Seismicity and S wave attenuation field in the region of Hindu Kush: processes of dehydration and migration of deep-seated fluids

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The space–time variations in the attenuation of shear waves in the Hindu Kush area are investigated. We examined the ratios of maximum amplitudes in S and P waves (the lg(AS/AP) parameter, which we denote as S/P for a brewity), obtained from records of deep-focus earthquakes within the depth range of 151-270 km. The events were recorded at the AAK station in 1993–2016 at epicentral distances of 700–800 km. The dependence of the amplitude on the radiation pattern for S and P waves was taken into account by averaging the S/P parameter over different time spans. Substantial space variations in S wave attenuation were found in different depth ranges in the zone of deep-focus seismicity in 1993-2015. At the same time considerable temporal variations of S/P parameter were found only for the depth range of 211-270 km. We show that the lowest attenuation in 2013–2015 prior to the great earthquake of October 26, 2015 (Mw = 7.5, h = 231 km) was observed for hypocenters above the rupture zone, at depths of 151–210 km, while the highest attenuation occurred at depths of 231–270 km. Following the earthquake, the attenuation rapidly decreased at depths of 231–270 km and increased in the depth range of 191–230 km. These effects are hypothesized to have been caused by dehydration of mantle rocks, as well as by migration of deep-seated fluids. Such effects are well-known in subduction zones, but they occur there at considerably smaller depths (usually – up to 70 km). These processes lead finally to diminishing potential energy of our planet.