Upper mantle anisotropy beneath Sri Lanka region using shear-wave splitting analysis

*Shivam Chandra[1]

1. Undergraduate student member

Anisotropy in the Earth’ s upper mantle is a signature of past and present deformation. Seismic anisotropy beneath a seismic station can be inferred by analyzing core-refracted (SK(K)S, PK(K)S) seismic phases. In this study, upper mantle anisotropy is investigated using shear wave splitting of SK(K)S phases at 3 stations in Sri Lanka. Sri Lanka consist of four main lithological units, viz., the Highland Complex (HC), the Wanni Complex (WC), the Vijayan complex (VC) and the Kadugannawa complex (KC). Shear wave splitting measurements were done for ~30 high-quality waveforms recorded in the region, using rotational correlation (RC), minimum energy (SC) and eigenvalue techniques. The result of the shear-wave splitting measurement shows the presence of two anisotropic layers in the upper mantle, viz., the upper layer with fast polarization direction (Φ): NW-SE and delay time (δt): 0.4-0.5 s, and the lower layer with Φ: NE-SW and δt: 0.6-0.8 s. Our study suggests that fast axis direction of lower layer with an average delay time of 0.6 s depicts a ~67 km thick anisotropic layer with 4% anisotropy beneath Sri Lanka region. Comparison of Absolute Plate Motion (APM) direction with fast directions infer that the Simple Asthenospheric Flow (SAF) model prevails in this region. On the other hand, Comparison of Maximum Horizontal stress (S_{hmax}) and the Global Positioning System (GPS) with the fast direction infer that there is partial contribution from lithospheric mantle. So, the anisotropy in Sri Lanka is mainly governed by asthenospheric flow, and partially due to lithospheric mantle.

Keywords: Shear wave splitting, Fast direction, Asthenospheric flow, Anisotropy