Atmos. Meas. Tech. Discuss., 8, C1–C3, 2015
www.atmos-meas-tech-discuss.net/8/C1/2015/

Atmospheric Measurement Techniques Discussions

Interactive comment on "Zeeman effect in atmospheric O_2 measured by ground-based microwave radiometry" *by* F. Navas-Guzmán et al.

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Received and published: 9 January 2015

The paper extends work reported in previous papers by Staehli et al.(2013) and Navas-Guzman et al.(2014) on the TEMPERA instrument, which produces simultaneous retrievals of tropospheric and stratospheric temperature. The present report extends the possible measurement range to altitudes above 50 km by incorporating the Zeeman effect in the radiative transfer calculation, and presents some preliminary measurements of brightness temperature. The Zeeman effect needs to be accurately modeled so that the measurements can be corrected for it. The paper demonstrates this agreement between the model and measurements in Fig. 11.

Here are a few comments: 1. To put this work in a larger context, the introduction

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could mention that ground-based measurements of the atmosphere with good temporal resolution can provide complementarity to satellite measurements which may be limited by revisit times, depending on the instrument and the orbital parameters.

2. What is the antenna beam efficiency? With the beam being reflected three times as shown in Fig. 6, is a correction for stray radiation into the far sidelobes of the antenna necessary and if so, how was it done?

3. In connection with Fig. 5, it may be helpful to the reader to note that given the magnetic field orientation at Bern, and observing at an elevation angle of 60 deg., the direction of propagation is nearly parallel to the Earth's magnetic field at the azimuth angle of 181 deg., resulting in minimal difference between vertical and horizontal polarization at that position.

4. Equations 4 and 6 are inconsistent as written. I understand the authors' meaning, but clarity would be improved if in line 5 on page 11, p is defined as [1 1 0 0] L(chi), and that paragraph is joined to the next one. Then eq. 6 would read:

T_bˆp = [1 1 0 0] L(chi) s'

5. A missing relevant reference is J. W. Waters, "Ground-based measurement of millimetre-wavelength emission by upper stratospheric O2," Nature vol. 242, pp. 506-508, 1973. Thus, the present work is not the first ground-based measurement of Zeeman broadening at 53.07 GHz (as said on page 4, lines 3-4 and page 16, lines 13-14), since Water's fig. 3 clearly shows that effect. However, it would be correct to say that this is the first measurement of polarization for that line (or more precisely the variation of polarization with azimuth angle) since Water's measurement was not sufficiently sensitive to measure the polarization.

6. In the reference Rosenkranz(1993), typesetting has garbled the name of the publisher and location. This reference is out of print, but it is available on the Web at http://hdl.handle.net/1721.1/68611, which could be added at the end of the citation.

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Interactive comment on Atmos. Meas. Tech. Discuss., 8, 1, 2015.