ABSTRACT

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Atmospheric gravity waves play a critical role in the vertical coupling of energy and momentum across different layers of the atmosphere. This study focuses on the detection and spectral analysis of convection-triggered gravity waves using ground-based LIDAR remote sensing data obtained from the National Atmospheric Research Laboratory (NARL), Gadanki. Over an 8-week research internship under the Summer Research Fellowship Programme (SRFP), LiDAR backscatter profiles were analyzed to extract temporal and spatial variations in atmospheric structures.

More than 800 files containing LiDAR returns were pre-processed and combined to form a multi-dimensional dataset. Range-Time Intensity (RTI) plots were generated to visualize wave signatures, and altitude-specific time series were extracted to perform Fast Fourier Transform (FFT)-based spectral analysis. The dominant frequencies identified across multiple altitude bins revealed consistent low-frequency oscillations, confirming the presence of gravity waves typically associated with convective activity.

The analysis demonstrated that LiDAR remote sensing is an effective tool for capturing the vertical propagation characteristics of gravity waves in the lower and middle atmosphere. The extracted wave periods matched theoretical expectations, and the results contribute valuable insights into mesoscale atmospheric dynamics. This work lays the groundwork for future research using advanced filtering techniques and multi-instrumental observations to enhance the detection accuracy and understand wave source mechanisms in the tropical atmosphere.

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