

Vinit Sehgal

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EDUCATION

Ph.D., Biological & Agricultural Engineering (BAEN), Texas A&M University (TAMU), 2017–2023

Major: Water Management & Hydrological Science (WMHS)

M.S., Biological Systems Engineering, Virginia Tech (VT), 2015–2017

B.E., Civil Engineering, Birla Institute of Technology (BIT), Mesra, India, 2009–2013

HONORS & AWARDS

- *Dissertation Fellowship*, Graduate & Professional School, TAMU (2022-2023)
- *Data Science Ambassador Scholarship*, Texas A&M Institute of Data Science (2022)
- *Charles & Frances Fleming Academic Excellence Scholarship*, TAMU (2022)
- *Class of 2017 Endowed Aggie Ring Scholarship*, TAMU (2022)
- *Kirkham Conference Travel Award*, Soil Science Society of America (2022)
- *Valeen Silvy Fellowship*, WMHS, TAMU (2021)
- *Robert E. Stewart Graduate Excellence Award*, Dept. of Bio & Ag. Eng. (BAEN), TAMU (2021)
- *WMHS Academic Scholarship*, TAMU (2017 & 2020)
- *Graduate Student Competitive Scholarship*, BAEN, TAMU (2019 & 2020)
- *Water Daze Award* for first place in the student poster competition, WMHS, TAMU (2018)
- *Outstanding Contribution in Reviewing* award by *Journal of Applied Soft Computing* (2018) & *Journal of Hydrology* (2017), Elsevier
- *Erasmus Mundus Joint Masters Scholarship*, European Union (2015)
- *Best Paper Award* for the paper, “Wavelets in Hydrological Modeling,” at Int’l. Conf. on Modeling Tool for Sustainable Water Resources Management, Indian Institute of Technology, Hyderabad, India (2014)
- *Young Scientist Award* for the paper “Development of a novel fly ash based zeolite for treatment of wastewater,” Indian Council of Chemists (2010)

EMPLOYMENT

Graduate Research Assistant | Vadose Zone Research Group, TAMU (2017 – 2021)

Dissertation: *Remote Sensing of Soil Physics: Emergent Properties & Applications.*

- Quantified landscape–scale emergent signatures of soil–vegetation–climate interactions using satellite sensed soil moisture
- Parameterized global surface soil moisture drydown patterns & pathways
- Estimated preferential hydrological regimes & crossing properties of global surface soil moisture
- Developed operational near–real–time global flash drought monitoring system using SMAP satellite

Graduate Research Assistant | Biological Systems Engineering, VT (2015 – 2017)

Thesis: Near Real–Time Seasonal Drought Forecasting & Retrospective Drought Analysis Using Simulated Multi–Layer Soil Moisture from Hydrological Models at Sub–Watershed Scales.

- Studied mechanistic understanding of drought propagation through soil profile in space & time
- Coupled SWAT model with CFS–v2 forecasts for seasonal sub–watershed–scale drought forecasting for Southeastern U.S.

Project Associate | Dept. of Civil Eng., Indian Institute of Technology, Delhi (2014 – 2015)

- Developed a wavelet–based multiscale statistical downscaling framework for temperature & precipitation from General Circulation Models (GCMs) for India

Research Intern | Dept. of Ag. & Food Eng., Indian Institute of Technology, Kharagpur (2012)

- Developed wavelet–based statistical flood forecasting models for watersheds in Eastern India

PUBLICATIONS

REFEREED JOURNAL (*h–index*: 12, *Citations*: 451)

Sehgal, V., Gaur, N., & Mohanty, B. P. (2021). Global flash drought monitoring using surface soil moisture. *Water Resources Research*, 57(9), e2021WR029901. <https://doi.org/10.1029/2021WR029901>

Sehgal, V., Gaur, N., & Mohanty, B. P. (2020). Global surface soil moisture drydown patterns. *Water Resources Research*, 57(1), e2020WR027588. <https://doi.org/10.1029/2020WR027588>

