Atmos. Chem. Phys. Discuss., 7, S5636–S5639, 2007
www.atmos-chem-phys-discuss.net/7/S5636/2007/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Properties of polar stratospheric clouds obtained by combined ACE-FTS and ACE-Imager extinction measurements" *by* A. Y. Zasetsky et al.

Anonymous Referee #1

Received and published: 3 October 2007

This paper presents an analysis of the ACE solar occultation to identify the composition and size of polar stratospheric clouds. Specifically, two cloud cases are discussed in detail, showing spectra that are fit as NAT with ice, and STS. This work is interesting in that it utilizes the infrared and visible wavelengths available in SCISAT, providing better constraints on composition and size.

One major weakness is that the analysis focused on just two cases and gives little context to ACE observations -are the frequency and location of PSC measurements consistent with other data? What about temperature and gas phase species from ACE - are they consistent with PSC identification? In addition, there is no context of previous

efforts along this line, and the error analysis is weak to nonexistent.

Some specific comments:

1. page 13274, line 16. The ATMOS and mkIV measurements have provided a valuable body of work on interpretation aerosol signatures in solar occultation data. In particular, Steele et al (applied optics 2003; 2006) has provided a through discussions of the retrieval of aerosol parameters of interest and the errors associated with these retrievals. Although Steele's work focused on sulfuric acid aerosols, the principles are completely relevant to Zatesky's work. I suggest the authors review those papers and incorporate relevant references into their paper.

2. pg 13274 line 24 The authors provide lat and lon boundaries for the 20 cases that they identified with a volume of more than 0.5 μm3/cm3. Are these boundaries or the spatial distributions of the ACE PSC observations consistent with other PSC climatologies? Would a map of the location of the cases be valuable to the reader?

3. page 13278 lines 7-14 this is essential information - The authors write: "As a result, if the reference spectra of a given component reproduce one or more of the major features in the measured spectrum, then the presence of that component in the observed sample can be considered to be proven" What if there are many solutions that are equally good - how do we see any of that information in what is presented here: The reports only show a single result but don't talk about how this compared to other fits - are there a number that are within noise, or only one.

4. page 13278 line 20: The authors write: "The relative intensities othe characteristic features, of course, give the amount of that component present in the sample" Yet, no information about amount is presented in the results. Earlier in the paragraph the authors argue that there is residual gas phase information. How does that impact the amount and the best fit of the aerosols?

5. pg 13278 line 23 Earlier in the paper, 20 cases of significant cloud volume were cited,

ACPD

7, S5636–S5639, 2007

yet at this point the table has 6 cases with composition identification. What happened to the other 14 cases? I would be very interested in statistics of the composition of the 20 cases.

6. page 13279 and following. This section leads into discussion of the two cases shown with detail spectra. Are these representative of the only 2 distinct types of cases that were seen in the 20 first identified? Are they the best looking cases?

7. page 13280 line 17 and following Figure 4 illustrates the 'best fit' aerosol model to the observations, yet it appears that there are NAT like features in the spectrum between 1200 and 2000 cm-1. This is a case where it would help to see all the fits that are within the uncertainty of the spectra. Rather than only identifying the minimum residual, it would be valuable to know what range fit the spectra. Alternatively, the fitting procedure finds the weighting of all of the aerosol models that minimizes the difference, yet the labeling only identifies on aerosol species. We all of the other aerosols weighted as zero?

8. page 13272 The abstract and conclusions are written much more broadly than the paper. The abstract suggest that there is analysis of clouds for a month, and then some typical characteristics are provided. All we see in the body of the paper are a table with 6 of 20 cases, and spectral fits for two cases. There is also a disconnect where the high HNO3 content - this is not discussed fully in the paper, nor do we get a sense of what fraction of the 20 cases had these characteristics.

9. There is a large body of theory about the conditions that result in NAT, ice, or STS PSCs. In the caption figures, temperature are mentioned. I think this paper would be much stronger if the authors addressed the composition of the clouds in light of the temperature and chemical information that ACE and others measure. This is hinted at in the concluding statements, but should be thoroughly analyzed and discussed in the context of the 20 cases first identified.

10. Although the size distributions do have reported errors, Table 1, which reports

ACPD

7, S5636–S5639, 2007

EGU

aerosol volume, has no uncertainties on the quantities. It is important to also include that information.

References:

Helen M. Steele, Annmarie Eldering, Bhaswar Sen, Geoffrey C. Toon, Franklin P. Mills, and Brian H. Kahn (2003) Retrieval of stratospheric aerosol size and composition information from solar infrared transmission spectra, Applied Optics, vol 42, no 12 p 2140.

Helen M. Steele, Annmarie Eldering, and Jerry D. Lumpe (2006) Simulations of the accuracy in retrieving stratospheric aerosol effective radius, composition, and loading from infrared spectral transmission measurements, Applied Optics, vol 45, no 9, p 2014.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 13271, 2007.