Shahryar Khalique Ahmad

Contact Information

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Research Interests

Reservoir Operations Modeling and Optimization
Renewable Energy Systems Analysis, Planning, and Modeling
Remote Sensing Applications
Land Surface Modeling
Geospatial Data Analysis and Machine Learning

Education

University of Washington, Seattle 2018 - present
Doctor of Philosophy in Civil and Environmental Engineering
Hydrology and Hydrodynamics Program
Dissertation: *Weather forecast-informed hydropower operations*
Advisor: Dr. Faisal Hossain
GPA: 3.95/4.0

University of Washington, Seattle 2016 - 2017
Master of Science in Civil and Environmental Engineering
Hydrology and Hydrodynamics Program
Thesis: *Investigating the value of Weather Forecasts from Numerical Prediction Models for hydropower maximization in small to medium storage dams*
GPA: 3.97/4.0

Indian Institute of Technology, Kanpur 2012 - 2016
B.Tech. in Civil Engineering
Department Rank: 2
GPA: 9.54/10.0

Research Experience

Graduate Research Assistant Fall'16 - present
SASWE Research Group, University of Washington

- Management of fully automated operational web interface of South Asian Surface Water Modeling System (SASWMS) used by various operational agencies in South Asia (http://depts.washington.edu/saswe)
- Development of cropwater demand model for an irrigation advisory for marginal scale-farmers in Southeast Asia using weather forecasts and remote sensing products such as GRACE
- Prototyping Flood Inundation Forecast and Management system for Houston
- Deployment and management of Variable Infiltration Capacity (VIC v5.1) hydrologic model for Mekong River Basin
- Assessment of future volume change in Tonle Sap Lake in Mekong River Basin using climate model projections and satellite data (INFEWS project)

Student Intern (Remote), NASA Goddard Space Flight Center
Supervisor: Dr. Sujay V. Kumar, NASA GSFC Summer'20

- Developed a robust machine learning algorithm to classify flooded and permanent waters from realtime microwave remote sensing products

- Trained the algorithm over multiple flood events in the U.S. and demonstrated its transferrability over a variety of events worldwide
- Integrated Google's cloud computing-based AI platform with Google Earth Engine's server side processing to achieve fast and computationally efficient method of flood mapping

Student Intern, NASA Goddard Space Flight Center Summer'17
Supervisor: Dr. Sujay V. Kumar, NASA GSFC

- Developed interactive state-of-the-art web based framework, **LIS Atlas**, to visualize Land Information System (LIS)-generated model output from multiple model domains and configurations at different timescales
- Programmed initial prototype for the FEWS NET project over Central Asia and Africa to monitor snow conditions and water availability, respectively
- Implemented capabilities to generate outputs from Land surface Verification Toolkit (LVT) at various spatial and temporal scales, including quantitative evaluations of model outputs compared to observations.

MITACS Globalink Research Intern Summer'15
Supervisor: Prof. Anders Knudby, Simon Fraser University, Burnaby, Canada

- Applied radiative transfer model for satellite-derived bathymetry with case study of Canadian waters
- Simulated above-water reflectance to retrieve per-pixel water depth
- Employed efficient model inversion algorithms using BSP tree and ALUT
- Performed case study of Boundary Bay for field validation of depth estimates

