Spectral analysis of lunar swirls at Descartes, Airy and Van De Graff crater: A case study to understand space weathering

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Lunar swirls are high albedo regions with curvilinear shape, found to be associated with magnetic anomalies on the Moon surface that occur in both mare and highland terrains. A detailed spectral analysis of swirls may help us to understand space weathering modification processes and might help to correlate it with a specific mode of swirl formation [1]–[4]. In this study, spectral trends are examined for swirls located at Descartes crater in nearside highlands (11°42′S, 15°42′E), Airy crater in the southern highlands (18°6′S, 5°42′E) and Van De Graff crater on the northeast edge of Mare Ingenii (27°24′S, 172°12′E). We rely on the reflectance data obtained from the Moon Mineralogy Mapper (M^3) on-board ISRO's Chandrayaan-1 mission for spectral analysis of swirls [5]. Reflectance spectra from on and off-swirl locations and nearby fresh craters are systematically extracted to compare the space weathering trends in and outside of magnetic anomaly regions. The selection of different regions of interest from individual swirls is based on the derived, minimum noise fraction (MNF) (Figure 1) and integrated band depth (IBD) mosaics from M^3 reflectance data. In this work, detailed spectral analysis of all the three swirls is presented along with comparison of their mineralogy and space weathering trends on and off swirl locations. Further, results obtained from spectral analysis in combination with maturity maps derived from Clementine mission and magnetic anomaly maps derived from Kaguya mission are discussed with expected outcomes by integrating Chandrayaan-2 mission observations.

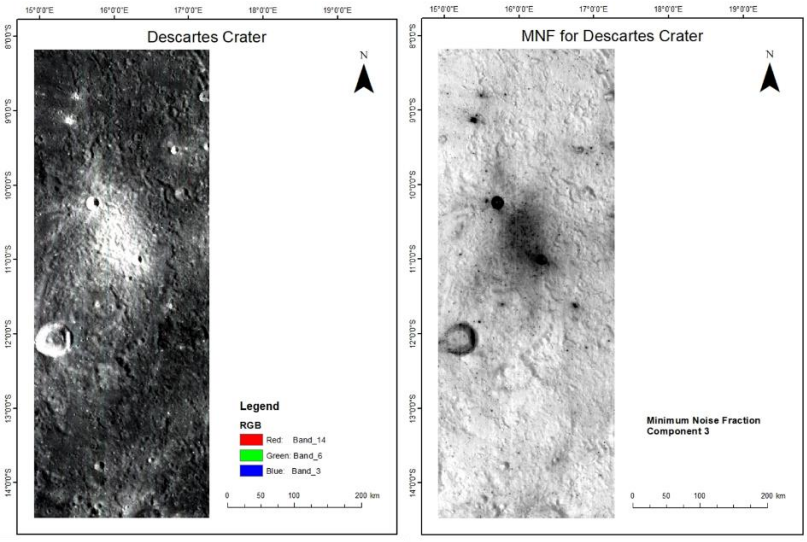

Figure 1. Swirls with high albedo at Descartes Crater and MNF Component 3 for Descartes showing the different spectral behavior on and off-swirls region

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