

Postdoctoral Research Associate  
Environmental Sciences Division  
Oak Ridge National Laboratory  
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### **Educational Qualifications**

**Doctor of Philosophy (Ph.D.)** from Department of Geology and Geophysics, Indian Institutes of Technology (IIT) Kharagpur (2017). Thesis title: *Groundwater recharge and storage across parts of the Indian sub-continent by in situ measurements, satellite-based observations, and numerical simulations*

**Master of Science (M.Sc.)** in Environmental Science from University of Calcutta (2009)

**Bachelor of Science (B.Sc.)** in Chemistry (Hons.), Physics and Mathematics from University of Calcutta (2007)

### **Research expertise**

1. Distributed and semi-distributed hydrological modeling
2. Machine learning and remote sensing applications in Earth Sciences in high performance computing (HPC) platforms
3. Biogeochemical model development for water quality applications and soil greenhouse gas emissions
4. Groundwater storage quantification, groundwater-surface water interaction, water management

### **Awards and recognition**

1. Article was highlighted in **Nature Asia**: <https://www.natureasia.com/en/nindia/article/10.1038/nindia.2020.6>
2. **C. V. Raman Postdoctoral Fellowship 2019** from Indian Institute of Science (IISc), India
3. Article was highlighted in **Nature Asia**: <https://www.natureasia.com/en/nindia/article/10.1038/nindia.2018.121>
4. Article was highlighted in **NASA's "IMAGE of the Day"** blog: <https://earthobservatory.nasa.gov/IOTD/view.php?id=91008>
5. Won '**Best Poster Award**' in '**Best Science Story**' category at NASA Goddard Space Flight Center (GSFC)'s annual poster event, Annual Poster Blowout party, 2016
6. **Fulbright-Nehru Doctoral Research fellowship 2015-16** and worked at the Hydrological Sciences Laboratory, Goddard Space Flight Center (GSFC), NASA between August 24, 2015, and May 23, 2016
7. **Shastri Indo-Canadian Institute (SICI) Student mobility award 2013-14** for an internship at a Canadian University
8. **CSIR- Shyama Prasad Mukherjee Fellowship (SPMF) in Earth sciences**
9. UGC National Eligibility Test (NET) in June-2012 in Environmental Sciences (**All-India Rank within top 10** out of approximately 8500 students)
10. Secured an **All-India Rank (AIR) 4<sup>th</sup>** out of approximately 6000 students on Joint CSIR UGC National Eligibility Test (NET) in June-2011 in Earth Sciences

### **Research Experiences**

1. Postdoctoral Research Associate, Environmental Sciences Division, Oak Ridge National Laboratory from 14th June 2021 to present. Research topic: *Fully resolved, 3-D application of Advance Terrestrial Simulator (ATS) at regional scale catchments and machine learning based approaches to reduce computational cost of complex physical models*
2. C. V. Raman Postdoctoral Fellow, Interdisciplinary Centre for Water Research (ICWaR), Indian Institute of Science (IISc) Bangalore from 22nd August, 2019 to 4th June, 2021. Research topic: *Groundwater storage quantification and biogeochemical model development for simulating water quality parameters*
3. Postdoctoral Fellow, Athabasca University, Canada from 15th August, 2017 to 31st July, 2019. Research topic: *Biogeochemical model development in SWAT framework; Chemical changes associated with soil organic matter decomposition and oxygen diffusion in soil-water environment, the processes are mainly responsible for oxidation-reduction potential, pH, water quality dynamics, soil greenhouse gas emissions*
4. CSIR- Shyama Prasad Mukherjee Fellow (SPMF), Department of Geology and Geophysics, Indian Institute of Technology (IIT) Kharagpur from 2nd July, 2012 to 19th June, 2017. Research topic: *Groundwater recharge and storage using in situ measurements, satellite-based observations and numerical simulations*
5. Science Collaborator at Hydrological Sciences Laboratory, Goddard Space Flight Center (GSFC), NASA between 24th August, 2015 and 23rd May, 2016. Research topic: *Satellite geodesy applications in water resources, data assimilation*

