

Regional Magnitude Scale for Earthquakes along Spreading Ridges and Transform Faults in Arctic Zone

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We analyzed seismic records from 132 earthquakes (M_w 4.6 – 6.5) that occurred along the spreading ridges and transform faults in Arctic zone during 2000–2015 to derive a useful regional magnitude scale using high-frequency Pn and Sn phases from those shocks. The source regions include North of Svalbard, Svalbard, Greenland Sea, Norwegian Sea and Jan Mayen Island region, and records are from 19 seismographic stations in eastern Greenland, Svalbard and northwestern Scandinavia of which 12 are operated by the Norwegian National Seismic Network. The root-mean-squared (RMS) amplitude measurements of 980 Pn and 560 Sn phases are inverted for distance–amplitude curves, station magnitude corrections and source adjustments. We employed a power-law distance dependent RMS amplitude decay and moderate frequency dependence is included. The amplitude measurements show a great scatter probably due to complex wave propagation paths consist of oceanic and continental crust and uppermost mantle segments. The amplitude-distance curve, A_0 , is written as: $\log A_0 = 0.434 c f - (a f + b) \log (D_0 / D)$, where f = frequency, D =epicentral distance in km, and D_0 = reference distance of 200 km. For Pn phase in the distance range 200 – 2,000 km, amplitude distance curve for RMS amplitude in 1-5 Hz band can be modeled with constants, $c = 0.5$, $a = 0.1$, and $b = 3.0$.

Preliminary result suggests that regional Pn body-wave magnitude, $m_b(Pn)$, may require adjustment for source regions. Observed amplitudes from the events along the Jan Mayen transform fault and Nansen fracture zone indicate that Pn phase from events in these regions are amplified relative to events in other regions, whereas events from Mohns Ridge and southern half of Knipovich Ridge show below average amplitudes. Hence, we define the source specific magnitude corrections (SSMC) for NNSN and Greenland stations in the region. Source regions are formed based on the Flinn-Engdahl seismic regions. SSMC values range from +0.31 m.u. for earthquakes in Greenland Sea region, and –0.15 m.u. at Jan Mayen Island regions. By using SSMC for those events, we obtained regional Pn magnitudes with a scatter of ± 0.15 m.u. when compared with the moment magnitude of these 132 events on the global Centroid Moment Tensor (gCMT) catalog.