

SHAHRYAR KHALIQUE AHMAD

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RESEARCH INTERESTS	Reservoir Operations Modeling and Optimization Renewable Energy Systems Analysis, Planning, and Modeling Remote Sensing Applications Land Surface Modeling Machine Learning and Geospatial Data Analysis	
EDUCATION	University of Washington, Seattle <i>Doctor of Philosophy in Civil and Environmental Engineering</i> Hydrology and Hydrodynamics Program Dissertation: <i>Weather forecast-informed hydropower operations</i> Advisor: Dr. Faisal Hossain GPA: 3.95/4.0	2018 - present
	University of Washington, Seattle <i>Master of Science in Civil and Environmental Engineering</i> Hydrology and Hydrodynamics Program Thesis: <i>Investigating the value of Weather Forecasts from Numerical Prediction Models for hydropower maximization in small to medium storage dams</i> GPA: 3.97/4.0	2016 - 2017
	Indian Institute of Technology, Kanpur <i>B.Tech. in Civil Engineering</i> Department Rank: 2 GPA: 9.54/10.0	2012 - 2016
RESEARCH EXPERIENCE	Graduate Research Assistant <i>SASWE Research Group, University of Washington</i> <ul style="list-style-type: none">• 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)	Fall'16 - present
	Student Intern (Remote), NASA Goddard Space Flight Center <i>Supervisor: Dr. Sujay V. Kumar, NASA GSFC</i> <ul style="list-style-type: none">• Developed a robust machine learning algorithm to classify flooded and permanent waters from realtime microwave remote sensing products	Summer'20

- 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. 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
3. **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
4. **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
5. **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
6. 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*.
7. **Ahmad, S.K.**, Bonnema, M., Hossain, F. (2020). Generating more hydro-power with less dams and better ecosystem outcomes: is it possible? Inter-

national Water Power and Dam Construction Magazine, January 2020 issue, pp. 38-40.

8. 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
9. **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
10. **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
11. **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
12. 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.
13. 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.
14. 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.
15. **Ahmad, S. K.**, Hossain, F. (2018). Generating More Hydropower Using Weather Forecasts. AWRA Impact May 2018 issue.
16. 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? *Proceedings of the National Academy of Sciences*
2. Bose, I, Jayasinghe, S., Meechaiya, C., **Ahmad, S.K.**, Biswas, N., Hossain, F. (2020). Using SRTM and Landsat Visible Data to Estimate Time Varying River Water Height for Chindwin River in Myanmar, *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*
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*
4. **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 Trans-boundary Runoff-Dominated Wetlands Using Citizen Science and Satellite Remote Sensing Data, *Water Resources Research*

Posters/Oral Presentations

1. **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.*
2. 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.*
3. **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.*
4. 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.*
5. **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 (IC-CMS) 2014, India.*
6. **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

Lightning Talk, Second AI and Data Science Workshop February 2021
Invited for lightning talk on 'Energy from AI: Ushering in a New Frontier in Smart Hydropower Generation through Artificial Intelligence' at Second AI and Data Science Workshop to be hosted by JPL

Speaker, Sensing Rivers Workshop September 2020
Delivered Talk on 'Remote Sensing of River Temperatures' during three-day virtual workshop organized at University of Washington.

RELEVANT
PROJECTS

AI-driven flow forecasting system

- Designed a feedforward artificial neural network for short-term reservoir in-flow 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 generating the 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

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
- 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 academic years 2015-16 and 2014-15, 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, Pyreann

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 (4)
- Journal of Hydrologic Engineering (2)
- 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 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