Mesosphere-thermosphere penetration of stratosphere planetary waves from TIMED/SABER temperature measurements

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The SABER instrument on the TIMED satellite is capable of making measurements of atmospheric temperature from about 20 to 120 km up to 83 degrees latitude during both day and night, and thus offers unprecedented opportunity to delineate the vertical propagation of tides and planetary waves from the stratosphere to the mesosphere and lower thermosphere. In this paper we investigate stationary planetary waves and long-period (10-20 days) traveling waves in this context. Not only are the traditional quasi-10-day and -16 day normal modes with zonal wavenumber s = 1 observed, but waves of similar period with s = 0 and s = 2 are discovered, that suggest possible generation by nonlinear interaction between the normal modes and the stationary planetary wave with s = 1 (SPW1) during Northern Hemisphere winter. During Southern Hemisphere winter, eastward-traveling waves with 10-20 day periods and s = 1,2,3 are observed that suggest similar origins in terms of nonlinear coupling with SPW1. Wave fields are depicted to illustrate dependencies on the zonal mean wind field; vertical, latitudinal and inter-hemispheric penetration; and seasonal evolution.