Responses to Referee 2 (Chris McLinden) on Behalf of the Authors

We would like to thank the referee for their helpful comments and suggestions. Included below is each of the referee's comments (italics) followed by our reply.

Specific Comments

Line 36 *Incorrect reference - this paper should be cited doi:10.1029/2009JD012488*

Reply: Thank you, this has been fixed.

Table 1 *what was the rationale for choosing these combinations? Are these indicative of OSIRIS, SCIA, ALTIUS, etc...?*

Reply: These combinations were initially chosen as representative for ALTIUS, but they are fairly representative for near polar sun-synchronous orbits that have an equitorial crossing time not near dawn/dusk. We have added a statement to this effect in the manuscript.

Table 1 *What about using SZAs through sunrise/sunset (e.g., 85-95) – some useful information can be gleaned analyzing limb observations through this period. See, e.g., Atmos. Chem. Phys., 8, 5529–5534, 2008*

Reply: We definitely agree that this would be a very useful exercise and something that should be done. Right now it is beyond the scope of what we set out to do and would have to be done in future work. Previously we had a statement in the conclusions that more extreme solar zenith angles should be checked, but the way it was written it could be interpreted that was specifically for checking solar refraction. We have modified the statement in the conclusions to better emphasize the importance of larger solar zenith angles.

Line 369 *"Both SASKTRAN (HR and MC) and GSLS make the assumption that V is identically 0" ... I assume this is what is assumed here, and not a limitation of the models. That is, they can handle a 4x4 phase matrix. Please clarify.*

Reply: You are correct that this is not a limitation of either technique, there is nothing in the equations themselves that prevent you from using a 4x4 phase matrix. However, both models, at least right now, do not have an option that you can turn on/off to switch between a 3x3 or 4x4 phase matrix. We have added the statement "The approximation is

not fundamental to the method of solution used by SASKTRAN (HR and MC) and GSLS, but currently the models do not have an option to remove it."

Table 2 / line 245 *what is the aerosol OD? Provide at a reference wavelength, or add to table 2. I assume the extinction of number density profile is provide with the other reference material? If not, please add.*

Reply: Yes the aerosol profile is provided as part of the reference data. The vertical optical depth at 675 nm has been added to the manuscript.

In a future work it would be good to compare under more demanding conditions, such as larger SZA and higher aerosol loadings and/or clouds, non-Lambertian surfaces

Reply: We agree on all these points, the conclusions have been modified to include all of these points as potential areas of future work.

Is it useful to compare the multiple-scattered component by itself (I – Iss) ?

Reply: This is something that we thought about for a while during the comparison process, with the motivation being that $I_{MS} = I - I_{SS}$ is the actual difficult quantity to calculate. The problem was that in various scenarios I_{MS} is quite small, making % difference not a perfect metric of the observed differences. In the end since I_{SS} agrees very well between all of the models and I is the actual quantity of measurement interest it was decided to do the comparisons with I.

Mention some general findings related to the 1700 nm comparisons where the signal would be dominated by aerosol scattering.

Reply: This is an interesting point. When we initially did the comparisons we found that the differences at longer wavelengths were comparable to 675 nm, and thus the decision was made to not go farther out since it becomes increasingly difficult to execute some of the models to good precision at longer wavelengths. But based on this comment we went back and looked at why this would be the case and we found that even at 675 nm, for some of the solar geometries and high albedo, aerosol scattering can be 75% of the signal at the aerosol peak. We have added the statement "We have found no differences that are indicative of differences in stratospheric aerosol scattering. Differences at longer wavelengths (not shown) are comparable to differences at 675 nm, and at 675 nm aerosol scattering can make up 75% of the observed signal in the forward scatter high albedo case."