HYDROLOGY

AGU HYDROLOGY
SECTION NEWSLETTER

Members of AGU's Hydrology Section are concerned with the cycling of continental water at all scales, and with physical, chemical and biological processes driven by that cycling.

MAY 2026

APPLY NOW

Bridges to the Future Student Grants Program

Background

Celebrating the past and future of hydrology, the [AGU Hydrology Bridges to the Future Program] is intergenerational. Bridges connects foundational work in our field with the expanding range and diversity of students interested in water, and honors those who've made an impact in our field. The program program provides $2,000 grants to support undergraduate, master's, and doctoral students facing financial barriers in pursuing careers in hydrology. Funding can be used for activities like attending scientific meetings, visiting research groups, or engaging in career development.

Who Can Apply

Students enrolled full- or part-time at two-year colleges, four-year universities, or graduate programs, with a demonstrated interest in hydrological sciences. Preference is given to undergraduate students, but all career stages are eligible.

This issue:

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Application Materials Include

A current CV, two-page essay describing your hydrology interests and proposed activity, budget explaining how the grant makes the activity feasible, and one letter of reference confirming your qualifications and potential impact

How to Apply

Submit your application to Venkataraman Lakshmi, Hydrology Section President (vlakshmi@virginia.edu), who can also be contacted for additional information.

Applications are due by October 15. Award announcements will be made in November.

Announcements

Call for Editors-in-Chief: Water Resources Research & JGR: Oceans

AGU is seeking Editors-in-Chief for Water Resources Research and JGR: Oceans, with terms beginning 1 January 2027. These roles offer an opportunity to shape research quality, editorial direction, and community standards.

We encourage you to apply or share with colleagues. **The application deadline has been extended to 14 June 2026**.

View the calls and apply:
- Water Resources Research Editor-in-Chief search
- JGR: Oceans Editor-in-Chief search

For general questions, contact pubmatters@agu.org

Water Resources Research Search Committee:
- Venkataraman Lakshmi (Chair) – vlakshmi@virginia.edu
- Fiona Johnson – f.johnson@unsw.edu.au
- Yi Zheng – zhengy@sustech.edu.cn
- Sara Goeking – sara.goeking@usda.gov
- Taikan Oki – taikan@iis.u-tokyo.ac.jp
- Kamini Singha – ksingha@mines.edu
- Jaime Gomez-Hernandez – jaime@dihma.upv.es

AGU26 Timeline: Save the Dates

Planning for AGU26 is underway! If you submitted a session proposal, keep an eye on your email for notification of acceptance in the coming weeks.

Abstract submissions will open in mid-June—watch for the official announcement and be ready to submit.

Key Dates
- **Mid-June** – Abstract submissions open; session proposal decisions released
- **5 August** – Abstract submission deadline

Stay tuned to AGU communications for updates and next steps.

Announcements

Call for Contributions – Only a few spots left!

We are seeking contributions for our 2026 issues of the AGU Hydrology Section Newsletter. Nominate yourself or a colleague to be featured in one of our regular columns by emailing agu.hydro.news@gmail.com.

Column opportunities include:

- **Science to Solutions** – Hydrologic research connecting science to policy, practice, and community outcomes.
- **Hydrology Horizons** – Emerging tools, datasets, methods, or technologies shaping the future of hydrology.
- **Early Career Spotlight** – Profiles of early career hydrologists highlighting research, career paths, and reflections.
- **Student Spotlight** – Short features showcasing undergraduate or graduate students' research, fieldwork, or academic journeys in hydrology.
- **Other** – Have a piece that doesn't quite fit? Let's find a space for it or create one

Most 2026 slots are taken, so be sure to reach out soon to grab a spot!

Sam Zipper

Hydrologic Sciences Early Career Award

Kansas Geological Survey + University of Kansas

I deeply appreciate my nominator, Steve Loheide, and the others who wrote letters on my behalf, along with my research group, collaborators, colleagues, and the AGU community — especially my fellow self-identified ecohydrologists. When we think about who shapes us as scientists, these are usually the people we recognize, and I don't want to minimize their contributions

Zipper presenting to state agency staff and policymakers about the drying of the Arkansas River in western Kansas at the Kansas Geological Survey Field Conference

But there is another important group that rarely appears in the acknowledgments section: water practitioners, by which I mean the people who are making water-related decisions every day. I'm fortunate to hold a position where my work is expected to be both scientifically novel and societally useful. Since I work mostly in agricultural landscapes, this has led me to conversations with farmers, the food industry, advocacy groups, water managers, and passersby — often on Zoom, sometimes in conference rooms, and occasionally (when I'm lucky) in a corn field or standing by a stream. Those conversations have also shaped my science, including the types of projects I pursue, the methods I use, and how I present my findings.

