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# Radio occultation criterion and detection of internal gravity waves

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A necessary and sufficient criterion is obtained for a layer to be located at the radio occultation (RO) ray perigee. The displacement of an ionospheric or atmospheric layer from the RO ray perigee can be assessed both, qualitatively and quantitatively using this criterion. RO data from the CHAllenge Minisatellite Payload (CHAMP) is used to validate the criterion introduced when significant variations of the amplitude and phase of RO signals are observed at RO ray perigee altitudes below 80 km. The new criterion opens a new avenue in terms of measuring the altitude and slope of the atmospheric and ionospheric layers. This is important for the location and determination of the wind shear and the direction of internal gravity wave (IGW) propagation in the lower ionosphere, and possibly in the atmosphere. The inclination of the wave front can be used to find the angular frequency of GWs. An application of the criterion to the RO data has given the possibility to identify the IGWs in the Earth's stratosphere and to determine the magnitudes of key wave parameters such as the intrinsic frequency, amplitudes of vertical and horizontal perturbations of the wind velocity, vertical and horizontal wavelengths, intrinsic vertical and horizontal phase (and group) speeds, kinetic and potential energy, vertical fluxes of the wave energy and horizontal momentum. The obtained results of internal wave studies in the Earth's stratosphere deduced from the COSMIC and CHAMP GPS occultation temperature profiles are presented and discussed.
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