Sachindra, D., A., K., Rashid, M., **Sehgal**, V., Shahid, S., Perera, B., et al. (2019). Pros & cons of using wavelets in conjunction with genetic programming & generalised linear models in statistical downscaling of precipitation. *Theoretical & Applied Climatology*, 138(1), 617–638. <https://doi.org/https://link.springer.com/article/10.1007/s00704-019-02848-2>

Sehgal, V., & Sridhar, V. (2019). Watershed–scale retrospective drought analysis & seasonal forecasting using multi–layer, high–resolution simulated soil moisture for southeastern US. *Weather & Climate Extremes*, 23, 100191. <https://doi.org/10.1016/j.wace.2018.100191>

Sehgal, V., Lakhanpal, A., Maheswaran, R., Khosa, R., & Sridhar, V. (2018). Application of multi–scale wavelet entropy & multi–resolution Volterra models for climatic downscaling. *Journal of Hydrology*, 556, 1078–1095. <https://doi.org/10.1016/j.jhydrol.2016.10.048>

Sehgal, V., & Sridhar, V. (2018). Effect of hydroclimatological teleconnections on the watershed–scale drought predictability in the southeastern United States. *Int'l Journal of Climatology*, 38, e1139–e1157. <https://doi.org/10.1002/joc.5439>

Sehgal, V., Sridhar, V., Juran, L., & Ogejo, J. A. (2018). Integrating climate forecasts with the soil & water assessment tool (SWAT) for high–resolution hydrologic simulations & forecasts in the southeastern U.S. *Sustainability*, 10(9), 3079. <https://doi.org/10.3390/su10093079>

Lakhanpal, A., **Sehgal**, V., Maheswaran, R., Khosa, R., & Sridhar, V. (2017). A non–linear & non–stationary perspective for downscaling mean monthly temperature: A wavelet coupled second order Volterra model. *Stochastic Environmental Research & Risk Assessment*, 31(9), 2159–2181. <https://doi.org/10.1007/s00477-017-1444-6>

- Sehgal**, V., Sridhar, V., & Tyagi, A. (2017). Stratified drought analysis using a stochastic ensemble of simulated & in-situ soil moisture observations. *Journal of Hydrology*, 545, 226–250. <https://doi.org/10.1016/j.jhydrol.2016.12.033>
- Agarwal, A., Maheswaran, R., **Sehgal**, V., Khosa, R., Sivakumar, B., & Bernhofer, C. (2016). Hydrologic regionalization using wavelet-based multiscale entropy method. *Journal of Hydrology*, 538, 22–32. <https://doi.org/10.1016/j.jhydrol.2016.03.023>
- Sahay, R. R., & **Sehgal**, V. (2014). Wavelet–ANFIS models for forecasting monsoon flows: Case study for the Gandak river (India). *Water resources*, 41(5), 574–582. <https://doi.org/10.1134/S0097807814050108>
- Sehgal**, V., & Chatterjee, C. (2014). Auto updating wavelet based MLR models for monsoonal river discharge forecasting. *Int. J. Civ. Eng. Res*, 5, 401–406.
- Sehgal**, V., Sahay, R. R., & Chatterjee, C. (2014). Effect of utilization of discrete wavelet components on flood forecasting performance of wavelet based ANFIS models. *Water resources management*, 28(6), 1733–1749. <https://doi.org/10.1007/s11269-014-0584-4>
- Sehgal**, V., Tiwari, M. K., & Chatterjee, C. (2014). Wavelet bootstrap multiple linear regression-based hybrid modeling for daily river discharge forecasting. *Water resources management*, 28(10), 2793–2811. <https://doi.org/10.1007/s11269-014-0638-7>
- Sahay, R. R. & **Sehgal**, V. (2013). Wavelet regression models for predicting flood stages in rivers: A case study in Eastern India. *Journal of Flood Risk Management*, 6(2), 146–155. <https://doi.org/10.1111/j.1753-318X.2012.01163.x>
- Sharma, N. K., Mitra, S., **Sehgal**, V., & Mishra, S. (2012). An assessment of physical properties of coal combustion residues w.r.t. their utilization aspects. *Int. J. Environ. Protection*, 2(2), 31–38.

