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Atmospheric Measurement Techniques Discussions

Supplement of

A sensitivity study on the retrieval of aerosol vertical profiles using the oxygen A-band

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In this Supplement, table charts for the complete set of resolutions are shown.

Resolution		$\boldsymbol{S}_a$ (relative error) **Urban** scenario					
$\Delta\nu$	FWHM	0.7	0.5	0.2	0.1	0.05	0.01
[cm^{-1}]	[cm^{-1}]	(83.7%)	(70.7%)	(44.7%)	(31.6%)	(22.4%)	(10.0%)
1	5	1.94	1.82	1.51	1.29	1.12	0.78
0.2	1	2.72	2.54	2.06	1.74	1.46	1.00
0.1	0.5	3.22	3.05	2.60	2.26	1.92	1.25
0.02	0.1	4.89	4.68	4.08	3.62	3.13	2.07
0.01	0.05	5.94	5.68	4.97	4.44	3.89	2.59

Table S1. Complete set of resolutions DoF for different aerosol extinction profile uncertainties $\boldsymbol{S}_a$, as panel (a) in Fig.4.

Resolution		ω **Urban** scenario			
$\Delta\nu$ [cm^{-1}]	FWHM [cm^{-1}]	0.8	0.85	0.9	0.95
1	5	1.10	1.51	1.80	1.94
0.2	1	1.50	2.06	2.31	2.42
0.1	0.5	1.98	2.60	2.83	2.93
0.02	0.1	3.34	4.08	4.27	4.36
0.01	0.05	4.19	4.97	5.15	5.24

Table S2. Complete set of resolutions DoF for the single scattering albedo test, as panel (b) in Fig.4.

Aerosol scenario						
Resolution		**Urban**	**Highly polluted**	**Elevated layer**	**Marine**	**Arctic**
$\Delta\nu$ [cm^{-1}]	FWHM [cm^{-1}]	k_{ext}=0.2 km^{-1} BLH=1 km albedo=0.1	k_{ext}=1 km^{-1} BLH=1 km albedo = 0.1	k_{ext}=0.2 km^{-1} Height=0.6-1 km albedo = 0.1	k_{ext}=0.05 km^{-1} BLH=0.6 km albedo=0.05	k_{ext}=0.05 km^{-1} BLH=0.6 km albedo=0.9
1	5	2.01	2.11	1.40	1.19	0.34
0.2	1	2.54	2.96	1.89	1.56	0.70
0.1	0.5	3.03	3.37	2.33	1.92	1.32
0.02	0.1	4.49	4.90	3.76	3.09	2.64
0.01	0.05	5.38	5.92	4.60	3.84	3.43

Table S3. Complete set of resolutions DoF for all the scenarios, as panel (a) in Fig.5.

			Altitude range **Urban** scenario			
Resolution			I	II	III	IV
$\Delta\nu$ [cm^{-1}]	FWHM [cm^{-1}]	Total DoF	0 - 2 [km]	2 - 5 [km]	5 - 15 [km]	15 - 50 [km]
1	5	2.01	0.36	0.65	0.20	0.80
0.2	1	2.54	0.48	0.79	0.35	0.92
0.1	0.5	3.03	0.59	1.01	0.45	0.98
0.02	0.1	4.49	1.03	1.65	0.68	1.13
0.01	0.05	5.38	1.48	1.96	0.75	1.19

Table S4. Complete set of resolutions DoF for the Urban scenario, as panel (b) in Fig.5.

			Altitude range **Highly polluted** scenario			
Resolution			I	II	III	IV
$\Delta\nu$ [cm^{-1}]	FWHM [cm^{-1}]	Total DoF	0 - 2 [km]	2 - 5 [km]	5 - 15 [km]	15 - 50 [km]
1	5	2.11	0.41	0.79	0.28	0.62
0.2	1	2.96	0.65	1.08	0.43	0.81
0.1	0.5	3.37	0.73	1.27	0.49	0.88
0.02	0.1	4.90	1.16	1.98	0.74	1.02
0.01	0.05	5.92	1.70	2.34	0.81	1.07

Table S5. Complete set of resolutions DoF for the Highly polluted scenario, as panel (c) in Fig.5.

