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Interseismic strain across the Altyn Tagh and Haiyuan faults at the northern edge of the tibetan plateau, measured by space geodesy.

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The tectonics of the northern tibetan plateau is characterized by large strike-slip faults and associated thrusts, resulting from the collision between India and Asia. During the past 15 years, the ERS and Envisat satellites have been acquiring SAR data over this region, and GPS data have been collected. These data sets help quantify the present-day deformation across the faults. We characterize the interseismic deformation along selected sections of two major strike-slip faults at the northern edge of the tibetan plateau : the Altyn Tagh and the Haiyuan faults. The selected fault sections have not produced large earthquakes since several hundred years.

We processed SAR data covering two tracks across the central and eastern sections of the Altyn Tagh, as well as two adjacent tracks across the Tianzhu seismic gap on the Haiyuan fault, located between two areas that have been the loci of two M$\sim$8 earthquakes in 1920 (strike-slip event) and 1927 (thrust event). We use image pairs covering time intervals of up to 6 years to construct line of sight surface velocity maps. The phase coherence is good over most of the imaged areas. Large tropospheric phase delays are observed despite dry conditions and high elevations, due to important topographic variations. We mitigate such effects using interferograms stacking and empirical corrections based on the local correlation between phase and elevation.

InSAR data show a concentration of interseismic deformation within 20 km from the Altyn Tagh fault. The left-lateral rate we derive decreases eastwards, from 16 ± 5 mm/yr near longitude E90, to 11 ± 2 mm/yr near longitude E95. This decrease in slip rate is in agreement with the expected fault kinematics, as slip is gradually transfered to thrust and fold systems in the Qaidam basin and the Qilian Shan. In contrast, GPS data appear to show the same rate of $\sim$ 9 mm/yr at both longitudes. Along the Haiyuan fault, the fault-parallel velocity field shows a sharp concentration of deformation within a few kilometers from the fault, consistent with left-lateral slip at a rate of 8 ± 3 mm/yr. The steep velocity gradient at the fault indicates that the fault is currently creeping at shallow depth (below $\sim$ 2 km), well above the base of the seismogenic zone ($\sim$ 15 km). In 1994,1996,1999, and 2005, we measured a GPS profile across the fault, at the same longitude as the InSAR strips. The GPS data indicate a similar estimate of the slip-rate of the fault. They also seem to confirm the existence of shallow creep, which may be related to dynamical processes associated with the 1920 and 1927 earthquakes.