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Improved Nitrous Oxide Calibration Scale Developed by NOAA/ESRL

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NOAA/ESRL and Cooperative Institute for Research in Environmental Sciences (CIRES) scientists are authors of a just published paper "The NOAA Nitrous Oxide Standard Scale for Atmospheric Observations" (Hall et al., 2007, Journal of Geophysical Research). This work describes NOAA's success, as a World Meteorological Organization/Global Atmosphere Watch (WMO/GAW) Central Calibration Laboratory (CCL), to establish and maintain an improved international calibration scale for nitrous oxide. The central improvement in the scale is in the reproducibility: from 3 ppb in the 1980's (NIST scale) to 0.8 ppb in the 1990's (prior NOAA scale) to 0.2 ppb in the new NOAA scale. Improved reproducibility is key to understanding the N₂O atmospheric budget.

Background: Nitrous oxide (N₂O) is a long-lived trace gas (100 years) that plays important roles in stratospheric ozone chemistry and climate forcing. It is the third strongest greenhouse gas. N₂O, on per molecule basis, has a global warming potential that is 300 times that of CO₂ over a 100-yr time horizon, but CO₂ is over a thousand times more abundant with a greater climate forcing (1.66 watt per square meter versus 0.16 for N₂O since 1750). The atmospheric abundance has increased markedly from ~270 parts-per-billion (ppb) in pre-industrial times (1750) to nearly 320 ppb, and continues to increase at a rate of 0.2-0.3% yr⁻¹. Tropospheric nitrous oxide is measured in a global network by scientists at the NOAA /ESRL. In order to promote data standardization, the WMO/GAW program adopted the NOAA nitrous oxide scale as the GAW standard. NOAA provides compressed gas standards to the World Calibration Center at Garmisch-Partenkirchen, Germany to be used for auditing and assessing the quality of N₂O measurements performed by various other laboratories around the globe.

Significance: Publication of this work supports international efforts to measure the global distribution of nitrous oxide and better understand its sources and sinks. NOAA considers its obligations to the WMO as an important international collaboration. Standardization of important climate forcing data is an important part of the Global Earth Observing System of Systems (GOESS). From the Strategic Plan for the U.S. Integrated Earth Observation System (http://usgeo.gov/docs/EOCStrategic_Plan.pdf), "observation systems must provide for integration of the data in the full end-to-end system that meets the requirements for: 1) stringent standards of calibration, sampling and accuracy necessary for useful data; 2) stability to maintain ongoing data archive; and 3) continued improvement through technical advances and user feedback." This work also addresses objectives in the Climate Forcing Program of NOAA's Climate Goal.

Citation: Hall, B. D., G. S. Dutton, and J. W. Elkins (2007), The NOAA nitrous oxide standard scale for atmospheric observations, J. Geophys. Res., 112, D09305, doi:10.1029/2006JD007954.

For more information see:

<http://www.wmo.int/pages/prog/arep/gaw/monitoring.html> and

<http://www.esrl.noaa.gov/hats/standard>.

More information:

<http://www.wmo.int/pages/prog/arep/gaw/monitoring.html>

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