The most common complaint I hear about academics is a familiar one: we decide what we want to study, get a letter of support for the proposal, present our findings when the work is done, and call it collaboration. I've done this myself. It is easy, and it produces publishable science. It just doesn't always produce useful science.

> "Meaningful collaboration requires that the conversation begins before the proposal is drafted, so we can identify questions that deserve answers."

Meaningful collaboration requires that the conversation begins before the proposal is drafted, so we can identify questions that deserve answers. It requires that conversations continue regularly throughout a project, so we can get help interpreting our findings in the context of what is most exciting, relevant, or useful. And it requires that the relationship extends past the publications, so that the beneficiaries of our science have our support when they start trying to use it. This doesn't mean abandoning basic scientific research – far from it – but it does mean making sure our research is responsive to societal needs, which is a moral imperative for those of us who work at public institutions or do taxpayer-funded research. That type of collaboration takes time, humility, and coordination, but it's the only way to make sure our findings are benefitting the people who can use them.

As I transition from early to mid career, this is what I most want to improve: building strong partnerships with a variety of water practitioners to ensure I am asking the right questions and that my science is useful.

STUDENT SPOTLIGHT

Uncertainty in Estimating Short-Duration Extreme Precipitation Frequency and Trend

Nischal Kafle, PhD Candidate, University of Memphis, Memphis, Tennessee

Short-duration extreme precipitation events—lasting from a few minutes to 2 hours—are the primary driver of flash floods and urban pluvial flooding. To safely design infrastructure for now and the future, we must understand how much rain can fall during a short, intense storm, and how often does this happen? Are short-duration extreme precipitation events becoming more frequent and intense? Answering these questions requires accurate depth-duration-frequency (DDF) estimates and robust trend analyses.

Despite their outsized societal impact, accurately characterizing these extreme events remains a fundamental challenge. These extremes are typically produced by highly localized convective storms and exhibit high spatial heterogeneity and temporal intermittency. Yet most studies rely on point-based analyses. Such approaches face several limitations: (i) sparse gauge networks, as found in the U.S., often fail to capture localized extremes; (ii) coarse temporal resolution of observations dampens peak intensities and biases estimates downward; and (iii) the resulting station-level trends often have low signal-to-noise ratios, producing inconsistent or even contradictory outcomes compared to climate projections.

To address the first question, I developed hierarchical Bayesian and bootstrapping frameworks to quantify the uncertainty in DDF estimates stemming from the spatio-temporal resolution of rainfall data. These analyses revealed average recurrence-interval-dependent bias in DDFs. I also proposed an algorithm that identifies spatially dependent extremes by approximating the rain-storm motion across a rain-gauge network (Kafle & Meier, 2025b). Theoretical analysis and radar-based validation show that using our method improves the accuracy of precipitation frequency analyses.

To address the second question, I am developing neighborhood-based methods to improve the signal-to-noise ratio in extreme rainfall by leveraging both synthetic and empirical precipitation fields. These approaches aim to detect spatially coherent trends in short-duration extreme rainfall (Kafle et al., 2025). Preliminary results suggest increasing trends in extreme rainfall magnitudes across much of the Southeastern U.S. (Figure 1).

To make these advances accessible, I developed nsEVDx, an open-source Python library for modeling non-stationary extreme values with both frequentist and Bayesian approaches (Kafle & Meier, 2025a). Since its release in July 2025, it has surpassed 1,400 downloads.

