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Geoscientific Instrumentation Methods and Data Systems
Discussions

Interactive comment on "Neutral temperature and atmospheric water vapour retrieval from spectral fitting of auroral and airglow emissions" *by* Joshua M. Chadney and Daniel K. Whiter

Anonymous Referee #1

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General comments

This paper deals with airglow measurements HiTIES instrument located in Svalbard. Emissions originate from O+, OH and N2. The measured spectra are fitted by a model spectrum consisting of Gaussian emission peaks. Tropospheric water vapor absorption has also been included. From the fit some geophysical quantities like temperatures and precipitable water amounts have been retrieved. The main emphasis is still on the error analysis of the method.

The paper is reasonably well written, and its subject is appropriate for Geoscientific Instrumentation, Methods and Data Systems. The measurements in the paper are

important and the paper provides good analysis of them. The paper does not really include retrieved geophysical results and necessary validation is also missing. I hope the authors prepare further publications about results.

In my mind there is some weakness in the structure of the paper. Often a straightforward logic works best: Intro, instrument, measurements, data analysis methods, results, comparisons to earlier works and summary/ discussion. Well, it is not a show stopper for me and I recommend the paper to be published after my specific comments are answered. My comments are listed below.

Specific comments:

1. Abstract is too short.

2. Introduction: You assume LTE. Please specify the altitude ranges where the emissions originate. Is the LTE assumption valid in all your cases?

3. Section 2: HiTES. This section is also too short. Add instrument's general description. Provide information about the timing and frequency of measurements.

4. In Sec. 3.2 you mention that the ratio of two O+ doublets depends on neutral temperature. Later you consider this ratio, but you do not show results for temperature. Why?

5. Sec. 4: Eqs. (1)-(2): How are you including these constrains in the fitting process?

6. Sec. 5: N2 database: Temperature range 150-1150 K by 10 K resolution. Please justify these numbers.

7. Sec. 4, line 23: You see large deviations in the residual and you think that it is related to O2 emission. So why didn't you include these emissions in the fitting?

8. Sec. 5: Normally the least squares fitting provides uncertainties of the retrieved quantities in the form of co-variance matrices. Some uncertainty estimates of the measurements (and sometimes modelling uncertainty) is needed for these estimates. You

do not provide any discussion about this, but rush to make a Monte Carlo analysis. Please, open up your thinking about error analysis here.

9. Sec. 5.1, line 23: The mean error. Usually it is called bias?

10. Figs. 6, 7, 9,10. The unit of the relative error is not mentioned. Is it absolute or %?

11. In Conclusions you start studying the impact of thermal noise. In my mind the right place for this is in Sec. 5 and not in Conclusions.

12. In the paper you do not really show geophysical results but concentrate on uncertainties of your method. Are you going to show, compare and validate your results with other peoples' work in some future publications? If so, please advertise your plans in Conclusions. Hopefully this comes before trend studies!

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