

Spectral element simulations for 1975 M_w -4.1 shallow moonquake

Yellapragada Meenakshi^{1,*}, S. T. G. Raghukanth¹, P. Senthil Kumar² and Daniel Peter³

¹Indian Institute of Technology Madras, Chennai 500 036, India

²CSIR-National Geophysical Research Institute, Hyderabad 500 007, India

³King Abdullah University of Science and Technology, Thuwal 23955, Saudi Arabia

In the present study, synthetic seismograms on the Moon are generated for a shallow moonquake event that occurred on 3 January 1975, of M_w -4.1 using the spectral element method. The spectral element seismograms for this event are also compared against the MI-NEOS normal mode solutions. Moreover, the influence of the low-velocity layer, surface topography, crustal thickness, and medium heterogeneity on the synthetic lunar seismograms has been studied. In addition, the comparisons between the recorded and synthetic seismograms for M_w -4.1 event showed that the implemented model was able to reproduce the lunar characteristics that are observed in the lunar seismic data.

Keywords: Ground motion, lunar seismograms, moonquakes, spectral element simulations, scattering.

unusual characteristics observed in the APSE data is that seismic energy propagates through a strongly scattering, low-attenuating medium^{5,6}.

Blanchette-Guertin *et al.*⁷ investigated the scattering properties of the APSE data. They proposed that the Megaregolith layer, which is composed of distributed ejecta, fine dust, and boulders, is considered a major contribution to the scattering. In addition, Blanchette-Guertin *et al.*⁸ have reported that the surface topography and lateral heterogeneity in the medium also contribute to the scattering on the Moon. Jiang *et al.*⁹ numerically modelled the horizontal shear waves (SH) in a 2D whole Moon model using the Pseudo Spectral Method (PSM) hybrid technique in a parallel cluster (PC). Numerical models by Wang *et al.*¹⁰ and Wang *et al.*¹¹ did not capture the slow coda decay over a long duration, as observed in the recorded seismic data. Wang *et al.*¹¹ extended the model, which was initially proposed by Wang *et al.*¹⁰, by generating random heterogeneity in the upper crust of the Moon using Von-Karman spectral density function (PSDF). Recently, Onodera