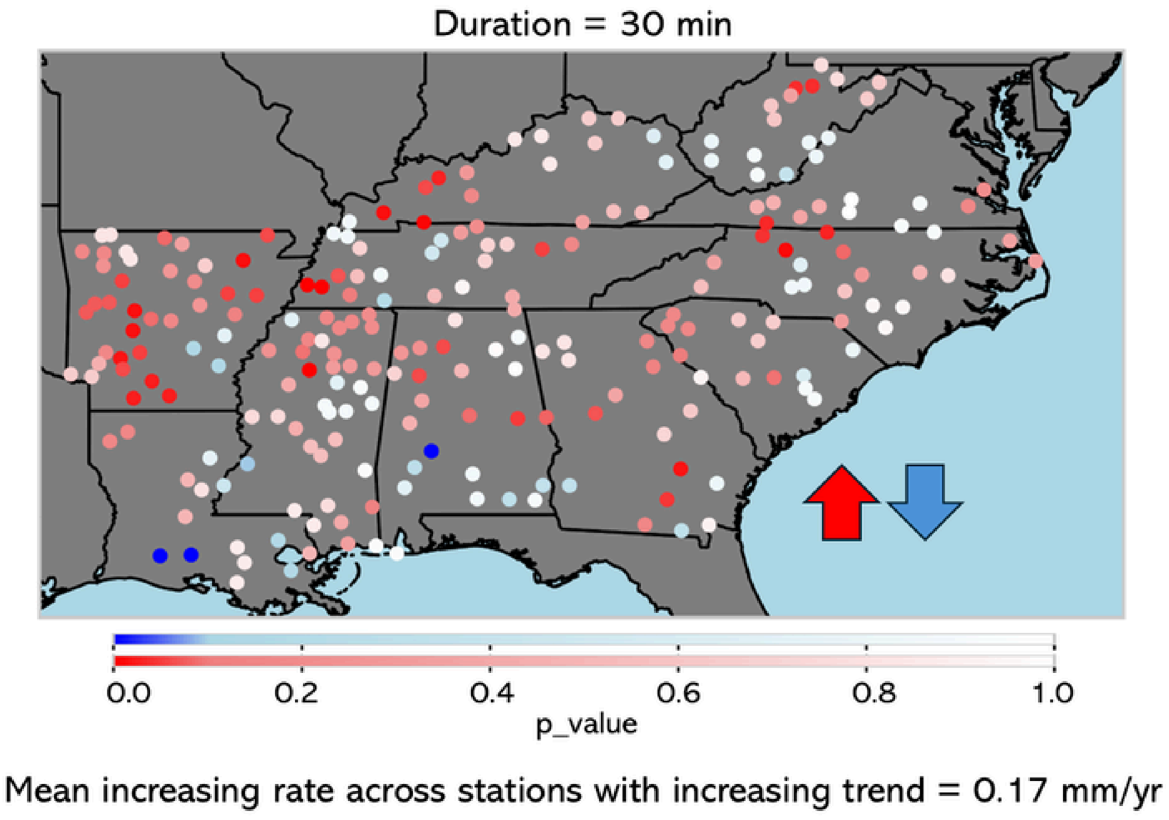


Figure 1. Trend in 30-min extreme precipitation magnitude for the Southeastern U.S. derived using Neighborhood method. Intensity of colors in the color bar represents statistical significance of the trend (p value).

Beyond methodological research, I have applied these insights to urban flood modeling in Memphis, Tennessee, using PCSWMM to simulate inundation during a historic extreme rainfall event. These simulations help illustrate how short-duration extreme rainfall translates into flood risk for vulnerable communities.

Short-duration extreme rainfall is not only changing but also difficult to measure accurately. Quantifying this uncertainty is essential if cities are to design infrastructure capable of withstanding future storms. My work aims to bridge stochastic hydrology, atmospheric science, and practical infrastructure design to help engineers and planners make more resilient decisions under an evolving climate.

EARLY CAREER SPOTLIGHT

Benjamin Bass

University of California, Los Angeles

My interest in hydrology has been shaped by two contrasting experiences: growing up with floods and an abundance of water in Houston, Texas and exposure to cities across the Southwestern United States that cope with water scarcity. These continue to serve as my motivation for understanding how extreme weather and hydrology shape the natural environment and human decisions in the built environment.

This is Mono Lake, California where I recently completed a two-year study on water and environmental management of the Lake's water resources in the face of climate change. I'm in the middle and joined by student researchers and stakeholders on the sides.

After studying groundwater and water resources at the University of Texas at Austin, I developed expertise in urban and coastal flooding at Rice University. Now, as a Research Scientist at the University of California, Los Angeles, my research has grown in two complementary directions: i) large-scale modeling and assessments of how climate change is altering hydrology, and ii) stakeholder-driven research at the basin-scale focused on climate attribution and adaptation.

> "Identifying the right question naturally leads to the right methods."

