

## The Construction of a Unified, High-Resolution Nitrous Oxide Data Set for ER-2 Flights During SOLVE

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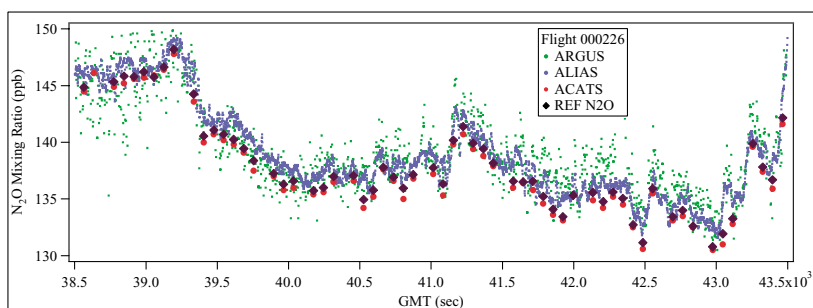
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Four nitrous oxide (N<sub>2</sub>O) instruments were part of the NASA ER-2 aircraft payload during the 2000 SAGE-III Ozone Loss and Validation Experiment (SOLVE): the CMDL Airborne Chromatograph for Atmospheric Trace Species (ACATS), two tunable diode laser (TDL) spectrometers, and a whole air sampler. The three in situ instruments reported N<sub>2</sub>O data at very different intervals (1.8, 3.7, and 70 s). Coincident measurements by these instruments were generally in good agreement, however, there were several types of important differences between the data sets. These differences prompted a collaborative effort to combine data from the three in situ instruments, using an objective statistical method, to produce a high-resolution, self-consistent unified N<sub>2</sub>O data set for each SOLVE flight. The construction method is described in detail. An important step in the method is an evaluation and reduction of biases between the in situ data sets before they are combined. Quality of the unified N<sub>2</sub>O data product is examined through its agreement with high-accuracy and high-precision whole air sampler N<sub>2</sub>O data. Typical agreement between these two data sets is 2.9 ppb (1.5%), better than the agreement between any pair of N<sub>2</sub>O instruments.

This construction method can be used to combine the measurements of any number of redundant instruments, even if they report data at very different rates. It is geared primarily to reduce short- and long-term biases between instruments, but will also suppress noise in the product data when instruments make coincident measurements. The method can be easily adjusted to a specified output data rate, but the choice of faster data rates must be weighed against the need for noise suppression.

(Top panel) N<sub>2</sub>O data from the three in situ instruments for a segment of the ER-2 flight on February 26, 2000.



(Bottom panel) Unified N<sub>2</sub>O data (red circles) for the same flight segment. Reference N<sub>2</sub>O (black diamonds), a weighted mean of coincident data from ACATS and at least one TDL, is shown in both panels. Note the good correspondence between unified and reference N<sub>2</sub>O.

