1 General comment

The paper deals with ground based measurements of ClO with a microwave radiometer operated at high altitude in the Atacama desert. ClO measurements are important for understanding processes of ozone chemistry. Unfortunately groundbased measurements are extremely sparse and today mainly satellite data from MLS on AURA are available and some from JEM/SMILES. Measurements from the ground are very difficult as the spectral feature of ClO is extremely weak what calls for a very sensitive receiver operated at a very dry location. So far only a few microwave instruments have been able to observe this molecule from the ground. It would be of great interest to have a groundbased instrument operating on a regular basis to monitor ClO, e.g. in the frame of NDACC, in order to provide data for long term monitoring of ClO even if this is from a single location. In contrast to satellite measurements the groundbased instruments can provide information of the diurnal variation of atmospheric constituents. This is an important aspect.

The work presented in the paper deals with measurements taken over a few days in 2009. The paper gives a description of the instrument, presents the retrieval approach and an error analysis and shows a few examples of the diurnal variation. Retrieved profiles are compared to MLS and SMILES. The main novelty of the paper actually are the measurements of the diurnal variation of ClO. Unfortunately the authors just show one single example of this variability. Here the authors could improve the paper by showing more data of the diurnal variability. In a sense the paper is a proof of concept that this radiometer, called NATAOS, is capable of delivering such information.

As the journal AMTD is dedicated to measuring techniques the topic fits. However what is described in the paper from a technical point of view is not new. There are other instruments working more or less on the same principle. What is new is the presentation of measurements taken at southern midlatitudes.

The structure of the paper is well organized. However it lacks from several weaknesses (see next section), some of the equations given are erroneous, several important details are missing. Information given in the figures could be optimised. The paper also would need some brush up of the English idiom. However this latter point should not be weighted too heavily as the author team is not native English speaking.

In summary the paper is interesting however needs a major revision of the manuscript before it can be accepted in AMT.

2 Specific comments

Instrument:
The radiometer is operated in double side band mode (line 11, p.1911). It would be interesting to know how the authors deal with the other sideband. Are there any significant lines in the other sideband? Is it perfectly DSB?

The instrument is very narrow beam (line 26, p. 1910) what is excellent. On line 4, p. 1915 they say that the lowest elevation angle is 15° due to sidelobe effects. What is the sidelobe suppression and at what angle is the sidelobe showing up?

Observation method:
The given equations are difficult to read due to typesetting and they are erroneous.
Line 22, p. 1912: $e^{-\tau}$ is the transmissivity and not the absorption coefficient. I recommend to modify the following equations with a better typesetting for better readability. Use $e^{-\tau}$ instead of $exp(\tau)$. Replace the angles like EL_{ref} by α or similar. It would be even easier to replace $e^{-\tau}$ by t, the transmissivity.

There is an error in equation (2) and (3). The very first term with T_{line} should not be divided by $\sin EL$. Equation (2) and (3) could be rewritten as:

$$T_{ref} = T_l t_{ref} t_{pl} + T_{trop}(1 - t_{ref}) t_{pl} + T_{pl}(1 - t_{pl}) + T_{rec}$$

where I used T_{rec} instead of T_{sys} as actually $T_{sys} = T_l + T_{rec}$

$$T_{obs} = T_l t_{obs} + T_{trop}(1 - t_{obs}) + T_{rec}$$

Line 11, p. 1913. T_{trop} is the equivalent temperature of the troposphere. Give details of how it is determined!

Line 11, p. 1914 It should read P_{obs} and P_{ref}.
I believe that equation (8) is wrong. The factors with $\frac{1}{\sin EL}$ are not needed and should be deleted. The sign in front of T_{trop} is a minus and not a plus. There are however terms missing. Equation (8) can be written as

$$T_l = \left[\frac{P_{obs} - P_{ref}}{\alpha} - T_{trop}(1 - t_{obs} - t_{pl} + t_{ref} t_{tpl}) \right] / \left(t_{obs} - t_{ref} t_{pl} \right)$$

Line 19, p.1914: Justify why it can be assumed $T_{trop} = T_{plate}$. This question is linked with the above one relative to T_{trop}.

Data analysis:
Line 8, page 1915. Is local time identical to local solar time? Line 2, p. 1916. The text enough difference... is twice. Delete.

Retrieval method:
Line 14, p. 1916. Why is $\mathbf{S}_R$ independent of altitude?
Line 20, p. 1916. Give details about how the vertical resolution can be improved and how it relates to the width of the averaging kernels.

Results and discussion:
Line 20, p. 1917: It is said that spectra in Figure 3 have been averaged from 12:00 - 15:00. If I understand correctly actually it has been averaged over this time window but for ten days.The text is somewhat misleading. Please clarify.

Line 16, p. 1918: It is stated that the most reliable data are from 40 to 50 km altitude. Actually this would just correspond to one information as the altitude resolution is of the same order. Please be more specific regarding the information content of your measurement. For example determine the measurement response according Rodgers.

The whole error analysis could be presented in a more compact way. All the figures dealing with the error could be summarized in one single figure. Please use a grid in the figures to facilitate reading of the values.

Line 24, p. 1920. The effective temperature is assumed to be equal to the hot load temperature. What do you mean by effective temperature. Is it T_{trop} used before? If yes, this would not be correct.

Figure 4: Please explain why the error gets smaller the further away you are in altitude from the region of 40-50km where you get reliable data. Probably the information content is vanishing an the retrieved profile is approaching the a-priori one. But please specify otherwise this is misleading.

Figure 11 right: Is the relative error relative to MLS or relative to NATAOS?

Figure 12: I see no arrows.

3 Technical comments

At the beginning of the paper you should tell the reader that the instrument is called NATAOS.

Line 11, p.1908: ... spectral data at 204.3 GHz

Line 24, p. 1909: What is difficulty of spectroscopy?

Line 12, p. 1913: ... of atmosphere below the stratosphere. This is the troposphere ;-)

Line 2, p.1916: ...enough difference... this sentence is printed twice.

Line 8, p.1931: Geneva and not Genova. Genova is in Italy.