My approach to research has matured over time. As a PhD student, I was eager to learn and apply the best available tools in physics-based and AI-based modeling. Over time, however, I've come to appreciate that identifying the right question naturally leads to the right methods. In my research, I commonly combine native and downscaled reanalysis and climate datasets, observations, physics-based hydrology modeling, and statistics and AI to represent and better understand present and future hydroclimate conditions. As my research has expanded, so have opportunities for collaboration, stakeholder engagement, and mentoring students. Through such collaborations, I have built probabilistic flood forecast and risk emulators, decision-support interfaces for water supply planning, led the development of hydrology projections for California's 5th Climate Assessment, and assessed how climate change has and may continue to influence dry and wet hydrology extremes.

As climate hazards continue to evolve, I also feel a corresponding responsibility to grow as a researcher and to pursue work that is both innovative and service-oriented. I am actively deepening my expertise in hydrology and expanding my focus from the local- and continental-scale to the global-scale; however, I am also currently researching how hazards like landslides, wildfires, and tropical cyclones are changing. The opportunity to study interconnected processes spanning the atmosphere to the land surface, including floods, droughts, and other hazards, has cultivated my enduring and growing passion for the climate and hydrologic sciences.

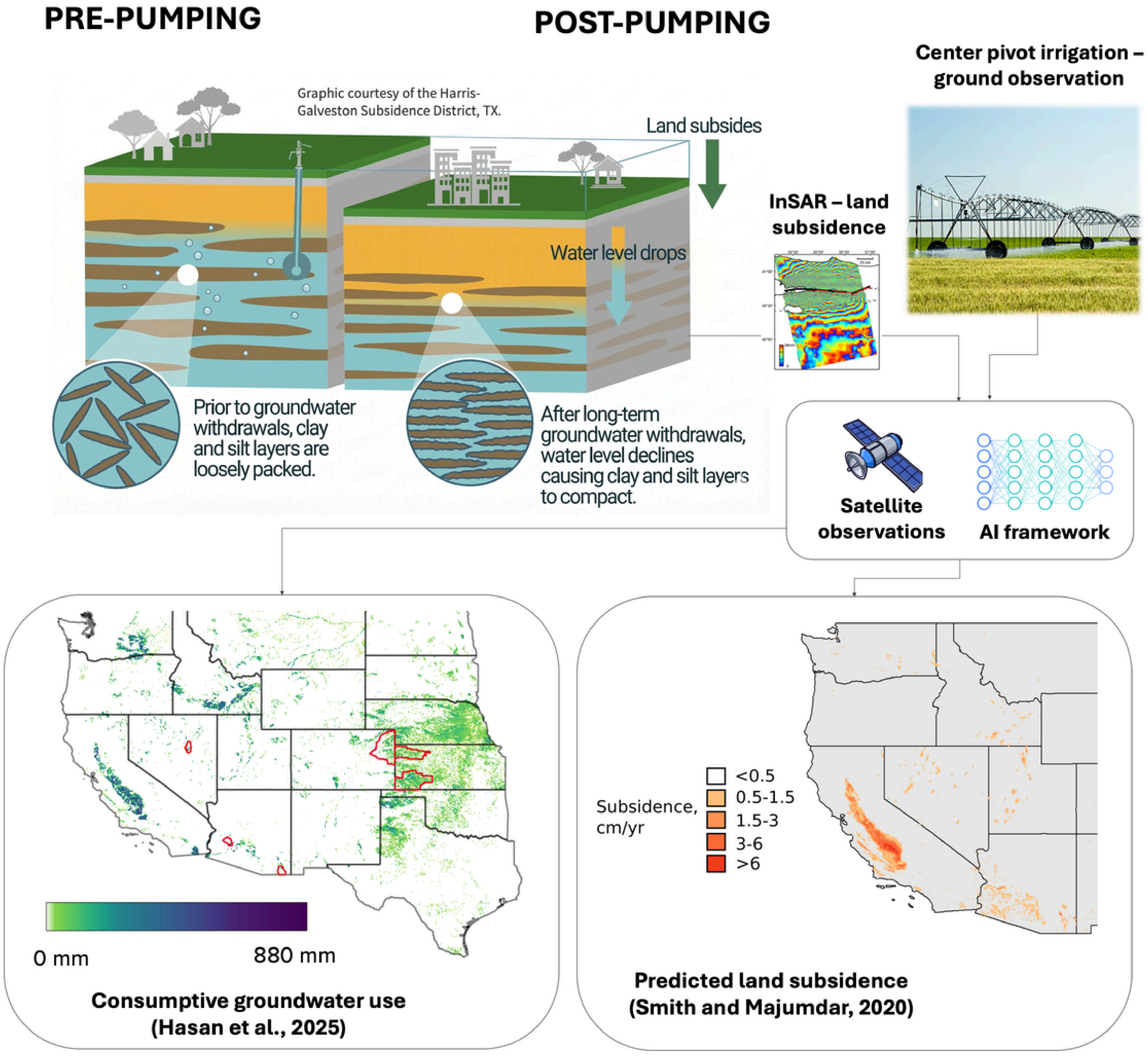
Management-scale groundwater solutions from space

