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Variations in the vertical profile of ozone at four high-latitude Arctic sites from 2005 to 2017

Shima Bahramvash Shams et al.

Correspondence to: Shima Bahramvash Shams (s.bahramvashshams@wsu.edu)

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Supplementary

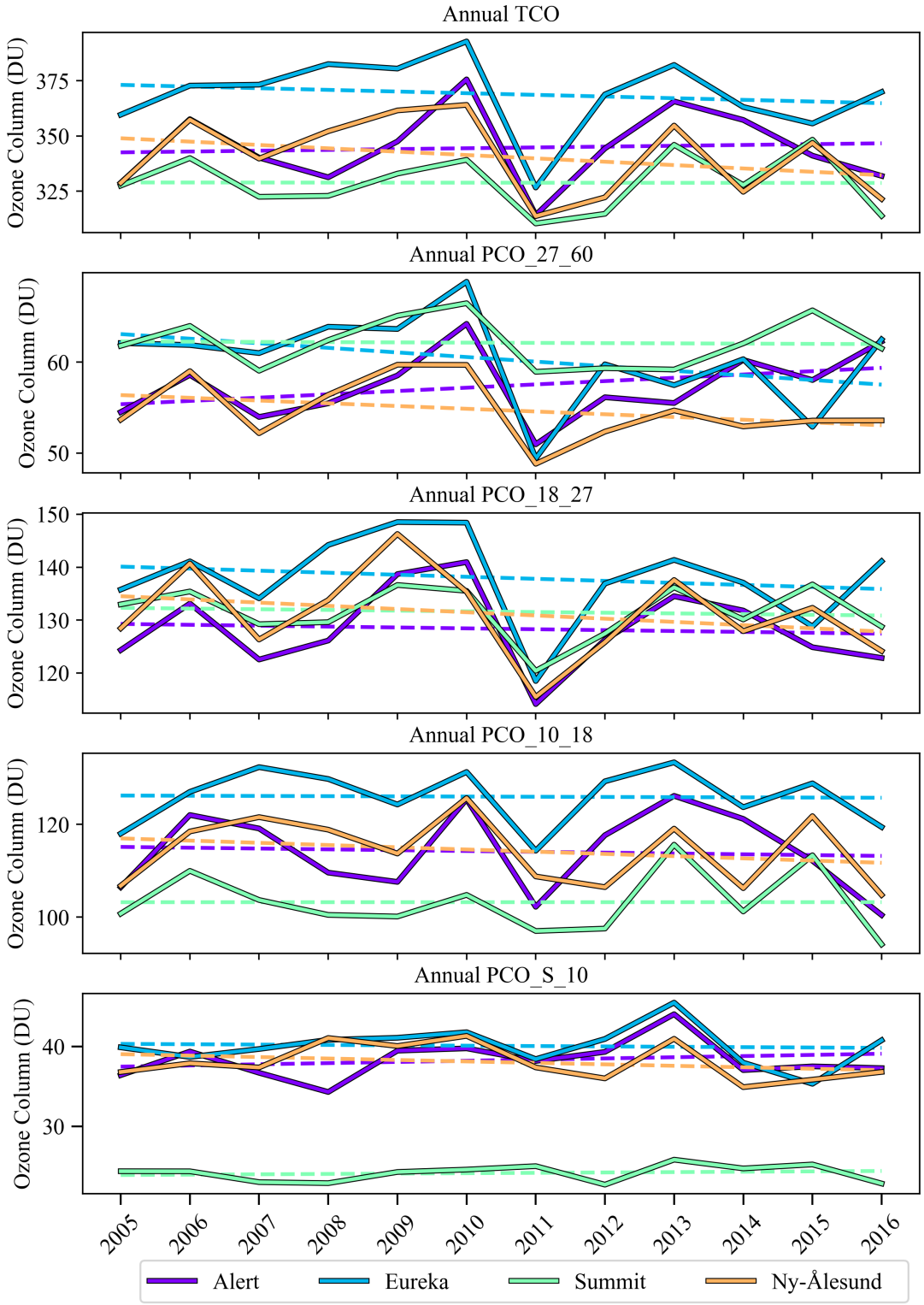

Figure S. 1 : Annual averaged of total ozone column and 4 level partial columns and the regression line at Alert, Eureka, Summit and Ny-Ålesund.

