RYAN SMITH

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EDUCATION

Stanford University, Stanford, CA *August 2018*
Ph.D. in Geophysics
Thesis title: The relationship of surface deformation to groundwater storage and quality in the San Joaquin Valley, California
Thesis advisor: Rosemary Knight

Brigham Young University, Provo, Utah *June 2014*
B.S. in Geology, Cum laude

RESEARCH INTERESTS

Groundwater is a critical resource for drinking water and food supply, yet great uncertainty in the key drivers of groundwater flux at local and global scales challenges our ability to effectively model future resource availability. My research focus is to integrate large-scale remote sensing and geophysical datasets to improve our understanding of groundwater systems using process-based and machine learning models. The main datasets I use are Interferometric Synthetic Aperture Radar (InSAR) and Time-Domain Electromagnetics (TEM). My research group has a towed TEM (tTEM) system that can acquire roughly 100 line km of resistivity data ranging from the surface to a depth of 80 m. This is currently being used for aquifer characterization in the Kansas River Alluvial Aquifer and in Parowan Valley, Utah. In addition to the above datasets, I also work with gravity and passive remote sensing datasets in the optical and thermal wavelengths. Integrating these datasets into groundwater models can both improve model quality and challenge traditional model assumptions that may bias model predictions.

EMPLOYMENT

2022-Present	Assistant Professor, Civil Engineering, Colorado State University, Fort Collins, CO
2018-2022	Assistant Professor, Geological Engineering, Missouri University of Science and Technology, Rolla, MO
2017	Environmental Geoinformatics Intern, Climate Corporation, St. Louis, MO
2015-2018	National Science Foundation Graduate Research Fellow, Stanford University, Stanford, CA
2015	Geophysics Intern, SM Energy, Denver, CO
2014-2015	Graduate Research Fellow, Stanford University, Stanford, CA
2013-2014	Hydrogeology Engineer Intern, Rio Tinto/Kennecott, Salt Lake City, UT

GRANTS AND FELLOWSHIPS

- Total awarded since August 2018 (start of Assistant Professor position): $5,345,413.
- PI share of awarded proposals since August 2018: $1,744,861.

2023-2026 NASA, Earth Surface and Interior
Disentangling Tectonic and Hydrologic Signals in Regions with Non-linear Aquifer System Deformation. PI: Ryan Smith, co-I: Jeremy Maurer
Award amount: $539,132

2023-2025 DOD, US Army Corps of Engineers
Dye tracing and springshed characterization near Fort Leonard Wood, Missouri . PI: Michael Ronayne, co-I: Ryan Smith
Award amount: $215,000

2021-2026 National Institutes of Health, R01
The Impact of Drought on Arsenic Exposure and Cardiometabolic Outcomes in a Rural Aging Population. multiple PIs: Kathy James, Ryan Smith, Matthew Gribble
Award amount: $2,989,218, Smith share: $282,718

2021-2024 NASA, Terrestrial Hydrology
High-Resolution Estimation of Groundwater Withdrawals using Machine Learning Integration of Satellite Datasets. PI: Ryan Smith, co-I: Venkat Lakshmi, Katherine Grote, JT Reager, Jim Butler
Award amount: $487,934

2021-2023 USGS, Gulf Coast Water Science Center
Estimating Groundwater Withdrawals using Satellite Data in the Mississippi Alluvial Plain. PI: Ryan Smith (single investigator)
Award amount: $150,000

2020-2022 National Geospatial Intelligence Agency
New Investigator Proposal: Global Monitoring of Groundwater Extraction Using Automated Assessment of Land Subsidence. PI: Ryan Smith (single investigator)
Award amount: $193,243

2019-2020 NSF, Geobiology and Low-temperature Geochemsitry
RAPID: Assessing the fate of flood-born contaminants. PI: Marek Locmellis, co-I: Ryan Smith, Jonathan Obrist-Farner
Award amount: $44,888, Smith share: $14,963

2018-2021 NASA, Earth Science Applications: Water Resources
Integration of InSAR with Airborne Geophysical Data for the Development of Groundwater Models. PI: Rosemary Knight, Institutional PI: Ryan Smith
Award amount: $940,998, Smith share: $76,871

2015-2018 National Science Foundation Graduate Research Fellowship
Predicting hydraulic properties using InSAR and geologic models
$138,000

HONORS

- American Geophysical Union Near Surface Geophysics Early Career Award, 2021
- Missouri S&T Outstanding Teaching Commendation, 2020-2021
- Outstanding Thesis Award, Stanford University Department of Geophysics, 2019
- National Science Foundation Graduate Research Fellowship, 2015-2018

PEER-REVIEWED PUBLICATIONS

Citations/year on Google Scholar since first publication (2017) :

2017	2018	2019	2020	2021	2022
6	20	41	76	111	163

** for student author*

15. Li, J.*, **Smith, R.**, Grote, K., 2023, Analyzing Spatio-Temporal Mechanisms of Land Subsidence in the Parowan Valley, Utah, *Hydrogeology Journal.*