Ryan Smith, Md Fahim Hasan, & Rahel Pommerenke
Colorado State University

Groundwater stores more than 99% of the world's liquid freshwater, and is increasingly tapped as climate change exacerbates droughts. Consider the current record-breaking low snowpacks in the western U.S., which will almost certainly lead to significant groundwater pumping this summer to supplement diminished surface water supplies. As reliance on groundwater increases, many basins across the United States and the world are at some stage of implementing groundwater management plans. To be effective, these plans must set targeted groundwater withdrawals that enable water use by the communities that need it, while avoiding or reducing negative impacts of over-use, such as aquifer storage loss, subsidence, depletion of streams, and contamination. A significant challenge remains: most of the world does not measure the volume of groundwater pumped, with estimates often varying by a factor of two. How can we confidently curtail water use if current water use is not known?

AI Solutions Leverage Satellite Imagery and Ground-based Observations

The Remote Sensing Hydrology research group at Colorado State University is working to address this issue using satellite datasets. Since the vast majority of un-metered withdrawals come from agriculture, estimating water use for irrigation is critical. Leveraging limited pumping records, our research group implements AI solutions to estimate groundwater use from satellite-derived evapotranspiration estimates and other proxies for plant water demand and irrigation efficiency in the High Plains Aquifer, the Mississippi Alluvial Aquifer, several Basin and Range Aquifers, and major watersheds of the world. Recent work by Ph.D. student Fahim Hasan has extended these estimates to the entire Western U.S. using a novel approach that subtracts effective precipitation from OpenET evapotranspiration estimates. While these methods show promise, more metered records of groundwater use are still needed to provide higher confidence estimates, especially in high-use regions like California.



Satellite observations of land subsidence, plant growth and evapotranspiration can be used with AI models to predict groundwater storage loss and consumptive groundwater use.

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Management-scale groundwater solutions from space

Ryan Smith, Md Fahim Hasan, & Rahel Pommerenke
Colorado State University

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Groundwater Storage and Subsidence

Groundwater withdrawals can lead to land subsidence, or sinking of the land surface. Land subsidence is also linked to groundwater storage loss, which is often irrecoverable. In the Central Valley of California, United States; Mexico City, Mexico; Tehran, Iran; the east coast of China; Jakarta, Indonesia; and many other parts of the world, the land surface is sinking by 10 cm/year or more due to groundwater pumping. Even after pumping ceases, delayed subsidence often continues due to the slow release of water from soft clays that are susceptible to consolidation.

Interferometric Synthetic Aperture Radar (InSAR) provides high-resolution estimates of land deformation with millimeter-scale accuracy, which can be used to track groundwater storage changes. This technique is most effective in clay-rich, confined aquifers. Our research group leverages these data to improve estimates of groundwater storage loss in southwest Utah, southern Colorado, and the Central Valley of California. We are also developing models to forecast future subsidence given different management scenarios. Our research shows that it is possible to stop subsidence early by artificially recharging aquifers, but it requires proactive groundwater management.

A Path Forward

Withdrawals are the biggest gap in groundwater measurements and are crucial for water accounting and assessing storage change. To develop sustainable solutions for groundwater management, we need greater accuracy in our estimates of groundwater use. Leveraging current AI and satellite technologies, we can supplement existing ground-based water use measurements. Research in our group has been done in collaboration with water managers, including state and local agencies, in Arizona, Utah, Mississippi, and Colorado. By providing policy makers and those that implement policy with actionable information about current and historical pumping trends, sustainable volumes of groundwater that can be pumped, and the best locations to recharge aquifers when water is available, we aim to provide them the tools necessary to implement practical solutions for improved water use.

