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SCIENTIFIC ANALYSIS AND ACCESSIBILITY OF POTENTIAL LANDING SITES FOR ESA'S PROSPECT INSTRUMENT

Abstract

Identifying safe, accessible and scientifically interesting landing sites in the lunar south polar region is of importance for future missions. Renewed interest in the lunar south polar region due to the potential presence of water ice and volatiles has instigated a number of missions to target the lunar south pole, aligning with the National Research Council (NRC) 2007 objectives. Here, we focus on analysing the potential landing sites for the ESA instrument PROSPECT, which will explore the south polar region of the Moon and will sample the lunar surface, using the PROSPECT drill. These samples will be analysed in the onboard laboratory (ProSPA). To ensure the samples collected yield the greatest scientific return, potential landing sites are being investigated using remote sensing methods. We investigated the safety of the south polar region (81.5-90 S) by creating slope maps using the LOLA (30m/px) digital elevation model and classified slopes into safe areas (slopes ¡10) and unsafe areas (slopes ¿10). We created slope maps classified in 2 intervals from 0-14 and greater than 14, to further investigate which areas have the lowest slopes and therefore potentially the safest landing sites. Additionally, we mapped areas that may reach temperatures low enough to sustain water ice if present, using seasonal data from the Diviner Lunar Radiometer Experiment at (240 m/px). Additionally, we used the Paige et al 2010 and King et al 2020, Oxford thermal model to further analyse the thermal conditions in the south polar region. We found across the south polar region, there are areas that reach temperatures low enough for water ice to be stable if present and some of these areas correlate with slopes less than 10 and therefore may be accessible. This initial investigation into the potential landing sites has identified areas which could be safe for landing PROSPECT and where there may be temperatures low enough for water ice to be stable. Future work will use multiple datasets to explore the scientific potential of the landing sites including investigating the surface roughness, identifying craters and boulders, which could present a hazard to the lander, using thermal maps to measure the thermal stability, and exploring the illumination conditions and Earth visibility at each of the landing sites.