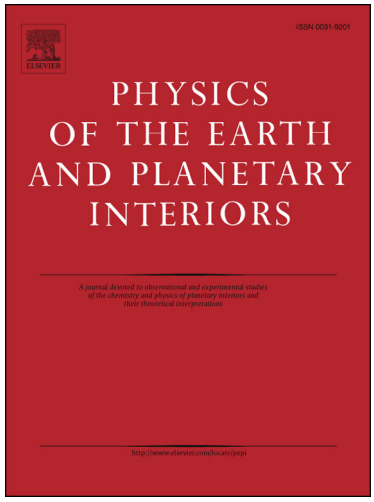

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PII: S0031-9201(17)30336-9
DOI: https://doi.org/10.1016/j.pepi.2018.09.006
Reference: PEPI 6195

To appear in: *Physics of the Earth and Planetary Interiors*

Received Date: 15 December 2017
Revised Date: 23 September 2018
Accepted Date: 23 September 2018

Please cite this article as: Kumar, S., Singh, P., Singh, P., Shekhar, C., Estimation of scattering and intrinsic attenuation based on multiple lapse time window analysis in Sikkim Himalayan region, India, *Physics of the Earth and Planetary Interiors* (2018), doi: https://doi.org/10.1016/j.pepi.2018.09.006

Estimation of scattering and intrinsic attenuation based on multiple lapse time window analysis in Sikkim Himalayan region, India

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Abstract: Attenuation of seismic wave energy was estimated in and around the source region of the Sikkim earthquake of 18 September, 2011 using aftershocks. The main shock had a moment magnitude 6.9 and after this main shock, approximately 283 aftershocks with a magnitude distribution ranging from 1.02 to 5.0 were recorded by 8 temporary broad band seismometers. In the present study, the relative contributions of scattering attenuation and intrinsic absorption are estimated by multiple lapse time window analysis under the hypothesis of isotropic scattering and a uniform distribution of scatterers in the crustal part of the study area. The coda wave attenuation is also estimated using single backscattering method. All of the attenuation parameters are estimated as a function of frequency in the range 1 to 16 Hz. The results show that scattering attenuation is greater than intrinsic absorption for all of the frequencies. The relative contribution of scattering attenuation decreases with increasing frequency. Around the 1 to 4 Hz frequency band, scattering attenuation primarily contributes to seismic wave attenuation in the Sikkim region. The estimated values of seismic albedo ranges from 0.65 to 0.79; as seismic albedo is higher than 0.5 for all frequencies, it is concluded that the medium in the Sikkim Himalayas is highly heterogeneous and tectonically active. Our knowledge of the attenuation mechanism of the Sikkim region is enhanced by the application of the multiple lapse time window analysis method, and results can be useful for the hazard assessment.

Keywords: Sikkim earthquake aftershocks; Scattering and intrinsic attenuation coefficients; Multiple lapse time window analysis; Python library functions; Hazard assessment.

1. Introduction

Attenuation of seismic waves is referred to as the decrease of amplitude of seismic energy from its source to receiver. Normally, the amplitude attenuation of a seismic wave through a