* Doctoral Dissertation Completion Award (UNBC)
* UNBC Conference Travel Award
* NSERC Research Grant through the BaySys Project
* UNBC Doctoral Tuition Scholarship
* Best Paper Presentation (5th National Civil Engineering Students’ Symposium, 2013, IIT Bombay, India)

**Outstanding Points in Career:**

Fall 2013 to present (Date samples only)

2008 – 2013

2008 – 2013

2009 – 2013

2011 – 2012

**Awards, Scholarships, Fellowships**

**Presentations**

**Conference Paper/ Presentations/ Abstract:**

**Lilhare, R.**, Déry S. J., Stadnyk T. A., and Koenig K. (2017). “Hydrologic sensitivity of the Lower Nelson River Basin to lakes, wetlands and frozen ground”, Presented in Arctic Change 2017, Québec City, Québec, Canada

**Lilhare, R.**, and V., Mishra (2014). “Climate Change Impacts on Water Resources in Mahanadi River basin (India)”, (Paper ID Number: 14816), AGU Fall meeting 2014, San Francisco, USA

**Lilhare, R.**, Garg, V., and Nikam, B.R. (2013). “Sediment Yield Estimation using Modified MMF Model in a Geospatial Environment”, Proceedings of International Conference on Hydraulics, Water Resources, Coastal and Environmental Engineering, HYDRO 2013, ISH, IIT Madras, 4-6 December, IIT Madras, India, pp.946-960.

**Lilhare, R.**, Garg, V., and Nikam, B.R. (2013). “Impact of Rainfall Variability on Reservoir Sedimentation Using Modified MMF Model RS and GIS”, Proceedings of 5th National Civil Engineering Students Symposium (NCESS 13), IIT Bombay, 9 March 2013, IIT Bombay, India.

Worked on the Information Technology Research Academy (ITRA) Water Project, Measurement to Management (M2M): Improved water use efficiency and agricultural productivity through experimental sensor network

* as a Senior Research Fellow in Civil Engineering Department, Indian Institute of Technology (IIT), Gandhinagar, India for 1.5 years
* as a Senior Research Fellow in Agricultural and Food Engineering Department, IIT Kharagpur, India for 6 months

**Journal Articles:**

**Lilhare, R.**, Déry, S. J., Stadnyk, T. A., & Koenig, K. A. (2020). Warming soil temperatures and increasing baseflows in response to recent and potential future climate change across a permafrost gradient in north-central Canada. Climatic Change (*in preparation*).

Pokorny, S., Stadnyk, T. A., Ali, G., **Lilhare, R.**, Déry, S. J., & Koenig, K. A. (2020). Cumulative effects of uncertainty on simulated streamflow in a hydrologic modeling environment. Elementa: Science of the Anthropocene (*under revision*).

Pokorny, S., Stadnyk, T. A., **Lilhare, R.**, Ali, G., Déry, S. J., & Koenig, K. A. (2020). Towards assessing input data uncertainty in hydrologic models from ensemble-based gridded climate data. Journal of Hydrometeorology (*under review).*

**Lilhare, R.**, Pokorny, S., Déry, S. J., Stadnyk, T. A., & Koenig, K. A. (2020). Sensitivity analysis and uncertainty assessment in water budgets simulated by the Variable Infiltration Capacity model for Canadian sub-arctic watersheds. Hydrological Processes, 34, 1–19. <https://doi.org/10.1002/hyp.13711>

**Lilhare, R.**, Déry, S. J., Pokorny, S., Stadnyk, T. A., & Koenig, K. A. (2019). Intercomparison of multiple hydro-climatic datasets across the Lower Nelson River Basin, Manitoba, Canada, Atmosphere-Ocean, 57(4), 262–278. <https://doi.org/10.1080/07055900.2019.1638226>

Mishra, V., & **Lilhare, R.** (2016). “Hydrologic sensitivity of Indian sub-continental river basins to climate change”, Global and Planetary Change, 139, 78–96. <https://doi.org/10.1016/j.gloplacha.2016.01.003>

**Lilhare, R.**, Garg, V., and Nikam, B. (2014). “Application of GIS-Coupled Modified MMF Model to Estimate Sediment Yield on a Watershed Scale”, Journal of Hydrologic Engineering, ASCE, C5014002, DOI: <http://dx.doi.org/10.1061/(ASCE)HE.1943-5584.0001063>