Publications

Refereed

1. Jameel, Y., Stahl, M., **Ahmad, S.K.**, Kumar, A., Perrier, G. (2020). India needs an effective flood policy. *Science* 369(6511), pp. 1575.
2. **Ahmad, S.K.**, F. Hossain, T. Pavelsky, G. Parkins, S. Yelton, M. Rodgers, S. Basile, S. Ghafoor, D. Haldar, R. Khan, N. Shawn, A. Haque and R. Biswas (2020). Estimating Volumetric Water Storage in Seasonal and Transboundary Runoff-Dominated Wetlands Using Citizen Science and Satellite Remote Sensing Data, *Water Resources Research*, p.e2020WR027989. DOI:10.1029/2020WR027989
3. Beveridge, C., Hossain, F., Biswas, R.K., Haque, A.A., **Ahmad, S.K.**, Biswas, N.K., Hossain, M.A. and Bhuyan, M.A., 2020. Stakeholder-driven development of a cloud-based, satellite remote sensing tool to monitor suspended sediment concentrations in major Bangladesh rivers. *Environmental Modelling and Software*, p.104843. DOI: 10.1016/j.envsoft.2020.104843
4. **Ahmad, S.K.**, and Hossain, F., 2020. Realizing ecosystem-safe hydropower from dams. *Renewables: Wind, Water, and Solar*, 7(1), pp.1-23. DOI: 10.1186/s40807-020-00060-9
5. **Ahmad, S.K.**, Hossain, F. (2020). Forecast-Informed Hydropower Optimization at Long and Short-time scales for a Multiple Dam Network. *Journal of Renewable and Sustainable Energy* 12. DOI: 10.1063/1.5124097
6. **Ahmad, S. K.**, Hossain, F. (2020). Maximizing Energy Production from Hydropower Dams using Short-Term Weather Forecasts. *Renewable Energy* 146, pp.1560-1577. DOI: 10.1016/j.renene.2019.07.126

7. Daly, K., Hossain, F., **Ahmad, S.K.**, Bonnema, M., Beveridge, C. Nijssen, B., Holtgrieve, G. (2020). Recent Warming of the Tonle Sap Lake, Cambodia: Implications for one of the World's Most Productive Inland Fisheries. *Lakes and Reservoirs*.
8. **Ahmad, S.K.**, Bonnema, M., Hossain, F. (2020). Generating more hydropower with less dams and better ecosystem outcomes: is it possible? International Water Power and Dam Construction Magazine, January 2020 issue, pp. 38-40.
9. Hossain, F., Harsha, K.S., Goyal, S., **Ahmad, S.K.**, Lohani, B., Balaji, N., Tripathi, S. (2020). Towards Affordable and Sustainable Water-Smart Irrigation Services. AWRA Impact Jan 2020 issue
10. **Ahmad, S. K.**, Hossain, F. (2019). A generic data-driven technique for forecasting of reservoir inflow: Application for hydropower maximization *Environ. Model. Softw* 119, pp.145-167. DOI: 10.1016/j.envsoft.2019.06.008
11. **Ahmad, S. K.**, Hossain, F. (2019). A Web-Based Decision Support System for Smart Dam Operations Using Weather Forecasts. *Journal of Hydroinformatics* 21(5), pp.687-707. DOI: 10.2166/hydro.2019.116
12. **Ahmad, S. K.**, Hossain, F., Eldardiry, H., Pavelsky, T. (2019). A Fusion Approach for Water Area Classification using Visible, Near Infrared and Synthetic Aperture Radar for South Asian Conditions, *IEEE Transactions on Geoscience and Remote Sensing*, pp.1-10. DOI: 10.1109/tgrs.2019.2950705
13. Sikder, S., **Ahmad, S. K.**, Hossain, F., Gebregiorgis, A., Lee, H. (2019). Case Study: A Rapid Urban Inundation Forecasting Technique Based on Quantitative Precipitation Forecast for Houston and Harris County Flood Control District. *Journal of Hydrologic Engineering*, 24(8), p.05019017.
14. Eythorsson, D., Gardarsson, S.M., **Ahmad, S. K.**, Hossain, F., Nijssen, B. (2019). Arctic Climate and Snow Cover Trends – Comparing Global Circulation Models with Remote Sensing Observations. *International Journal of Applied Earth Observation and Geoinformation*, 80, pp.71-81.
15. Hossain, F., Bonnema, M., Biswas, N., **Ahmad, S. K.**, Duong, B., Luong, N. (2019). When Floods Cross Borders, Satellite Data Can Help. EOS (AGU) Feb 16, 2019.
16. **Ahmad, S. K.**, Hossain, F. (2018). Generating More Hydropower Using Weather Forecasts. AWRA Impact May 2018 issue.
17. Knudby A., **Ahmad S. K.**, Ilori C. (2016). The potential for Landsat-based bathymetry in Canada. *Canadian Journal of Remote Sensing, 42(4), pp.367-378.*

