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Atmospheric Measurement Techniques Discussions

Interactive comment on "Variable anisotropy of small-scale stratospheric irregularities retrieved from stellar scintillation measurements by GOMOS/Envisat" *by* V. Kan et al.

Anonymous Referee #2

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General comments:

The paper continues a series of publications by a group of well-known experts in the field of space-based optical remote sensing of the Earth atmosphere. This is a well-written paper on a novel measurement technique for stratospheric small-scale inhomogeneities caused by internal gravity waves. The approach is based on satellite optical observations of bi-chromatic stellar scintillations during occultation using GMOS fast photometers. In their previous papers the authors successfully employed this technique during vertical and oblique star occultation. Now, they extended it toward horizontal or tangential occultation. This new geometry allowed them to better separate the

isotropic component of scintillations from the anisotropic one. Also, longer time series of the data during these horizontal occultations provided them with a better statistical averaging of the measured spectra. Such measurements made possible estimations of the dependence of the anisotropy coefficient on a spatial frequency for a large range of spatial scales. These estimations were performed using both measurements and simulations of theoretical models of the scintillations caused by anisotropic inhomogeneous atmosphere. The employed technique provides a valuable tool to study the structure of stratospheric internal gravity waves which complements more traditional ground-based radar measurements, and more recently, the radio-occultation technique which employs signals from satellite beacons and GNSS.

The paper addresses relevant scientific questions and is well within the scope of AMT. The results are novel and substantial conclusions from the results are reached. Besides atmospheric remote sensing community, they might be of interest to the community of researchers in the field of dynamics of the upper troposphere. Generally, the scientific methods and assumptions are valid and clearly outlined. The description of experiments and calculations sufficiently complete, however, for new readers in order to get a deeper understanding of these methods it would require additional reading of the references provided by the authors. They give proper credit to related work and clearly indicate their own new/original contribution. The title clearly reflects the contents of the paper, and the abstract provides a concise and complete summary. The paper is clearly written and well structured.

Specific comments:

The main difference in the approach compared to the previous papers of the authors is that occultations here are horizontal (or tangential) whereas before they employed measurements during vertical or slant occultations. On page 7 (line 191) they state that “the condition for tangential occultations are realized seldom.” Why seldom? If the line of sight is directed almost perpendicularly to the plane of satellite orbit, toward the Earth horizon the tangential occultations for an appropriate stars by the atmosphere

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should happen as frequently as the vertical occultations. If conditions for tangential occultations indeed take place seldom what are circumstances responsible for the seldom appearance of these events? Is this just an engineering issue related to a fixed pointing direction for the sensor, or due to a choice of specific stars?

The most unfortunate limitation of the data analysis presented in the paper is averaging of the sought turbulent characteristics over all available lon/lat locations. It means that dependence of spectral parameters over the geographic coordinates is lost. Is there any prospect of relaxing this limitation in the future analysis, or this is the best what can be done under circumstances? According to Table 1 the tangential occultations were limited to the Northern hemisphere. Why it is so?

Technical corrections:

Line 360. Current version: "For occultations with 43 km, also the estimates of the inner turbulence scale . . . ." Suggested version: "Also, for occultations with 43 km the estimates of the inner turbulence scale . . ."

Line 386: Current version: "In this procedure, we get for each occultation an estimate. . ." Suggested version: "In this procedure, for each occultation we get an estimate. . ."

Line 407: Current version: "Figure 4B,C compare. . ." Suggested version: either "Figure 4B,C compares. . .", or "Figures 4B,C compare. . ."

Line 660: Current version: ". . .multiplied on wavenumber and normalized by scintillation variance." Suggested version: ". . .multiplied by the wavenumber and normalized by the scintillation variance."

Captions to Figs. 2 and 4: For completeness please indicate that the numbers in boxes are orbit numbers.

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 1275, 2014.