Project report:

Fold-and thrust belts (FTBs) form in response to tectonic convergence across plate margins in geological time scale and are areas of active crustal deformation associated with devastating natural hazards like earthquakes. Therefore geodetic measurements from these regions are essential for an in-depth understanding of the deformation kinematics at the crustal scale in these regions. The Zagros mountain belt of Iran (geographically located in south-west Asia), formed by the collision of the Arabian and the Eurasian tectonic plates during the Late Cretaceous time (as part of the Alpine-Himalayan orogeny) is one of the youngest and most tectono-seismically active regions in the world. Some distinct features of the deformation front of the Zagros FTB includes its distinct curvature in the Fars arc region which has reportedly been formed as a result of gravitational spreading and vertical rotations alongside lateral constraints on its eastern and western margins. Some of my recent studies (*Roy et al., 2020, 2024, JSG)* have shown that such similar spatial variations in deformation front curvature can also be caused by spatially varying coupling strength of the basal decollement underlying the fold-and-thrust belts and that crustal scale transverse faults may potentially localise at the margins of transition in coupling strength. These experimental insights have been further validated by analysing the Zagros mountain belt with the present day observational tools like the GNSS and InSAR which are instrumental in developing an integrated and more robust model for the complex deformation metrics involved in the Zagros. Analyses of these deformation kinematics provide information on the rheological behaviour of the earth's crust in these deformed areas, which help us, in estimating the inter-seismic activity (from the time-series of displacement) within the extent of the deformed region in Zagros.

Here at ERI, I therefore, focussed on analysing each reference frame (a total of 72 frame IDs) for the entire length of the Zagros fold-and-thrust belt with stacks of unwrapped interferograms (both ascending and descending) using the open source Python based tool LiCSBAS. Analysing the frame IDs resulted in deriving the velocity, cumulative displacement, noise indices and the time series of displacement for each of the geographic coordinates within the reference frame ID. I further derived different topographic profiles within the frame IDs to compare with the known deformation structures of the Zagros which will further help us in estimating the regions of seismic activity and inter-seismic breaks in between. After this I am now focussed on merging the frame IDs by eradicating the areas of geographic overlap for calculating a detailed profile and time series analysis of the region to potentially locate areas of seismic activity and estimate how the rheology of the region is affecting the stages of inter-seismic activity. This is a collaborative work in progress and the insights from our models based on the Zagros belt will potentially shed more light on the temporal inter-seismic activity in the Zagros belt. Once synthesized, these results will also be extrapolated to other similar tectonic settings with strikingly common deformation structures to help in gaining considerable insights on the rheology of those regions as well.