



Was the 2015 Hindu-Kush intermediate-depth earthquake a repeat of the previous $M \sim 7$ earthquakes ?

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On Oct. 26, 2015, an $M_w 7.5$ earthquake occurred at intermediate depth (230 km) beneath Hindu-Kush. This event took place in the source region of the six previous $M \sim 7$ earthquakes which recurred about every nine years: 1956 (mb 6.5), 1965 (mb 7.5), 1974 (mb 7.1), 1983 (M_w 7.4), 1993 (M_w 7.0), and 2002 (M_w 7.3). On the basis of these past events, Harada and Ishibashi (2012, EGU) proposed that next event might be imminent in this region. However, recurrence interval between the 2002 and 2015 events is longer than those of events before 2002.

In this study, in order to examine whether the 2015 earthquake re-ruptured the source region of the repeating $M \sim 7$ earthquakes, we performed the same analysis of Harada and Ishibashi (2012) for the previous $M \sim 7$ intermediate-depth earthquakes; namely, simultaneous relocation of the 1956 main shock and the earthquakes from 1964 to 2015, and mechanism determination / slip distribution estimation of the six events by tele-seismic body-wave analysis.

As a result, the 2015 main shock is located close to the 1956, 1965, 1974, and 1983 main shocks and the 1993 foreshock (M_w 6.3) which occurred about 30 minutes before the main shock. The 2015 mechanism solution is very similar to those of the former six events (ESE-WNW striking and southward-dipping high-angle reverse faulting with a down-dip tension). However, the 2015 slip is distributed at the un-ruptured area by the five earthquakes from 1965 to 2002. The 1965, 1974, 1983, and 1993 events rupture the same region repeatedly. The main slips of the 1993, 2002, and 2015 events do not overlap each other; this was confirmed by re-analysis of the waveforms recorded at the same stations. As for the 1965, 1974, and 1983 earthquakes, overlap of the slip distributions may be caused by the low quality of the waveform data. From slip distributions, the $M \sim 7$ earthquakes, at least for the 1993, 2002, and 2015 events, may not be considered as characteristic earthquakes. However, it is notable that main shocks, or initial rupture points, of some events are close to each other and rupture areas of the six earthquakes were concentrated within a narrow area, as well as their almost regular recurrence interval.

Relocation was made by Hurokawa (1995)'s Modified Joint Hypocenter Determination (MJHD) method. For the 1956 main shock, reported data by ISS (International seismological Summary) were used. For the other earthquakes between 1964 and 2015, data in the ISC (International Seismological Centre) Bulletin were used. The Kikuchi and Kanamori (2003)'s teleseismic body-wave inversion analysis programs were used in the focal mechanism determination and slip estimation. Waveform data for the 1965, 1974, and 1983 earthquake are from the WWSSN's micro-films and those for the 1993, 2002, and 2015 events are from the IRIS's Data Management Center.