Investigating the Dynamics of the Earth's Middle Atmosphere Using the CEDAR Mesospheric Temperature Mapper

by

M.J. Taylor, W.R. Pendleton Jr., and L.C. Gardner
Space Dynamics Laboratory and Physics Department
Utah State University, Logan, Utah, USA

C.Y. She,
Department of Physics, Colorado State University,
Ft. Collins, Colorado, USA.

and

H.L. Liu, and R. G. Roble, NCAR, Boulder, Colorado, USA

The CEDAR Mesospheric Temperature Mapper (MTM) is a versatile CCD imager that was designed to investigate the properties of short period (<1hour) atmospheric gravity waves as they propagate through the earth's upper mesosphere. The imager samples two selected emission lines in the hydroxyl OH M (6,2) band emission (peak altitude ~87 km) to determine nocturnal temperature and wave-induced intensity and temperature perturbations with high precision. In addition the MTM has also proven to be exceptionally capable of studying much larger scale wave perturbations of tidal and planetary wave origin. To date, observations have been made at mid-latitudes alongside two powerful Na lidar systems: at Ft. Collins, CO (June 1997-May-1998) and at the Starfire Optical Range, NM (November 1998 – January 2000). However, an enhanced MTM system will shortly be deployed at Haleakala Crater, Maui, HI for low-latitude studies as part of the MAUI-MALT program. The potential of this imaging system for investigating short-term, wave-induced, and seasonal dynamics within the Mesosphere and Lower Thermosphere (MLT) region (~80-100 km) will be discussed with reference to recent measurements of terdiurnal (8-hr) tidal oscillations in OH intensity and rotational temperature and the unexpected detection of a large-scale, recurrent perturbation in mesospheric temperature around the autumnal equinox period associated with the penetration of planetary wave energy from the troposphere into the mesosphere. Plans for coordinated ground-based measurements using the MTM (and other instrumentation) during the forthcoming NASA TIMED satellite mission will also be discussed.