

Water ice detection in permanently shadowed regions of Lunar North Pole

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The permanent shadowed regions are those parts which never get sunlight. The reason behind their darkness is because of the axis of the moon is nearly perpendicular to the direction of the sunlight. It may allow cold trapping of volatiles in the lunar polar regions. As the sunlight never reaches in these regions, the temperature of the shaded regions remains cold. This temperature of the moon is cold enough to freeze volatiles and may allow cold trapping of water ice molecules in polar regions. Various studies have been carried out for the water ice detection in these permanent shadowed regions of the lunar poles. Chandrayan-1 is one such mission that was launched for lunar surface mapping and detection of water deposits near the lunar poles. In this project Chandrayan-1 M3 data and Mini-SAR data have been used for water ice detection on the Erlanger crater of the lunar north pole. The Moon Mineralogy Mapper is a hyperspectral image used to analyze the absorption feature of water ice spectra of permanently shadowed region. The calculation of true reflectance for shaded regions have been done for absorption feature analysis of permanently shadowed regions. For Spectral Angle Mapper classification, the image has undergone various image processing techniques such as MNF, PPI, n-D visualization for end member selection and their validation from the JHU spectral library. Further Spectral Angle Mapper technique was used for mapping the water ice deposits. The target detection wizard has been used to compare the results obtained from SAM classification. The target detection wizard is the inbuilt tool in ENVI that finds the target pixel by using reference spectra. The hybrid polarimetric Mini-SAR data were used to measure Stokes parameters. With the help of Stokes parameters child parameters i.e. Degree of polarization (m), phase difference (δ), ellipticity angle (χ), polarization angle (α) was calculated. These child parameters have been used for three different decomposition technique m - δ , m - χ and m - α decomposition. The scattering mechanisms were characterized from these decomposition models. At last comparison of results obtained from decomposition models has been done along with CPR results.

Index Terms - CPR, hybrid polarimetry, m - α , m - δ , m - χ , water ice, permanently shadowed region, scattering.

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