

Characteristics of an internal gravity wave derived from electron and atomic oxygen density profiles

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A rocket experiment was conducted to obtain the atomic oxygen and the electron density profiles as a part of the observation campaign, Waves in Airglow Structure Experiment over Kagoshima in 2000 (WAVE2000). We found wavelike structures around 100 km height in both of the profiles and attributed these structures to an internal gravity wave (IGW) modulation. The characteristics of the internal gravity wave (IGW) and the neutral wind profile were derived from the data using the theory of the plasma and atmospheric-layer responses to a gravity wave.

The vertical wavelength was estimated to be about 10 km from the obtained profiles, and the horizontal wavelength is considered as longer than 1000 km so that thin electron layers might be produced at the observed altitude.

The zonal wind profile deduced from the electron density profile using the windshear theory shows a large shear around 80 km and a decrease in the amplitude with height till about 120 km. The Richardson number is about 1/4 around 90 km, suggesting the occurrence of shear instability. The modulation rate of the MSISE-90 model atomic oxygen profile using this wind is about 15 to 30 %, which is in good agreement with the value observed.