6. Research Intern, Department of Geosciences, University of Calgary from 27<sup>th</sup> February to 30<sup>th</sup> March, 2014. Research topic: *Estimation of frost depth by electromagnetic induction (EMI) technique*
7. Junior Research Fellow (CSIR) from 2<sup>nd</sup> January, 2012 to 1<sup>st</sup> July, 2012 in Department of Geology and Geophysics, Indian Institute of Technology (IIT) Kharagpur
8. Project Assistant at the Civil Engineering department, Indian Institute of Technology (IIT) Kharagpur from 24<sup>th</sup> September, 2009 to 14<sup>th</sup> December, 2011. Research topic: *Submicron Aerosols; chemical composition, optical properties and climate impacts*
9. Summer intern at the Centre for Oceans, Rivers, Atmosphere and Land sciences (CORAL), Indian Institute of Technology (IIT) Kharagpur. Research topic: *Regional warming over India*

### **Publications** (Peer reviewed journal articles)

Citations: **1576**; h-index: **20**; i-10 index: **31**; International journal articles: **38**; 1st-authored: **17**; Cumulative journal impact factors: **189.84**

#### **Biogeochemical model development for water quality applications and soil greenhouse gas emissions**

1. **S. N. Bhanja**, J. Wang, R. Bol (2022). Soil CO<sub>2</sub> emission largely dominates the total ecosystem CO<sub>2</sub> emission at Canadian boreal forest. *Frontiers in Environmental Science*. [**I. F.: 5.41**]
2. **S. N. Bhanja**, J. Wang (2021). Influence of environmental factors on autotrophic, soil and ecosystem respirations in Canadian boreal forest. *Ecological Indicators*, 125, 107517. [**I. F.: 6.26; Citations: 5**]
3. J. Wang, N. K. Shrestha, M. A. Delavar, T. W. Meshesha, **S. N. Bhanja** (2021). Modelling watersheds and river basins in cold climate regions: A review. *Water*, 13(4), 518. [**I. F.: 3.53; Citations: 6**]
4. **S. N. Bhanja**, J. Wang (2020). Estimating influences of environmental drivers on terrestrial heterotrophic respiration. *Environmental Pollution*, 257, 113630. [**I. F.: 9.99; Citations: 13**]
5. **S. N. Bhanja**, J. Wang, N. Shrestha, X. Zheng (2019). Modelling microbial kinetics and thermodynamic processes for quantifying soil CO<sub>2</sub> emission. *Atmospheric Environment*, 209, 125-135. [**I. F.: 5.76; Citations: 16**]
6. **S. N. Bhanja**, J. Wang, N. Shrestha, X. Zheng (2019). Microbial kinetics and thermodynamic (MKT) processes for soil organic matter decomposition and dynamic oxidation-reduction potential: Model descriptions and applications to soil N<sub>2</sub>O emissions. *Environmental Pollution*, 247, 812-823. [**I. F.: 9.99; Citations: 20**]

