Figure 1 data (Figure\_1.tar):

CMAQ calculated photolysis frequencies of HNO3 and pNO3 are included in the following file:

COMBINE\_PNO3\_PHOT\_ANO3\_PHOT\_108NHEMI\_STAGE\_2018\_annual\_daytime\_avg.nc

The following file contains a variable named “OPEN” which was used to separate photolysis frequencies over ocean and land:

OCEAN\_01\_L3m\_MC\_CHL\_chlor\_a\_108NHEMI2.ncf

The following file contains layer height (ZF) which can be used to calculate altitude for each model layer.

METCRO3D\_20180101\_avg.nc

Figure 2 data (Figure\_2.tar):

Data containing pNO3, HONO, NOx, and O3 without pNO3 photolysis:

COMBINE\_CONC\_NO\_ANO3\_PHOT\_108NHEMI\_STAGE\_2018\_annual\_daytime\_avg.nc

Data containing pNO3, HONO, NOx, and O3 with pNO3 photolysis:

COMBINE\_CONC\_ANO3\_PHOT\_108NHEMI\_STAGE\_2018\_annual\_daytime\_avg.nc

The following file contains a variable named “OPEN” which can be used to separate photolysis frequencies over ocean and land:

OCEAN\_01\_L3m\_MC\_CHL\_chlor\_a\_108NHEMI2.ncf

The following file contains layer height (ZF) which can be used to calculate altitude for each model layer.

METCRO3D\_20180101\_avg.nc

Figure 3 data:

Model pNO3 concentrations without and with pNO3 photolysis are included in files for Figure 2. Observed pNO3 concentrations at the IMPROVE, CASTNET and CSN sites are publicly available. AMET tool was used for creating the plot which is also publicly available.

Figure 4 data:

Model NO2 concentrations without and with pNO3 photolysis are included in files for Figure 2.

Figure 5 data:

Seasonal Mean Bias of vertical NO2 column densities without and with pNO3 photolysis were calculated using data included in files for Figure 2 and OMI satellite retrievals. OMI satellite data are publicly available.

The following file contains layer height (ZF) which can be used to calculate altitude for each model layer.

METCRO3D\_20180101\_avg.nc

Figure 6 data:

Model HONO without and with pNO3 photolysis are also included in files for Figure 2.

Figure 7 data:

Model OH mixing ratio without and with pNO3 photolysis are also included in files for Figure 2.

Figure 8 data (Figure\_8.tar):

Model O3 mixing ratios without and with pNO3 photolysis are also included in files for Figure 2.

In addition, monthly mean surface O3 mixing ratios without pNO3 photolysis are included in the following files:

COMBINE\_ACONC\_NO\_ANO3\_PHOT\_108NHEMI\_STAGE\_201801\_avg.nc

COMBINE\_ACONC\_NO\_ANO3\_PHOT\_108NHEMI\_STAGE\_201802\_avg.nc

COMBINE\_ACONC\_NO\_ANO3\_PHOT\_108NHEMI\_STAGE\_201803\_avg.nc

COMBINE\_ACONC\_NO\_ANO3\_PHOT\_108NHEMI\_STAGE\_201804\_avg.nc

COMBINE\_ACONC\_NO\_ANO3\_PHOT\_108NHEMI\_STAGE\_201805\_avg.nc

COMBINE\_ACONC\_NO\_ANO3\_PHOT\_108NHEMI\_STAGE\_201806\_avg.nc

COMBINE\_ACONC\_NO\_ANO3\_PHOT\_108NHEMI\_STAGE\_201807\_avg.nc

COMBINE\_ACONC\_NO\_ANO3\_PHOT\_108NHEMI\_STAGE\_201808\_avg.nc

COMBINE\_ACONC\_NO\_ANO3\_PHOT\_108NHEMI\_STAGE\_201809\_avg.nc

COMBINE\_ACONC\_NO\_ANO3\_PHOT\_108NHEMI\_STAGE\_201810\_avg.nc

COMBINE\_ACONC\_NO\_ANO3\_PHOT\_108NHEMI\_STAGE\_201811\_avg.nc

COMBINE\_ACONC\_NO\_ANO3\_PHOT\_108NHEMI\_STAGE\_201812\_avg.nc

Monthly mean surface O3 mixing ratios with pNO3 photolysis are included in the following files:

