PREFACE

The Middle Atmosphere Nitrogen TRend Assessment (MANTRA) 1998 Balloon Campaign

Ozone concentrations have declined significantly since about 1980, largely in response to enhanced levels of chlorine in the stratosphere resulting from anthropogenic emissions of chlorofluorocarbons. Total ozone columns at northern mid-latitudes have declined by approximately 3% during the past two decades. This depletion is significantly underestimated by current two-dimensional models. Ozone destruction is partly controlled by NO_x ($NO + NO_2$) through both the NO_x catalytic cycle and its influence on the level of free chlorine in the lower stratosphere. It follows that changes in the amount of total odd nitrogen ($NO_y = NO_x$ + all oxidized nitrogen species) or changes in the partitioning of nitrogen compounds between NO_x and the longer-lived constituents will have an impact on the ozone budget.

A number of balloon campaigns and satellite instruments have measured some, or all, of the components of the NO_y family at mid-latitudes during the past 25 years, yielding a wide range of estimates for NO_y in the middle stratosphere. Long-term studies of odd nitrogen in the stratosphere are relatively few. In the 1970s and 1980s, the Atmospheric Environment Service of Canada led the Stratoprobe series of balloon flights that included early estimates of the northern hemisphere mid-latitude odd-nitrogen budget. The historical Stratoprobe measurements thus provide a useful benchmark against which current measurements can be compared to examine the possibility of detecting long-term changes.

The Middle Atmosphere Nitrogen TRend Assessment (MANTRA) series of high-altitude balloon flights was thus undertaken to investigate changes in the odd-nitrogen budget of the northern hemisphere mid-latitude stratosphere, building on the earlier Stratoprobe campaigns. While the accurate detection of trends using limited datasets is difficult, the intention of the MANTRA project is to contribute to the international body of knowledge needed to address the issue of the changing chemical balance of the stratosphere. Four campaigns have been carried out to date, all from Vanscoy, Saskatchewan. The first took place in August 1998, with the primary balloon flight being the first Canadian launch of a large high-altitude balloon in about 15 years. It carried a suite of instruments to measure stratospheric composition and took measurements on ascent and from a float altitude of approximately 35 km for one day. This flight gained notoriety and considerable publicity as the balloon made an unintended trans-Atlantic crossing and ended up in Finland; however, this had no impact on the scientific return from the campaign.

The papers in this Special Issue present results from the MANTRA 1998 campaign. They include descriptions of the balloon-borne and ground-based instruments, the retrieval algorithms and measurements, and comparisons between these measurements and atmospheric models. They serve as the foundation for ongoing research by the MANTRA Science Team, which continues to work on the analysis, interpretation, and synthesis of data from the subsequent MANTRA campaigns.

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