#### **Groundwater recharge, storage and its controlling factors; hydrologic modeling**

7. A. Mukherjee, **S. N. Bhanja**, M. Rodell, Y. Wada, P. Malakar, D. Saha, A. MacDonald (2023). Contending the Ganges Water Machine in South Asia: theory versus reality. *ACS ES&T Water*.
8. **S. N. Bhanja**, E. T. Coon, D. Lu, S. L. Painter (2023). Evaluation of distributed process-based hydrologic model performance using only a priori information to define model inputs. *Journal of Hydrology*. [**I. F.: 6.71**]
9. P. Malakar, **S. N. Bhanja**, A. A. Dash, D. Saha, R. K. Ray, S. Sarkar, A. Zahid, A. Mukherjee (2022). Delineating variabilities of groundwater level prediction across the agriculturally intensive transboundary aquifers of South Asia. *ACS ES&T Water*.
10. **S. N. Bhanja**, M. Sekhar (2022). Short-Term and Long-Term Replenishment of Water Storage Influenced by Lockdown and Policy Measures in Drought-Prone Regions of Central India. *Remote Sensing*, 14(8), 1768. [**I. F.: 5.35**]
11. P. Malakar, A. Mukherjee, **S. N. Bhanja**, D. Saha, S. Sarkar, R. Ray (2021). Deep learning-based forecasting of groundwater level trends over India: Implications for crop production and drinking water supply. *ACS ES&T Engineering*. [**Citations: 8**]
12. P. Malakar, A. Mukherjee, **S. N. Bhanja**, A. R. Ganguly, R. K. Ray, A. Zahid, S. Sarkar, D. Saha, and S. Chattopadhyay (2021). Three decades of depth-dependent groundwater response to climate variability and human regime in the transboundary Indus-Ganges-Brahmaputra-Meghna mega river basin aquifers. *Advances in Water Resources*, 149, 103856. [**I. F.: 5.36; Citations: 14**]
13. P. Malakar, A. Mukherjee, **S. N. Bhanja**, D. Saha, R. Ray, S. Sarkar, A. Zahid (2021). Machine learning-based regional-scale groundwater level prediction using GRACE. *Hydrogeology Journal*, 29 (3), 1027-1042. [**I. F.: 3.15; Citations: 11**]
14. P. Malakar, A. Mukherjee, **S. N. Bhanja**, D. Saha, R. Ray, S. Sarkar, A. Zahid (2020). Importance of spatial and depth-dependent drivers in groundwater level modeling through machine learning. *Hydrology and Earth System Science Discussions*. [**Citations: 6**]

15. **S. N. Bhanja**, A. Mukherjee, M. Rodell (2020). Groundwater storage change: Estimates from major river basins across India. *Hydrological Sciences Journal*, 65(4), 650-659. [**I. F.: 3.94; Citations: 18**]
16. B. Li, M. Rodell, S. Kumar, H. Beaudoin, A. Getirana, B. Zaitchik, L. DeGoncalves, C. Cossetin, **S. N. Bhanja**, A. Mukherjee, S. Tian, N. Tangdamrongsub, Di Long, J. Nanteza, J. Lee, F. Policelli, I. Goni, D. Daira, M. Bila, G. Delannoy, D. Mocko, S. Steele-Dunne, H. Save, S. Bettadpur (2019). Global GRACE data assimilation for groundwater and drought monitoring: Advances and challenges. *Water Resources Research*, 55(9), 7564-7586 [**I. F.: 6.16; Citations: 128**]
17. **S. N. Bhanja**, P. Malakar, A. Mukherjee, M. Rodell, P. Mitra, S. Sarkar (2019). Using satellite-based vegetation cover as indicator of groundwater storage. *Geophysical Research Letters*, 46(14), 8082-8092 [**I. F.: 5.58; Citations: 22**]
18. **S. N. Bhanja**, A. Mukherjee (2019). In situ and satellite-based estimates of usable groundwater storage across India: implications for drinking water supply and food security. *Advances in Water Resources*, 126, 15-23. [**I. F.: 5.36; Citations: 36**]
19. **S. N. Bhanja**, A. Mukherjee, R. Rangarajan, B. R. Scanlon, P. Malakar and S. Verma (2019). Long-term groundwater recharge rates across India by in situ measurements. *Hydrology and Earth System Sciences*, 23, 711-722. [**I. F.: 6.62; Citations: 38**]
20. A. Y. Sun, D. Walling, B. R. Scanlon, Z. Zhang, **S. N. Bhanja**, A. Mukherjee, Z. Zhong (2019). Combining Physically-Based Modeling and Deep Learning for Fusing GRACE Satellite Data: Can We Learn from Mismatch? *Water Resources Research*, 55(2), 1179-1195. [**I. F.: 6.16; Citations: 77**]
21. **S. N. Bhanja**, X. Zheng, and J. Wang (2018). Estimating long-term groundwater storage and its controlling factors in Alberta, Canada. *Hydrology and Earth System Sciences*, 22, 6241-6255. [**I. F.: 6.62; Citations: 31**]
22. A. Mukherjee\*, **S. N. Bhanja\*** and Y. Wada (2018). Groundwater depletion causing reduction of baseflow triggering Ganges river drying. *Scientific Reports*, 8, 12049. [**I. F.: 5.00; Citations: 94** [\*]Joint first author]
23. **S. N. Bhanja**, A. Mukherjee, M. Rodell, Y. Wada, S. Chattopadhyay, I. Velicogna, K. Pangaluru, and J. S. Famiglietti (2017). Groundwater rejuvenation in parts of India influenced by water-policy change implementation. *Scientific Reports*, 7, 7453. [**I. F.: 5.00; Citations: 112**]
24. M. Giroto, G. J. De Lannoy, R. H. Reichle, M. Rodell, C. Draper, **S. N. Bhanja**, and A. Mukherjee (2017). Benefits and pitfalls of GRACE data assimilation: A case study of terrestrial water storage depletion in India. *Geophysical Research Letters*, 44(9), 4107-4115. [**I. F.: 5.58; Citations: 81**]
25. **S. N. Bhanja**, M. Rodell, B. Li, D. Saha, A. Mukherjee (2017). Spatio-temporal variability of groundwater storage in India. *Journal of Hydrology*, 544, 428-437. [**I. F.: 6.71; Citations: 36**]
26. **S. N. Bhanja**, A. Mukherjee, D. Saha, I. Velicogna, and J. Famiglietti (2016). Validation of GRACE based groundwater storage anomaly using in-situ groundwater level measurements in India. *Journal of Hydrology*, 543(B), 729-738. [**I. F.: 6.71; Citations: 105**]
27. A. Mukherjee, D. Saha, C. F. Harvey, R. G. Taylor, K. M. Ahmed and **S. N. Bhanja** (2015). Groundwater systems of the Indian Sub-Continent. *Journal of Hydrology: Regional Studies*, 4, 1-14. [**I. F.: 5.44; Citations: 207**]

