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Mesosphere and Lower Thermosphere (MLT) Climatology and Variabilities

J.H. Yee (1), E. Talaat (1), X. Zhu (1), J.M. Russell (2), M. Mlynczak (3), L. Paxton (1), and W. Skinner (4)

(1) Johns Hopkins University, Applied Physics Laboratory, Laurel, MD, USA (2) Hampton University, Hampton, VA, USA (3) NASA Langley, Hampton, VA, USA (4) University of Michigan, Ann Arbor, MI, USA

The Mesosphere and Lower Thermosphere (MLT) is a region of the Earth atmosphere that is very sensitive to external influences from the sun above and atmospheric layers below it. Its chemical, momentum and thermal balance, thus basic states (i.e. pressure, density, and temperature, and winds) can change in different time scales due to naturally-occurring and/or human-induced changes to the composition and energy contained within this region. The NASA Thermosphere-Ionosphere-Mesosphere Energetics and Dynamics (TIMED) mission, since its successful launch in December 2001, has provided for the first time a global climatological view of the basic structure of the MLT system during the descreasing phase of this current solar cycle. It has documented the impacts on MLT structures by the tropospheric and stratospheric weather, varying solar EUV radiation and x-ray flares, geomagnetic storms powered by solar corona mass ejections, and the powerful high speed streams of energetic particles. This paper gives a 5-year climatological view of the MLT system as observed by the TIMED spacecraft and reports the characteristics and magnitudes of its temporal and spatial variabilities. Examples of the observed climatology and variabilities will be used to examine and assess our basic understanding of coupled radiative/chemical/dynamical processes that occur in the system.