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Extraordinary distance limits of landslides triggered by the 2011 Virginia earthquake, USA

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The 23 August 2011 Mineral, Virginia earthquake (Mw 5.8) was the largest to strike the eastern U.S. since 1897 and was felt over an extraordinarily large area. Though no large landslides occurred, the shaking did trigger many rock and soil falls from steep river banks and natural cliffs in the epicentral area and from steep road cuts along and northwest of the Blue Ridge Parkway. We mapped the occurrence of rock falls to determine distance limits that could be compared with those from other documented earthquakes. Studies of previous earthquakes indicated a maximum epicentral distance limit for landsliding of about 60 km for a M-5.8 earthquake; the maximum distance limit for the 2011 earthquake was 245 km, the largest exceedance of the historical limit ever recorded. Likewise, the previous maximum area affected by landslides for this magnitude was 1,500 km^2; the area affected by landslides in the 2011 earthquake was 33,400 km^2. These observations provide physical evidence that attenuation of strong shaking for eastern U.S. earthquakes is significantly lower than for plate-boundary earthquakes. Also, distance limits parallel to the regional structural trend are greater than those that transect the structure, which suggests anisotropic attenuation related to the regional geologic structure. Peak ground acceleration at the landslide distance limits is estimated to have been about 0.02-0.04 g.