大気光・ライダー観測による大気重力波の鉛直伝搬構造

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Gravity wave propagation from the lower to the upper atmosphere derived from airglow and lidar measurements

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In order to investigate vertical propagation of gravity waves from the lower to the upper atmosphere, combined measurements with an airglow imager and lidars were carried out at the Arctic Lidar Observatory for Middle Atmosphere Research (ALOMAR) station (69.3N, 16.0E) in northern Norway. Airglow imaging reveals two-dimensional structures of gravity waves in the mesopause region, while the ALOMAR Rayleigh/Mie/Raman (RMR) lidar and sodium lidar provide the vertical structures covering from the stratosphere to the lower thermosphere. On 26 November 2010, the imager identified a mesoscale gravity wave structure in the sodium airglow, which had a horizontal wavelength of 290 km, wave period of 59.1 min and propagated northeastward at a phase speed of 82 m/s. Simultaneous lidar measurements also showed the upward wave signatures with a similar wave period in the temperature perturbations. In the vicinity of the airglow height, the vertical wavelengths derived from the lidar data were consistent with those estimated from the dispersion relation of gravity waves using the airglow results. A ray-tracing analysis suggests that the observed gravity wave was generated from a distortion of the polar jet at the tropopause through the geostrophic adjustment.