			Altitude range **Elevated layer** scenario			
Resolution			I	II	III	IV
$\Delta\nu$ [cm^{-1}]	FWHM [cm^{-1}]	Total DoF	0 - 2 [km]	2 - 5 [km]	5 - 15 [km]	15 - 50 [km]
1	5	1.40	0.15	0.26	0.05	0.93
0.2	1	1.89	0.31	0.43	0.06	1.09
0.1	0.5	2.33	0.46	0.55	0.08	1.24
0.02	0.1	3.76	0.87	1.17	0.18	1.53
0.01	0.05	4.60	1.27	1.46	0.22	1.65

Table S6. Complete set of resolutions DoF for the Elevated layer scenario, as panel (d) in Fig.5.

			Altitude range **Marine** scenario			
Resolution			I	II	III	IV
$\Delta\nu$ [cm^{-1}]	FWHM [cm^{-1}]	Total DoF	0 - 2 [km]	2 - 5 [km]	5 - 15 [km]	15 - 50 [km]
1	5	1.19	0.24	0.44	0.08	0.42
0.2	1	1.56	0.33	0.52	0.10	0.61
0.1	0.5	1.92	0.43	0.62	0.17	0.70
0.02	0.1	3.09	0.80	1.10	0.34	0.86
0.01	0.05	3.84	1.18	1.36	0.40	0.91

Table S7. Complete set of resolutions DoF for the Marine scenario, as panel (e) in Fig.5.

			Altitude range **Arctic** scenario			
Resolution			I	II	III	IV
$\Delta\nu$ [cm^{-1}]	FWHM [cm^{-1}]	Total DoF	0 - 2 [km]	2 - 5 [km]	5 - 15 [km]	15 - 50 [km]
1	5	0.34	0.02	0.05	0.04	0.23
0.2	1	0.70	0.09	0.15	0.07	0.38
0.1	0.5	1.32	0.36	0.43	0.08	0.46
0.02	0.1	2.64	0.80	1.02	0.19	0.64
0.01	0.05	3.43	1.18	1.31	0.23	0.71

Table S8. Complete set of resolutions DoF for the Arctic scenario, as panel (f) in Fig.5.

	$\boldsymbol{S}_a$ (relative error) **Urban** scenario					
Integration time	0.7	0.5	0.2	0.1	0.05	0.01
Δt [sec]	(83.7%)	(70.7%)	(44.7%)	(31.6%)	(22.4%)	(10.0%)
0.1	4.55	4.36	3.83	3.42	3.01	2.03
0.2	4.75	4.56	4.03	3.63	3.22	2.24
0.5	5.03	4.83	4.29	3.89	3.49	2.53
1	5.24	5.03	4.49	4.09	3.69	2.74
2	5.46	5.25	4.69	4.29	3.89	2.95
5	5.78	5.54	4.97	4.56	4.16	3.22

Table S9. DoF for integration time sensitivity for Urban scenario for different $\boldsymbol{S}_a$, as panel (a) in Fig.6.

	Urban scenario				
Integration time	FWHM [cm^{-1}]				
Δt [sec]	5	1	0.5	0.1	0.05
0.1	1.73	2.12	2.60	3.83	4.59
0.2	1.82	2.24	2.73	4.03	4.83
0.5	1.93	2.40	2.90	4.29	5.14
1	2.01	2.54	3.03	4.49	5.38
2	2.09	2.68	3.16	4.69	5.63
5	2.19	2.88	3.35	4.97	5.97

Table S10. Complete set of resolutions DoF for integration time sensitivity for Urban scenario for different resolution, as panel (b) in Fig.6.