Climatology of the Midnight Temperature Maximum

At low latitudes there is an interesting large-scale phenomenon called the midnight temperature maximum that occur when thermospheric winds converge upon the midnight sector creating downwelling and a consequential heating. The thermospheric temperature near midnight will show an increase of 50 to 150 K in amplitude that extends over several thousand kms. This phenomenon has several different additional names such as the “midnight collapse” or the “brightness wave”.

Six examples of the MTM seen near midnight. The blue line is the NRL MSIS 00 reference, and the green line is a Gaussian fit to the data after subtraction of the MSIS reference curve.

The “brightness wave” that illustrates the MTM phenomenon latitudinal extent. This montage shows Boston University all-sky 630 nm imaging data obtained from the three sites of Arequipa, Tucuman, and El Leoncito in South America. Results provided, courtesy M. Colerico and M. Mendillo.

Climatology of the MTM amplitude plotted against day number. Data from 396 nights from 1997 to 2001 were used to produce these results. The amplitude value was derived from the FPI temperatures for each night after subtraction of the NRL MSIS 00 reference curve. Data from overlapping nights were averaged together.