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Estimating horizontal phase velocities of a traveling ionospheric disturbance from single site vertical ionograms

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Horizontal phase velocities for a medium scale traveling ionospheric disturbance (TID) are calculated from three different atmospheric gravity wave dispersion relations using vertical phase velocities derived from vertical ionograms measured by a single ionosonde. Actual heights derived from a network of four ionosondes in southern New Mexico provide the measured phase velocities. Horizontal phase velocities calculated from the dispersion relations are compared to measured TID velocities as a function of altitude showing general agreement. However, the linear relationship between the vertical and calculated horizontal AGW velocities for this TID frequency and wavenumber range predicts larger variations than observed by the measurements. The inclusion of viscosity and thermal diffusion in the dispersion relations increases the agreement with measurements. This technique provides a method of predicting horizontal TID phase velocities from measurements at a single ionosonde site.