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UNRAVELLING LUNAR MYSTERIES THROUGH WAVELET ANALYSIS OF APOLLO SEISMIC DATA

Abstract

The moon has been the most fascinating celestial body, holding invaluable secrets about the solar system's history. Seismic activity on celestial bodies provides a unique avenue for understanding their interior structures and dynamic processes. The seismic data collected during various missions, such as Apollo, provides a unique opportunity for in-depth exploration. This research focuses on the wavelet analysis of these seismic waves recorded by the lunar seismometers. Wavelet analysis is a robust tool for scrutinizing time-frequency representations of signals, uniquely tailored for deciphering seismic data characterized by diverse frequencies and amplitudes. By applying wavelet transforms to the recorded lunar seismic signals in a planned way, this study aims to find unique features that point to subsurface geological structures. This investigation draws from the rich dataset acquired through the Apollo seismic network, encompassing seismic records from pivotal missions. The analysis facilitates the identification of distinct seismic events, temporal variations, and patterns within the lunar subsurface. Through decomposition and reconstruction, valuable insights are extracted into the nature of seismic events. This process involves scaling the wavelet function to cover various frequencies, enabling a comprehensive analysis of the seismic data's spectral content. The results obtained contribute to the localization of seismic events, noise reduction, and the delineation of geological structures beneath the lunar surface. Additionally, the study explores the potential applications of wavelet analysis for enhancing signal-to-noise ratios, thereby improving the clarity of seismic data interpretation. This research not only extends the boundaries of our knowledge regarding the Moon's geophysical characteristics but also serves as a beacon within the realm of planetary seismology. These findings will contribute to a refined understanding of the Moon's geological evolution, inform future space exploration missions, and deepen our knowledge of planetary seismology. The insights gained from this study may serve as a template for similar investigations on other celestial bodies and further our understanding of the dynamic processes shaping planetary interiors.