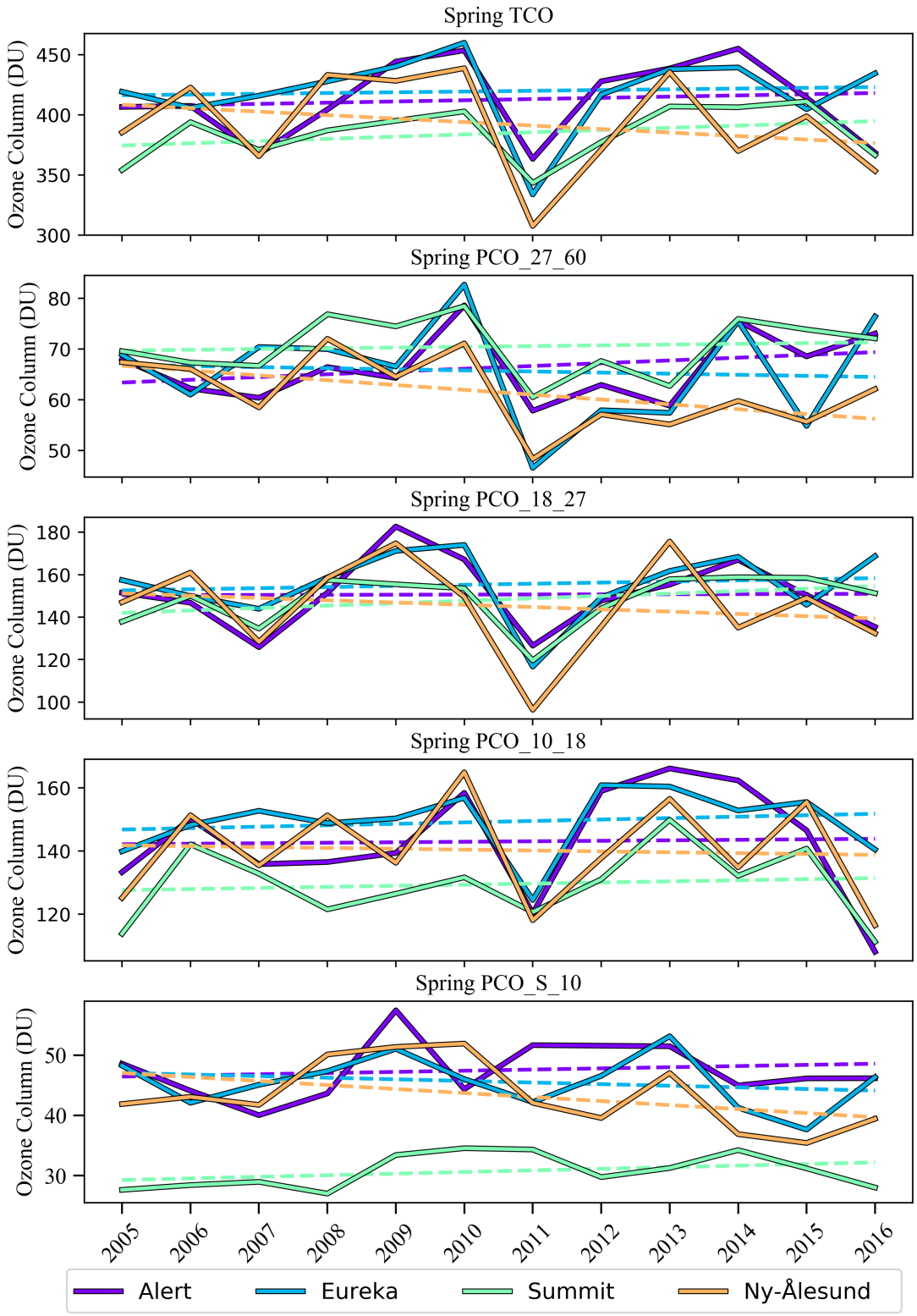

Figure S. 2: Spring averaged of total ozone column and 4 level partial columns and the regression line at Alert, Eureka, Summit and Ny-Ålesund.