IN PREPARATION / UNDER REVIEW

- Mohanty, B. P., Miller, G., Moore, G., Everett, M., Rajan, N., Mbabazi, D., Morgan, C., Gaur, N., **Sehgal**, V., & et al. (2022). Texas water observatory: A distributed network for monitoring water, energy, & carbon cycles under variable climate & land use on gulf coast plains (Under review in WRR).
- Sehgal**, V., & Mohanty, B. P. (2022). Preferential hydrologic states & crossing properties of global surface soil moisture (in preparation).
- Sehgal**, V., & Mohanty, B. P. (2022). Hydrologic state dynamics of global surface soil moisture regionalize soil–vegetation–climate coexistence patterns (in preparation).
- Mbabazi, D., **Sehgal**, V., & Mohanty, B. P. (2022). Global patterns of land–surface energy partitioning with surface soil moisture (in preparation).

BOOK CHAPTER

- Sehgal**, V., Sridhar, V., & R., Maheswaran. (2019). Comparative analysis of the performance of wavelet-based & stand-alone models in capturing non-stationarity in climate downscaling. *Water resources & environmental engineering ii* (pp. 195–203). Springer, Singapore.

SELECT CONFERENCE PROCEEDINGS, PRESENTATIONS & POSTERS

Mohanty, B. & **Sehgal, V.**, (2022, Poster). Emergent Properties of Soil Moisture Dynamics Beyond Darcy Scale & Their Applications in Hydrology. Kirkham Conference, Soil Science Society of America

Mohanty, B. & **Sehgal, V.**, (2022, Poster). Soil Response Units: Discretizing Watersheds Using Observed Soil Hydrological Behavior at Remote Sensing Scale. Frontiers in Hydrology Meeting, American Geophysical Union (AGU).

Mohanty, B., Mbabazi, D., & **Sehgal, V.** (2021, Oral). Exploring evapotranspiration–soil moisture coupling relationships from the eddy covariance to satellite scale. AGU Fall Meeting Abstracts, H21C–04.

Sehgal, V., Gaur, N., & Mohanty, B. (2021, Poster). Introducing an open–source tool for near–real–time global flash drought monitoring with SMAP. AGU Fall Meeting Abstracts, H15W–1314.

Gaur, N., Rokad, B., **Sehgal, V.**, & Mohanty, B. (2020, Oral). A land–surface heterogeneity index to classify continental scale near–surface soil moisture dynamics. AGU Fall Meeting Abstracts, H02–01.

Sehgal, V., & Mohanty, B. (2020, Oral). Multiscale soil hydraulic parameterization for improved hydrologic simulations using SMAP. AGU Fall Meeting Abstracts, H187–07.

Gaur, N., Mohanty, B., & **Sehgal, V.** (2019, Oral). How do we deal with soil hydrology beyond the rev scale? AGU Fall Meeting Abstracts, H22A–05.

Sehgal, V., Gaur, N., & Mohanty, B. P. (2019, Oral). The signature of climate & vegetative influence on the effective soil water retention at a continental scale. ASA, CSSA & SSSA Int'l Annual Meetings.

Sehgal, V., Mohanty, B., & Gaur, N. (2019, Oral). Soil & vegetative controls on global soil moisture drydowns using SMAP: Implications for large scale soil hydraulic parameterization. AGU Fall Meeting Abstracts, H53E–08.

Sehgal, V., & Mohanty, B. (2018, Oral). Soil heterogeneity—a moderator of soil moisture memory? Soil Survey & Land Resource Workshop, Texas A&M University.

