VAMSHI KARANAM

Ph.D. Candidate, Geophysics, Southern Methodist University
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Professional Summary

NASA FINESST awarded Geophysicist specializing in InSAR, GNSS, and geomechanical modeling to investigate deformation processes across the solid Earth. My work integrates satellite geodesy, poroelastic modeling, and multi-sensor data fusion to study subsidence, tectonic strain accumulation, fluid-induced deformation, and infrastructure hazards. I led high-impact studies that received significant media, policy, and industry attention. I am committed to inclusive, hands-on, and impactful teaching, and to mentoring students through solid Earth processes and environmental geoscience applications.

Education

Ph.D. in Geophysics 2021 – (Expected May 2026)

Southern Methodist University (SMU), Dallas, USA, (GPA 3.98)

Dissertation: *InSAR Remote Sensing & Poroelastic Modeling of Oil & Gas Geohazards in the Permian Basin*

M.Tech in Geomatics Engineering 2018 – 2020

Indian Institute of Technology (IIT) Roorkee, India, **(**Gold Medal, GPA 3.9)

Dissertation: *Geospatial modeling of coal fires on mine subsidence in Jharia Coalfields, India*

Bachelor of Architecture 2013 – 2018

National Institute of Technology (NIT) Calicut, India

Research Interests

- Satellite geodesy: InSAR, GNSS, 3D deformation retrieval
- Geodynamics, and coupled multi-hazard analyses
- Fluid-driven deformation, induced seismicity, subsurface geomechanics
- Computational Earth science: poroelastic and hydromechanical modeling
- Machine-learning geospatial analytics for hazard detection
- Deformation of hydrocarbon basins, aquifers, mining regions, and tectonic system

Research Experience

Research Assistant, SMU Radar Lab, Dallas, USA 08/2021 – 12/2025

Advisor: Dr. Zhong Lu, Professor

- Produced decadal-scale deformation products using time-series InSAR and GNSS to characterize strain, subsidence, and infrastructure risk in the Permian Basin.
- Developed 3D poroelastic models to quantify fluid-driven stress evolution and operational hazards.
- Investigated wastewater-related well blowouts using multi-sensor remote sensing and subsurface modeling.
- Advanced geocoded SLC offset-tracking workflows and 3D deformation retrieval for the upcoming NISAR.
- Led collaborations on seismicity–subsidence coupling and infrastructure exposure assessment.

Research Assistant, Dept. of Geospatial Engineering, IIT Roorkee, India 02/2021– 06/2021

Advisor: Dr. Saurabh Vijay, Asst. Professor

- Modeled coastal flooding and subsidence interactions using machine-learning geospatial workflows, evaluating risk to vulnerable coastal urban infrastructure in India.

Research Intern, German Research Center for Geosciences (GFZ), Germany 03/2020 – 06/2020

Advisor: Dr. Mahdi Motagh, Professor

- Mapped groundwater-driven subsidence in Delhi using InSAR and in-situ datasets, delineating deformation hotspots with implications for urban safety and water management.

Visiting Researcher, Leibniz University Hannover (LUH), Germany 09/2019 – 02/2020

Advisor: Dr. Mahdi Motagh, Professor

- Quantified coal fire–induced subsidence across a large mining region in India by integrating thermal anomaly mapping using Landsat-8 with InSAR deformation products.

Teaching Experience

- **Courses assisted/taught** (across SMU, IIT Roorkee, and LUH):
  - Introduction to Remote Sensing
  - Geographic Information Systems (GIS)
  - Introduction to Radar Remote Sensing
  - Earth Systems, Earthquakes & Volcanoes
  - Analytical Photogrammetry & Geospatial Analysis
- Led a two-day Google Earth Engine workshop at SMU, introducing students to large-scale geospatial analysis.
- Designed hands-on labs in InSAR processing, field GNSS/total-station surveying, and geospatial workflows.