#### Remote sensing applications in earth sciences

28. S. Sarkar, A. Mukherjee, S. Duttagupta, **S. N. Bhanja**, A. Bhattacharya. Predicting Regional-Scale Elevated Groundwater Nitrate Contamination Risk Using Machine Learning on Natural and Human-Induced Factors (2022). *ACS ES&T Engineering*.
29. S. Sarkar, A. Mukherjee, S. Duttagupta, **S. N. Bhanja**, A. Bhattacharya, S. Chakraborty (2021). Emerging spatiotemporal trends of groundwater nitrate pollution across India. *Journal of Contaminant Hydrology*. [**I. F.: 4.18; Citations: 2**]
30. S. Duttagupta\*, **S. N. Bhanja\***, A. Dutta\*, S. Sarkar, M. Chakraborty, A. Ghosh, A. Mukherjee (2021). Impact of Covid-19 lockdown on river and groundwater-sourced drinking water sustainability in the arsenic-affected Ganges river basin. *International Journal of Environmental Research and Public Health*, 18(6), 2832. [**I. F.: 4.61; Citations: 10**] [\*]Joint first author]
31. A. Singhal, S. Sahu, S. Chattopadhyay, A. Mukherjee, **S. N. Bhanja** (2020). Using night time lights to find regional inequality in India and its relationship with economic development. *PLOS One*, 15 (11), e0241907. [**I. F.: 3.75; Citations: 13**]
32. S. Duttagupta, A. Mukherjee, **S. N. Bhanja**, S. Chattopadhyay, S. Sarkar, K. Das, S. Chakraborty, D. Mondal (2020). Achieving sustainable development goal for clean water in India: influence of natural and

anthropogenic factors on groundwater microbial pollution. *Environmental Management*, 66, 742–755, <https://doi.org/10.1007/s00267-020-01358-6> [**I. F.: 3.64; Citations: 9**]