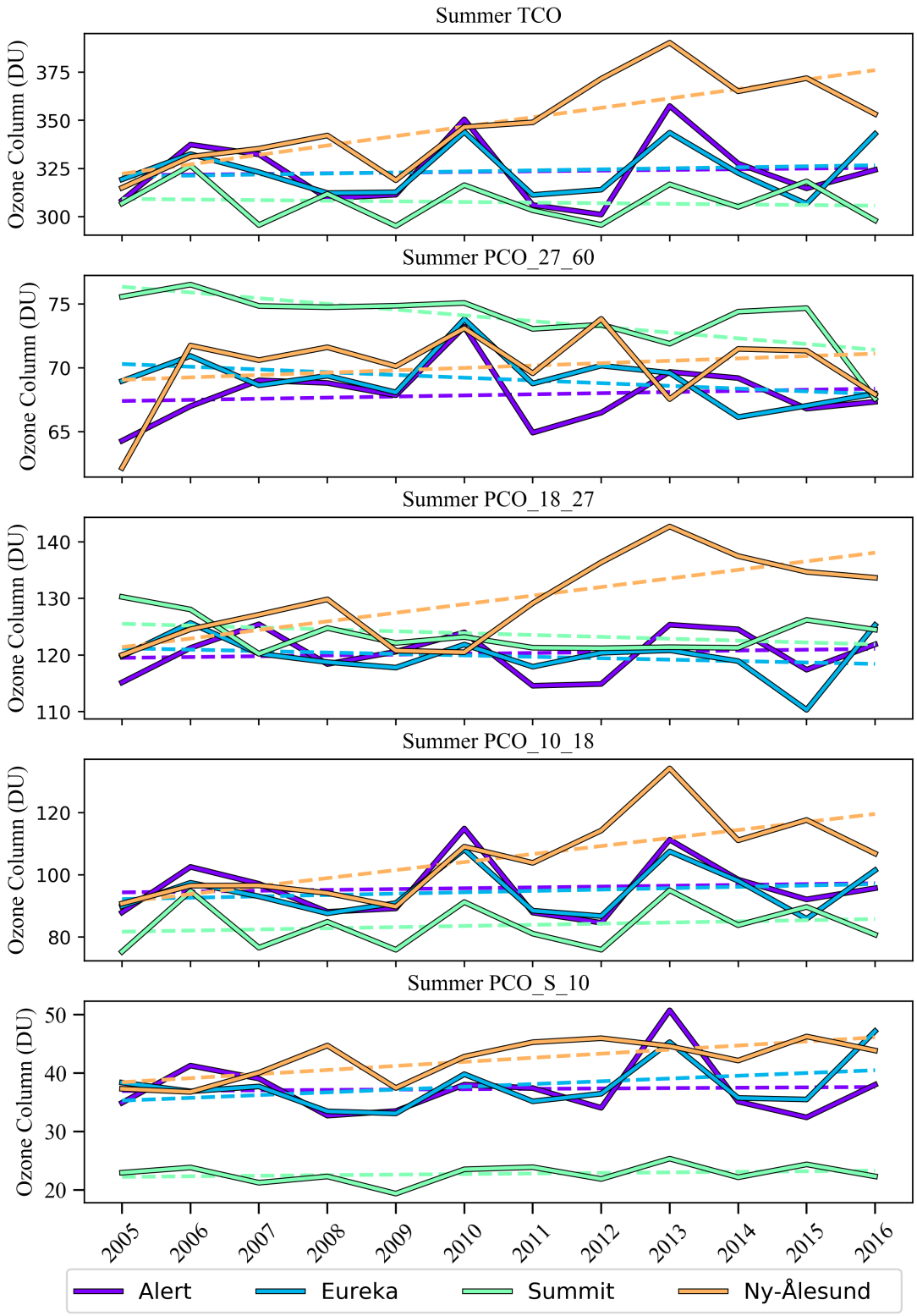

Figure S. 3: Summer averaged of total ozone column and 4 level partial columns and the regression line at Alert, Eureka, Summit and Ny-Ålesund.

