Response to Reviewer #1

We appreciate your very meaningful comments.
It gave us a deeper understanding of what we overlooked and didn't take into account, which enriched the manuscript.

Line 45-46 Replace "Before reaching ... passes through …" with "Upon reaching … interacts with …"

→ Revised. We modified the sentence as you suggested.

Line 91 This needs to be rewritten. Maybe the Stokes parameters (I, Q, and U) for various atmospheric conditions were calculated and the DoLPs are arranged in a LUT.

→ DOLPs are not directly included of LUTs as parameter. Instead, the sentence has been improved by replacing "comprised of LUT" with "included of LUT" in the original wording.

Line 126 The acronym SMA need to be expanded. Is it Scan Mechanism Assembly? Scan Mirror Angle? Also, sometimes it is used as "SMA Angle: and other times as "SMA Position" or "angle at which the SMA is located".

→ Revised, it denotes "Scan Mirror Assembly (SMA)". I wrote down the full word of the SMA acronym.

Line 128 Linear Polarization Sensitivity or Polarization Factor? The term LPS is introduced in Line 89 but is never used. The term PF is used often.

→ Revised, in order to avoid confusing, we have unified the representation with Polarization Factor (PF). LPS and PF are often used interchangeably, but to avoid confusion, we won't refer to LPS. Also, the sentence on Line 89 has been modified.

Line 296. Says that the polarization was only characterized for one North/South position at the center. Figure 1. Is the test setup used to get measurements over the in-orbit range of scan mirror viewing angles? Table 2 has 1 for SMA position. What about the East / West characterization? Was the assembly moved to vary the mirror scan angles?

→ No, the GEMS polarization test on the ground has been done for a very limited environment. This is why it is difficult for us to understand the nature of the variation in polarization for the north-south or east-west directions. Although not shown here, the change in PF with regards to the scan mirror angle in the East-West direction, which BATC provided as a model-based, was very small. However, the model results are not necessarily the actual values.

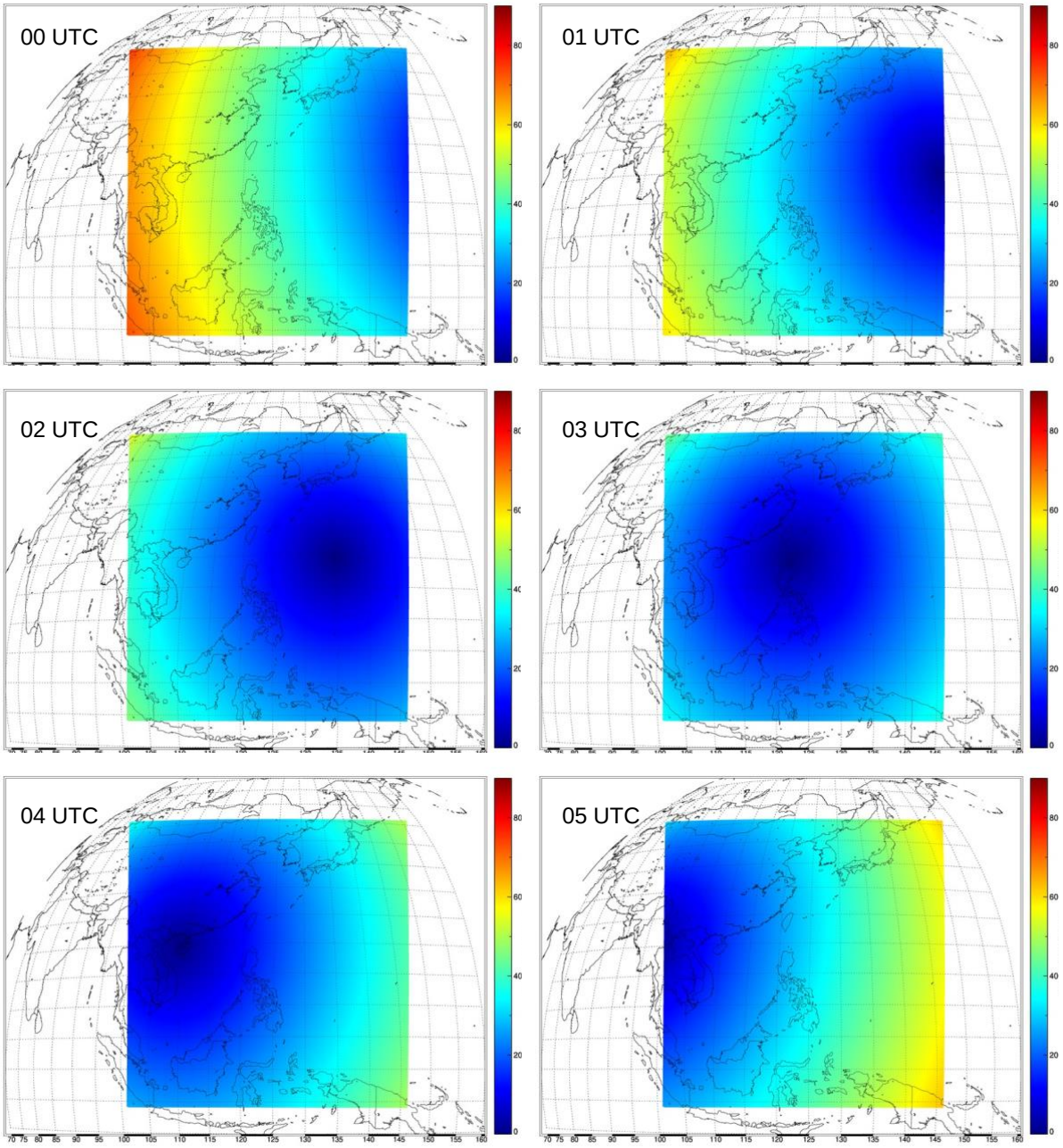
Line 238 "The polarization error caused by changes in total ozone is less than those caused by other changes." Figure 4. Could the authors comment on why Figure 4 does not have any (or maybe very small) dependence on TOZ? I would expect that the ozone would selectively shield the shorter channels with higher ozone absorption from the surface and clouds and thus produce wavelength-dependent changes similar in magnitude to the albedo and surface pressure changes as ozone amounts

increase. That is, alter the relative amounts of single scattered, multiple scattered and reflected radiances.

→ Fig. 4 shows the effect of each parameter on polarization error change with both the polarization state of the atmosphere and instrument considered. This is not to say that ozone does not affect polarization (the change in DOLP with and without consideration of ozone in radiative transfer models is large and significant compared to other trace gases). Since polarization is primarily affected by scattering, the change in polarization error with ozone accounted for was relatively small compared to other variables such as geometry. This suggests that we may be able to reduce the dimensionality of the LUT (e.g. using fixed total ozone amount) in the future to improve the effectiveness of the calculation.

Figure 4 and Figure 8. Figure 4 shows errors versus SZA and SVA of 1% or more. Figure 8 does not show corrections larger than 0.1%. (Are the units in Figure 4, 8, 11 and 12 all in % error in radiances?) Was the range of cases used to construct Figure 8 much less varied than the real cases in Figures 11 and 12? Particularly in SZAs?

→ Yes, the figures mean polarization error [%]. The synthetic data presented in Fig. 8 is for January 15, 2016 at 03 UT. The IOT period presented in Figs. 11, 12 is July 25, which has a large difference in the position of the sun (The figure below shows the change of SZA over a day, corresponding to the IOT period data shown in Fig. 11). From Fig. 4, it can be seen that when SZA and VZA are 30 degrees, the smaller the RAA, the larger the polarization error.



SZA distribution as presented in Fig. 11.