Sinan Rasiya Koya

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Education

University of Nebraska-Lincoln Jan. 2021 – Aug. 2025 (expected)
PhD, Civil and Environmental Engineering

Indian Institute of Technology Gandhinagar Jul. 2016 – Aug 2020
Bachelor of Technology, Civil Engineering

Research Experience

Graduate Research Assistant Jan 2021 – Present
University of Nebraska-Lincoln

- Designed ML-based models for the National Drought Mitigation Center to predict civil unrest from droughts
- Improved the state-of-the-art machine learning-based streamflow prediction with Temporal Fusion Transformers
- Developed a prototype flood forecasting system for the Elkhorn Basin in Nebraska.
- Quantified the cascading effects of snow droughts and associated compound events on streamflow worldwide.
- Developed a diffusion-based (DDPM) rainfall runoff modeling framework.
- Discovered a direct causal relationship with Rain-on-Snow events in North America and Northern Pacific sea-level pressure.
- Developed SnoDRI, a novel autoencoder-based index to capture snow droughts.
- Investigated seasonal effects of precipitation and river stage on groundwater level in the Midwestern US.
- Enhanced the Hillslope Link Model and Hymod-2 by integrating snow parameterizations.
- Conducted hydrologic model simulations for the Great Lakes Runoff Inter-comparison Project Phase 4: the Great Lakes (GRIP-GL).

Undergraduate Researcher May 2018 – Jun 2020
Water and Climate Lab, IIT Gandhinagar

- Investigated the role of drought, flood, and groundwater pumping on groundwater recharge in the Sabarmati basin using SWAT-MODFLOW model calibrated using SWAT-CUP.
- Designed a simple hydrological model consisting of surface water and groundwater variables.
- Investigated the effects of human interaction on surface and groundwater systems by introducing different scenarios of groundwater withdrawal.
- Assessed drought conditions in India's top 100 urban areas.
- Analyzed future drought scenarios using five relevant Global Climate Models outputs.

Publications

Google Scholar (Total citations: 147, h-index: 4, i10-index: 4 as of 05/04/2025)
Total published: 7 (4 first author)
Total under review: 4
Total in preparation: 3

Peer-Reviewed Journal Articles:

[7] **Rasiya Koya, S.**, & Roy, T. (2024) Temporal Fusion Transformers for Streamflow Prediction: Value of Combining Attention with Recurrence, *Journal of Hydrology*, https://doi.org/10.1016/j.jhydrol.2024.131301

[6] **Rasiya Koya, S.**, Kar, K. K., & Roy, T. (2024) Northern Pacific Sea-level Pressure Controls Rain-onSnow in North America, *Communications Earth & Environment.*, https://doi.org/10.1038/s43247-024-01431-6

[5] **Rasiya Koya, S.**, Kar, K. K., Srivastava, S., Tadesse, T., Svoboda, M., & Roy, T. (2023) . An Autoencoder-based Snow Drought Index, *Scientific Reports*, https://doi.org/10.1038/s41598-023-47999-5.

[4] **Rasiya Koya, S.**, Velasquez, N., Mantilla, R. I., Rojas, M., Harvey, K., Ceynar, D., Krajewski, W. F., & Roy, T. (2023) . Applicability of a Flood Forecasting System for Nebraska Watersheds. *Environmental Modelling & Software*, 164, 105693, https://doi.org/10.1016/j.envsoft.2023.105693

[3] Velasquez, N., Quintero, F., **Rasiya Koya, S.**, Roy, T. & Mantilla, R. I.(2023). Snow-detonated floods: Assessment of the US midwest march 2019 event. Journal of Hydrology: Regional Studies*Journal of Hydrology: Regional Studies*, 47, 101387, https://doi.org/10.1016/j.ejrh.2023.101387

[2] Mai, J., Shen, H., Tolson, B. A., Gaborit, É., Arsenault, R., Craig, J. R., Fortin, V., Fry, L. M., Gauch, M., Klotz, D., Kratzert, F., O'Brien, N., Princz, D. G., **Rasiya Koya, S.**, Roy, T., Seglenieks, F., Shrestha, N. K., Temgoua, A. G. T., Vionnet, V., and Waddell, J. W., (2022) The Great Lakes Runoff Intercomparison Project Phase 4: the Great Lakes (GRIP-GL), *Hydrol. Earth Syst. Sci.*, 26, 3537–3572, https://doi.org/10.5194/hess-26-3537-2022

