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Interseismic deformation along the Altyn Tagh Fault, Tibet: Implications for shallow creep

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The 1600 km-long Altyn Tagh Fault (ATF) is a major intra-continental strike-slip fault in the Northern Tibetan Plateau, the slip rate of which has significant implications for our understanding of the tectonic processes of the Tibetan Plateau region. The operational nature and radar characteristics of the Sentinel-1 Synthetic Aperture Radar (SAR) mission offers the potential for using Interferometric SAR (InSAR) to accurately constrain deformation along the entire ATF, which has been difficult to achieve with previous SAR sensors.

In this study, we derive the interseismic velocity field over the central portion of the ATF at 86.8˚E using Sentinel-1 interferograms spanning the period between late 2014 and 2016. As the ATF is located at the border between the Tarim Basin and the Tibetan Plateau, the tectonic deformation is correlated with the topography, making it difficult to separate tectonic and tropospheric signals in the interferograms. To improve our retrieval of the tectonic signal, we have developed a new spatially-varying scaling method for InSAR tropospheric corrections, based on the high resolution European Centre for Medium-Range Weather Forecasts (HRES-ECMWF) products.

We use the HRES-ECMWF data to define function used in the empirical approach and incorporate a spatially-varying scaling factor to correct the magnitude of the original weather model estimates. Based on the tropospheric corrected interferograms, we derive the interseismic deformation signals of which the slip rate and locking depth are 9 $\pm$ 2 mm/yr and 14 $\pm$ 4 km respectively, which are consistent with the previous modelling of surrounding camping GPS measurements. Velocity discontinuities in our results imply that possible shallow creep reaches the surface along a $\sim$40 km section of the central ATF, has not been detected by the previous geodetic measurements, moving at an average fault-parallel rate of 7 mm/yr.