14. Majumdar, S.*, **Smith, R.**, Conway, B., Lakshmi, V., 2022, Advancing Remote Sensing and Machine Learning-Driven Frameworks for Groundwater Withdrawal Estimation in Arizona: Linking Land Subsidence to Groundwater Withdrawals. *Hydrological Processes.* Link to article

13. Adams, K. H., Reager, J. T., Rosen, P., Wiese, D. N., Farr, T. G., Rao, S., **Smith, R.** et al., 2022, Remote sensing of groundwater: Current capabilities and future directions. *Water Resources Research*, 58, e2022WR032219. https://doi.org/10.1029/2022WR032219

12. Lees, M.*, Knight, R., **Smith, R.**, 2022, Development and Application of a 1D Compaction Model to Understand 65 Years of Subsidence in the San Joaquin Valley, *Water Resources Research.* Link to article

11. Smith, R., Hashemi, H., Chen, J., Knight, R., 2021, Apportioning deformation among depth intervals in an aquifer system using InSAR and head data, *Hydrogeology Journal.* Link to pre-print

10. Smith, R., Li, J.*, 2021, Modeling elastic and inelastic pumping-induced deformation with incomplete water level records, *Journal of Hydrology.* Link to pre-print

9. Smith, R., Oyler, L.*, Campbell, C., Hansen, N., Hopkins, B., Svedin, J., Woolley, A., 2021, A new approach for estimating and delineating within-field crop water stress zones with satellite imagery, *International Journal of Remote Sensing.* Link to pre-print

8. Majumdar, S.*, **Smith, R.**, Butler, J., Lakshmi, J., 2020, A New Hybrid Water Balance and Machine Learning Approach for Groundwater Withdrawal Prediction using Integrated Multi-Temporal Remote Sensing Datasets. *Water Resources Research.*

7. Smith, R., Majumdar, S.*, 2020, Groundwater Storage Loss Associated with Land Subsidence in Western US Mapped Using Machine Learning. *Water Resources Research.*

6. Smith, R., Knight, R., 2019, Modeling land subsidence using InSAR and airborne electromagnetic data. *Water Resources Research*, 55. https://doi.org/10.1029/2018WR024185.

5. Smith, R.G., T. Mukerji, 2018, *Geophysics*, Correlating Geological and Seismic Data with Unconventional Resource Production Curves Using Machine Learning.

4. Smith, R.G., R. Knight, S. Fendorf, 2018, *Nature Communications*, Over-Pumping Leads to California Groundwater Arsenic Threat.

3. Knight, R., **Smith, R.G.**, Asch, T., Abraham, J., Cannia, J., Viezzoli, A., Fogg, G., 2018, *Groundwater*, Mapping Aquifer Systems with Airborne Electromagnetics in the Central Valley of California.

2. Smith, R.G., R. Knight, J. Chen, J.A. Reeves, H.A. Zebker, T. Farr, and Z. Liu, 2017, *Water Resources Research*, Estimating the permanent loss of groundwater storage in the southern San Joaquin Valley, California.

1. Nordin, M., **Smith, R.G.**, Knight, R., 2016, *The Leading Edge*, The use of color wheels to communicate uncertainty in the interpretation of geophysical data.

SELECTED CONFERENCE PAPERS

** for student author*

6. S. Majumdar*, **R. Smith**, B. D. Conway, J. J. Butler, V. Lakshmi, and C. H. Dagli, Estimating Local-scale Groundwater Withdrawals using Integrated Remote Sensing Products and Deep Learning. Submitted to the IEEE IGARSS 2021 Conference, Belgium.

5. **Smith, R.G.**, Knight, R., 2020, Towards Sustainable Groundwater Management: Predicting Deformation Scenarios with Coupled Hydrogeophysical Models, IEEE International Geoscience and Remote Sensing Symposium.

4. **Smith, R.G.**, Mukerji, T., Lupo, T., 2018, Correlating geological and seismic data with unconventional resource production curves using machine learning, Society of Exploration Geophysicists Annual Meeting, Anaheim, California.

3. **Smith, R.G.**, R. Knight, 2018, Modeling subsidence through the joint inversion of AEM and InSAR data, Airborne Electromagnetics Conference, Kolding, Denmark.

2. Dewar, N., Gottschalk, I., Knight, R., **Smith, R.G.**, Silvestri, S., Viezzoli, A., Anshari, G., Behroozmand, A., Comas, X., Effers, F., Faber, I., Flanagan, N., Parsekian, A., Richardson, C., Wright, W., 2018, Estimation of peat thickness in Indonesia from airborne time domain EM data through machine learning, Airborne Electromagnetics Conference, Kolding, Denmark.