COMBINE\_ACONC\_ANO3\_PHOT\_108NHEMI\_STAGE\_201801\_avg.nc

COMBINE\_ACONC\_ANO3\_PHOT\_108NHEMI\_STAGE\_201802\_avg.nc

COMBINE\_ACONC\_ANO3\_PHOT\_108NHEMI\_STAGE\_201803\_avg.nc

COMBINE\_ACONC\_ANO3\_PHOT\_108NHEMI\_STAGE\_201804\_avg.nc

COMBINE\_ACONC\_ANO3\_PHOT\_108NHEMI\_STAGE\_201805\_avg.nc

COMBINE\_ACONC\_ANO3\_PHOT\_108NHEMI\_STAGE\_201806\_avg.nc

COMBINE\_ACONC\_ANO3\_PHOT\_108NHEMI\_STAGE\_201807\_avg.nc

COMBINE\_ACONC\_ANO3\_PHOT\_108NHEMI\_STAGE\_201808\_avg.nc

COMBINE\_ACONC\_ANO3\_PHOT\_108NHEMI\_STAGE\_201809\_avg.nc

COMBINE\_ACONC\_ANO3\_PHOT\_108NHEMI\_STAGE\_201810\_avg.nc

COMBINE\_ACONC\_ANO3\_PHOT\_108NHEMI\_STAGE\_201811\_avg.nc

COMBINE\_ACONC\_ANO3\_PHOT\_108NHEMI\_STAGE\_201812\_avg.nc

Figure 9 data:

Seasonal Mean Bias of model O3 column densities without and with pNO3 photolysis were calculated using data included in files for Figure 2 and OMI satellite retrievals. OMI satellite data are publicly available.

Figure 10 data (Figure\_10.tar):

Seasonal Mean Bias of daily 8-hr maximum O3 mixing ratios at the CASTNET and AQS sites were calculated using data included in files for Figure 2. CASTNET and AQS data are publicly available.

Daily 8-hr maximum O3 without pNO3 photolysis are included in the following files:

COMBINE\_ACONC\_NO\_ANO3\_PHOT\_108NHEMI\_STAGE\_201801\_8HRMAX.nc

COMBINE\_ACONC\_NO\_ANO3\_PHOT\_108NHEMI\_STAGE\_201802\_8HRMAX.nc

COMBINE\_ACONC\_NO\_ANO3\_PHOT\_108NHEMI\_STAGE\_201803\_8HRMAX.nc

COMBINE\_ACONC\_NO\_ANO3\_PHOT\_108NHEMI\_STAGE\_201804\_8HRMAX.nc

COMBINE\_ACONC\_NO\_ANO3\_PHOT\_108NHEMI\_STAGE\_201805\_8HRMAX.nc

COMBINE\_ACONC\_NO\_ANO3\_PHOT\_108NHEMI\_STAGE\_201806\_8HRMAX.nc

COMBINE\_ACONC\_NO\_ANO3\_PHOT\_108NHEMI\_STAGE\_201807\_8HRMAX.nc

COMBINE\_ACONC\_NO\_ANO3\_PHOT\_108NHEMI\_STAGE\_201808\_8HRMAX.nc

COMBINE\_ACONC\_NO\_ANO3\_PHOT\_108NHEMI\_STAGE\_201809\_8HRMAX.nc

COMBINE\_ACONC\_NO\_ANO3\_PHOT\_108NHEMI\_STAGE\_201810\_8HRMAX.nc

COMBINE\_ACONC\_NO\_ANO3\_PHOT\_108NHEMI\_STAGE\_201811\_8HRMAX.nc

COMBINE\_ACONC\_NO\_ANO3\_PHOT\_108NHEMI\_STAGE\_201812\_8HRMAX.nc

Daily 8-hr maximum O3 with pNO3 photolysis are included in the following files:

