Review Fluctuations of radio occultation signals in sounding the Earth's atmosphere

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In the manuscript the previuosly developed for analysis of the stellar occultation data theory and model of turbulent atmopsheric inhomogeneities are applied (after some modernization) to process the GPS/MET RO experimental results. According to the model, the random structure of the atmosphere is represented as an aggregate of two components: (i) the Kolmogorov isotropic; (ii) significantly anisotropic disk-shaped highly flattened horizontal inhomogeneities. The Rytov theory of weak perturbations and the phase-screen method are used to relate the characteristics of IGWs and variations in the amplitude and phase of RO signals propagating through the atmosphere. For strongly anisotropic inhomogeneities, RO signal fluctuations are determined by the vertical velocity of the ray immersion for different occultation angles. High intensity of the anisotropic component in oblique occultations indicated areas of significant activity of IGW's in the atmosphere.
The authors argued that their method can become the basis for global remote sensing of IGW's activity.
The manuscript's material contains valuable information for the audience of the AMT journal.

The publication is possible after significant revision.

Remarks and suggestions.

The difficulty of the developed stellar technique transformation for use in radio occultation remote sensing consists in a substantial difference, by several orders of magnitude, of the carrier frequencies, recording and processing methods, and also in the applicable altitude domains in the atmosphere.

1. Radioholograms containing the dependence on time of the amplitude and phase path excess (eikonal) are registered during RO experiments. The scintillations have been measured by GOMOS fast photometers (FP) on board the Envisat satellite at two wavelength $\lambda_B = 499\ nm$; $\lambda_R = 672\ nm$.

So, the RO method has very important additional informative highly accurate phase channel. This channel can be used for identification and separation of the regular layers and turbulence by joint analysis of the RO amplitude and phase data at a single frequency (Pavelyev et al., 2015). The manuscript does not indicate in the reference list or in the text any valuable information on the topic. It is not clear, how one can use the phase RO channel for IGW's analysis.

The suggested in the manuscript technique in the current state does use only the two component statistical model and it is not clear how it separates the possible influence of regular layers from the turbulence contribution in the RO signal. It is well known, that for statistical analysis it is necessary to exclude any systematic influence of regular component on the results.

2. In the manuscript the regular altitude dependence of the refractivity in the atmosphere is described by an exponential model. This is a good approximation for altitudes greater than 20-30 km. However there are clearly defined layers in the stratosphere and troposphere below 30 km. The influence of the regular layers should be taken into account in the formula for the average eikonal estimation (Page 7, line 1, psi=). This is underestimated value. For the troposhere and lower stratosphere this formula should include the bending angle according to the accurate phase path excess formula given by Pavelyev et al., 2015. This concerns also the formula (24) for the refractive attenuation.

3. Besides the above mentioned remarks the paper should contain a clear Figure indicating the main geometrical parameters used in the manuscript (the incidence angle, refractive angle, impact parameter …).

Reference

A.G.Pavelyev, Y.A.Liou, S.S.Matyugov, A.A.Pavelyev, V.N.Gubenko, K.Zhang, and Y.Kuleshov Application of the locality principle to radio occultation studies of the Earth's atmosphere and ionosphere. Atmos. Meas. Tech., 8, 2885–2899, 2015. www.atmos-meas-tech.net/8/2885/2015/. doi:10.5194/amt-8-2885-2015.