Supplemental Text

Normalized mean biases (NMB, in ppb) were calculated with Eq. (S1)

$$NMB = \frac{\sum_{i=1}^{N}(R_i - O_i)}{\sum_{i=1}^{N} O_i} \quad \text{(S1)}$$

where R_i are the retrievals and O_i are the observations for the i^{th} co-location and N is the total number of retrieval-observation co-locations. To calculate root mean squared error (RMSE, in ppb) we used Eq. (S2).

$$RMSE = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(R_i - O_i)^2} \quad \text{(S2)}$$

Supplemental Figures

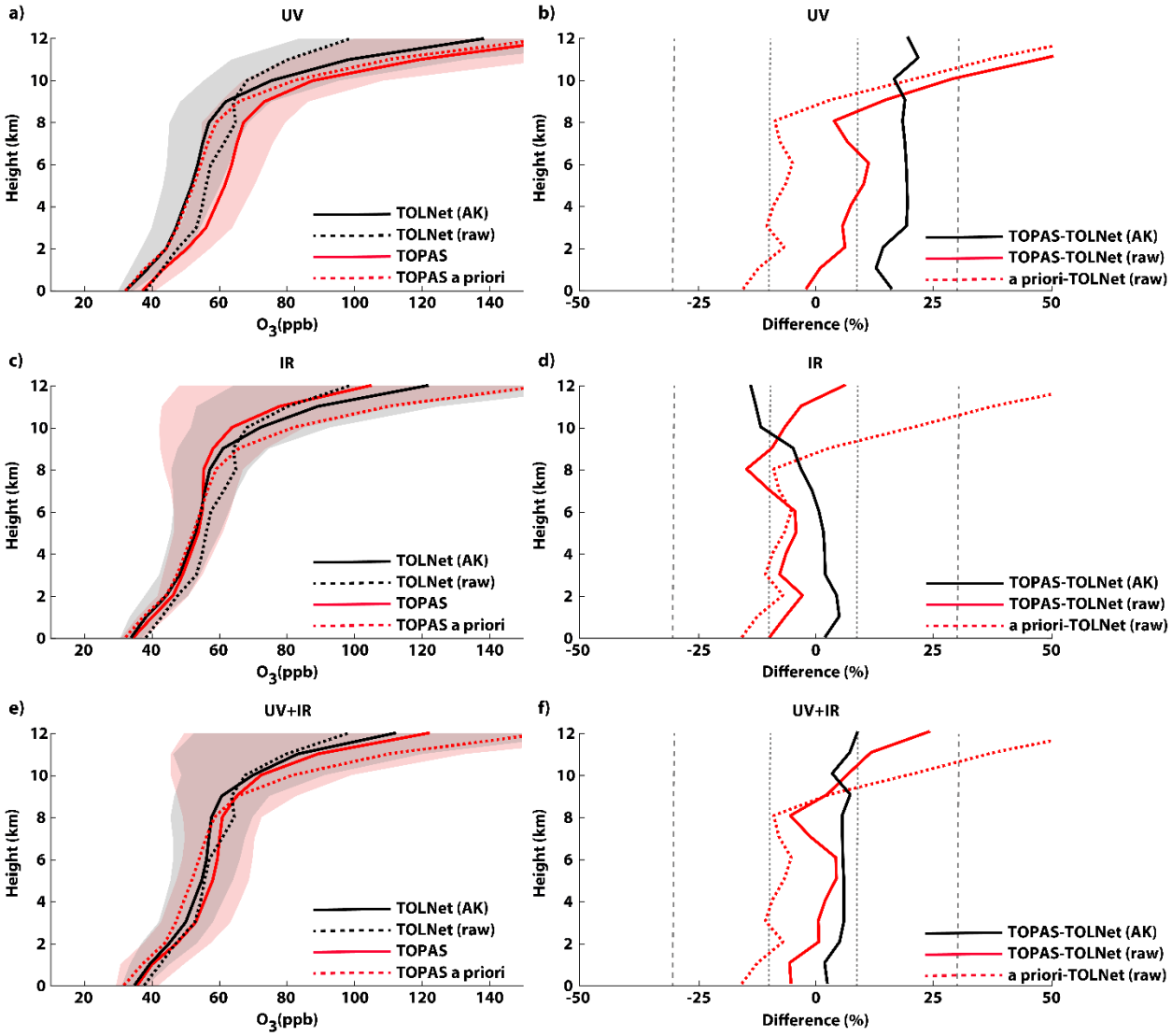

Figure S1. Vertical O_3 profile comparison of TOLNet interpolated to the satellite vertical grid (TOLNet-raw), TOLNet convolved with the TROPOMI AK (TOLNet-AK), UV, IR, and UV+IR TOPAS satellite retrievals, and the a priori profile information used in the TOPAS retrieval (total number of colocations (N) = 109). The direct comparison of the profiles and percent difference for UV-only (a, c) IR-only (b, d), and UV+IR (e, f) retrievals are displayed, respectively, using the coarser co-location criteria of 5 hour and 100 km. The percent difference between TOPAS satellite retrievals and TOLNet-AK and TOLNet-raw are labeled as TOPAS-TOLNet (AK) and TOPAS-TOLNet (raw), respectively. The percent difference between the TOPAS a priori and TOLNet-raw is labeled as a priori-TOLNet (raw). The grey and pink shaded regions illustrate the 1σ standard deviation of TOLNet-AK and satellite O_3 vertical profiles, respectively. NMB values of 30% and 10% are displayed using grey dashed and dotted lines, respectively.