COMBINE\_ACONC\_ANO3\_PHOT\_108NHEMI\_STAGE\_201801\_8HRMAX.nc

COMBINE\_ACONC\_ANO3\_PHOT\_108NHEMI\_STAGE\_201802\_8HRMAX.nc

COMBINE\_ACONC\_ANO3\_PHOT\_108NHEMI\_STAGE\_201803\_8HRMAX.nc

COMBINE\_ACONC\_ANO3\_PHOT\_108NHEMI\_STAGE\_201804\_8HRMAX.nc

COMBINE\_ACONC\_ANO3\_PHOT\_108NHEMI\_STAGE\_201805\_8HRMAX.nc

COMBINE\_ACONC\_ANO3\_PHOT\_108NHEMI\_STAGE\_201806\_8HRMAX.nc

COMBINE\_ACONC\_ANO3\_PHOT\_108NHEMI\_STAGE\_201807\_8HRMAX.nc

COMBINE\_ACONC\_ANO3\_PHOT\_108NHEMI\_STAGE\_201808\_8HRMAX.nc

COMBINE\_ACONC\_ANO3\_PHOT\_108NHEMI\_STAGE\_201809\_8HRMAX.nc

COMBINE\_ACONC\_ANO3\_PHOT\_108NHEMI\_STAGE\_201810\_8HRMAX.nc

COMBINE\_ACONC\_ANO3\_PHOT\_108NHEMI\_STAGE\_201811\_8HRMAX.nc

COMBINE\_ACONC\_ANO3\_PHOT\_108NHEMI\_STAGE\_201812\_8HRMAX.nc

Figure 11 data:

Mode O3 concentrations were compared to ozonesonde data from the World Ozone and Ultraviolet Radiation Data Centre (WOUDC) and the National Oceanic and Atmospheric Administration (NOAA) Earth System Research Laboratories (ESRL). Files containing hourly model O3 concentrations are large (requiring gigabytes of data) and not provided. Ozonesonde data from the WOUDC the NOAA ESRL are publicly available.

Figure 12 data (Figure\_12.tar):

Monthly mean O3 without pNO3 photolysis and without wind-blown dust:

COMBINE\_ACONC\_NO\_ANO3\_PHOT\_108NHEMI\_STAGE\_NO\_DUST\_201801\_8HRMAX\_avg.nc

Monthly mean O3 without pNO3 photolysis and with wind-blown dust:

COMBINE\_ACONC\_NO\_ANO3\_PHOT\_108NHEMI\_STAGE\_201801\_8HRMAX\_avg.nc

Monthly mean O3 with pNO3 photolysis and without wind-blown dust: COMBINE\_ACONC\_ANO3\_PHOT\_108NHEMI\_STAGE\_NO\_DUST\_201801\_8HRMAX\_avg.nc

Monthly mean O3 with pNO3 photolysis and with wind-blown dust:

COMBINE\_ACONC\_ANO3\_PHOT\_108NHEMI\_STAGE\_201801\_8HRMAX\_avg.nc

Documentation and observed data:

The original CMAQ model results are stored on the /asm archival system accessible through the atmos high-performance computing system. The format of the files used in this analysis is ioapi/netcdf. Documentation of this format, including definitions of the geographical projection attributes contained in the file headers, are available at <https://www.cmascenter.org/ioapi/documentation/3.1/html/AA.html>

The manuscript contains plots that were also created using model predictions and observed data retrieved from the Clean Air Status and Trends Network (CASTNet):

<https://www.epa.gov/castnet>

The manuscript also contains plots that were also created using model predictions and observed data retrieved from the Chemical Speciation Network (CSN):

<https://www.epa.gov/amtic/chemical-speciation-network-csn-general-information>

The manuscript also contains plots that were also created using model predictions and observed data retrieved from the Interagency Monitoring of Protected Visual Environments(IMPROVE):

<http://vista.cira.colostate.edu/Improve/>