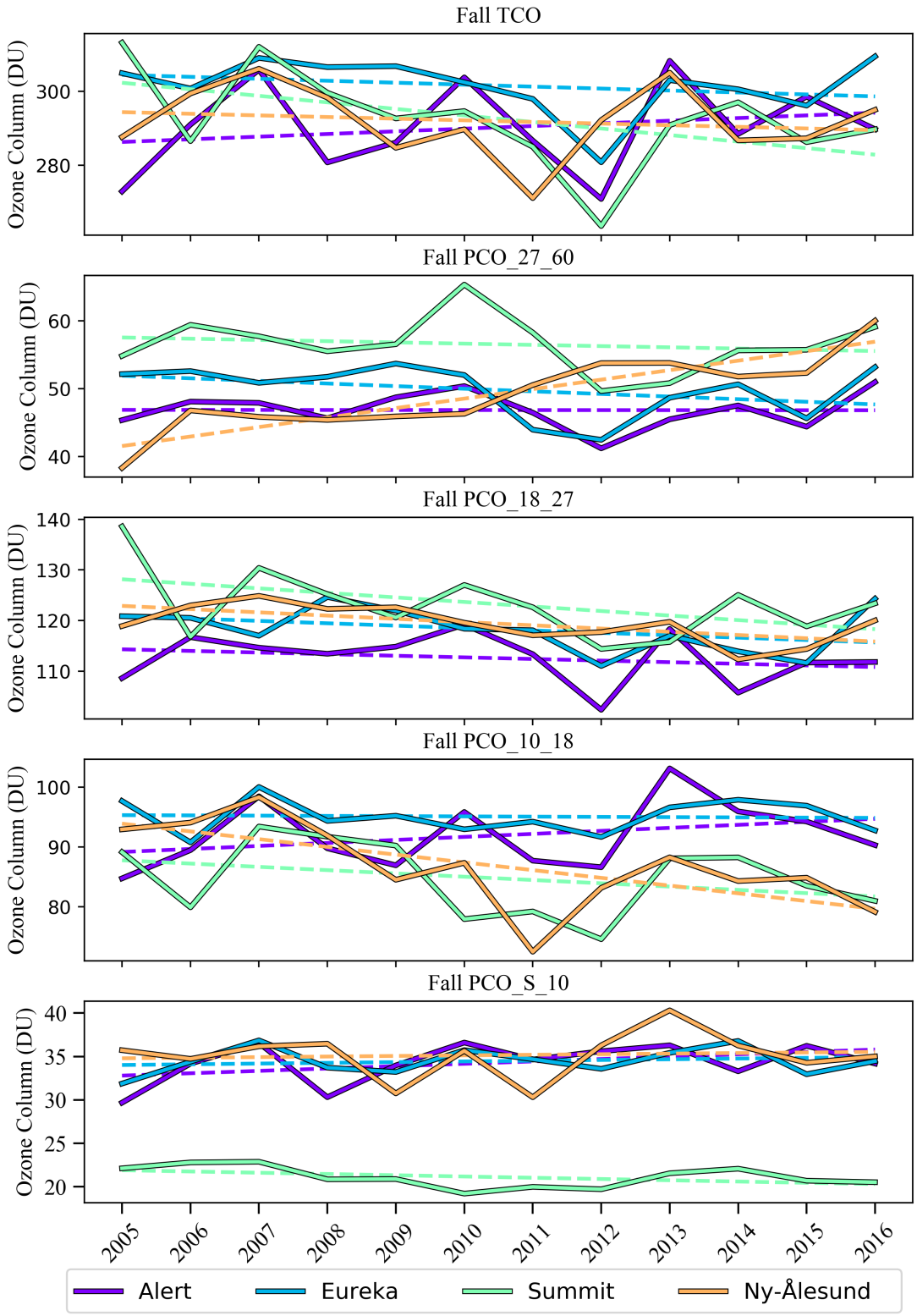

Figure S. 4: Fall averaged of total ozone column and 4 level partial columns and the regression line at Alert, Eureka, Summit and Ny-Ålesund.

