In this document, I will present the comments from Sriram Bhiravarasu in bold preceded by a right chevron

>As such.

My reply will be in plain text.

I would like to begin by thanking Sriram Bhiravarasu for his effort in reviewing the manuscript.

>As demonstrated in this well written paper, EISCAT 3D would provide excellent opportunities for lunar mapping at a wavelength that was never used before to understand the physical properties of deep lunar subsurface. Important aspects in ground-based radar mapping which are the ionospheric Doppler broadening and North-South ambiguity are well addressed and discussed in detail in this paper. As a planetary radar user, I am particularly interested to see the results of the planned lunar mapping campaigns described in the last section. I don't have any major concerns with the text and figures presented here, so I would strongly recommend this paper for publication. However, I have a few minor suggestions (below) which could be addressed by the authors before this manuscript gets published:

>1) Line 31: Stacy et al., 1997 is not a good reference to use when you describe about the radar studies of water ice for solar system objects. This study particularly describes the lunar polar observations using Arecibo radar. Campbell et al., 2016 (used in this paper) might be a good alternative here.

>2) Line 33: Spudis et al., 2013 didn't use Arecibo data in their analysis. The results of this paper is based exclusively on LRO Mini-RF data. So the phrase "in conjunction with Arecibo radar" may be removed.

>3) Line 38: "... that the planet was geologically active relatively recently..." : Add a reference here

>4) Line 43: "Compositional" might be a better word here instead of "chemical"

>5) Line 59-60: Rephrase the sentence as "Radar observations of Asteroids can also aid in determining their spin state through...." for the Busch et al., 2010 reference.

>6) Line 112: Replace "very many" with "sufficient"

I agree with points 1 through 6. The reviewers comments are well founded and agreeable. The recommended changes have been added to the manuscript.

>7) Lines 133- 135: It would help the reader if the beamwidth of EISCAT 3D can be mentioned here in case of lunar mapping. Does the EISCAT 3D beamwidth encompasses the entire lunar globe for a single "snapshot"? Also, is it possible to point the radar beam to the desired hemisphere (N/S) by slightly adjusting the radar beam as done in the case of Venus mapping from the Arecibo radar? For Arecibo Venus mapping, see Campbell, 2002 and Campbell et al., 2016.

The beamwidth of EISCAT 3D varies with elevation angle. At 90 degrees, the half-power beamwidth is approximately one degree (two moons). As the radar is steered towards 30 degrees, the beamwidth becomes elongated to approximately five degrees (ten moons) wide. This makes it impractical to attempt to illuminate only one hemisphere at a time. The difference in illuminating power from one hemisphere to the other will not be large enough to be able to ignore the ambiguity. The interferometric disambiguation method will be a more reliable tool for separating the northern and southern hemispheres.

>8) Line 195: If you employ circularly polarized Tx only, how can you generate the full scattering matrix as mentioned in the abstract and section 2? And when you employ linear pol for Tx, how would you compensate for the Faraday effect? A small note on this discussion may be included here.

A set of two linearly independent polarizations can be used to synthesize any polarization state. One way of estimating the two-way Faraday rotation is by using the sub-radar point. We can assume that this area near the sub-radar point is "flat" and aligned normal to the propagation direction, and will therefore act like a mirror. The signal we measure from the sub-radar point can then be assumed to be dominated by specular scattering, including the effects of two-way Faraday rotation. As such, the polarization of the signal from the sub-radar point will then be the polarization we expect from specular scattering from the entire lunar face. It follows that the polarization expected from subsurface scattering is the polarization which is linearly independent from the one dominating the sub-radar point.

>9) Line 245: Does the left panel of figure 5 indicate the radar look direction as perpendicular to the phase front or parallel? Because it was mentioned as parallel in line 214.

These waves are transverse waves, and so the wave vector is always perpendicular to the phase front. In line 214, I am discussing the TID wave vector, while in line 245 i am discussing the phase front. This phrasing can easily confuse readers, and one way to rectify it may be to add an arrow in figure 5 showing the wave vector, and adding that these are transverse waves. See figure 1 for a suggested change to figure 5 (only showing the left part). The cyan arrow will be described as the wave vector of the TID.

>10) Lines 271-273: Add a reference here for previous ionosphere studies at Tromso region.

The book Physics of the Upper Polar Atmosphere by Asgeir Brekke might be a suitable reference here. Many of the figures in the book are based on studies from the region around Tromsø.

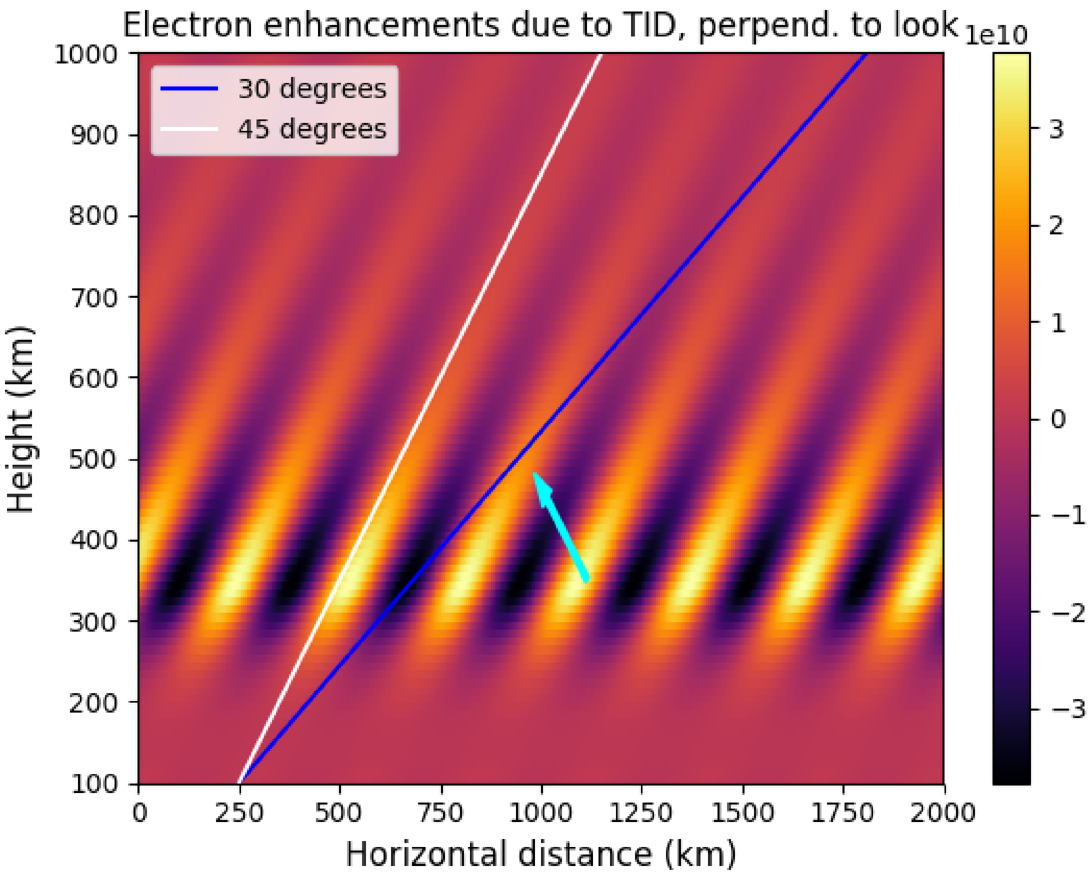

Figure 1: Updated version of figure 5 with wave vector