Sehgal, V., & Mohanty, B. (2018, Oral). Soil moisture drydowns over space, time & depth: A combination of remote sensing & land surface model. AGU Fall Meeting Abstracts, H41F–03.

Sehgal, V., & Sridhar, V. (2016, Oral). Sensitivity analysis of soil moisture to drought indices. American Society of Agriculture & Biological Engineers (ASABE) Annual Int'l Meeting.

Sehgal, V., Maheswaran, R., & Khosa, R. (2014, Oral). Application of wavelet analysis in hydrological modelling. Intl Conference on Modeling Tools for Sustainable Water Resources Management, IIT Hyderabad, India.

INVITED TALKS

Large–scale Geospatial Analysis with R (2020). Tech–Talk Series, Texas A&M Institute of Data Science.

Using soil moisture for drought monitoring in a warming world (2020). School of Civil Engineering, Reva University, India.

RESEARCH PRODUCTS

Operational Global Flash Drought Monitoring (Funding agency: *NASA*)

Designed & operationalized *FLASH* (**FL**ash drought **A**ssessment using **SMAP** **H**ydrology)

- Automated system for near–real–time global flash drought monitoring
- Open data access to global gridded (36 km, daily) SMAP–based Flash Drought Stress Index (2015–present) with 2–day latency
- Weekly publication of the latest global drought outlook (& county–wise summary for Texas) on Twitter for public engagement & awareness

Website: <https://vadosezone.tamu.edu/flash/>

Climate Downscaling Tool (Funding agency: *Dept. of Science & Technology, India*)

Designed & deployed a free MATLAB–based tool for downscaling climate variables to local scales using a wavelet–based multiscale approach

Website: <https://sites.google.com/site/climaticdownscalingtool/>

TEACHING & MENTORSHIP

Teaching Assistant, BAEN 675 – Hydrology Across Scales | TAMU (Spring 2020 & 2022)

- Instructed hands–on computer lab on geostatistics, precipitation variability, random number generation, Fourier transform, time–frequency analysis using wavelets, upscaling/downscaling using MCMC, Neural networks, & Kalman filters (software used: ArcMap, MATLAB)
- Re–designed lab assignments with MATLAB Live Editor to improve data visualization & code access
- Graded assignments & provided feedback to students
- Mentored students for the capstone project

Mentor, BAEN 491 – Research (High–impact learning for undergraduates) | TAMU (Spring 2020 & 2022)

- Supervised two (2) undergraduate students on hydrology, remote sensing & scientific computing
 - *Emily Lopez*, Sophomore, BAEN (1 credit)
Research Focus: Estimating Evapotranspiration from Satellite Soil Moisture
 - *Aidan Brown*, Sophomore, Electrical Engineering (3 credits)
Research Focus: High–Resolution Global Flash Drought Monitoring at a 9–km Footprint Using Satellite Remote Sensing

Team leader, Aggie Research Program | TAMU (2021– 2022)

- Mentored nine (9) interdisciplinary undergraduates on R coding, large–scale satellite data analysis & visualization, high–performance computing, global flash drought monitoring, flood forecasting & effective science communication. Students were engaged in:
 - Drought consultancy to collaborators in Argentina & Lower Colorado River Authority, Texas
 - Publishing detailed regional drought impact assessment for severely affected regions of the world for public awareness as a part of the *Student Twitter Takeover*
 - Developing statistical models for flood forecasting using satellite precipitation & soil moisture

STUDENT SUCCESS

Aidan Brown secured **2nd runner-up** place in the student poster competition for presenting *High-resolution Global Flash Drought Monitoring in Near-Real-Time* at Student Research Week, TAMU (2022)

Aidan Brown presented a poster on *Enhancing near-real-time global flash drought monitoring with high-resolution satellite soil moisture* at Pathways Symposium, TAMU (2022)

Krish Chhabra (Freshman, College of Engineering) presented a poster on *Flood Forecasting Using Satellite Precipitation with Statistical Models* at Pathways Symposium, TAMU (2022)