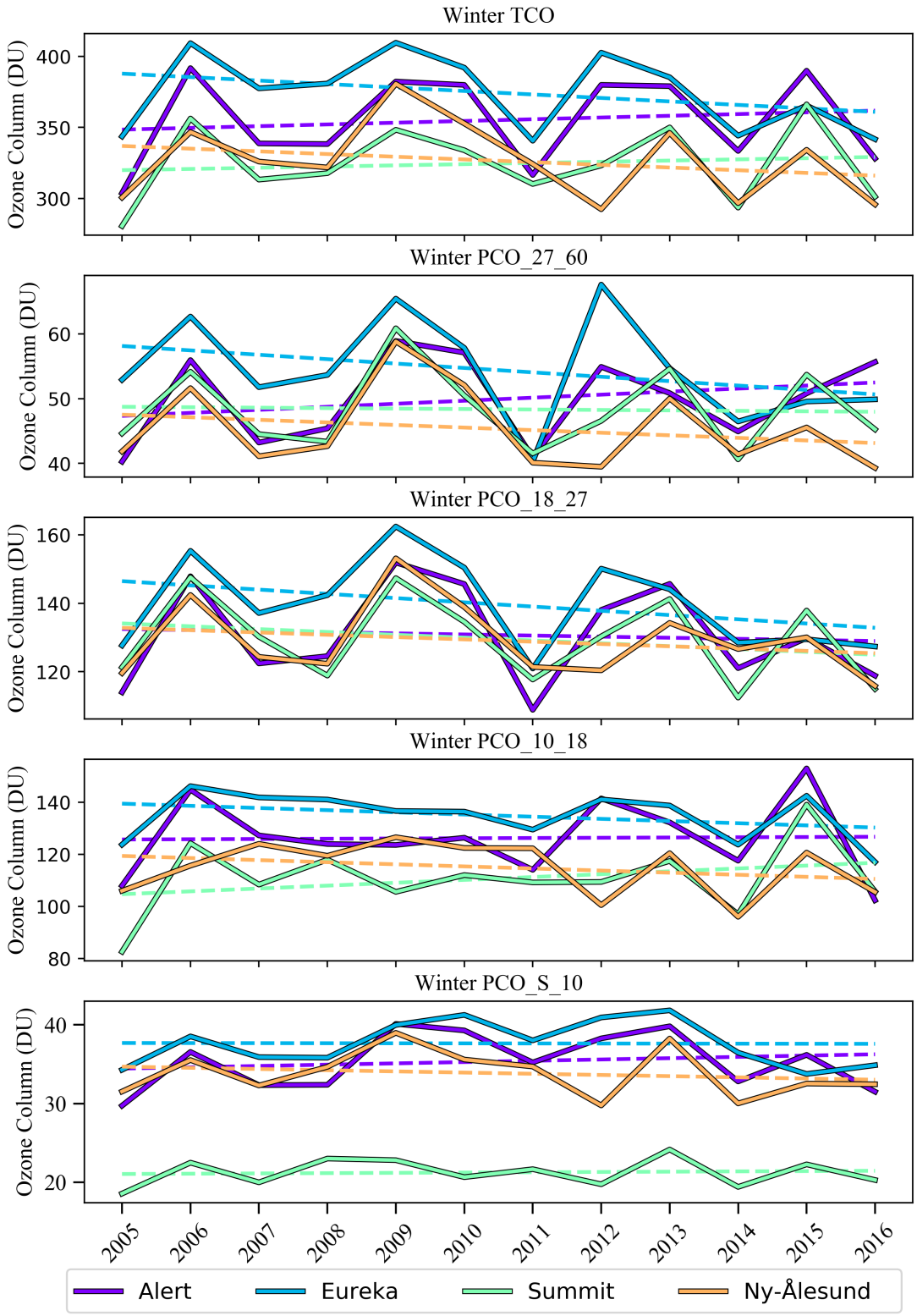

Figure S. 5: Winter averaged of total ozone column and 4 level partial columns and the regression line at Alert, Eureka, Summit and Ny-Ålesund.

	Alert	Eureka	Summit	NY Alesund
		Annual		
TCO	0.37±1.69	-0.75±1.65	-0.02±1.24	-1.52±1.66
27-60	**0.36±0.34**	**-0.51±0.47**	-0.03±0.27	-0.3±0.31
18-27	-0.17±0.75	-0.39±0.81	-0.13±0.48	-0.61±0.78
10-18	-0.18±0.87	-0.04±0.6	0.0±0.65	-0.48±0.71
s-10	0.15±0.23	-0.05±0.24	0.05±0.1	-0.18±0.21
		Spring		
TCO	1.0±3.21	0.62±3.08	1.84±2.08	-2.9±3.88
27-60	0.54±0.62	-0.22±1.02	0.15±0.56	**-0.95±0.6**
18-27	0.06±1.63	0.53±1.55	**1.14±1.12**	-1.07±2.12
10-18	0.16±1.72	0.45±0.99	0.35±1.12	-0.27±1.53
s-10	0.19±0.46	-0.27±0.41	**0.27±0.26**	**-0.67±0.49**
		Summer		
TCO	0.35±1.78	0.54±1.33	-0.32±1.02	**4.89±1.39**
27-60	0.09±0.23	**-0.21±0.18**	**-0.45±0.16**	0.19±0.3
18-27	0.14±0.4	-0.25±0.37	**-0.33±0.28**	**1.52±0.49**