Remote Sensing

Committee Updates

Huilin Gao (Texas A&M University); Andrew Feldman & Kristen Whitney (NASA GSFC/University of Maryland)

The Remote Sensing Technical Committee (RSTC) is delighted to share the following updates:

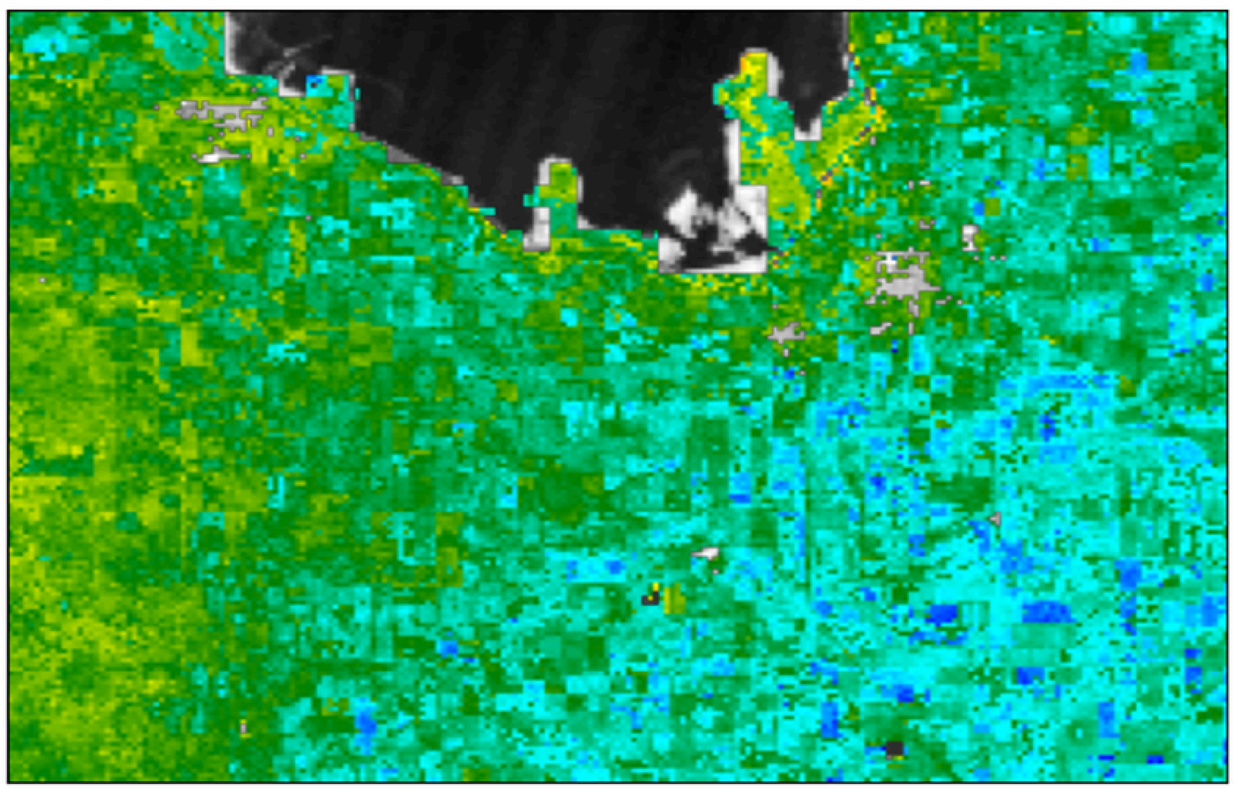
- The RSTC currently has 24 active members across six subcommittees (e.g., newsletter, social media, awards).
- LinkedIn has been a key platform for connecting with the broader community, with over 1,500 members. In addition to announcements, research highlights from recent remote sensing of hydrology publications and news are posted regularly (approximately every two weeks).
- At AGU25, the RSTC organized 15 sessions and one workshop, and 10 students received the RSTC Best Student Presentation Award. For AGU26, more than 10 sessions have been proposed.
- The community-driven Live Cheat Sheet on "*Remote Sensing Products for Hydrology*" continues to grow and has become a valuable resource for teaching and research. Community members can contribute to this living resource by suggesting new datasets through the Cheat Sheet Suggestion Form.

