Supplement to:

Ozone and spectroradiometric UV changes in the past 20 years over high latitudes

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Measurements of total ozone from the ground were not available at all high latitude stations or included several gaps in some stations, and therefore we selected to use total ozone from satellite retrievals which provide global coverage of total ozone.

In the following we present comparisons of ground-based and satellite data over the available high latitude stations for the period 1990-2011. We selected to compare monthly means when at least 14 days were available in each month. We applied the t-test for the difference of the two means, to evaluate whether there are statistically significant differences between the two means of the individual ozone datasets at the 0.01 level. The t-test was applied for common months, so that the number of data, N , at each station is the same.

The t-value for the difference between two means for $2 \times N - 2$ degrees of freedom was calculated by the following formula:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{S_1^2 + S_2^2}{N}}}$$

Where, $\bar{x}_1$ is the mean and S_1^2 is the variance of observed total ozone at each station.

$\bar{x}_2$ is the mean and S_2^2 is the variance of satellite total ozone at each station.

N is the number of common months at each station.

The null hypothesis that $\bar{x}_1 - \bar{x}_2$ is zero is accepted when $|t| < t_{0.01}$ and it is rejected when

$|t| > t_{0.01}$ for $2 \times N - 2$ degrees of freedom.

Figure S1 shows the time series of total ozone from satellite and ground based data over Barrow, Sodankyla, Jokioinen and Churchill, and the respective correlation coefficients between the two datasets. Figure S2 shows the respective time series of total ozone for the southern high latitude stations. For Palmer we present only the satellite-derived total ozone because there were not available ground-based measurements from WOUDC or NSF databases. Table S1 summarizes the results of the t-test for the difference of the two ozone means at the various stations.

The correlation coefficients between satellite-derived and ground-based total ozone range between 0.90 and 0.99 and are highly significant at all stations ($p < 0.0001$). It also appears that the differences between the satellite-derived and ground-based total ozone are not significant at the 0.01 level at any of the examined stations except Ushuaia. Nevertheless, the deseasonalized total ozone anomalies from satellite and ground-based observations at Ushuaia are also highly correlated (Figure S4) and the total ozone trend at Ushuaia was not statistically significant.

The consistency between the satellite and ground-based observations of total ozone allowed us to analyze the satellite-derived total ozone data for which we had available data for all examined stations with no gaps.

Figure S1: Time series of total ozone (D.U.) from satellite and ground-based observations at Barrow, Sodankyla, Jokioinen and Churchill.

Figure S2: Time series of total ozone (D.U.) from satellite and ground based observations at Ushuaia, Palmer and Syowa.

Table S1: Mean total ozone and results of the t-test for the difference of the two means (satellite-derived and ground-based) at each station.

	Mean ozone		N	t-value for the difference of the two means	$t_{2N-2;0.01}$
	satellite	GB			
Barrow	350.5	352.5	90	0.2523	2.605
Sodankylä	334.5	338.3	169	0.80385	2.592
Jokioinen	330.7	330.8	184	0.02072	2.590
Churchill	357.2	357.9	234	0.16931	2.587
Ushuaia	297.6	286.2	181	-5.71266	2.590
Palmer	272.9	N/A	263	N/A	N/A
Syowa	256.1	255.1	185	-0.20327	2.590

Figure S3: Time series of deseasonalized total ozone (%) from satellite and ground-based observations at Barrow, Sodankyla, Jokioinen and Churchill.

Figure S4: Time series of deseasonalized total ozone (%) from satellite and ground based observations at Ushuaia, Palmer and Syowa.