The JPL Ozone lidars and Measurements Within the Framework of the NDSC

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Abstract.

The Jet Propulsion Laboratory (JPL) lidars operate within the framework of the Network for the Detection of Stratospheric Change (NDSC), which comprises a set of high-quality, remote-sounding research stations for observing and understanding the physical and chemical state of the stratosphere. The NDSC is a major component of the upper atmosphere research effort and has been endorsed by national and international scientific agencies including the IOC, UNEP and WMO. The current basic objectives of the NDSC can be summarized as follows: To study the temporal and spatial variability of atmospheric composition and structure in order to provide early detection and subsequent long-term monitoring of changes in the physical and chemical state of the stratosphere, as well as ancillary data to discern and understand the causes of such changes; To establish the links between changes in stratospheric ozone, UV radiation at the ground, and climate; To contribute independent validation and calibration data for space-based sensors of the atmosphere and to make complementary measurements; also to support field campaigns focusing on specific processes occurring at various latitudes, altitudes, and seasons; To produce verified data sets of geophysical parameters for testing and improving multi-dimensional chemistry and transport models of both the stratosphere and the troposphere.

The JPL Atmospheric Lidar Group currently operates three ground-based differential absorption lidar (DIAL) systems. These systems provide high-resolution vertical profiles of tropospheric and stratospheric ozone and aerosols, and stratospheric and mesospheric temperature. The original system located at the JPL-Table Mountain Facility, California (TMF, 34.4°N, 117.7°W) has been measuring nighttime ozone number density from ~18-50 km and temperature from ~30-75 km, since 1988. An improved system was installed at the Mauna Loa Observatory, (MLO, 19.5°N, 155.6°W), Hawaii, in 1993, allowing ozone, aerosol, and temperature measurements between 15-90 km. A new tropospheric system has been recently developed at TMF, operating routinely since late 1999, and providing high-resolution ozone profiles between 5-20 km. Each of these lidars makes observations 2 to 3 nights a week, on average, and a very large database of ozone profiles has been obtained since 1998 allowing climatologies to be developed and a wide range of temporal variability to be investigated.

There are still large uncertainties in the quantification of latitudinally dependent ozone trends and it is important that the anticipated recovery of ozone following the reduction in the release of certain chlorofluorocarbons be closely monitored. Many of the measurements being made by the NDSC are also closely linked to climate change issues. It is therefore essential that a continuous and log-term global survey of ozone and its depleting substances be maintained.

We will present a brief overview of the lidar systems and methodology for ozone measurements. We will then show results illustrating the vertical structure of ozone and its variation on different time-scales at mid- (TMF) and tropical- (MLO) latitudes.

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