33. A. Mukherjee, S. Dutta Gupta, S. Chattopadhyay, **S. N. Bhanja**, A. Bhattachayra, S. Chakraborty, S. Sarkar, T. Ghosh, J. Bhattacharya, S. Sahu (2019). Impact of sanitation and socio-economy on groundwater fecal pollution and human health towards achieving sustainable development goals across India from ground-observations and satellite-derived nightlight. *Scientific Reports*, 9, 15193 [**I. F.: 5.00; Citations: 15**]
34. Y. Yoon, S. V. Kumar, B. A. Forman, B. Zaitchik, Y. Kwon, Y. Qian, S. Rupper, V. Maggioni, P. Houser, D. Kirschbaum, A. Richey, A. Arendt, D. Mocko, J. Jacob, **S. N. Bhanja**, A. Mukherjee (2019). Evaluating the uncertainty of terrestrial water budget components over High Mountain Asia. *Frontiers of Earth Science*, 7, 120. [**I. F.: 3.66; Citations: 34**]
35. S. Dutta Gupta, A. Bhattacharya, A. Mukherjee, S. Chattopadhyay, **S. N. Bhanja**, S. Sarkar, P. Malakar, J. Bhattacharya (2019). Groundwater faecal pollution observation in parts of Indo-Ganges-Brahmaputra river basin from in-situ measurements and satellite-based observations. *Journal of Earth System Science*, 128. [**I. F.: 1.91; Citations: 9**]

#### Aerosols and climate change

36. S. Verma, B. Priyadarshini, S. K. Pani, D. Bharath Kumar, A. R. Faruqi, **S. N. Bhanja**, M. Mandal (2016). Aerosol extinction properties over coastal West Bengal Gangetic plain under inter-seasonal and sea breeze influenced transport processes. *Atmospheric Research*, 167, 224-236. [**I. F.: 5.97; Citations: 21**]
37. S. Verma, **S. N. Bhanja**, A. Misra and S. K. Pani (2014). Aerosol optical and physical properties during winter monsoon pollution transport in an urban environment. *Environmental science and pollution research*, 21 (7), 4977-4994. [**I. F.: 5.19; Citations: 22**]
38. S. Verma, S. K. Pani and **S. N. Bhanja** (2013). Sources and Radiative Effects of Wintertime Black Carbon Aerosols in an urban atmosphere in east India. *Chemosphere*, 90, 260–269. [**I. F.: 8.94; Citations: 41**]

#### Book chapters (peer reviewed)

1. **S. N. Bhanja** and J. Wang (2021). Emerging groundwater and surface water trends in Alberta, Canada. *Global Groundwater*. Elsevier, Netherlands.
2. **S.N. Bhanja** and A. Mukherjee (2021). Groundwater sustainability and security in South Asia. *Global Groundwater*. Elsevier, Netherlands.
3. P. Malakar, S. Sarkar, A. Mukherjee, **S. N. Bhanja**, A. Sun (2021). Application of Artificial Intelligence methods for the prediction of groundwater quality and quantity. *Global Groundwater*. Elsevier, Netherlands.
4. A. Mukherjee and **S. N. Bhanja** (2019). An Untold Story of Groundwater Replenishment in India: Impact of Long-Term Policy Interventions. In: A. Singh et al. Eds. *Water Governance: Challenges and Prospects*. Springer Nature Singapore Pte Ltd, 205-218. [**Citations: 4**]
5. **S. N. Bhanja**, A. Mukherjee and M. Rodell (2018). Groundwater storage variations in India. In: A. Mukherjee Ed. *Groundwater of South Asia*. Springer Nature Singapore Pte Ltd, 49-59. [**Citations: 6**]
6. A. Mukherjee and **S. N. Bhanja** (2018). Estimating Present-Day Groundwater Recharge Rates in India. In: A. Mukherjee Ed. *Groundwater of South Asia*. Springer Nature Singapore Pte Ltd, 37-47. [**Citations: 2**]
7. S. A. Hussain, K. Das, **S. N. Bhanja**, and A. Mukherjee (2018). Potential Impact of Climate Change on Surface Water and Groundwater Interactions in lower reaches of Ganges river, India. In: A. Mukherjee Ed. *Groundwater of South Asia*. Springer Nature Singapore Pte Ltd, 583-591. [**Citations: 2**]