10-18	0.27±0.94	0.44±0.76	0.37±0.72	**2.58±0.89**
s-10	0.06±0.5	**0.47±0.39**	0.1±0.15	**0.7±0.24**
		Fall		
TCO	0.72±1.16	-0.53±0.74	**-1.77±1.11**	-0.44±0.94
27-60	-0.01±0.26	**-0.38±0.34**	-0.18±0.39	**1.4±0.24**
18-27	-0.32±0.47	**-0.47±0.41**	**-0.9±0.59**	**-0.64±0.28**
10-18	0.5±0.52	-0.04±0.27	-0.55±0.57	**-1.3±0.52**
s-10	**0.27±0.2**	0.08±0.15	**-0.14±0.1**	0.07±0.26
		Winter		
TCO	1.22±3.07	-2.45±2.48	0.84±2.6	-1.9±2.59
27-60	0.47±0.64	-0.68±0.74	-0.07±0.62	-0.4±0.6
18-27	-0.32±1.42	**-1.24±1.21**	-0.83±1.18	-0.67±1.06
10-18	0.09±1.47	-0.83±0.85	1.1±1.31	-0.8±0.96
s-10	0.16±0.34	-0.01±0.28	0.04±0.17	-0.15±0.28

Table S. 1: Slope and ± standard error of slope for each regression for total column and partial column layers at Alert, Eureka, Summit and Ny-Ålesund. Slope higher than standard error are bolded. Significant slope are defined by standard error being at least 0.1 less than slope are highlighted.