[1] Aliev, A., **Koya, S. R.**, Kim, I., Eun, J., Traylor, E., & Roy, T. (2023). Application of Neural Networks for Hydrologic Process Understanding at a Midwestern Watershed. *Hydrology*, 10(2), 27, https://doi.org/10.3390/hydrology10020027

Manuscripts under Review:

[4] **Rasiya Koya, S.** and T. Roy, Efficacy of Temporal Fusion Transformers for Runoff Simulation, under review in *Journal of Hydrology.*

[3] Kumar, N., K. K. Kar, S. Srivastava, S. Pokharel, **S. Rasiya Koya**, M. Likins, and T. Roy, Trends and Causal Structures of Rain-on-Snow Flooding, under review in *Journal of Hydrology.*

[2] Patil, A., R. Das Bhowmik, **S. Rasiya Koya**, T. Roy, and N. Kumar, Revising calibration of a lumped watershed model to yield high extreme streamflow, under review in *Journal of Water and Climate Change.*

[1] Kim, I., **Koya, S. R.**, Roy, T., & Eun, J. Seasonal Influences of Precipitation and River Stage on Groundwater Levels in Platte River Watersheds Vulnerable to Spring Floods, under review in *Journal of Hydrologic Engineering*

Manuscripts in Preparation:

[3] **Rasiya Koya, S.**, AghaKouchak, A., & Roy, T., Cascading Effects of Snow Droughts and Associated Compound Events on Streamflow, *Manuscript in preparation.*

[2] **Rasiya Koya, S.**, & Roy, T., A Diffusion Inspired Rainfall-Runoff Modeling Framework, *Manuscript in preparation.*

[1] **Rasiya Koya, S.**, Niu, G.Y., & Roy, T., Impact of Rain-on-snow events in runoff generation in the continental US, *Manuscript in preparation.*

Preprints:

[3] **Rasiya Koya, S.**, K. K. Kar, S. Srivastava, T. Tadesse, M. Svoboda, and T. Roy (2023), An Autoencoder-based Snow Drought Index, *ArXiv*, doi:10.48550/arXiv.2305.13646

[2] **Rasiya Koya, S**. and T. Roy (2023), Temporal Fusion Transformers for Streamflow Prediction: Value of Combining Attention with Recurrence, *ArXiv*, doi:10.48550/arXiv.2305.12335.

[1] Mai, J., H. Shen, B. A. Tolson, É. Gaborit, R. Arsenault, J. R. Craig, V. Fortin, L. M. Fry, M. Gauch, D. Klotz, F. Kratzert, N. O'Brien, D. G. Princz, **S. Rasiya Koya**, T. Roy, F. Seglenieks, N. K. Shrestha, A. G. T. Temgoua, V. Vionnet, and J. W. Waddell (2022), The Great Lakes Runoff Intercomparison Project Phase 4: The Great Lakes (GRIP-GL), *Hydrology and Earth System Sciences Discussions*, doi:10.5194/hess-2022-113

Conferences/Symposiums:

[20] **Rasiya Koya, S**. and T. Roy (2024), The Cascading Effect of Snow Droughts on Streamflow, *AGU Annual Meeting*, Dec 9-13, Washington D.C.

[19] **Rasiya Koya, S**. and T. Roy (2024), A diffusion-inspired rainfall-runoff modeling framework, *HydroML Symposium*, May 29-31, Richland, WA.

[18] **Rasiya Koya, S**. and T. Roy (2023), Streamflow Forecasting with Temporal Fusion Transformers, *AGU Fall Meeting*, Dec 11-15, San Francisco.

[17] Patil, A., R. Das Bhowmik,**S. Rasiya Koya**, T. Roy, and N. Kumar (2023), Evaluate the Occurrence of Extreme Events in Two Indian Basins Using Rainfall-Runoff Model, *AGU Fall Meeting*, Dec 11-15, San Francisco.

[16] Kumar, N., K. K. Kar, S. Srivastava, **S. Rasiya Koya**, S. Pokharel, M. Likins, and T. Roy (2023), Causal Discovery Methods to Investigate Rain-on-Snow Flooding, *AGU Fall Meeting*, Dec 11-15, San Francisco.

[15] **Rasiya Koya, S.**, K. K. Kar, and T. Roy (2023), Causal Drivers of Rain-on-Snow Events in North America, *Nebraska Water Conference*, Oct 3-4, Omaha.

