Regional Monitoring of the Aftershock Sequence of the 2002 M 7.9 Denali Fault, Alaska, Earthquake

Natalia A. Ruppert, Roger A. Hansen, J.C. Stachnik, Steve Estes • University of Alaska, Fairbanks

The 2002 Denali fault, Alaska, earthquake sequence provides an exciting opportunity to study major continental strike-slip events. The sequence began with the magnitude Mw 6.7 Nenana Mountain event on October 23, 2002. The source mechanisms from teleseismic and regional data indicate right-lateral strike-slip faulting on a vertical fault plane. Ten days later, on November 3, 2002, the magnitude Mw 7.9 Denali Fault earthquake ruptured for nearly 340 km along the three different faults. It initiated as a thrust event on the previously unrecognized Susitna Glacier Thrust fault, a splay fault located south of the main DF strand. The rupture then transferred onto the main DF strand and continued as a predominately right-lateral strike-slip event for ~220 km until it reached the Totschunda fault (TF) near 143°W longitude. At that point, it right-stepped onto the more south-easterly trending TF strand and stopped after rupturing nearly 70 km. A team of geologists surveyed the total length of the ruptured faults and reported maximum vertical and horizontal offsets of 2.8 m and 8.8 m, respectively, west of the DF and TF junction.

Following the Mw 6.7 event, the Alaska Earthquake Information Center (AEIC) installed a network of seven instruments west and south of its aftershock zone. This initial network consisted of three strong motion and four broadband stations. From this portable network two strong motion and three broadband instruments recorded the Mw 7.9 mainshock. The nearest site was 34 km from its epicenter. Within a few days of the mainshock an additional nineteen temporary sites were installed for monitoring the central and eastern segments of the rupture zone. The temporary installations greatly improved regional station coverage around the DF and provided valuable data. The temporary network consisted of a mixture of strong motion and broadband instruments. The sites were serviced every three to four weeks, when the data were retrieved from the instruments and brought back to the AEIC to be merged with the permanent network data. Data recovery continued throughout the difficult Alaska winter leading to a recovery rate of less than 75%. The temporary sites were dismantled in June, 2003. The AEIC located ~30,000 aftershocks through the end of 2004. The aftershock sequence provides valuable information on the characteristics of the rupture zone.

USGS contract #01HQAG0138 and NSF grant EAR-0328043