COMPLEX SYSTEMS, COMPUTING, INFRASTRUCTURE & SENSORS FRONTIERS

Xie Hu

Ph.D. – Southern Methodist University
Assistant Professor, Civil and Environmental Engineering

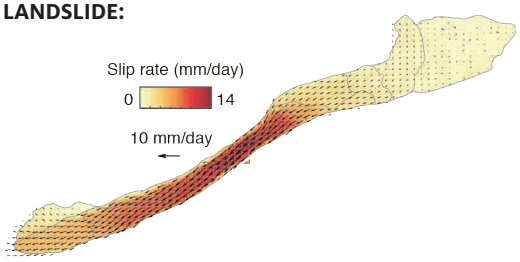
Dr. Hu joined UH as an Assistant Professor in Geosensing in Civil and Environmental Engineering. Her research focuses on using geodetic and remote sensing data, e.g., SAR and GPS, to characterize ground deformation associated with geohazards and surface processes in various landscapes and geodynamic settings (e.g., landslides, aquifers, delta, dams, mines, and earthquakes). Dr. Hu has also engaged in investigating their natural or anthropogenic triggers and mechanisms using statistical, analytical, and numerical models. Her interdisciplinary research spans the fields of geomatics, geophysics, geotechnical engineering, hydrology, geology, and tectonics.

GEOHAZARD AND SURFACE PROCESS REMOTE SENSING LAB

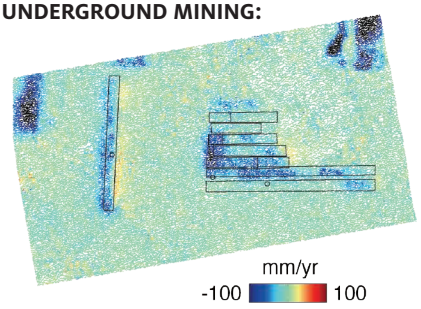
Natural geologic processes (e.g. landslides, earthquakes, soil degradation, and groundwater redistribution) and anthropogenically-triggered hazards (e.g. induced seismicity and mining) are associated with the deformation of the shallow crust. To better understand these processes and provide mitigation measures, there is a need for technical improvement to achieve high-accuracy spatiotemporal ground deformation, and model development to compile and interpret the multidisciplinary observations and phenomena.

Landsliding is an intriguing interdisciplinary phenomenon that generalizes the mass wasting process downslope. Dr. Hu uses SAR imaging techniques to derive spatiotemporal displacements and to develop physical models to quantify the environmental and hydroclimatic forcings. With its large area of ~1 km² and perennial motions at a couple of centimeters per day, the Slumgullion landslide in Colorado represents an ideal natural laboratory to study the mobile slopes. Dr. Hu relied on hybrid remote sensing data and methods to recover the four-dimensional surface motions during 2011-2018. A joint analysis of SAR-derived surface displacements and LiDAR DEM-derived landslide thickness at its toe was used to invert for the intrinsic viscosity based on non-Newtonian models.

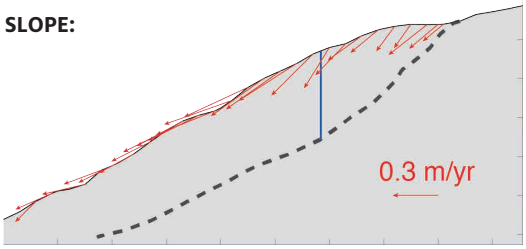
LANDSLIDE:



UNDERGROUND MINING:



SLOPE:



Selected Publications

1. Hu, X., Bürgmann, R., Schulz, W., Fielding, E.J., 2020, Four-dimensional surface motions of the Slumgullion landslide and quantification of hydrometeorological forcing. Nature Communications, 11, 2792.

2. Hu, X., Bürgmann, R., 2020, Aquifer dynamics in the seismically hazardous Salt Lake Valley, Utah, USA. Earth and Planetary Science Letters, 547.

3. Hu, X., Bürgmann, R., Lu, Z., Handwerger, A. L., Wang, T., Miao, R., 2019, Mobility, thickness, and hydraulic diffusivity of the slow-moving Monroe landslide in California revealed by L-band satellite radar interferometry. J. Geophys. Res. Solid Earth, 124.

4. Hu, X., Lu, Z., Pierson, T. C., Kramer, R., George, D. L., 2018, Combining InSAR and GPS to determine transient movement and thickness of a seasonally active low-gradient translational landslide. Geophys. Res. Lett., 45, 1453-1462.

