

Metadata

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Title	BaySys Theses and Dissertations
	Abstract
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Version	1.0
Publisher	BaySys
Date Published	2021
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Author Name	BaySys

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License Name	Creative Commons Attribution 4.0 International
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	CC-BY-4.0
Licence Schema Name	SPDX
Licence URL	https://spdx.org/licenses
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Relationship to this publication	Online Resource

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Language	

Data and Resources

Field	Value
URL	https://canwin-datahub.ad.umanitoba.ca/data/dataset/31740642-18a1-4b3c-b6f0-58resource/291c2943-7c02-4e47-b059-90064ce01f69/download/matthes_lisa.pdf
Name	Lisa Matthes (2021)
Description	<p>**Title:** Light propagation in ice-covered environments: seasonal progression and big implications Beginning in the 1960s and increasing through to the present, regulation of reservoirs for hydroelectric generation has become more prevalent in the Nelson Churchill Basin and the La Grande Rivière Complex, together making up close to half of the total freshwater flux entering Hudson Bay annually. Coincident with hydroelectric development, effects of climate change have intensified and are more pronounced at higher latitudes in the majority of the Hudson Bay Drainage Basin (HBDB). Whether the effects of climate change and hydroelectric regulation are additive or offsetting is unclear, creating uncertainty as to the driving cause of the observed changes; with added complication due to the relatively poor representation of regulation in continental-scale hydrologic models. This work aims to quantitatively distinguish the impacts of climate change and hydroelectric regulation on the majority of the freshwater supply to Hudson Bay by running two parallel sets of hydrologic simulations using the HYPE model. The first set improves reservoir regulation in HYPE and the second creates a wholly re-naturalized set of simulations with no anthropogenic influence. An ensemble of the Phase 5 Climate Model Intercomparison Project (CMIP5) general circulation models (GCMs) and representative concentration pathways (RCPs) drive simulations of the HBDB at a daily time-step from 1981 to 2070. By subjecting both models (regulated and re-naturalized) to climate change, the effects of hydroelectric regulation can be isolated and quantitatively distinguished from climate change. This research improves the performance of a hydrological model in a highly regulated system, and further succeeds in distinguishing the spatio-temporal scales of different change factors. Intra-annual changes of flow timing are primarily due to hydroelectric regulation, inter-annual change is driven by upstream stochasticity, and inter-decadal impacts are the result of climate change. With these results, a variety of other simulations (i.e., sea-ice, carbon-cycling, biogeochemical) can be run to ascertain the overall health of Hudson Bay and the effects of climate change and reservoir detention can be quantified quantitatively.</p>
Format	PDF

Field	Value
Resource Category	documents
URL	https://canwin-datahub.ad.umanitoba.ca/data/dataset/31740642-18a1-4b3c-b6f0-588e-2c573b14-b317-4f23-b62d-e53e2b56c884/download/rajtantra_lilhare.pdf
Name	Rajtantra Lilhare (2020)
Description	<p>**Title:** Assessing the effects of uncertainty and climate change on hydrological simulation across a permafrost gradient in North-Central Canada Hudson Bay, a vast inland sea in Canada, receives the highest average annual freshwater from the Nelson River system and 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, we present a comprehensive intercomparison of available climate datasets, their performance, and application within the macroscale Variable Infiltration Capacity (VIC) model, over the LNRB Nelson River Basin (LNRB). This work aims to identify the VIC parameters sensitivity and quantify uncertainty in water balance estimations and investigates future warming impacts on permafrost thermal regimes and hydrology in the LNRB. An intercomparison of six climate datasets reveals an equally weighted mean reveals generally consistent air temperature climatologies and trends (1981–2010) but with a prominent disagreement in annual precipitation trends with existing data and wetting trends in reanalysis products. VIC simulations forced by these datasets are used to examine parameter sensitivity and uncertainties due to input data and model parameters. Findings suggest that infiltration and prescribed soil depth parameters show prevailing influence on annual 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 region permafrost hydrology and soil thermal conditions across the study domain. Results suggest that, under 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 impacts in hydrology across the LNRB's permafrost gradient with industrial relevance of future resource management, hydroelectric generation, infrastructure development, operations, optimization, and implementation of adaptation measures for current and future developments. **Link to full text of Northern British Columbia library :** https://unbc.arcabc.ca/islandora/object/unbc%5Bsolr_nav%5Bid%5D=6bd9d43960a3ad30cf63&solr_nav%5Bpage%5D=0&solr_nav%5B</p>
Format	PDF
Resource Category	documents

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URL	https://canwin-datahub.ad.umanitoba.ca/data/dataset/31740642-18a1-4b3c-b6f0-58resource/5663f328-27da-4011-9b05-c9fcafcf1431/download/36652.pdf
Name	Marie Pierrejean (2020)

