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Engineering & Scientific Consulting

Sarfaraz Alam, Ph.D.

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Professional Profile

Dr. Alam has extensive experience working at the intersection of hydrology, water resources engineering, remote sensing, and environmental policy. He uses his expertise in environmental modeling and data science to investigate complex processes and devise solutions to environmental and policy-related problems.

Dr. Alam led several projects to improve understanding of large-scale hydrologic processes and predict future changes. He quantified groundwater storage changes in the California Central Valley aquifers using ensemble methods, including in-situ measurements, satellite observations, water balance, and hydrologic models. Additionally, he developed hydrologic and optimization models to assess the relative contribution of climatic and human factors to surface-groundwater processes for both historical and projected future periods. He also conducted numerical investigations to understand the impact that large-scale managed aquifer recharge implementation could have on groundwater overdraft and in meeting the objectives of California's Sustainable Groundwater Management Act. Dr. Alam contributed to multiple projects focused on developing remote sensing-based models to quantify regional and local-scale groundwater changes. By leveraging ensemble remote-sensing data, he has quantified variations in groundwater storage, along with the accompanying uncertainties, providing insight into these aquifers. His work on remote sensing extends to the investigation of the interactions between crops, energy, and water, shedding light on critical dynamics during drought years.

Dr. Alam's previous projects also include efforts to understand nutrient movement in surface and groundwater. To identify non-point sources of phosphorus from an agricultural landscape, he co-developed a source attribution model that could be readily applied to a range of watershed sizes. The model was an integration of a hydrologic model, Bayesian statistics, and network structure. He also led a project to improve understanding of nitrate leaching into groundwater, integrating nitrate data with airborne electromagnetic (AEM) geophysical data to identify vulnerable areas. Furthermore, Dr. Alam worked on a project to optimize irrigation and water management systems in tea plantation.

In his prior work on the hydrodynamics of river and coastal processes, Dr. Alam developed 1D, 2D, and 3D hydrodynamic models to predict flood inundation/propagation, river erosion/deposition, and coastal morphological changes. He also developed dam and reservoir models to quantify the impact of various climate conditions on reservoir storage and release.

Dr. Alam's professional experience is complemented by a robust research background that included advanced data analysis techniques. His programming experience has allowed him to develop modeling tools from scratch and collaborate in large groups in developing such tools. He collaborated on projects to automate the process to detect specific land use changes (e.g., concentrated animal feeding operations (CAFO), crop type) from satellite imagery.

Academic Credentials & Professional Honors

Ph.D., Civil Engineering, University of California, Los Angeles (UCLA), 2021

M.S., Water Resources Engineering, Bangladesh University of Engineering and Technology (BUET), Bangladesh, 2015

B.S., Water Resources Engineering, Bangladesh University of Engineering and Technology (BUET), Bangladesh, 2013

Editor's choice award from AGU Water Resources Research journal publication (2021)

UCLA Civil and Environmental Engineering department outstanding Ph.D. student award (2021)

Dissertation Year Fellowship from UCLA for outstanding performance (2020)

Academic Appointments

Postdoctoral Scholar, Geophysics & Regulation, Evaluation and Governance Lab (RegLab), Stanford University, 2021-2023

Assistant Professor, Water Resources Engineering, Bangladesh University of Engineering and Technology, 2016

Lecturer, Water Resources Engineering, Bangladesh University of Engineering and Technology, 2013-2016

Prior Experience

Postdoctoral Scholar, Stanford University, 2021-2023

Graduate Student Researcher, University of California Los Angeles, 2016-2021

Assistant Professor, Bangladesh University of Engineering and Technology, 2016

Lecturer, Bangladesh University of Engineering and Technology, 2013-2016

Professional Affiliations

American Society of Civil Engineers (ASCE)

American Geophysical Union (AGU)

Sigma Xi scientific research honor society

Publications

Ahamed, A., Knight, R., Alam, S., Morphew, M. and Susskind, T., 2023. Remote sensing-based estimates of changes in stored groundwater at local scales: case study for two groundwater subbasins in California's Central Valley. *Remote Sensing*, 15(8), p. 2100.

Argus, D.F., Martens, H.R., Borsa, A.A., Knappe, E., Wiese, D.N., Alam, S., Anderson, M., Khatiwada, A., Lau, N., Peidou, A. and Swarr, M., 2022. Subsurface water flux in California's Central Valley and its source watershed from space geodesy. *Geophysical Research Letters*, 49(22), p. e2022GL099583.

Ahamed, A., Knight, R., Alam, S., Pauloo, R. and Melton, F., 2022. Assessing the utility of remote sensing data to accurately estimate changes in groundwater storage. *Science of The Total Environment*, 807, p. 150635.

Haleakala, K., Yue, H., Alam, S., Mitra, R., Bushara, A.I. and Gebremichael, M., 2022. The evolving roles of intensity and wet season timing in rainfall regimes surrounding the Red Sea. *Environmental Research Letters*, 17(4), p. 044039.

Alam, S., Gebremichael, M., Ban, Z., Scanlon, B.R., Senay, G., Lettenmaier, D.P. (2021). Post-drought groundwater storage recovery in California's Central Valley. *Water Resources Research*, 57(10), p. e2021WR030352.

Alam, S., Ali, M.M., Rahaman, A.Z. and Islam, Z., 2021. Multi-model ensemble projection of mean and extreme streamflow of Brahmaputra River Basin under the impact of climate change. *Journal of Water and Climate Change*, 12(5), pp. 2026-2044.

Alam, S., Borthakur, A., Ravi, S., Gebremichael, M., Mohanty, S. (2021). Managed aquifer recharge implementation criteria to achieve water sustainability. *Science of The Total Environment*, 768, p.144992.