Alert				
Proxy Name	R2	Slope	Std_err	P_value
Total Column				
TP	19	2.03E-03	4.70E-04	<0.01
EHF	8	6.18E-01	1.39E-01	<0.01
VPSC	5	-1.56E-04	3.00E-05	<0.01
EQL	4	-1.28E+00	2.02E-01	<0.01
Solar	1	1.58E-02	8.63E-03	0.05
Surface-10 km				
TP	19	5.21E-04	8.38E-05	<0.01
Trend	3	2.85E-02	9.59E-03	<0.01
AO	3	-7.11E-01	3.63E-01	0.05
ENSO	3	-1.43E+00	4.06E-01	<0.01
QBO10_cos_2pi	2	-6.36E-03	2.84E-03	0.03
QBO30_cos_2pi	2	-6.46E-03	2.72E-03	0.02
VPSC	2	-6.30E-06	3.27E-06	0.05
QBO30_sin_4pi	1	-5.77E-03	2.79E-03	0.04
EQL	1	-2.63E-01	4.06E-02	<0.01
QBO10_sin_2pi	1	-6.89E-03	2.77E-03	0.01
10-18 km				
VPSC	7	-6.53E-05	1.27E-05	<0.01
EHF	12	1.92E-01	4.21E-02	<0.01
QBO30_sin_2pi	1	-1.87E-02	8.91E-03	0.04
18-27 km				
TP	16	1.09E-03	2.01E-04	<0.01
EHF	8	2.74E-01	6.10E-02	<0.01
AO	7	-2.91E+00	9.52E-01	<0.01
EQL	7	-5.54E-01	8.22E-02	<0.01
VPSC	5	-6.90E-05	1.09E-05	<0.01
27-60 km				
EQL	23	-3.45E-01	4.88E-02	0
QBO10_cos_2pi	4	-1.09E-02	4.56E-03	0.02
QBO30	3	-8.54E-03	3.23E-03	0.01
TP	2	7.66E-04	1.10E-04	0
QBO30_sin_2pi	1	-9.11E-03	4.30E-03	0.04
QBO10_sin_4pi	1	-1.17E-02	4.16E-03	0.01

Table S. 2: correlation of determination (R^2) in %, slope, standard error of slope, and p_value obtained in the stepwise multiple regression analysis for total column ozone and partial column layers in Alert. The regression is performed on the deseasonalized ozone data.

Eureka				
Proxy Name	R2	Slope	Std_err	P_value
Total Column				
TP	37	4.44E-03	3.50E-04	<0.01
EQL	7	-1.08E+00	2.18E-01	<0.01
VPSC	5	-8.82E-05	1.00E-05	<0.01
QBO10_cos_2pi	2	-3.05E-02	1.18E-02	0.01
QBO10	2	1.87E-02	8.34E-03	0.03
Surface-10 km				
TP	20	6.13E-04	8.03E-05	<0.01
EQL	4	-3.14E-01	3.92E-02	<0.01
QBO10_cos_2pi	3	-6.57E-03	2.46E-03	0.01
Trend	3	2.22E-02	8.40E-03	0.01
QBO30_cos_2pi	2	-4.27E-03	2.31E-03	0.05
ENSO	2	-9.65E-01	3.62E-01	0.01
10-18 km				
TP	20	1.17E-03	1.69E-04	<0.01
AO	9	2.38E+00	7.24E-01	<0.01
VPSC	8	-4.00E-05	6.98E-06	<0.01
Solar	4	5.98E-03	2.95E-03	0.04
QBO10	3	1.19E-02	4.33E-03	0.01
EQL	1	-4.95E-01	6.92E-02	<0.01
18-27 km				
TP	30	2.03E-03	1.76E-04	<0.01
EQL	15	-2.68E-01	1.39E-01	0.05
VPSC	8	-3.11E-05	6.53E-06	<0.01
27-60 km				
EQL	38	-2.94E-01	8.22E-02	<0.01
VPSC	7	-2.02E-05	4.60E-06	<0.01
TP	3	1.21E-03	1.21E-04	<0.01
QBO10_sin_4pi	1	-1.02E-02	3.90E-03	0.01

Table S. 3: correlation of determination (R^2) in %, slope, standard error of slope, and p_value obtained in the stepwise multiple regression analysis for total column ozone and partial column layers in Eureka. The regression is performed on the deseasonalized ozone data.