[14] Roy, T., **S. Rasiya Koya**, S. Pokharel, N. Kumar, S. Srivastava, K. K. Kar, and I. Kim (2023), Convergent research towards building flood resilience in Nebraska, *Nebraska Water Conference*, Oct 3-4, Omaha.

[13] Blackwell, B., **S. Rasiya Koya**, N. Kumar, and T. Roy (2023), Causal Drivers of Flood-Induced Water Quality Issues in Nebraska, *Nebraska Summer Research Program Symposium*, Aug 3, Lincoln.

[12] **Rasiya Koya, S**. and T. Roy (2023), Application of Temporal Fusion Transformers in Streamflow Prediction, *HydroML Symposium*, May 22-24, Berkeley.

[11] **Rasiya Koya, S.**, Kanti Kar, K., Srivastava, S., and Roy, T.: SnoDRI: A Machine Learning Based Index to Measure Snow Droughts, (2023) In *EGU General Assembly* , Vienna, Austria, 24–28 Apr 2023, EGU23-8968, https://doi.org/10.5194/egusphere-egu23-8968

[10] Mai, J., Shen, H., Tolson, B., Gaborit, É., Arsenault, R., Craig, J., Fortin, V., Fry, L., Gauch, M., Klotz, D., Kratzert, F., O'Brien, N., Princz, D., **Rasiya Koya, S.**, Roy, T., Seglenieks, F., Shretha, N., Temgoua, A. G., Vionnet, V., and Waddell, J.: The Great Lakes Runoff Intercomparison Project (GRIP-GL), (2023) In *EGU General Assembly 2023*, Vienna, Austria, 24–28 Apr 2023, EGU23-968, https://doi.org/10.5194/egusphere-egu23-968

[9] **Koya, S. R**. (2022). Potential Drivers and Spatiotemporal Variability of Rain-on-Snow Events. In *AGU Fall Meeting* 2022.

[8] Mai, J., H. Shen, B. Tolson, E. Gaborit, R. Arsenault, J. R. Craig, V. Fortin, L. Fry, M. Gauch, D. Klotz, F. Kratzert, N. O'Brien, D. G. Princz, **S. Rasiya Koya**, T. Roy, F. Seglenieks, N. Shrestha, A. G. Temgoua, V. Vionnet, and J. M. Waddell (2022), The Great Lakes Runoff Intercomparison Project Phase 4: the Great Lakes (GRIP-GL), *AGU Fall Meeting*, Dec 12-16, Chicago.

[7] **Rasiya Koya, S**. and T. Roy (2022), Incorporating Snow Processes in the Iowa Flood Information System (IFIS) and Evaluating its Applicability to Nebraska, *Student Research Days, UNL*, Lincoln.

[6] **Rasiya Koya, S**. (2022), Flood Prediction in Nebraska: Comparison of Machine Learning Models and Conceptual Hydrological Model, *UNL Graduate Student Symposium*, Feb 25, Lincoln.

[5] **Rasiya Koya, S.**, Velasquez, N., Mantilla, R., Rojas, M., Harvey, K., Ceynar, D., Krajewski, W. and Roy, T., (2021), December. Development of a Flood Monitoring System Prototype for a Pilot Basin in Nebraska. In *AGU Fall Meeting*, Dec 13-17, New Orleans.

[4] Aliev, A., **Rasiya Koya, S.**, Kim, I., and Roy, T. (2021). Towards better hydrologic process understanding at Shell Creek Watershed. In AGU Fall Meeting, Dec 13-17, New Orleans.

[3] Kim, I., **Rasiya Koya, S.**, Roy, T., and Eun, J. (2021). Seasonal Effects of Precipitation and River Stage on Groundwater Level in the Midwestern United States. In *AGU Fall Meeting*, Dec 13-17, New Orleans.

[2] Aliev, A., **S. Rasiya Koya**, I. Kim, and T. Roy (2021), Towards Better Hydrologic Process Understanding at Shell Creek Watershed, *UNL College of Engineering Summer Undergraduate Research Fair*, Aug 3, Lincoln.

[1] Harvey, K., T. Roy, and **S. Rasiya Koya**(2021), Research Towards an Integrated Food Information System for Nebraska, NEASCE/NITE Transportation Conference, June 4, Virtual.

Teaching Experience

Guest Lecture Fall 2024
University of Nebraska-Lincoln
Statistical Hydrology — Advisor: Dr. Tirthankar Roy

- Collaborated with instructor to design and deliver course content on causality and causal inference.
- Engaged students in interactive discussions on fundamental concepts of causality and convergent cross mapping.
- Facilitated hands-on learning experiences in causal inference by guiding students through the analysis of real-world datasets.

