

O <sub>3</sub> 150 ppbv Tropopause				
ARCTIC (60N-90N)	b (OLS)	b (IRLS)	r <sup>2</sup>	Sig at 90%
H <sub>2</sub> O	5.507	5.453	<b>0.854</b>	YES
J(O <sup>1</sup> D)	1.127	1.120	0.370	NO
J(O <sup>1</sup> D)*O <sub>3</sub>	1.543	1.560	<b>0.650</b>	YES
O <sub>3</sub>	0.931	0.927	<b>0.490</b>	YES
Temp	1.058	1.054	0.117	NO
CO/NOx ratio	0.000	0.000	<b>0.406</b>	YES
NOx burden	377.100	373.394	0.089	NO
CO burden	-0.101	-0.101	0.303	NO

Climatological Tropopause				
ARCTIC (60N-90N)	b (OLS)	b (IRLS)	r <sup>2</sup>	Sig at 90%
H <sub>2</sub> O <sup>(2)</sup>	4.858	4.419	<b>0.683</b>	YES
J(O <sup>1</sup> D)	1.139	1.135	0.353	NO
J(O <sup>1</sup> D)*O <sub>3</sub>	1.650	1.667	<b>0.682</b>	YES
O <sub>3</sub>	0.950	0.945	<b>0.508</b>	YES
Temp	-0.200	-0.128	0.001	NO
CO/NOx ratio	0.000	0.000	<b>0.421</b>	YES
NOx burden	0.000	0.000	0.129	NO
CO burden	-0.112	-0.113	0.333	NO

<sup>(2)</sup> Remove  
GEOSChem  
from H<sub>2</sub>O:  
r<sup>2</sup>=0.96 (Sig  
at n)

GLOBAL				
	b (OLS)	b (IRLS)	r <sup>2</sup>	Sig at 90%
H <sub>2</sub> O <sup>(1)</sup>	0.812	1.971	0.346	NO
J(O <sup>1</sup> D)	0.059	0.060	0.008	NO
J(O <sup>1</sup> D)*O <sub>3</sub>	0.275	0.266	0.094	NO
O <sub>3</sub>	0.462	0.439	0.072	NO
Temp	0.734	0.723	0.276	NO
CO/NOx ratio	-0.002	-0.002	0.294	NO
NOx burden	-22.854	-23.353	0.085	NO
CO burden	-0.022	-0.022	<b>0.894</b>	YES

<sup>(1)</sup> Remove  
MOZART  
from H<sub>2</sub>O:  
r<sup>2</sup>=0.91(Sig  
at n)

GLOBAL				
	b (OLS)	b (IRLS)	r <sup>2</sup>	Sig at 90%
H <sub>2</sub> O <sup>(3)</sup>	0.879	2.237	0.318	NO
J(O <sup>1</sup> D)	0.089	0.090	0.019	NO
J(O <sup>1</sup> D)*O <sub>3</sub>	0.356	0.347	0.164	NO
O <sub>3</sub>	0.588	0.566	0.117	NO
Temp	6.483	6.306	<b>0.523</b>	YES
CO/NOx ratio	-0.002	-0.002	0.235	NO
NOx burden	0.000	0.000	0.012	NO
CO burden	-0.021	-0.021	<b>0.861</b>	YES

<sup>(3)</sup> Remove  
MOZART  
from H<sub>2</sub>O:  
r<sup>2</sup>=0.91 (Sig  
at n)

Global mean tropospheric OH:  
O<sub>3</sub> 150 ppbv Clim. Trop.

	11.29	11.26
	12.02	11.97
	10.16	10.18
	10.09	10.08
	10.67	10.70
	10.87	10.89
	10.53	10.50
	10.59	10.52
mean:	<b>10.78</b>	<b>10.76</b>
stdev:	0.63	0.62

**Table S1**

Slope coefficients (b) for the ordinary least squares (OLS) and iteratively re-weighted least squares (IRLS) regression lines and iteratively reweighted least squares (IRLS) regression lines fitted to the global mean tropospheric OH concentrations against several model variables with the coefficients of determination ( $r^2$ ). Air-mass weighting is used to calculate the mean concentrations. Two methods of diagnosing the tropopause is used, a climatological tropopause based on Lawrence et al., (2001) and the 150 ppbv O<sub>3</sub> contour.