5. Hu, X., Oommen, T., Lu, Z., Wang, T., Kim, J. W., 2017, Consolidation settlement of Salt Lake County tailings impoundment revealed by time-series InSAR observations from multiple radar satellites. Remote Sens. Environ., 202, 199-209.

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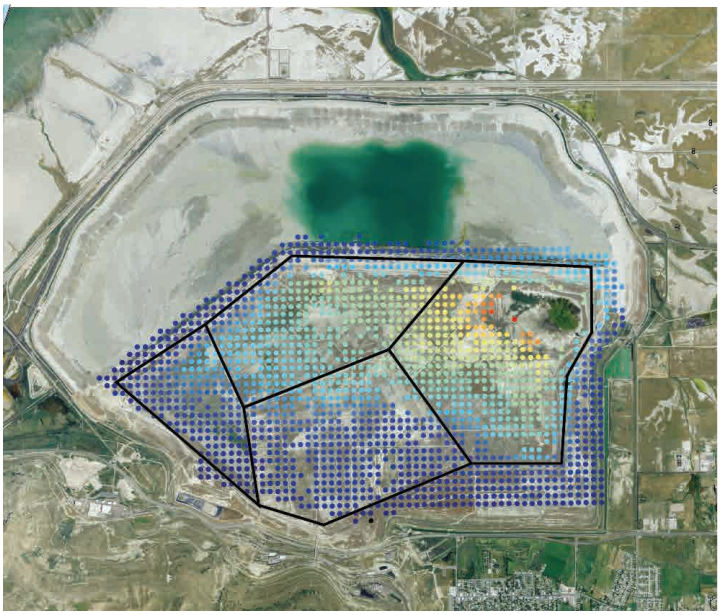
Aquifer skeletons deform actively in response to groundwater redistribution and hydraulic head change with various time scales of delay and sensitivity. However, determining the key hydrogeological properties generally requires the analysis of dense water gauge data and expensive drilling data. Instead, Dr. Hu used InSAR observations to quantify the water storage variation and stress perturbation to the fault systems in Salt Lake Valley, Utah.

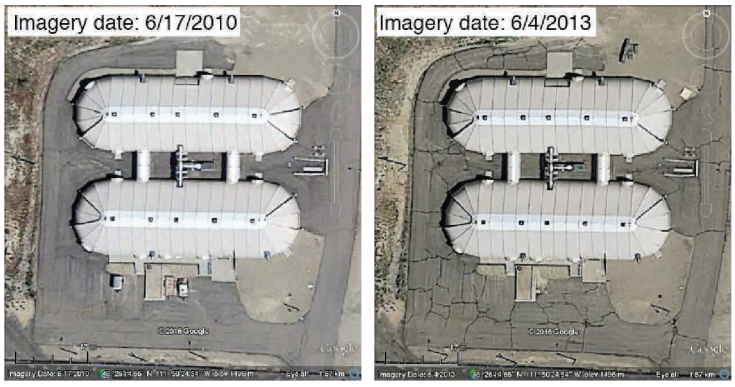
Tailings experience gradual consolidation settlement as the pore pressure dissipates and the terrain subsides. Dr. Hu integrated the SAR and DEM datasets to investigate the decelerating consolidation settlement over the tailings impoundment area in the vicinity of the Great Salt Lake, Utah.

TAILINGS IMPOUNDMENT:

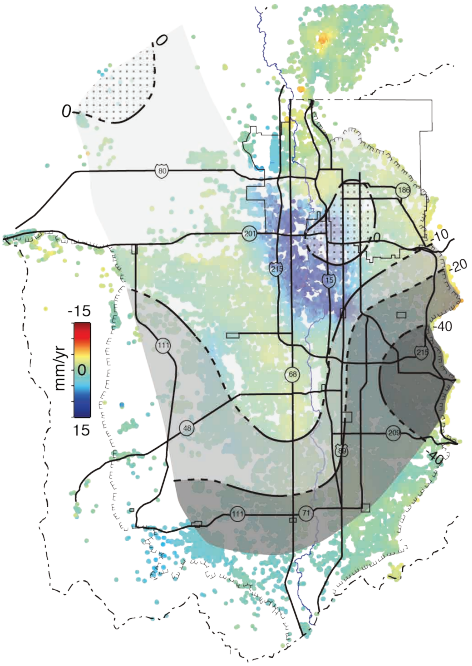


CREEPING FAULTS AND LANDSLIDES:

LAND SUBSIDENCE:



AQUIFER:



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