PROFESSIONAL ACTIVITIES

SCIENTIFIC SESSIONS FACILITATED

- *Convener & co-chair* of the proposed (now accepted) inaugural session on *Remote Sensing of Soil Processes* in the upcoming AGU Fall Meeting (2022)
- *Session co-chair*, Environmental Vadose Zone Hydrology, AGU Fall Meeting (2021)
- *Session manager*, Virtual sessions on hydrology and soil moisture, IEEE Geoscience & Remote Sensing Society (2020)

WORKSHOPS ORGANIZED

Data Visualization & Geospatial Analysis in R, TAMU (2018–2022)

Designed, organized & taught annual interactive workshops on data visualization & geospatial computing using R in collaboration with Texas A&M Institute of Data Science, training over 120 students

Large-Scale Geospatial Data Analysis & Visualization in R, AGU Annual Fall Meeting (2021)

Organized & taught advanced hands-on training for 22 early-career professionals on large-scale geospatial analysis & parallel computing in R in collaboration with AGU Remote Sensing Technical Committee

Outsmart Your Research Using Contemporary Technology, AGU Annual Fall Meeting (2018)

Designed and facilitated an interactive seminar on using contemporary tools for efficient research practices in collaboration with AGU Hydrology Section Student Subcommittee

FIELD DATA COLLECTION

NASA's Soil Moisture Active–Passive (SMAP) Validation EXperiment (SMAPVEX'22)

Collected data for field soil moisture, surface roughness, vegetation water content, soil bulk density, vegetation species distribution, and land–cover survey during the intensive observation period (IOP) in July 2022 at Millbrook, New York. NASA-JPL will use this dataset to improve the SMAP satellite retrieval algorithm over high biomass biomes.

Texas Water Observatory (2017–2021)

Assisted in the installation & maintenance of hydrologic sensors for monitoring water, energy, & carbon fluxes (soil moisture, matric potential, ground–water level, eddy–covariance, etc.) over TWO sites spanning native prairie, agriculture, salt marsh & forest ecosystems.

LEADERSHIP

- *Student Representative* (Nominated), Remote Sensing Technical Committee, AGU (2019–2022)
- *Chair–Travel Grant Committee*, Graduate Student Association, BAEN, TAMU (2020–2022)
- *Chair–Professional Development*, Texas A&M Water Network, TAMU (2018–2019)
- *Vice President–Professional Development*, Graduate Student Council, COALS, VT
- *President*, Literary Society, BIT Mesra (2012–2013)

SERVICE

PEER–REVIEW

Reviewed **90** manuscripts for 25 disciplinary journals, including Water Resources Research, Geophysical Research Letters, Journal of Hydrology, Global & Planetary Change, Scientific Reports, Earth’s Future, Remote Sensing of Environment, Agricultural Water Management, Water Resources Management, Journal of Water Climate Change.

Verified reviews: <https://www.webofscience.com/wos/author/record/H-5848-2018>

DEPARTMENTAL SERVICE

- Student Member, College of Agriculture & Life Sciences Awards Committee, TAMU (2022)
- Volunteer Judge, BAEN Undergraduate Capstone Event, TAMU (2019)

PROFESSIONAL DEVELOPMENT

Fellow, Graduate Mentoring Academy | Graduate & Professional School, TAMU (2022)

Completed core mentoring competencies & learning outcomes in Maintaining effective communication; Aligning expectations; Assessing understanding; Addressing equity & inclusion; Fostering independence; Promoting professional development; & Articulating mentoring philosophy & plan

CIRTL Associate | Center for the Integration of Research, Teaching & Learning (2022)

Completed the introductory & advanced CIRTL courses on STEM teaching & participated in the Local Learning Community

AFFILIATIONS

- American Geophysical Union (AGU), Member
- American Society of Agronomy (ASA), Member
- Crop Science Society of America (CSSA), Member
- Soil Science Society of America (SSSA), Member
- American Water Works Association (AWWA), Member

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