

# SHAHRYAR KHALIQUE AHMAD

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CONTACT INFORMATION	4629 21 <sup>st</sup> Ave NE, A-207 University of Washington Seattle - 98105	email: <a href="mailto:skahmad@uw.edu">skahmad@uw.edu</a> <a href="http://students.washington.edu/skahmad">http://students.washington.edu/skahmad</a> +1 206 557 2741
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	<b>University of Washington, Seattle</b> <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
	<b>University of Washington, Seattle</b> <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
	<b>Indian Institute of Technology, Kanpur</b> <i>B.Tech. in Civil Engineering</i> Department Rank: 2 GPA: 9.54/10.0	2012 - 2016
RESEARCH EXPERIENCE	<b>Graduate Research Assistant</b> <i>SASWE Research Group, University of Washington</i> <ul style="list-style-type: none"><li>• Management of fully automated operational web interface of South Asian Surface Water Modeling System (SASWMS) used by various operational agencies in South Asia (<a href="http://depts.washington.edu/saswe">http://depts.washington.edu/saswe</a>)</li><li>• 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</li><li>• Prototyping Flood Inundation Forecast and Management system for Houston</li><li>• Deployment and management of Variable Infiltration Capacity (VIC v5.1) hydrologic model for Mekong River Basin</li><li>• Assessment of future volume change in Tonle Sap Lake in Mekong River Basin using climate model projections and satellite data (INFEWS project)</li></ul>	Fall'16 - present
	<b>Student Intern (Remote), NASA Goddard Space Flight Center</b> <i>Supervisor: Dr. Sujay V. Kumar, NASA GSFC</i> <ul style="list-style-type: none"><li>• Developed a robust machine learning algorithm to classify flooded and permanent waters from realtime microwave remote sensing products</li></ul>	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 hydropower 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., **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*
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*

#### 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 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

TECHNICAL TRAINING	<b>JPL Summer School in Climate Sciences</b> August, 2020 <ul style="list-style-type: none"> <li>Participated in two-week virtual summer school organized by Jet Propulsion Laboratory (JPL) Center for Climate Sciences and Keck Institute for Space Studies on <i>Satellite Observations and Climate Models</i>.</li> </ul>
	<b>Google Earth Engine Workshop for Advanced Users</b> December, 2018 <ul style="list-style-type: none"> <li>Participated in two-day workshop organized by Google, Washington DC</li> <li>Hands-on tutorials on areal computations, optical/radar data fusion, and multi-temporal compositing and classification using Earth Engine API.</li> </ul>
AWARDS AND FELLOWSHIPS	<ul style="list-style-type: none"> <li>NASA Space Apps Challenge <i>Best Use of Data</i> Award, 2020</li> <li>Grow with Google Challenge Scholarship, 2018</li> <li>Washington State AWRA Student Fellowship, 2017 (\$ 2000)</li> <li>Ivanhoe Foundation Fellowship, 2017 (\$ 5000)</li> <li>Mitacs Globalink Graduate Fellowship for research internship at Simon Fraser University, Canada, 2016</li> <li>Academic Excellence Award in academic years 2015-16 and 2014-15, IIT Kanpur, India</li> <li>Nominated by Ministry of Human Resource Development, India for Commonwealth Scholarships, UK, 2016</li> <li>Merit-cum-Means scholarship for academic year 2013-14, IIT Kanpur, India</li> </ul>
SKILLS	<b>Programming</b> - Python, C/C++, MATLAB, Bash Scripting <b>Cloud Computing</b> - Google Earth Engine <b>Machine Learning/Data Analysis</b> - TensorFlow, Keras, Pyrenn <b>Version Control</b> - Git <b>Software/Modeling</b> - Variable Infiltration Capacity Model (VIC), SWAT, HEC-RAS, WRF, StormCAD, FlowMaster, CulvertMaster, ArcGIS, GDAL <b>Web Development</b> - HTML, CSS, JavaScript, PHP, SQL, WordPress
SOCIETY AFFILIATIONS	<b>American Society of Civil Engineers (ASCE)</b> , Student Member, 2017-present <b>American Geophysical Union</b> , Student Member, 2017-present <b>American Water Resources Association</b> , Student Member, 2016-present <b>American Water Resources Association</b> , Webmaster, 2016-2017 <b>Freshwater Initiative</b> , Steering Committee Member, 2017-2018
COMMUNITY SERVICE	<b>Peer reviews for international scientific journals</b> <ul style="list-style-type: none"> <li>Environmental Modeling and Software (4)</li> <li>Journal of Hydrologic Engineering (2)</li> <li>Water Resources Research (1)</li> <li>Journal of Hydrometeorology (1)</li> <li>Journal of Water Resources Planning and Management (1)</li> </ul> <b>Training and Outreach</b> <ul style="list-style-type: none"> <li>Trained and helped participants during 2020 SWOT Early Adopter Virtual Hackathon organized by NASA, CNES and UW.</li> <li>Engaged in middle school science outreach for Discovery Days, an event organized by UW College of Engineering</li> <li>Trained participants during WaterHackWeek'19 on Google Earth Engine</li> <li>Organized events for UW Chapter of American Water Resources Association</li> </ul>