Technical Skills

- **Programming:** Python, MATLAB, Bash, Google Earth Engine (JavaScript)
- **Remote Sensing:** ERDAS Imagine, GAMMA, StaMPS, MintPy, SARScape, ISCE, SNAP
- **GIS & Modeling:** ArcGIS Pro, QGIS, AutoCAD, COMSOL Multiphysics, GBIS
- **Remote Sensing Analytics:** InSAR time-series analysis, 3D deformation retrieval, poroelastic modeling, geospatial data fusion, change detection, hazard mapping

Grants & Awards

- **NASA FINESST Research Grant,** $88,700, SMU, USA 2024 – 2026
- **DAAD KOSPIE Fellowship,** $11,000**,** Leibniz University Hannover**,** Germany 2019 – 2020
- **Gold Medal**, M.Tech, Geomatics Engineering, IIT Roorkee, India 2020
- **MHRD National Graduate Scholarship**, Government of India 2018 – 2020
- **Professional Development Microgrants**, IEEE GRSS 2023
- **IEEE IGARSS Travel Grant,** IEEE GRSS

Professional Service

- **Manuscript Reviewer**
  - IEEE Transactions on Geoscience and Remote Sensing, Engineering Geology, Advances in Space Research, Natural Hazards & Risk, Science of the Total Environment, Remote Sensing, etc.
- **Organizing Committee**, International Conference on Unmanned Aerial Systems in Geomatics (UASG 2020)
- **President**, Society of Exploration Geophysicists (SEG) SMU Student Chapter (2025)
- **Member**, AGU, EGU, IEEE & AAPG
- **Registered Architect**, Council of Architecture, India
- **Volunteer**, Thanima International Architectural Conference, NIT Calicut, India

Publications

Journal Articles:

- **Karanam, V.,** Lu, Z., Kim, J., (2024). Investigation of Oil Well Blowouts Triggered by Wastewater Injection in the Permian Basin, USA. *Geophysical Research Letters* 51, e2024GL109435. https://doi.org/10.1029/2024GL109435.
- **Karanam, V**., Lu, Z., (2023). Hydrocarbon production induced land deformation over Permian Basin; analysis using persistent scatterer interferometry and numerical modeling. *International Journal of Applied Earth Observation and Geoinformation* 122, 103424. https://doi.org/10.1016/j.jag.2023.103424.
- **Karanam, V**., Motagh, M., Garg, S., & Jain, K. (2021). Multi-sensor remote sensing analysis of coal fire induced land subsidence in Jharia Coalfields, Jharkhand, India. *International Journal of Applied Earth Observation and Geoinformation,* 102, 102439. https://doi.org/10.1016/j.jag.2021.102439.
- Aziz Zanjani, A., DeShon, H.R., **Karanam, V.**, Savvaidis, A., (2024). Insights into Temporal Evolution of Induced Earthquakes in the Southern Delaware Basin Using Calibrated Relocations from the TexNet Catalog (2017–2022). *Earth and Space Science,* 12, e2024EA004027. https://doi.org/10.1029/2024EA004027.
- Liang, K., Kim, J., Lu, Z., Fattahi, H., Bato, M.G., Brancato, V., Jeong, S., **Karanam, V.** (2025). Offset tracking with geocoded SLC. *IEEE Transactions on Geoscience and Remote Sensing*. https://doi.org/10.1109/TGRS.2025.3570627.
- Aziz Zanjani, A., DeShon, H.R., Karanam, V., Savvaidis, A., (2024). Insights into Temporal Evolution of Induced Earthquakes in the Southern Delaware Basin Using Calibrated Relocations from the TXAR Catalog (2009–2016). The Seismic Record 4, 140–150. https://doi.org/10.1785/0320240011.
- Garg, S., Motagh, M., Indu, J., & **Karanam, V**. (2022). Tracking hidden crisis in India's capital from space: Implications of unsustainable groundwater use. *Scientific Reports*, 12(1), 651. https://doi.org/10.1038/s41598-021-04193-9.