1. Knight, R., **Smith, R.G. (presented)**, Asch, T., Cannia, J., Abraham, J., Viezzoli, A., 2016, Subsurface mapping with airborne electromagnetics in the Central Valley of California, SEG Technical Program Extended Abstracts.

SELECTED CONFERENCE ABSTRACTS

15. **Smith, R.G.**, 2020, How does compaction affect aquifer response to pumping? The impact of temporally variable specific storage on current and future water availability, American Geophysical Union, Fall Meeting 2020, Virtual.

14. Oyler, L., **Smith, R.G.**, 2020, Statistical Observations of Water Stress in Kansas Winter Wheat and Corn from Remotely Sensed Evapotranspiration and NDWI, American Geophysical Union, Fall Meeting 2020, Virtual.

13. Majumdar, S., **Smith, R.G.**, Conway, B.D., Butler, J.J., Lakshmi, V., 2020, Integrating Remote Sensing and Machine Learning for Groundwater Withdrawal Estimation in Arizona , American Geophysical Union, Fall Meeting 2020, Virtual.

12. Li, J., **Smith, R.G.**, Grote, K., 2020, InSAR Time-Series Analysis of Progressive Land Subsidence Caused by Groundwater Pumping in Parowan, Utah, American Geophysical Union, Fall Meeting 2020, Virtual.

11. **Smith, R.G.**, 2019, Land Subsidence in Western US Mapped Using Machine Learning , American Geophysical Union, Fall Meeting 2019, San Francisco, California.

10. **Smith, R.G.**, Behroozemand, A., 2018, The application of a new electromagnetic method for imaging karst, American Geophysical Union, Fall Meeting 2018, Washington, DC.

9. Campbell, C., Hopkins, B., Svedin, J., Hansen, N., **Smith, R.G.**, 2018, Integrating Remote Sensing and Spatiotemporal Data to Improve Variable Rate Irrigation Systems, Crop Science Society of America International Meeting, Baltimore, Maryland.

8. **Smith, R.G.**, R. Knight, 2018, Improved Modeling of Land Subsidence through the Integration of InSAR and Airborne EM Data, XIII Congress Land Subsidence Symposium, San Francisco, California.

7. **Smith, R.G.**, R. Knight, J. Chen, J.A. Reeves, H.A. Zebker, T. Farr, and Z. Liu, 2017, Estimating the permanent loss of groundwater storage in the southern San Joaquin Valley, California, SAGEEP, Denver, Colorado.

6. **Smith, R.G.**, R. Knight, S. Fendorf, 2016, Subsidence Serves as an Indicator of Groundwater Arsenic Risk in the San Joaquin Valley, California, American Geophysical Union, Fall Meeting 2016, San Francisco, California

5. **Smith, R.G.**, R. Knight, H.A. Zebker, T. Farr, Z. Liu, J. Chen, J. Crews and J. Reeves, 2016, Estimating Aquifer Properties in the San Joaquin Basin, California, through the Analysis of InSAR Data, American Geophysical Union, Fall Meeting 2015, San Francisco, California.

4. **Smith, R.G.**, 2013, Identifying High-Risk Flood Scenarios in the Bhutanese Himalayas. Utah Conference of Undergraduate Research, Utah State University.

3. **Smith, R.G.**, 2012, Glacier Retreat in the Bhutanese Himalayas, 1976-2010. Student Research Conference, Brigham Young University.

2. Rupper, S., Schaefer, J., Burgener, L., **Smith, R.G.**, 2012, Glaciers and climate, modern observations and glacier modeling. Goldschmidt Conference, Montreal.

1. Rupper, S., Maurer, J., Schaefer, J., Cook, E., Putnam, A., Krusic, P., **Smith, R.G.**, 2012, Glacier Sensitivity to Climate Change in the Monsoonal Himalaya: Past, Present, and Future. American Geophysical Union, San Francisco.

INVITED TALKS

- University of Texas-Austin, 2022, Geosciences Department (DeFord Lecture Series)
- American Geophysical Union, 2021, Near Surface Geophysics Business Meeting
- American Geophysical Union, 2021, NS012 - Near-Surface Geophysics: A cross-cutting Section that facilitates diverse scientific and societal studies in support of Earth sciences.
- University of Virginia, 2021, Engineering Systems and Environment Dept Seminar
- Environmental and Water Resources Institute, ASCE, St. Louis Section, 2021
- Geological Society of America, 2021, T48: Addressing Complex Problems in Hydrogeology with Big Data and Machine Learning
- Washington University in St. Louis, 2021, Earth and Planetary Sciences Dept Seminar
- Oklahoma State Geoscience Department, 2019, Dept Seminar
- Brigham Young University Geology Department, 2019, Dept Seminar
- Missouri University of Science and Technology Geoscience Department, 2018, Dept Seminar

PROFESSIONAL SOCIETIES

American Geophysical Union
Geological Society of America
Society of Exploration Geophysicists
Association of Engineering Geologists