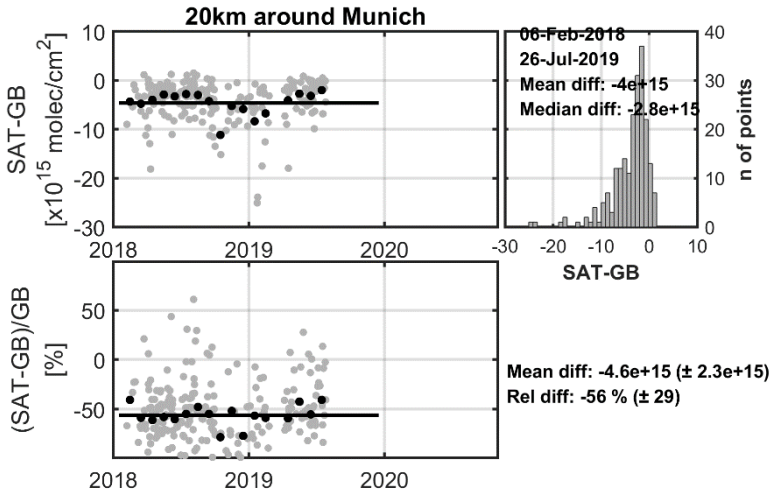

20km around Athens
SAT-GB [x10^15 molec/cm^2]
01-Jan-2018
27-Jun-2020
Mean diff: -3.4e+15
Median diff: -1.9e+15
n of points
SAT-GB
(SAT-GB)/GB [%]
Mean diff: -3.5e+15 (± 1.4e+15)
Rel diff: -53 % (± 22)


20km around Bremen
SAT-GB [x10^15 molec/cm^2]
01-Jan-2018
29-Jun-2020
Mean diff: -3.4e+15
Median diff: -2.8e+15
n of points
SAT-GB
(SAT-GB)/GB [%]
Mean diff: -3.7e+15 (± 1.2e+15)
Rel diff: -61 % (± 20)


20km around Cabauw
SAT-GB [x10^15 molec/cm^2]
16-Feb-2018
28-Jun-2020
Mean diff: -4.2e+15
Median diff: -3.2e+15
n of points
SAT-GB
(SAT-GB)/GB [%]
Mean diff: -4.7e+15 (± 2e+15)
Rel diff: -59 % (± 26)


20km around DeBilt
SAT-GB [x10^15 molec/cm^2]
16-Feb-2018
28-Jun-2020
Mean diff: -3.2e+15
Median diff: -2.3e+15
n of points
SAT-GB
(SAT-GB)/GB [%]
Mean diff: -3.4e+15 (± 1.7e+15)
Rel diff: -51 % (± 26)


20km around Mainz
SAT-GB [x10^15 molec/cm^2]
01-Jan-2018
29-Jun-2020
Mean diff: -5e+15
Median diff: -3.6e+15
n of points
SAT-GB
(SAT-GB)/GB [%]
Mean diff: -5.6e+15 (± 2.8e+15)
Rel diff: -60 % (± 31)


20km around Munich
SAT-GB [x10^15 molec/cm^2]
06-Feb-2018
26-Jul-2019
Mean diff: -4e+15
Median diff: -2.8e+15
n of points
SAT-GB
(SAT-GB)/GB [%]
Mean diff: -4.6e+15 (± 2.3e+15)
Rel diff: -56 % (± 29)

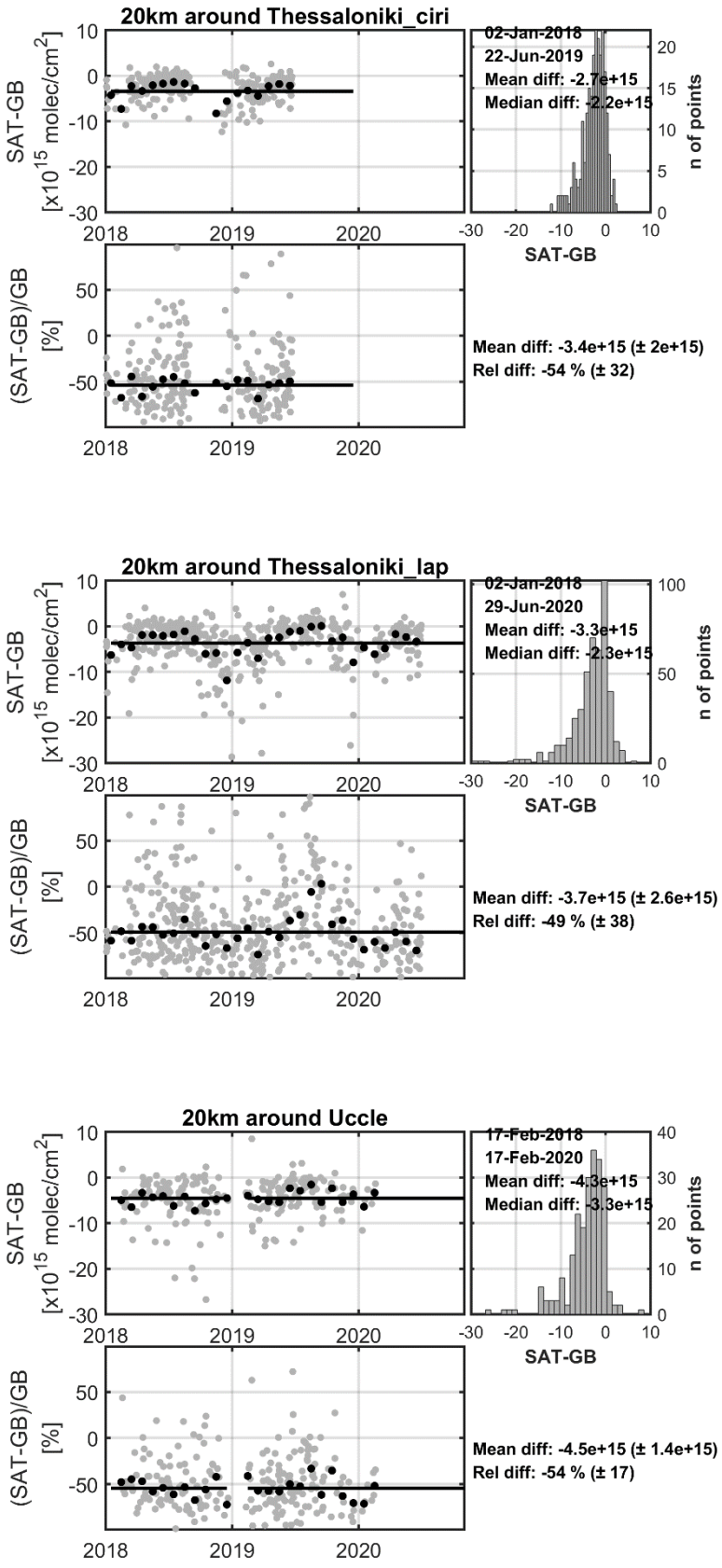


Figure S4. Similar as Fig. S3 but for the reference satellite retrieval algorithm over Athens, Bremen, Cabauw, De Bilt, Mainz, Munich, Thessaloniki_ciri, Thessaloniki_lap, and Uccle.