In Preparation/Under Review

- **Karanam, V.,** Lu, Z. An Integrated Workflow for Quantifying Fluid-Induced Deformation Using InSAR and 3D Poroelastic Modeling.
- Sui, Q., Lu, Z., Meng, T., Kim, J.-W., Higman, B., Dai, C., Budukumah, E., McColl, S., Howat, I., Hults, C., **Karanam, V.**, Liang, K. Hydrometeorological and Topographic Controls Govern Spatiotemporal Heterogeneity in Rock Glacier Kinematics: Insights from Satellite Interferometry in Southeastern Alaska.
- **Karanam, V.,** Lu, Z., Sui, Q. 3D Deformation Retrieval Using Complementary Sentinel-1 and NISAR Acquisition Geometries.
- **Karanam, V.,** Lu, Z., Kim, J. Energy Infrastructure Monitoring with InSAR in Central Basin Platform, West Texas, USA.

Selected Conference Presentations:

Oral Presentations

- **Karanam, V.**, Lu, Z., (2025). Poroelastic Modeling and InSAR Analysis of Hydrocarbon Production-Induced Surface Deformation in the Permian Basin, USA. *EGU General Assembly Conference Abstracts*, EGU25-14878.
- **Karanam, V.**, Lu, Z. and Kim, J. (2023) Geophysical Characterization of Oil Well Blowouts Triggered by Pore Pressure Propagation from Wastewater Injection Through Hydrogeologic Structures, In *AGU Fall Meeting 2023 Abstracts*.

- **Karanam, V.**, Lu, Z. and Kim, J.-W. (2023). Hydrocarbon Production Induced Land Deformation Over Delaware Basin, Analysed Using Persistent Scatterer Interferometry. 2023 *IEEE International Geoscience and Remote Sensing Symposium,* Pasadena, CA, USA: IEEE, pp. 1846–1849.
- *(invited)* Lu, Z., Zheng, W., **Karanam, V.**, Kim, J., (2023). Human-induced geohazards in Permian Basin, USA revealed by InSAR and numerical modeling. EGU General Assembly Conference Abstracts, EGU23-2152

Poster Presentations

- **Karanam, V.**, Motagh, M., Garg, S., & Jain, K. (2021). Combined Effect of Mining, Subsidence and Coal Fires in Jharkhand, India Investigated using Satellite Remote Sensing and Data Fusion. In *AGU Fall Meeting 2021 Abstracts* (Vol. 2021, pp. NH15D-0481).
- Aziz Zanjani, A., DeShon, H., **Karanam, V.**, Savvaidis, A., (2024), Spatiotemporal Evolution of Induced Earthquakes in the Southern Delaware Basin, Reeves-Pecos, West Texas, *SSA Annual Meeting 2024 Abstracts.*
- Garg, S., **Karanam, V.**, Motagh, M., Mishra, V., Xia, Z., Shevchenko, A. V., Stefanova Vassileva, M., Roessner, S. (2023). Monitoring land subsidence in Joshimath, Uttarakhand using InSAR: A preliminary study, XXVIII General Assembly of the International Union of Geodesy and Geophysics, Berlin.
- Garg, S., **Karanam, V.**, & Motagh, M. (2021). The continuous sinking of National Capital Region, India–Investigated using the Sentinel-1 time series InSAR approach. *FRINGE Workshop* 2021.

Selected Media Coverage

- **Bloomberg (2025):** "Texas oil boom spawns a toxic crisis of the Industry's own making"
- **The Dallas Morning News (2024):** "Is it natural or fracking? SMU study reveals cause of past Texas earthquakes"
- **Houston Chronicle (2024):** "Study: More blowouts to come"
- **The Texas Tribune (2024):** "Ranchers reported abandoned oil wells spewing wastewater"
- **Newsweek (2024):** "Well Blowouts in Texas Prompt $100M Emergency Funding Plea"
- **Carlsbad Current-Argus (2023):** "Oil and gas is 'deforming' New Mexico's land, study says"
- **BBC (2023):** "How a Delhi district stopped the ground from sinking"
- **Hindustan Times (2022):** "Excessive groundwater extraction causing parts of Delhi-NCR to sink"