Re-Analysis and Validation of the Ozone, Temperature and Water Vapour Lidar Long-Term Time-Series at Table Mountain Facility and Mauna Loa Observatory

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The NASA Jet Propulsion Laboratory has been operating four lidar instruments at the Table Mountain Facility, California (TMF) and Mauna Loa Observatory, Hawaii (MLO) for several decades now. Two Differential Absorption Lidar (DIAL) systems have contributed measurements to the Network for the Detection of Atmospheric Composition Change (NDACC) typically 3-5 times per week during nighttime, totaling more than 2500 stratospheric ozone profiles (12-50 km), aerosol profiles (12-40 km), and temperature profiles (12-90 km) at TMF and MLO since 1988 and 1993, respectively. A third DIAL system and a high-capability Raman lidar, both located at TMF, have contributed an additional 2500 tropospheric ozone profiles (3-24 km) and water vapor profiles (3-20 km) since 1999 and 2005 respectively.

The present work reviews the results obtained from the recent re-analysis of these long-term datasets using the new Global Lidar Analysis Software Suite (GLASS) developed for the centralized data processing/re-processing of a large number of instruments across three major ground-based lidar networks, namely NDACC, GRUAN (GCOS Reference Upper Air Network), and TOLNet (Tropospheric Ozone Lidar network) (Leblanc et al., 2016).

As part of the validation work, the GLASS products are compared to the historical LidAna products archived at NDACC, which have contributed to many past ozone and temperature long-term trend assessment reports (e.g., Steinbrecht et al., 2018). The present work also comprises a sensitivity study of several critical aspects of lidar data processing, in particular, the use of new ozone absorption cross-sections, and the use of different sources of ancillary data needed for the lidar raw data processing.

After several years of development, the GLASS reached a mature enough stage that allows the extension of data analysis to many other lidar systems, and constitutes a useful reference transfer tool for the comparison of multiple lidar products within the same network, and across networks. After re-analysis and validation of the full long-term datasets is completed, the LidAna products currently archived at NDACC will be replaced by the new GLASS products.

Key words: Lidar, Ozone, Temperature, Water Vapor, Long-Term trends

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