We thank the reviewer for very thorough and constructive comments. The quality of the manuscript has been improved by these comments and suggestions. Below are our responses to the comments. The response (in *blue*) follows each comment.

Reviewer #1 (amtd-7-C115-2014):

General comments:

In this paper, the authors verified the instrument function and SNR of polarized HABS, developed a fast HABS simulator, and evaluated the spectra performance of HABS by comparing with the HABS simulator. The HABS simulator developed by the authors is based on the DISORT code coupled with oxygen absorption profiles calculated from LBLRTM and collocated HITRAN2008 database, and a double-k approach to reduce the computational cost. The HABS measured spectral radiation is quite consistent with the related simulated spectral radiation for both direct and diffused beams, for different solar zenith angles and for different air mass. The main differences between observations and simulations occur at or near the strong oxygen absorption line centers mainly due to a combined effect of week signal, low SNR, errors in wavelength registration and absorption line parameters. Overall, the manuscript is a significant contribution to HABS literature and helps for the HABS development and future researches on clouds and aerosols. However some improvements/explanations are still needed. Please see my comments/suggestions below. I think the paper well fits within the stated scope of the journal and should be published with minor revisions.

Major comments:

1. The paper needs an improved introduction. As a newly developed instrument, HABS needs continuous studies. What had been discussed in the paper is a part of its development and certainly crucial. Please enhance your statement about the importance and interests of your research, what had been done in previous researches, and what would the research contribute to future researches. And also please give a brief introduction about your paper organization.

Answer: We have added a section (Section 5 in the revised paper) to discuss the potential application of HABS. In this section, we talked about some previous research work that based on the lower resolution O2 A-band spectrum measurement, and added some sentences to enhance the importance and interests of our research. We also stated our research plan based on the HABS measurements in the near future.

At the end of the introduction section, we have given a brief introduction about our paper organization.

2. It gives me an impression that the figures in the paper are not well introduced and analyzed. When you show the readers a figure, please explain first how do you plot the figures (i.e. time, data, methods) and then explain in more detail what can we get from the figures? There are much more to explain from your figures and please guide the readers to get useful information from these figures. For example in Figure 3, in which period did you calculate the spectrum ratios? Is it representative for long term statistics? What can we get from the figure (as much as possible)? Similarly in Figure 6, why could you conclude the oxygen A-band spectra has the capability to retrieve vertical profiles of clouds, please illustrate in more detail and make the readers understood.

Answer: We have added more detailed introduction of the figures into the revised paper as suggested. For the instrument performance testing, such as spectrum ratios and slit-function, we measure them many times, from the instrument assembling periods to in-lab calibration periods, from before field campaign to after field campaign. They are constant during these periods, thus we did not provide exact time in the paper. We have added more comments into the paper. For Figure 6, we moved the detailed discussion into another section (section 5 in the revised paper).

Specific comments:

Pp 1030, Line 13: Where do you discuss the potential application of HABS spectra measurements? If not please delete it.

Answer: In the revised paper, we added another section (section 5 in the revised paper) to discuss the potential application of HABS spectra measurements in the near future.

Pp 1032, line 21-23: Please cite

Answer: We have added some references in the revised paper as suggested.

Pp1033, Line 3: What is lamp GS0937?

Answer: The lamp GS0937 is a Gamma Scientific's Model 5000 FEL 1000-Watt lamp source and the GS0937 is the S/N number. We have revised it in the paper as follows: *To calibrate the response of the overall filter function, we use the Gamma Scientific's Model 5000 FEL 1000-Watt lamp source to provide the reference spectrum.*

Pp 1033, line 24: What are R and P branches?

Answer: R and P branches are two terms of rotation/vibration spectroscopy. The O2 A-band spectrum contains a R-branch (left part) and P-branch (right part), related to changes in the rotational angular moment N, $\Delta N = N'' - N' = \mp 1$. The detailed information is indicated in Spiering et al. (2010). We have added the reference into the paper.

Spiering, Frans R., Maria B. Kiseleva, Nikolay N. Filippov, Hans Naus, Bas van Lieshout, Chris Weijenborg, and Wim J. van der Zande. "Line mixing and collision induced absorption in the oxygen A-band using cavity ring-down spectroscopy." The Journal of chemical physics 133, no. 11 (2010): 114305.

PP1033, line 23-26: Please explain in more detail or please cite. In Fig 5, at which solar zenith angle is the SNR obtained? How does your algorithm automatically adjust to solar zenith angle and sky conditions?

Answer: We have added the detailed method of automatically adjusting exposure time into the paper:
"*…It is implemented by taking two measurements continuously: (1) the first measurement only takes very short exposure time, which works as a reference to estimate the strength of incident solar radiation; (2) the second measurement, which exposure time is calculated based on the amplitude of the first measurement, can obtain the maximum but not saturated spectral amplitude.*"

In Fig.5, the SNR is obtained at solar zenith angle of 31°; we have added it into the figure explanation and indicated it in the figure in the revised paper.

PP1034 line 4-6: With his method, how much error can be produced? Please state it in your paper.

Answer: In the revised paper, we have added the error range that produced by this method: "*This method can accurately register each measured spectrum individually and fast, which wavelength registration error is within 0.0001 nm.*"

PP1034 line 22: "and the MFRSR derived AOD (at 760 nm) is about 0.04" -> "and the MFRSR derived AOD (at 760 nm) is about 0.04 (Fig. 8b)"

Answer: We have revised it as suggested.

Figure 1 is useless. Please delete it

Answer: Figure 1is the picture of the HABS instrument. Because this is the first paper to introduce this instrument to the community, keep this picture may give other researcher a first impression of it.

Figures 3, 4, 5, and 7: In these figures, the x-axis represents the pixel index, which corresponds to the wavelength. As we don't know how to translate the pixel index to the wavelength, it would be better for us to understand if you use wavelength instead of the pixel index, as shown in the figures 6, 10, and 12.

Answer: For Figure 3, 4, 5, and 7, the data processing is based on the pixels, thus we use the x-axis represents the pixel index. In Figure 3 and 4, the spectral response ratio and slit-function are used to indicate the performance of the instrument itself. Even the instrument is not used to measure the O2 A-band spectrum, these performances also exist. The further application based on these two instrument performance are also processed in the pixel range, e.g., spectrum calibration. Furthermore, due to the issue of wavelength shifting, in Figure 3 and 4, the pixel index is hard to be translated into wavelength index accurately. Normally, we use the absorption lines of O2 A-band spectrum to determine the relationship between pixel index and wavelength index [*Li and Min, 2012*]. For Figure 5 and 7, we have used wavelength instead of the pixel index in the revised paper.

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 1027, 2014