Koppa, A., Alam, S., Miralles, D.G. and Gebremichael, M., 2021. Budyko-based long-term water and energy balance closure in global watersheds from earth observations. *Water Resources Research*, 57(5), p. e2020WR028658.

Gebremichael, M., Krishnamurthy, P.K., Ghebremichael, L.T. and Alam, S., 2021. What drives crop land use change during multi-year droughts in California's Central Valley? Prices or concern for water? *Remote Sensing*, 13(4), p. 650.

Alam, S., Gebremichael, M., Li, R., Dozier, J. and Lettenmaier, D.P., 2020. Can managed aquifer recharge mitigate the groundwater overdraft in California's Central Valley? *Water Resources Research*, 56(8), p. e2020WR027244.

Alam, S., Gebremichael, M., Li, R., Dozier, J. and Lettenmaier, D.P., 2019. Climate change impacts on groundwater storage in the Central Valley, California. *Climatic Change*, 157(3-4), pp. 387-406.

Alam, S., Gebremichael, M. and Li, R., 2019. Remote sensing-based assessment of the crop, energy and water nexus in the Central Valley, California. *Remote Sensing*, 11(14), p. 1701.

Cooper, M.G., Schaperow, J.R., Cooley, S.W., Alam, S., Smith, L.C. and Lettenmaier, D.P., 2018. Climate elasticity of low flows in the maritime western US mountains. *Water Resources Research*, 54(8), pp. 5602-5619.

Alam, S., Ali, M.M. and Islam, Z., 2016. Future streamflow of Brahmaputra River basin under synthetic climate change scenarios. *Journal of Hydrologic Engineering*, 21(11), p. 05016027.

Alam, S., and M. A. Matin, 2013. Application of 2D morphological model to assess the response of Karnafuli River due to capital dredging. *Journal of Water Resources and Ocean Science*, Vol. 2, No. 3, pp. 40-48.

Selected Conference Presentations:

Alam, S., Verma, M., Wei, Z., Hilderbran, M., Ho, D., Suckale, J., Attributing phosphorus in the Maumee River Basin to polluting sources by integrating a network model into a Bayesian framework. In American Geophysical Union Fall Meeting, December 2022.

Alam, S., Ahamed, A., Goebel, M., and Knight, R., The use of remote sensing data to monitor changes in stored groundwater in a heavily stressed subbasin in the Central Valley, December 2021.

Alam, S., Gebremichael, M., and Lettenmaier, D., Groundwater overdraft recovery during post-drought years in California's Central Valley. In American Geophysical Union Fall Meeting, December 2020.

Alam, S., Koppa, A., Miralles, D.G. and Gebremichael, M., Closing the combined water and energy balance of global watersheds based on satellite data. In European Geophysical Union General Assembly Conference. May 2020.

Alam, S., Gebremichael, M., Li, R., Dozier, J. and Lettenmaier, D.P., How much can managed aquifer recharge mitigate the Central Valley groundwater overdraft? In American Geophysical Union Fall Meeting, December 2019.

Alam, S., Li, R. and Gebremichael, M., Assessing the crop, energy and water nexus in the Central Valley California using remote sensing products. In American Geophysical Union Fall Meeting, December 2019.

Kaenel, M.V., Alam, S., Vimal, S., Su, L., Margulis, S.A., Lettenmaier, D.P. The role of soil moisture memory in spring runoff predictability in Western US river basins. In American Geophysical Union Fall Meeting, December 2019.

Alam, S., Koppa, A., Gebremichael, M. Validation of global precipitation and evapotranspiration datasets from a water and energy balance perspective. In 12th International Precipitation Conference. June 2019.

Alam, S., Gebremichael, M., Li, R., Lettenmaier, D.P. and Dozier, J., Potential impact of climate change on groundwater storage in Central Valley, California. In American Geophysical Union Fall Meeting, December 2018.

Alam, S., Ali, M.M. and Islam, Z., Potential impact of climate change on water availability of Brahmaputra River basin, CSCE Annual General Conference 2015, Regina, Saskatchewan, Canada. May 2015.

Kamal, R., Alam, S. and Matin, M.A., Modeling monsoon flood flows of lower Meghna river due to climate change and sea level rise, Proceedings of International Conference on Climate Change Impact and Adaptation (ICCA-2013), DUET, Dhaka, Bangladesh, pp. 14 –16. November 2013.

Ahmed, T., Alam, S. and Hasan, S., Modeling climate change impact on hydrology of Karnafuli river basin using Soil Water Assessment Tool (SWAT), 4th International Conference on Water Flood Management (ICWFM- 2013), IWFM, Dhaka, Bangladesh, Vol. 2, Theme 8, pp 529-536. October 2013.

Alam, S. and Matin, M.A., Application of deflt3d mathematical model in the river Karnafuli for two-dimensional simulation, Proceedings of 1st International Conference on Advances in Civil Engineering 2012 (ICACE 2012), 12 –14 , CUET, Chittagong, Bangladesh. Paper Id-WRM036. December 2012.

Invited talks:

Alam, S. IWFM users group meeting, "Understanding climate change impacts on groundwater storage". December 16, 2020.

Alam, S., UCLA Civil & Environmental Engineering Department Seminar Series, "How much can Managed Aquifer Recharge mitigate groundwater overdraft in California's Central Valley?" October 13, 2020.

Alam, S., Water Plan Team of California Department of Water Resources, "How much can Managed Aquifer Recharge mitigate groundwater overdraft in California's Central Valley?". July 21, 2020.

Alam, S., Lunch-MAR forum organized by California Department of Water Resources, "Can managed aquifer recharge mitigate the groundwater overdraft of California's Central Valley?". July 1, 2020.