We invite all colleagues interested in remote sensing—particularly early-career researchers—to stay connected by following us on our webpage and LinkedIn, or by subscribing to our mailing list. We also welcome posts of events, opportunities, and other remote sensing hydrology content on our LinkedIn group.

Featured article: A New Era for Soil Moisture Remote Sensing with NISAR

Vinit Sehgal (Louisiana State University); Jasmeet Judge (University of Florida); Rowena Lohman (Cornell University); Alex Lewandowski (Alaska Satellite Facility DAAC); Andrew Feldman (NASA GSFC/University of Maryland)

The recent launch of the NASA-Indian Space Research Organization (ISRO) Synthetic Aperture Radar (NISAR) mission has unlocked a long-anticipated observing capability of global soil moisture at high spatial resolutions for the hydrology community. Designed as the first joint Earth-observing satellite between NASA and ISRO, NISAR is a science-driven mission that is a combination of dual-frequency imaging radars, large swath, and twice every 12-days coverage to study changes in Earth's land surfaces at spatial resolutions of 5-80 m. In addition, because NISAR is an all-weather, day-night radar system, it provides consistent observations during extreme events such as floods, droughts, and rapidly evolving wetting episodes, while optical data depends upon solar illumination and is impeded by clouds. For users and enthusiasts interested in learning about NISAR's vision, algorithms and datasets, the mission's Science Users' Handbook and a summary article are great starting points



NISAR Soil Moisture product (higher soil moisture in blue, drier in yellow) overlain on HH-pol observations (brighter indicates higher backscatter) aggregated onto the 200-meter EASE-GRID2 used for the soil moisture product, for December 28, 2025, over the Everglades Agricultural Area, south of Lake Okeechobee, Florida.

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Remote Sensing

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At the center of the global soil moisture product is NISAR's L-band (24-cm wavelength) Synthetic Aperture Radar, which is capable of penetrating moderate vegetation and sensing surface soil moisture at spatial resolutions of 200 m or less with an uncertainty of 6% by volume. This is orders-of-magnitude finer than the current capabilities of microwave soil moisture products from the SMAP and SMOS missions, which typically operate at spatial scales of tens of kilometers. This uncertainty level is unprecedented at this spatial resolution. For hydrologists, the availability and quality of soil moisture at this scale bridges a long-standing gap between field observations, catchment-scale models, and satellite remote-sensing products

Early demonstrations and regional operational products further illustrate NISAR's potential. For example, over India, ISRO has shown soil moisture retrievals at resolutions as fine as 100 m using combined S- (9.4-cm wavelength) and L-band observations, enabling district/county-scale agricultural and hydrologic monitoring. These products capture field-scale irrigation signals, rainfall-driven wetting and drying cycles, and moisture stress across diverse agroclimatic regions, which have previously remained unresolved by existing resources. Such field-scale soil moisture will enable more rigorous testing of hydrologic and land-surface models, particularly in data-poor regions. NISAR has also opened new pathways for data assimilation, allowing models to ingest spatially explicit moisture information that represents real-world variability in terrestrial hydrology. Such a high-resolution capability is transformative for hydrology, where spatial heterogeneity in soil moisture strongly controls runoff generation, evapotranspiration, and land-atmosphere feedbacks. This scale is also key for improved land management on farms and ranches. Equally important is NISAR's role in advancing hydrology beyond soil moisture as a standalone variable. When combined with complementary datasets, such as evapotranspiration, precipitation, and groundwater observations, NISAR soil moisture supports improved estimation of water and energy fluxes, drought intensification, and land-atmosphere coupling strength.

Samples of preliminary NISAR observations, including the 200 m soil moisture product, are available through the NASA Earthdata platform for selected sites across the globe for the scientific community. The first public release of the global Level-1 and -2 products are anticipated in early summer 2026, along with a beta version of the soil moisture product. The updated soil moisture retrievals will be available upon completion of product calibration and validation, about 6-9 months later. The mission's free and open data policy, along with analysis-ready formats distributed through the NASA Earthdata and ISRO Bhoonidhi portals, further lowers barriers for broad scientific and operational use. Due to its large swath and high spatial resolution, NISAR will add upwards of 80 terabytes of data per day to the archive. Over the course of its 3-year mission, NISAR's data volume (including products at all Levels) will surpass that of all other NASA Earth Observation datasets combined. Individual data products are often tens of gigabytes in size and delivered in the HDF5 file format. To support the user community, the Alaska Satellite Facility has published an executable NISAR Cookbook and NISAR Data User Guide as regularly updated, living documents. They serve as resources for those wishing to learn about NISAR data, view updates from the mission Project and Science Teams, and learn methods to efficiently access and work with the dataset both in Python and with GIS software.

