Data supplied by VIPIR stations at Wallops Island and San Juan, Puerto Rico in dynasonde mode are used to study temporal and spectral characteristics of the wave disturbances at a wide range of thermospheric altitudes. Our proposed method allows for wave activity to be studied at all altitudes where the plasma frequency exceeds the minimum frequency used by the sounder, typically 1.8 MHz, and below the peak “foF2” frequency. This allows us to survey altitude ranges much higher than those available to most instruments used for gravity wave research. The wave amplitudes and horizontal wavenumbers are determined directly from the data, along with signatures of tidal effects on the ionospheric plasma. No “by eye” methods are required, all determined quantities are instantaneous and local and the result of automated procedures. The use of autonomous software procedures and the ability of dynasonde stations to operate continuously allow us to process vast amounts of data and obtain results that are truly representative for the local wave activity. High amplitude, low frequency activity is diagnosed using high resolution spectra computed over extended time periods. Also, the time evolution of high-frequency (up to 4 mHz) components is studied using a short (~2 hours) sliding window spectral calculation technique. The procedure has a relatively high sensitivity level and an estimate of it is provided. The observed activity differs depending on the time when the measurements are performed and on the station location. We discuss likely explanations for the observed differences. A transfer function incorporating gravity wave theory and the mechanics of ionosphere-thermosphere coupling is implemented. The amplitude of observed ionospheric perturbations is used to infer characteristics of the original neutral atmosphere fluid waves. Finally, the gravity wave parameters are used to track and back-track wave propagation, providing possible points of origin and implicitly the likely wave sources.