B Reactive nitrogen budget during the NASA SONEX mission


Abstract

The SASS Ozone and Nitrogen Oxides Experiment (SONEX) over the North Atlantic during October/November 1998 offered an excellent opportunity to examine the budget of total reactive nitrogen (NO$_y$) in the upper troposphere (8-12 km altitude). The median measured NO$_y$ mixing ratio was 425 parts per trillion volume (pptv). Two different methods were used to measure HNO$_3$: (1) the mist chamber technique and (2) chemical ionization mass spectrometry. Two merged data sets using these HNO$_3$ measurements were used to calculate NO$_y$ by summing the reactive nitrogen species (a combination of measured plus modeled results) and comparing the resultant values to measured NO$_y$ (gold catalytic reduction method). Both comparisons showed good agreement in the two quantities (slope > 0.9 and $r^2$ 0.9). Thus, the total reactive nitrogen budget in the upper troposphere over the North Atlantic can be explained in a general manner as a simple mixture of NO$_x$ (NO + NO$_2$), HNO$_3$, and PAN. Median values of NO$_x$/NO$_y$ were 0.25, HNO$_3$/NO$_y$ = 0.35 and PAN/NO$_y$ = 0.17. Particulate NO$_3^-$ and alkynitrates combined composed <10% of NO$_y$. At this point in time the magnitude of uncertainties in both measured and modeled quantities limit our ability to critically evaluate the reactive nitrogen budget in the remote troposphere.