**Posters Presented:**

**Lilhare R.**, Pokorny S., Déry S. J., Stadnyk T. A., and Koenig K. (2019). “Evaluating Uncertainties in Hydrological Modelling over the Lower Nelson River Basin, Manitoba, Canada”. Poster session presented at: 27th International Union of Geodesy and Geophysics (IUGG) General Assembly, Montreal, Canada

**Lilhare R.**, Déry S. J., Stadnyk T. A., and Koenig K. (2016). “High-resolution hydrological modelling of the Lower Nelson River Basin, Manitoba, Canada”. Poster session presented at: ArcticNet Annual Scientific Meeting, 2016, Winnipeg, Manitoba, Canada

Mishra V., Shah L. H., **Lilhare R.** (2014). “Climate Change Impacts on Water Resources and Flood Risk in Mahanadi River Basin (India)”. Poster session presented at: Indo-American Frontiers of Engineering Symposium, 19 - 21 May 2014, Mysore, India

**Publications:**

**PEER REVIEWED**

**Degrees**

**M. Tech.** Remote Sensing and GIS; Indian Institiute of Remote Sensing, Indian Space Research Organization, Dehradun, India (2013)

**B. Tech.** Agricultural Engineering; Jawaharlal Nehru Agriculture University, Jabalpur, India (2011)

**Examining Committee:**

Chair:  Dr. Roger Wheate, Associate Professor

Geography Program

University of Northern British Columbia

Supervisor: Dr. Stephen Déry, Professor

Environmental Science and Engineering Program

University of Northern British Columbia

Co-Supervisor: Dr. Tricia Stadnyk, Associate Professor

Department of Geography

University of Calgary

Committee Member:  Dr. Phil Owens, Professor

Environmental Science and Engineering Program

University of Northern British Columbia

Committee Member:  Dr. Xiaogang (John) Shi, Senior Lecturer

School of Interdisciplinary Studies

University of Glasgow, UK

External Examiner:  Dr. Francis Zwiers, Director, President and CEO

Pacific Climate Impacts Consortium (PCIC)

University of Victoria

**Welcome to the PhD Oral Defence for**

**Rajtantra Lilhare**



**Dissertation Abstract**

Hudson Bay, a vast inland sea in northern Canada, receives the highest average annual freshwater from the Nelson River system among all other contributing rivers. A rapidly changing climate and flow regulation from hydroelectric developments alter Nelson River streamflows timing and magnitude, affecting Hudson Bay’s physical, biological, and biogeochemical state. Despite recent developments and advances in climate datasets, hydrological models, and computational power, modelling the Hudson Bay system remains particularly challenging. Therefore, this dissertation addresses crucial research questions from the Hudson Bay System (BaySys) project by informing how climate change impacts variability and trends of freshwater-marine coupling in Hudson Bay. To that end, I present a comprehensive intercomparison of available climate datasets, their performance, and application within the macroscale Variable Infiltration Capacity (VIC) model, over the Lower Nelson River Basin (LNRB). This work aims to identify the VIC parameters sensitivity and uncertainty in water balance estimations and investigates future warming impacts on soil thermal regimes and hydrology in the LNRB.

An intercomparison of six climate datasets and their equally weighted mean reveals generally consistent air temperature climatologies and trends (1981–2010) but with a prominent disagreement in annual precipitation trends with exceptional wetting trends in reanalysis products. VIC simulations forced by these datasets are utilized to examine parameter sensitivity and uncertainties due to input data and model parameters. Findings suggest that infiltration and prescribed soil depth parameters show prevailing seasonal and annual impacts, among other VIC parameters across the LNRB. Further, VIC simulations (1981–2070) reveal historical and possible future climate change impacts on cold regions hydrology and soil thermal conditions across the study domain. Results suggest that, in the projected climate, soil temperature warming induces increasing baseflows as future warming may intensify infiltration processes across the LNRB. This dissertation reports essential findings in the application of state-of-the-art climate data and the VIC model to explore potential changes in hydrology across the LNRB’s permafrost gradient with industrial relevance of future water management, hydroelectric generation, infrastructure development, operations, optimization, and implementation of adaptation measures for current and future developments.

**DISSERTATION TITLE:**

**Assessing the Effects of Uncertainty and Climate Change on Hydrological Simulations Across a Permafrost Gradient in North-Central Canada**

***04 June 2020***

**Doctor of Philosophy**

**Natural Resources and Environmental Studies**