How Much Can We Learn About Nitrous Oxide Emissions from Background Sites and Simple Box Models?

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Atmospheric Nitrous Oxide (N_2O) is an important ozone-depleting gas that continues to rise in concentration even as chlorofluorocarbon emissions have virtually ceased. It is also a potent greenhouse gas with a global warming potential of 298 times per molecule that of carbon dioxide with 100 years time horizon. NOAA has been monitoring background concentrations of N_2O from weekly flask sampling since 1977, starting with five remote stations over a broad latitudinal coverage from Pt. Barrow, Alaska to South Pole, Antarctica. This network has expanded to thirteen flask sites and six *in situ* instrument sites. We have combined data from the collocated, ground-based sites using three different independent instruments all linked to the World Meteorological Organization N_2O calibration scale, primarily to assist in quantifying the global burden of atmospheric N_2O for international assessments of the state of the science in climate and stratospheric ozone depletion. The growth rate of atmospheric N_2O has been constant at 0.78±0.01(3σ) parts per billion (ppb) per year over the period (see figure), but with important deviations related to El Niño Southern Oscillation, transport, and changes in patterns of emissions. Recent studies used a combination of multiple atmospheric networks and different Global Climate Models to calculate emissions, even down to emission values for individual countries and sources. Slight calibration differences between networks of a few tenths of a ppb can have significant effects on the emissions calculated by these methods. Our approach is to use one calibration scale for our flask and *in situ* networks within different Global Monitoring Division (GMD) groups with simple box models to examine the locations of the emissions.

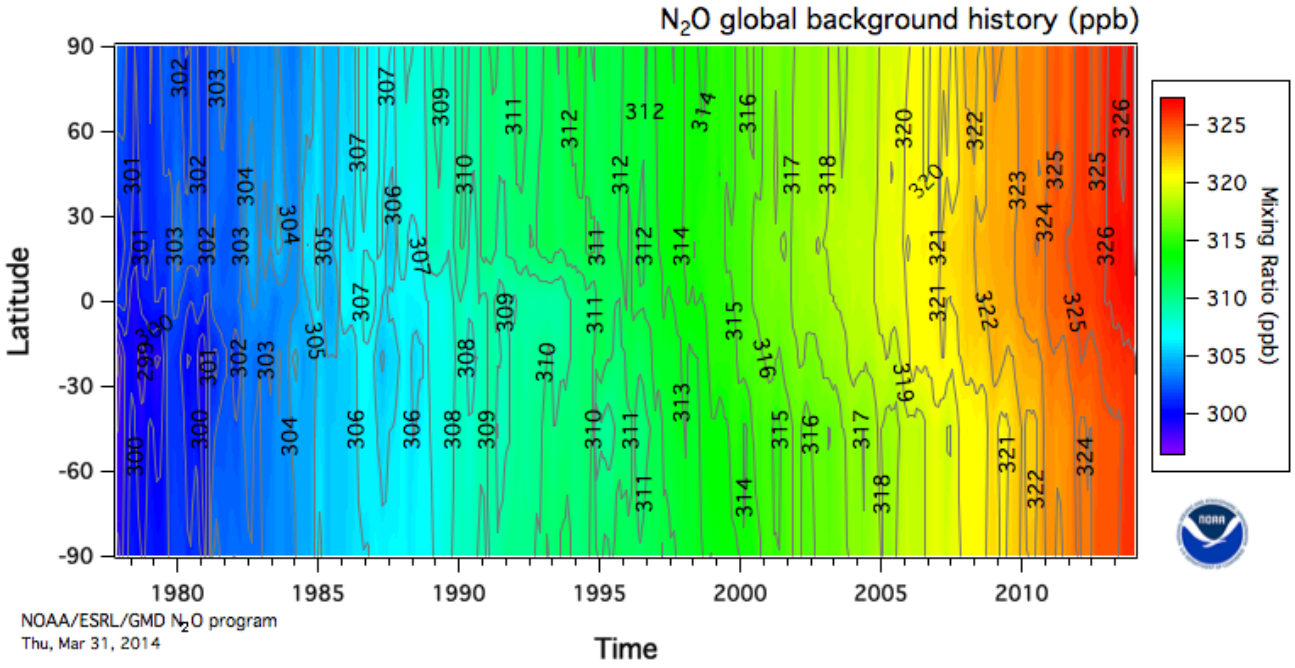

Figure 1. Global history of atmospheric N_2O (in ppb) from the NOAA GMD background observatories.