Candidate landing sites at the South Pole of the Moon for the LUVMI-X rover

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Abstract. Coordinated by Space Applications Services, LUVMI-X[1] is a technology development project funded by the EU program Horizon 2020. The LUVMI-X system main goal in its reference mission is to sample and analyze volatiles in the lunar polar regolith. Lunar volatiles, such as water, are most likely accumulated in cold traps of the Moon, especially in Permanently Shadowed Regions (PSR) at the poles. The present study aims at identifying suitable landing sites, and later on, possible traverses for LUVMI-X meeting the scientific objectives. To this end, said scientific objectives and technical specifications of the rover[1] and known landers were translated into a list of criteria and computed in a Geographic Information System (GIS)[2]. LROC, LOLA, Diviner, and LP remote sensing data (See references in [2]) were used to define compliant areas, which respect the following constrains: distance to PSR[3] < 5 km, sufficiently large landing areas with slopes < 7°, high Sun and Earth visibilities[3], depth of water ice[4] < 20 cm, and H signatures > 100 ppm.

Results (Figure 1) show six identified Regions of Interest (ROI) for the LUVMI-X reference mission along with ROI defined in the literature[2,5]. These ROI were further ranked based on their size, number of non-compliant pixels and zonal statistics. ROI 4 seems to present more evidence of surface water ice (based on LEND and M3[6]) along with highest H signatures (LEND and LP) and lowest temperatures (LRO). It is similar to the top site identified in Flahaut et al., (2020)[2]. Future work includes possible re-iterations of this approach with varying/relaxed parameters (e.g., slope of 10°) and high-resolution analyses of selected ROI in order to define possible traverses for the rover.

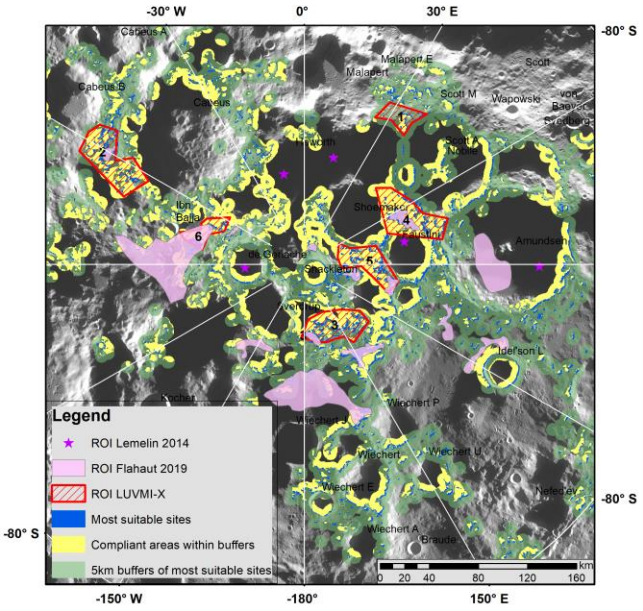

Figure 1. Map of ROI for the LUVMI-X rover (red, this study). ROI from Lemelin et al (2014, stars) and Flahaut et al (2020, pink) are shown for comparison.

[1] J. Gancet et al, *LUVMI & LUVMI-X Concept and Extension*, (2019).
[2] J. Flahaut et al, *Planetary and Space Science* 104750, (2020).
[3] E. Mazarico et al, *Icarus* 211, (2011).
[4] D. Paige et al, *Science* 330, (2010).
[5] M. Lemelin et al, *Planetary and Space Science* 101, (2014).
[6] S. Li et al, *Proc. Natl. Acad. Sci.* 115 (36), (2018).