Summit				
Proxy Name	R2	Slope	Std_err	P_value
Total Column				
TP	34	3.00E-03	4.30E-04	<0.01
EQL	9	-2.17E+00	2.98E-01	<0.01
VPSC	5	-1.00E-04	2.00E-05	<0.01
EHF	5	4.37E-01	1.02E-01	<0.01
QBO 10_sin_2pi	4	3.02E-02	1.16E-02	0.01
QBO 10	1	1.77E-02	8.39E-03	0.04
QBO 30_sin_4pi	1	-2.15E-02	1.14E-02	0.05
Surface-10 km				
TP	36	5.00E-04	6.00E-05	<0.01
EQL	1	-2.15E-01	2.63E-02	<0.01
10-18 km				
TP	35	5.00E-04	2.60E-04	0.05
EQL	7	-3.41E-01	1.14E-01	<0.01
VPSC	7	-1.00E-04	1.00E-05	<0.01
QBO10_sin_2pi	3	2.01E-02	6.91E-03	<0.01
EHF	3	2.71E-01	6.23E-02	<0.01
AO	2	4.53E+00	8.33E-01	<0.01
QBO 30_cos_2pi	1	-2.73E-02	6.66E-03	<0.01
18-27 km				
EQL	37	-1.71E-01	3.42E-02	<0.01
VPSC	13	-1.00E-04	1.00E-05	<0.01
QBO 10_sin_2pi	5	1.55E-02	6.59E-03	0.02
EHF	3	3.83E-01	5.23E-02	<0.01
27-60 km				
EQL	39	-7.51E-02	2.00E-02	<0.01
EHF	4	1.55E-01	3.10E-02	<0.01
VPSC	2	-2.48E-05	5.71E-06	<0.01

Table S. 4: correlation of determination (R^2) in %, slope, standard error of slope, and p_value obtained in the stepwise multiple regression analysis for total column ozone and partial column layers in Summit Staion. The regression is performed on the deseasonalized ozone data.

Ny Alesund				
Proxy Name	R2	Slope	Std_err	P_value
Total Column				
TP	18	1.43E-03	5.60E-04	0.01
EHF	11	5.57E-01	1.40E-01	<0.01
VPSC	7	-1.73E-04	2.00E-05	<0.01
QBO10_cos_2pi	4	-4.91E-02	1.68E-02	<0.01
AO	3	-4.68E+00	2.06E+00	0.02
EQL	2	-6.24E-01	1.98E-01	<0.01
Surface-10 km				
TP	12	1.97E-04	8.18E-05	0.02
QBO30	3	4.65E-03	2.00E-03	0.02
EQL	2	-7.25E-02	3.23E-02	0.03
10-18 km				
EHF	9	1.85E-01	3.56E-02	<0.01
QBO10	8	1.53E-02	5.61E-03	0.01
VPSC	6	-5.59E-05	1.11E-05	<0.01
QBO10_cos_2pi	4	-2.29E-02	7.49E-03	<0.01
18-27 km				
EHF	12	3.48E-01	6.99E-02	<0.01
VPSC	11	-6.83E-05	1.23E-05	<0.01
EQL	8	-8.01E-01	1.75E-01	<0.01
AO	4	-2.73E+00	1.00E+00	0.01
QBO10_cos_2pi	3	-2.13E-02	8.17E-03	0.01
TP	1	5.85E-04	2.80E-04	0.04
27-60 km				
EQL	8	-5.39E-02	2.25E-02	0.02
EHF	7	1.33E-01	3.69E-02	<0.01
AO	5	-1.80E+00	5.75E-01	<0.01
VPSC	2	-2.60E-05	6.69E-06	<0.01

Table S. 5: correlation of determination (R^2) in %, slope, standard error of slope, and p_value obtained in the stepwise multiple regression analysis for total column ozone and partial column layers in Ny-Ålesund. The regression is performed on the deseasonalized ozone data.