

## ***Interactive comment on “Planetary Radar Science Case for EISCAT 3D” by Torbjørn Tveito et al.***

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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

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

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