Supplemental Tables

Table S1. Statistical validation of TOPAS UV, IR, and UV+IR retrievals with convolved TOLNet-AK observations. All observations and satellite retrievals were co-located using 5 hour and 100 km threshold criteria.

Prior

Vertical Level	N (#)	Bias (ppb)	NMB (%)	RMSE (ppb)	Slope
0-2 km	107	-4.4	-13.6	15.8	0.07
2-4 km	206	-5.4	-8.8	13.8	0.03
4-6 km	205	-3.4	-8.1	12.2	0.11
6-8 km	192	-5.3	-6.5	18.2	0.15
8-10 km	153	7.6	-1.3	28.0	0.16
10-12 km	90	44.5	44.8	56.8	0.69
Trop. Column	953	2.0	-1.9	24.5	0.75

UV-only

Vertical Level	N (#)	Bias (ppb)	NMB (%)	RMSE (ppb)	Slope
0-2 km	107	5.5	14.2	11.7	0.41
2-4 km	206	9.1	18.8	14.0	0.11
4-6 km	205	9.9	19.0	15.4	0.20
6-8 km	192	10.2	18.7	16.1	0.44
8-10 km	153	11.8	18.3	17.7	0.82
10-12 km	90	23.7	18.8	30.7	0.91
Trop. Column	953	10.9	17.5	17.2	0.84

IR-only

Vertical Level	N (#)	Bias (ppb)	NMB (%)	RMSE (ppb)	Slope
0-2 km	107	1.7	3.4	5.9	0.57
2-4 km	206	0.9	3.1	6.3	0.51
4-6 km	205	0.5	1.7	7.2	0.58
6-8 km	192	-1.1	-0.1	8.3	0.70
8-10 km	153	-5.5	-4.0	12.7	0.84
10-12 km	90	-14.1	-12.2	19.5	0.93
Trop. Column	953	-1.9	-1.4	10.0	0.84

UV+IR

Vertical Level	N (#)	Bias (ppb)	NMB (%)	RMSE (ppb)	Slope
0-2 km	107	1.5	2.1	10.3	0.51
2-4 km	206	3.0	5.4	11.4	0.42
4-6 km	205	3.2	5.9	11.7	0.41
6-8 km	192	3.2	5.6	10.9	0.55
8-10 km	153	3.5	6.4	15.4	0.92
10-12 km	90	7.9	5.3	26.7	1.10
Trop. Column	953	3.5	5.1	14.1	0.87