Data from the Aura Microwave Limb Sounder (MLS) and the TIMED Doppler interferometer (TIDI) provide concurrent and independent measurements of mesospheric winds and temperatures from 2004 to the present time. We examine monthly mean wind and geopotential patterns in the winter hemisphere. At midlatitudes, wavenumber one propagates vertically to 90 km during January. TIDI winds are generally directed opposite to stratospheric gradient winds (computed from MLS), in part due to a vertical phase shift at the stratopause. TIDI horizontal winds also exhibit significant ageostrophy, suggesting a possible role for in-situ wave driving.