Slow slip Events Detected in the Pypocentral Area Days Before the 2001 M_w 7.8 Kokoxili Earthquake, Western China

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On November 14, 2001, the M_w 7.8 Kokoxili earthquake occurred at the western most segment of the East Kunlun Fault. The rupture was initiated at 36.0°N, 90.2°E, and propagated for about 450-km eastward. About 4 days before the quake, tremor-like seismic signals were recorded at about a dozen seismic stations located in northwest China, about 200-1000 km from the epicenter. These tremor-like events lasted for about two days from November 10 to 12 and peaked on November 11. The predominant frequency ranges from 0.1 to 0.2 Hz and is about one order of magnitude lower than that of tremors occurred in southwest Japan (Obara, 2002) and northern Cascadia (Rogers et al., 2003) subduction zones. To locate the sources of these tremor events, we first filtered the data with a band pass of 0.1-0.2 Hz. We then calculated squares of the data time series and obtained their smoothed envelops with 20s moving average. We next searched for potential “events” in the envelop data by taking cross-correlations of station pairs for 100s data string with a sliding time lag, retaining the ones whose correlations are greater than 0.80. Assuming the “events” are direct S-waves produced by slow slip earthquakes we attempted to locate the their hypocenters using the S-wave onsets and a relocation code. Stations with large arrival time postfit residuals were discarded until the solution was converged. About two dozens of slow slip events have been detected in this way, whose hypocenters are found to scatter in a region of 88.0-91.0°E, 34.5-37.5°N, indicating that the locations of the slow slip events are close to the epicenter of the Kokoxili earthquake. Moreover, the depths of these events fall within the range of 10 – 40 km, suggesting that slow slip events probably occurred in the brittle-ductile transition zone on or near the East Kunlun fault. The failure at the transition zone might have increased the Coulomb stress at the hypocenter and finally triggered the M_w 7.8 earthquake.