In-review

1. **Ahmad, S.K.**, Hossain, F., Holt, G., Galleli, S., Pavelsky, T. (2020). How will Future Dams Modify Temperature of Rivers around the World? *Earth's Future*
2. Bose, I., **Ahmad, S.K.**, Biswas, N., Hossain, F., Jayasinghe, S., Meechaiya, C. (2020). Using SRTM and Landsat Visible Data to Estimate Time Varying River Water Height for Chindwin River in Myanmar, *Remote Sensing Applications*

3. Bose, I, Hossain, F., Eldardiry, H., **Ahmad, S.K.**, Biswas, N.K., Lee, H., Aziz, M., and Kamal, M.S. (2020). Integrating Gravimetry Data with Thermal Infra-red Data from Satellites to Improve Efficiency of Operational Irrigation Advisory in South Asia, *Water Resources Research*

Posters/Oral Presentations

1. **Ahmad S. K.**, F. Hossain. (Dec 2020). Predicting Thermal Impact of Future Hydropower Dams for Ecosystem-Safe Operations.. *In AGU Fall Meeting Abstracts. Dec 2020.*
2. **Ahmad S. K.**, F. Hossain. (Dec 2019). Maximizing hydropower production with smart multi-dam operations using long and short-term forecasts. *In AGU Fall Meeting Abstracts. Dec 2019.*
3. Eythorsson, D., Gardarsson, S.M., **Ahmad, S.K.**, Hossain, F., Nijssen, B. (Dec 2019). Arctic Climate and Snow Cover Trends – Comparing Global Circulation Models with Remote Sensing Observations. *In AGU Fall Meeting Abstracts. Dec 2019.*
4. **Ahmad S. K.**, F. Hossain. (Dec 2018). Computationally Efficient Daily Streamflow Forecasting for Hydropower Maximization Using Artificial Neural Networks. *In AGU Fall Meeting Abstracts. Dec 2018.*
5. Knudby A., Roy D., **Ahmad S.K.**, Bird S., Ilori C., 2016. Satellite-derived bathymetry for Canada, *Canadian Hydrographic Conference, May 16-19, 2016, Halifax, Nova Scotia, Canada.*
6. **Ahmad S. K.**, Srinivasan V., Ghosh P., 2014a. Analysis of annular footings and anchors lying on elastic soil medium using finite difference technique. *5th International Congress on Computational Mechanics and Simulation (ICCMS) 2014, India.*
7. **Ahmad S. K.**, Srinivasan V., Ghosh P., 2014b. Analysis of axisymmetric foundations subjected to axial compressive or tensile static loads on Gibson soil model. *Indian Geotechnical Conference (IGC) 2014, India.*

Teaching Experience

Teaching Assistant Fall'19 and Fall'20
Satellite Remote Sensing For Water Resources, University of Washington

Guest Lecture Winter'18
Quantitative Water Resources Management, University of Washington

Invited Talks

Ecosystem-Safe Hydropower from Existing and Future Dams in a Challenging Climate Oct 2020
MIT Energy Nights, 2020

Energy from AI: Ushering in a New Frontier in Smart Hydropower Generation through Artificial Intelligence Feb 2021
Lightning talk, Second AI and Data Science Workshop to be hosted by JPL

Remote Sensing of River Temperatures Sep 2020
Sensing Rivers Workshop, University of Washington.

Relevant Projects

AI-driven flow forecasting system

- Designed a feedforward artificial neural network for short-term reservoir inflow forecasting
- Incorporated hydrologically relevant input nodes to minimize lag in peak reservoir inflows

Houston City Flood Inundation Forecasting and Management system

- Developed an operationally skillful flood inundation forecasting system using HEC-RAS 2D hydrodynamic model
- Simulated SWAT model over catchment in Harris County (Houston) to provide boundary conditions for HEC-RAS

Provision of Advisory for Necessary Irrigation (PANI)

- Used fusion of satellite and global numerical weather prediction data with hyperlocal sensor data on soils and crops to derive evapotranspiration
- Programmed web-based dissemination system for daily advisories on cropwater requirement to marginal scale farmers in Kanpur, India.

