Rayleigh-Lidar Determinations of the Vertical Wavelength of Mesospheric Gravity Wave

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Rayleigh-scatter lidar data from the Atmospheric component of the signal is the signal of interest. and subtracted from the signal. The remaining thermionic noise are measured at 120–150 km filtered, detected with a gated PMT and converted to counts percentages throughout large regions of the atmosphere to observe as it is above the aircraft accessible stratosphere and below airglow emissions and radar backscatter. In situ rocket observations are occasionally made, but they are expensive. ALO’s lidar is a 532-nm laser that observations are occasionally made, but they are expensive. ALO’s lidar is a 532-nm laser that scatters light off particles at a vertical resolution of 3.57 km and a temporal resolution of 2 minutes during 4-10 hour nights of observation. Photons returned through a 44-cm Newtonian telescope are mechanically chopped, optically filtered, detected with a gated PMT and converted to a digital signal. Background light levels and thermionic noise are measured at 120–150 km and subtracted from the signal. The remaining component of the signal is the signal of interest.

Relative density fluctuations are described in terms of vertical wavelength, period, amplitude, and vertical phase speed. One-hour and all-night integrations of density fluctuations display wave behavior measured and characterized by theoretical models of perturbation theory and thermodynamics. The methods of data reduction smooth noise and render monochromatic wave structures more clearly. The AGWs have vertical wavelengths previously measured with lidars in the 6–19 km range with a dominant peak at 12–16 km, and shorter wavelengths suggested by other research to have peaks in the distribution at specific wavelengths.

Data Analysis & Preliminary Results

Small-scale structure

No Altitude-Wavelength Relation

Continued Research

To confirm that the measurement methods used in this study adequately correspond to the theoretical construct, a wider variety of integrations on specific observing dates should be employed. Wave mechanics may confirm visual determinations. A larger sample of nights will be used (on the order of 800 nights, as opposed to this sample of 100). Hourly integrations will show phase shifts to properly determine wave speed and energy. Ultimately we seek to understand the mechanisms behind the observational data and reasons we observe dominant wavelengths within the atmospheric gravity wave spectrum.