**Conference and Workshop Participations:** More than 30 including AGU Fall meetings, EGU General Assembly

#### Other Academic Activities

1. **Associate Editor for *Frontiers in Water*** journal (<https://www.frontiersin.org/journals/water>)
2. **Associate Editor for *Journal of Coastal and Riverine Flood Risk*** (<https://journals.open.tudelft.nl/jcrfr>)
3. Edited a journal volume on topic "**Water Supply Sustainability and Challenges in Asian Mega-deltas under Global Change**" for *Frontiers in Water* journal.
4. **Discovery grant proposal reviewer for the NSERC, Canada.**
5. Reviewer for journals (Web of Science profile: <https://www.webofscience.com/wos/author/record/365164>):  
Nature Geoscience (1), Nature Communications (2), Nature Water (2), Geophysical Research Letters (4), Journal of Hydrology (29), Water Resource Research (3), Hydrology and Earth System Sciences (1), Journal of

Hydrology: Regional Studies (10), Advances in Water Resources (3), Journal of Hydrometeorology (4), Environmental Research Letters (4), Science of the Total Environment (9), Earth System Dynamics (2), Remote Sensing (10), Advances in Space Research (1), Hydrogeology Journal (3), Water Resource Management (1), International Soil and Water Conservation Research (2), Environmental Development (1), Hydrological Sciences Journal (3), Scientific Reports (4), ASCE Journal of Hydrologic Engineering (4), Journal of Earth System Science (3), Applied Water Science (1), Current Science (6), Groundwater for Sustainable Development (4)

6. Played key role to set up the **Environmental Sciences Laboratory**, School of Environmental Sciences and Engineering, IIT Kharagpur. The lab has high-end analytical instruments worth ~USD 4 million
7. Reviewed an article on GRACE satellite mission for **National Academy of Sciences, USA**. Weblink: [https://www.nap.edu/read/25754/pdf/frtr\\_annotated\\_amazinggrace.pdf](https://www.nap.edu/read/25754/pdf/frtr_annotated_amazinggrace.pdf)
8. Experience in **supervising >10 Master's and Doctoral level** students.

## **Skills**

1. Team-work and interdisciplinary studies
2. **Machine learning** (including deep learning) applications using **PyTorch, TensorFlow in both CPUs and GPUs at high-performance computing (HPC) platforms**
3. **Code development using Python, R, Ferret (NOAA), FORTRAN, C/C++, Microsoft Visual Studio**
4. **Geo-spatial statistics, remote sensing and GIS applications using Python, R, Ferret (NOAA), QGIS, ArcGIS, Surfer**
5. **Software development: Visual Studio Code, Jupyter Notebook, Xcode**
6. **Integrated hydrological model: Advanced Terrestrial Simulator (ATS)**
7. **Watershed to global scale hydrological models' development and operation: SWAT, CLSM**
8. **Python-based automated input file creation: Watershed Workflow development**
9. **Experience in working/handling/reprocessing/creating the large global/regional gridded data files**
10. Experience in working with **global-scale models on various US (DoE, NASA), French, and Indian HPCs**
11. **Plot creation and graphics software: Adobe Photoshop, Corel DRAW, Origin Pro, Inkscape, GIMP**
12. **CFD-based visualization software: Paraview and Visit**
13. Operating Systems- MacOS, LINUX (Fedora, Redhat, Ubuntu), Windows

## **Professional referees**

Dr. Abhijit Mukherjee (PhD Adviser)  
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Dr. Junye Wang (Postdoctoral Adviser)  
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