Smart Decision Support System for Optimized Reservoir Operations

- Developed an operational web-based portal to provide informed decisions for optimized reservoir operations
- Automated realtime optimization for Detroit Dam, OR, using short-term numerical weather forecasts, synergized with hydrologic and reservoir model to maximize hydropower

Multi-sensor Fusion Approach for Water Area Classification

- Developed a novel approach to obtain improved inundation extent using multiple sensors in visible and microwave wavelengths
- Established value in Fusion technique in challenging wetlands of South Asia comparing against high-resolution Planet imageries

INFEWS - Innovations at the Nexus of Food, Energy and Water Systems in Mekong River Basin Winter'18

- Developed python-based standalone module to assess future volume changes in Tonle Sap Lake using climate model projections and satellite data

Effect of DEM resolution on hydrological modeling Spring'17

- Used LiDAR data for high resolution bare earth model for watershed delineation
- Extracted saturated areas in watershed using TOPMODEL wetness index

Global Snow Cover Area Evaluation using remote sensing data with Google Earth Engine Winter'17

- Obtained trends in global snow cover area using MODIS data in Google Earth Engine
- Extracted trends for specific Köppen-Geiger Climate Classes over the Arctic to assess effect of climate change and topography

Development of web-based GIS for IIT Kanpur Spring - Summer'16

- Developed the first ever web-based GIS for IIT Kanpur community
- Programmed various spatial queries using feature layers from GIS database

- Built interactive GUI using HTML, CSS, JavaScript, and PHP

Technical Training

JPL Summer School in Climate Sciences August, 2020
- Participated in two-week virtual summer school organized by Jet Propulsion Laboratory (JPL) Center for Climate Sciences and Keck Institute for Space Studies on *Satellite Observations and Climate Models.*

Google Earth Engine Workshop for Advanced Users December, 2018
- Participated in two-day workshop organized by Google, Washington DC
- Hands-on tutorials on areal computations, optical/radar data fusion, and multi-temporal compositing and classification using Earth Engine API.

Awards and Fellowships

- NASA Space Apps Challenge *Best Use of Data* Award, 2020
- MIT Energy Hack *Chevron Challenge Winner*, 2020
- Grow with Google Challenge Scholarship, 2018
- Washington State AWRA Student Fellowship, 2017 ($ 2000)
- Ivanhoe Foundation Fellowship, 2017 ($ 5000)
- Mitacs Globalink Graduate Fellowship for research internship at Simon Fraser University, Canada, 2016
- Academic Excellence Award in 2015 and 2016, IIT Kanpur, India
- Nominated by Ministry of Human Resource Development, India for Commonwealth Scholarships, UK, 2016
- Merit-cum-Means scholarship for academic year 2013-14, IIT Kanpur, India

Skills

Programming - Python, C/C++, MATLAB, Bash Scripting
Cloud Computing - Google Earth Engine
Machine Learning/Data Analysis - TensorFlow, Keras, Pyrenn
Version Control - Git
Software/Modeling - Variable Infiltration Capacity Model (VIC), SWAT, HEC-RAS, WRF, StormCAD, FlowMaster, CulvertMaster, ArcGIS, GDAL
Web Development - HTML, CSS, JavaScript, PHP, SQL, WordPress

Society Affiliations

American Society of Civil Engineers (ASCE), Student Member, 2017-present
American Geophysical Union, Student Member, 2017-present
American Water Resources Association, Student Member, 2016-present
American Water Resources Association, Webmaster, 2016-2017
Freshwater Initiative, Steering Committee Member, 2017-2018

Community Service

Peer reviews for international scientific journals
- Environmental Modeling and Software (6)
- Journal of Hydrologic Engineering (3)
- Water Resources Research (1)
- Journal of Hydrometeorology (1)
- Journal of Water Resources Planning and Management (1)

Training and Outreach
- Trained and helped participants during 2020 and 2021 SWOT Early Adopter Virtual Hackathon organized by NASA, CNES and UW.

- Engaged in middle school science outreach for Discovery Days, an event organized by UW College of Engineering
- Trained participants during WaterHackWeek'19 on Google Earth Engine
- Organized events for UW Chapter of American Water Resources Association