In summary, the launch of NISAR marks a significant step forward for hydrologic sciences. Its high-resolution, globally consistent, and physically meaningful observations, enable cutting-edge science at previously inaccessible scales. The high-resolution soil moisture product from NISAR, along with complementary capabilities of current satellite missions such as NASA SMAP, ESA SMOS and Sentinel-1, will provide transformational advances in hydrologic sciences and applications. As adoption expands across the community, these datasets are expected to become foundational to next-generation hydrologic research and water-resource decision making.

Community Resources

Unlock powerful resources to help you grow in your career

Take full advantage of tools and opportunities designed specifically to support your professional growth—don't miss out!

- Learn and Develop | AGU: Grow your skills and career with learning tailored for Earth and space scientists
- Resource Guides:
  - Careers in Geosciences Resource Guide
  - Graduate School Resource Guide
- AGU Weekly eNewsletter: delivered to your inbox every Thursday!

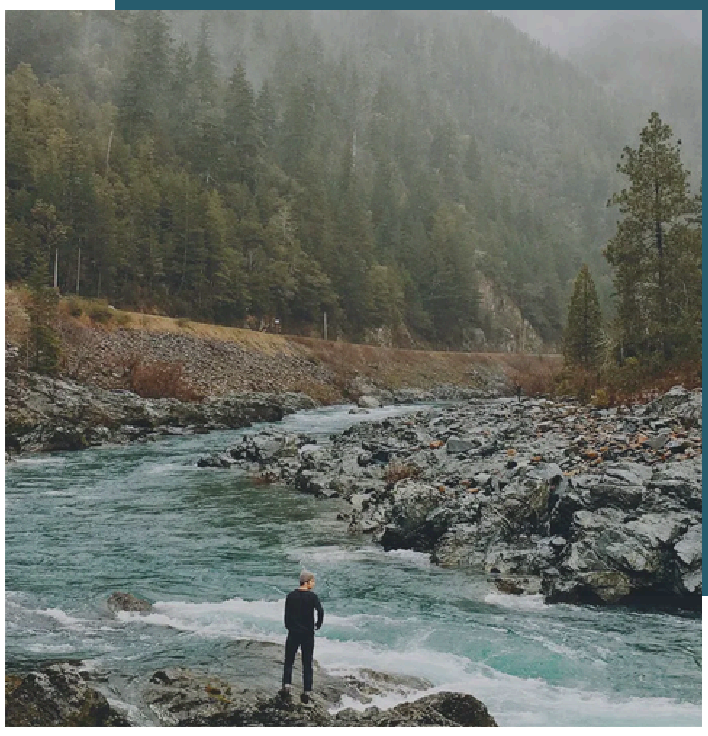
Impacted AGU Member Support Community

AGU has set up a community on AGU Connect for members impacted by job and funding losses. Participants can use this forum to share information and resources with one another. If you have any questions, please contact AGU's Section Support Team (agu-SectionHelp@agu.org).

Interviews with Interesting Hydrologists

The AGU Hydrology Section offers a video series featuring interviews with eminent hydrologists reflecting on key achievements in the field during the 20th century. These videos highlight the progression of hydrological science and offer valuable insights for scientists and educators alike.

Community Links



AGU Hydrology Section

Website: connect.agu.org/hydrology
BlueSky: @hydrology-agu.bsky.social
X: @Hydrology_AGU

Technical Committee Links

Catchment Hydrology
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LinkedIn: AGU Groundwater Hydrology

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X: @AGU_HU

Hydrology Section Student Subcommittee (H3S)
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Linkedin: AGU Precipitation

Remote Sensing
Website: connect.agu.org/hydrology/about/tc-committees/remote-sensing
LinkedIn: AGU Hydrology Section's Remote Sensing Technical Committee group

Soil Processes and Critical Zone
Website: connect.agu.org/biogeosciences/tc-committees/soils-spcztc

Unsaturated Zone
Website: connect.agu.org/hydrology/about/tc-committees/unsat
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Water and Society
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Water Quality
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