Graduate Teaching Assistant Spring 2024
University of Nebraska-Lincoln
Civil Engineering Analysis II — Advisor: Dr. Kaycie Lane

- Managed lab sessions focused on teaching Python programming.
- Collaborated with faculty to design and develop course content.

Undergraduate Teaching Assistant Fall 2017
Indian Institute of Technology, Gandhinagar
Engineering Graphics — Advisor: Dr. Gaurav Srivastava

- Instructed a cohort of 180 undergraduate freshmen.
- Facilitated lab sessions on Autodesk Inventor Professional.

Mentoring & Volunteering

High School Student Outreach Program Mentor Apr 2024
University of Nebraska-Lincoln

- Mentored students from Lincoln East High School, providing guidance and support in their academic and career development.
- Delivered lecture on the challenges and opportunities in water resource engineering.

Freshman Engineering Seminar Mentor Oct 2023
University of Nebraska Lincoln

- Mentored engineering freshmen at the University of Nebraska, offering guidance and support in their academic transition.
- Provided insights into various aspects of civil engineering and demonstrated a watershed model to enhance practical understanding.

Research Experience for Undergraduates (REU) Grad Student Mentor May 2023 - Aug 2023
University of Nebraska-Lincoln

- Mentored an undergraduate student from Howard University, providing research experience on the causal links between floods and water quality.

Research Experience for Undergraduates (REU) Grad Student Mentor May 2022 - Aug 2022
University of Nebraska-Lincoln

- Mentored an undergraduate student from the State University of New York, offering research experience in Machine Learning-based flood forecasting.

Research Experience for Undergraduates (REU) Grad Student Mentor May 2021 - Aug 2021
University of Nebraska-Lincoln

- Mentored an undergraduate student from the University of Maryland, providing research exposure in Machine Learning applications for understanding hydrologic processes at Shell Creek Basin.
- Co-authored and published the research findings in a peer-reviewed journal.

Peer Assisted Learning(PAL) Mentor Aug 2019 - Dec 2019
Indian Institute of Technology, Gandhinagar

- Trained and supported two undergraduate freshmen in their academic subjects and English communication skills.

Awards/Grants

- **Graduate Student Travel Award**, University of Nebraska Lincoln, Fall 2024
- **College of Engineering Professional Development Fellowship**, University of Nebraska-Lincoln, Fall 2024
- **HydroML Symposium Travel Grant**, Pacific Northwest National Laboratory, Summer 2024
- **James O. Jirsa Professional Development Award**, University of Nebraska Lincoln, Spring 2024
- **Graduate Student Travel Award**, University of Nebraska Lincoln, Fall 2023
- **Second prize, poster competition**, Nebraska Water Conference, 2023
- **Sorkin Scholarship Fund Fellowship**, University of Nebraska Lincoln, 2022-2023 Academic Year
- **Robert A. and Becky Reisdorff Student Support Fund**, University of Nebraska Lincoln, 2021-2022 Academic Year
- **Explorer Fellowship**, Indian Institute of Technology Gandhinagar, Summer 2017
- **Dean's List for Academic Excellence**, Indian Institute of Technology Gandhinagar, Spring 2019

Service

- Reviewer, *Journal of Hydrology.*
- Session moderator, HydroML symposium.
- Judge, Summer Research Symposium, University of Nebraska-Lincoln.
- Judge, Research Experience for Undergraduates (REU) Presentations.

Professional Association

- Member: **American Geophysical Union** (AGU)
- Member: **American Association for the Advancement of Science** (AAAS)

Technical Skills

- **Programming:** Python, R, MATLAB, C++, Shell
- **Tools:** HPC, Conda, Bash, VSCode, Jupyter, GitHub, Google Earth Engine, ArcGIS, QGIS, GMT, QSWATMOD, Autodesk Inventor Professional, Ansys Fluent, Adobe Illustrator, LaTeX
- **Hydrological Models:** Noah-MP, HYMOD2, Raven, HLM, SWAT, MODFLOW, HEC-RAS
- **Climate Models:** CESM2, SCAM6
- **Libraries:** PyTorch, Lightning, TensorFlow, Scikit-learn, Xarray, Dask, Scipy, NetCDF, GDAL, GeoPandas, Pandas, Numpy, Multiprocessing, Matplotlib, Seaborn