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 April 11, 2018

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To: VSRT Group
 From: Alan E.E. Rogers
 Subject: Comparison of ozone line at 11.072 and 142 GHz

The ozone line at 11.072 has been used to measure the wind velocity in the mesosphere at 95 km with results reported in (Rogers et al. 2016). The millimeter lines of ozone at 120 and 142 GHz can also be used to measure the wind velocity and because these lines are about 1000 times stronger it is possible to use them to measure the velocity vs altitude up to about 70 km. Above 70 km it becomes hard to separate the effect of winds at 70 km with those higher up because the Doppler broadening of the line at 95 km is similar to the pressure broadening at 70 km.

A comparison of the line shape and the effect of wind at different altitudes for the lines at 11 and 142 GHz is shown in Figure 1. In this figure the line shapes are compared using the layered model atmosphere given in the appendix of Rogers et al. 2012 with the line intensity at 300 K changed from -6.9997 to -4.15 for the change to 142 GHz from 11 GHz. In each case the same concentration and temperatures are used as follows:

Height (km)	Concentration (ppmV)	Temperature (K)
30-75	0.6	290
Gaussian centered at 95 km FWHM 10 km	10.0	190

Table Ozone concentration and temperature of model atmosphere.

The curves at 50 70 and 90 km are the difference spectra between simulated observation made at 8 degrees elevation pointing toward and away from 10 km/s wind at level of 50, 70 and 90 km within a 10 km band of altitude at each level. In each case the difference is multiplied by 10 to make the difference more visible. Note that the 11 GHz line is much more sensitive to the wind at 90 km than the wind at 70 km whereas the 142 GHz cannot distinguish between winds at 70 and those at 90 km.

Rogers, A.E.E., Erickson, P., Goncharenko, L.P., Alam O.B., Kerr, R. B., and Kapali, S. (2016), Seasonal and Local Solar Time Variation of the Meridional Wind at 95 km from Observations of the 11.072 GHz Ozone line and 557.7 nm Oxygen line, *J. Atmos. Ocean. Technol.*, 33, pp. 1355–1361. doi:10.1175/JTECH-D-15-0247.1

I used the model atmosphere given in appendix of

Rogers, A.E.E., Erickson, P., Fish, V.L., Kitteredge, J., Danford, S., Marr, J.M., Arndt, M.B., Sarabia, J., Costa D., May, S.K. (2012), Repeatability of the Seasonal Variations of Ozone near the Mesopause from Observations for the 11.072-GHz Line, *Journal of Atmospheric and Oceanic Technology*, 29, pp. 1492–1504. doi: <http://dx.doi.org/10.1175/JTECH-D-11-00193.1>

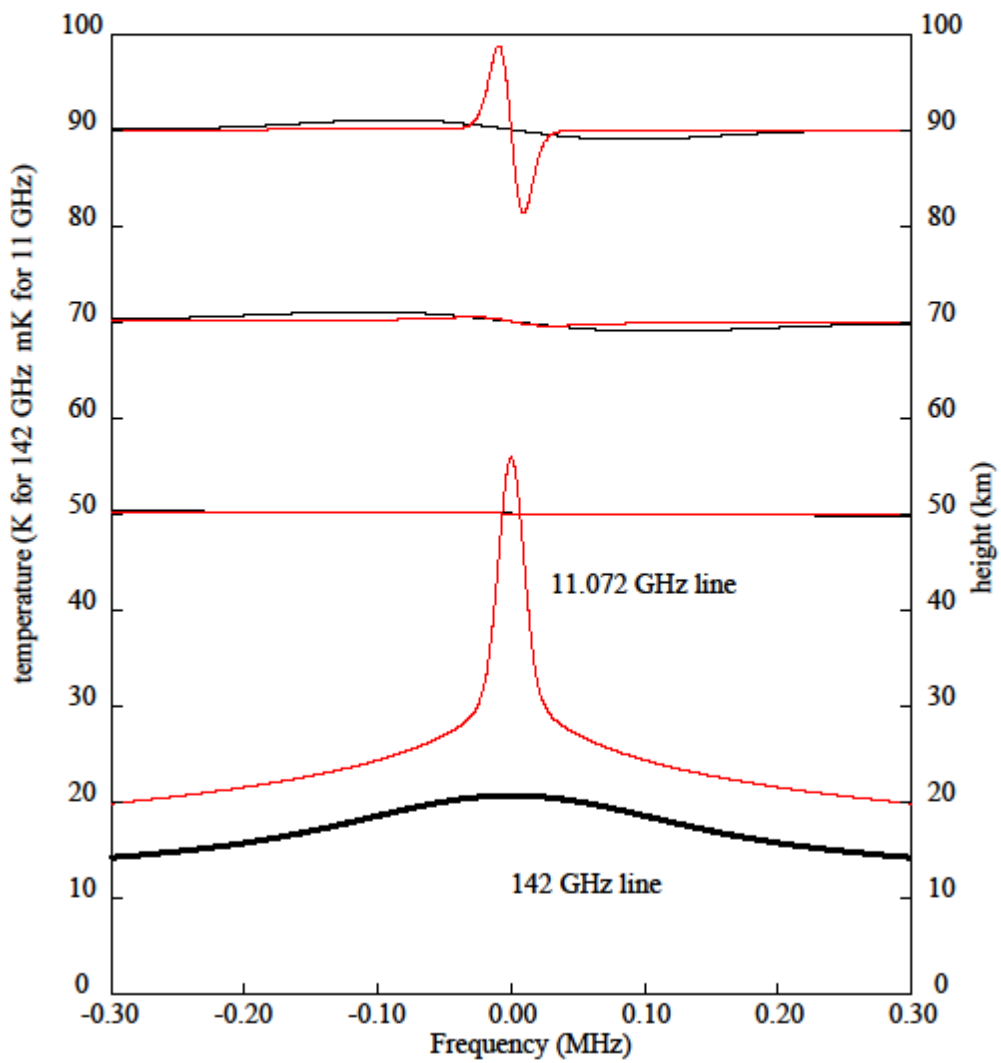


Figure 1. Simulated spectra and difference spectra (x10) for the 11 GHz line in red (mK) and the 142 GHz line in black (K).