Field

Value

Description

****Title:**** Current and future impacts of climate change on benthic communities in the Arctic The Arctic Ocean is emerging as one of the regions that is most affected by climate change. A significant increase in precipitation and sea surface water temperatures are expected and will undeniably lead to a significant loss of sea ice cover. Because of their effects on physicochemical parameters, these changes are expected to directly impact the surface producers (sea ice algae and phytoplankton), thereby limiting organic matter input to the seafloor. It is thus commonly accepted that climate change will affect the distribution, structure, and abundance of benthic communities, due to its impact on environmental parameters (e.g., benthic coupling and physicochemical parameters), and on ecosystem services and functions (e.g., benthic remineralization). As a consequence, the decrease in sea ice cover, the decrease of the surface layer or the increase in shipping traffic in the Hudson Bay Complex and the eastern Canadian Arctic will likely lead to major changes in benthic community structure and biogenic structural habitats. In this context and since the impacts of climate change on arctic ecosystems were still poorly understood, the objectives of this thesis were to i) provide the diversity and distribution of epibenthic communities in the Hudson Bay Complex and to understand the effects of climate change on biodiversity and benthic ecosystem functioning. The outcomes of this thesis allowed us to i) provide the most recent survey on epibenthic communities in the Hudson Bay Complex and their relationships with environmental variables; ii) identify diversity hotspots sensitive to climate change; and iii) document and compare benthic biodiversity and fluxes within biogenic structures and adjacent bare sediments in the Canadian Arctic. A total of 380 taxa have been identified from 46 stations sampled across the Hudson Bay Complex. Despite the relatively low spatial coverage of our sampling, we estimated that the survey represented 71% of the taxa present in the Hudson Bay Complex. We showed that biomass, abundance, diversity and spatial distribution of epibenthic communities were strongly influenced by substrate, salinity, food supply and sea ice cover. We also showed that freshwater inputs were responsible for the lowest biomass, abundance and diversity observed along the coasts. In contrast, data collected from polynyas, further offshore, showed strong pelagic-benthic coupling resulting in high productivity in terms of biomass, abundance and diversity. Moreover, hierarchical modelling of species communities highlighted the influence of sea ice, indirectly of sea ice algae on the epibenthic communities occupying the central Hudson Bay. Projections of the structure of epibenthic communities under a RCP4.5 climate scenario showed that the central Hudson Bay emerges as the most vulnerable area to climate change with diversity loss related to the decrease of sea ice. On the contrary, it would appear that coastal areas will serve as refuges and increase the diversity. In addition, our study showed that the presence of biogenic structures in deep habitats improved the trapping of organic matter, leading to a higher density of infauna in these environments compared to bare sediments. This has also been found to enhance sediment nutrient release in the form of nitrates and ammonium. However, our study could not demonstrate these effects in a shallower soft-bottom habitat. By providing new knowledge on the current and future distribution of epibenthic communities in the Hudson Bay Complex and the benthic ecosystem functioning in hard-bottom biogenic structures, results obtained during this thesis will contribute to the designation of Ecologically and Biologically Significant Areas, as well as to the establishment of Marine Protected Areas and conservation strategies in the Arctic Ocean. Document Type:

Format

PDF

Field	Value
Resource Category	documents
URL	https://canwin-datahub.ad.umanitoba.ca/data/dataset/31740642-18a1-4b3c-b6f0-5809b0900000/resource/d97c09cb-3083-4796-aaf0-a11971096fb2/download/9055d3ea-e749-43c0-9000-900000000000/deb1cb1c4491.pdf
Name	Natasha A. Ridenour (2020)
Description	<p>**Title:** On the circulation and freshwater dynamics of the Hudson Bay Complex. **Abstract:** The Hudson Bay Complex (HBC), which includes Hudson, James, and Ungava Bays, Foxe Basin, and Hudson Strait, is currently undergoing change from two anthropogenic sources; increasing global warming. The communities surrounding this region use the sea for travel, hunting, and social connections, year round. Changes in the food chain and ice conditions thus impact the daily lives of the locals. The HBC also has a large drainage basin, receiving about 900 km³ of freshwater annually, making it an ideal location for the production of hydroelectricity. The water traverses Hudson Bay and is advected to the North Atlantic via Hudson Strait, the primary pathway for exchange between the HBC and the global ocean. Hudson Strait is also the largest source of advected freshwater to the Labrador Sea after Fram and Davis Straits. However, our understanding of the role of riverine water in the bay is limited, and downstream effects of changes in river discharge is presently unknown. Additionally, knowledge of circulation patterns, such as Hudson Strait, is limited to a few observational datasets. These datasets focus primarily on the southern side of the strait which contains fresh eastward flow, and while valuable, there are no recent published data for the north side of the strait containing westward flowing water entering the bay. I begin by presenting the first multi-year freshwater budget for the HBC. Using four model simulations and three river discharge datasets, I show that river discharge dominates freshwater fluxes out of the region on timescales longer than a year. Decreased river discharge and seasonality led to reduced freshwater and volume exchange within the HBC and to the Atlantic. Model resolution had minimal impact on freshwater and volume fluxes in areas of simple flow dynamics. I also provide estimates of the Ekman, mean, and turbulent interior components of freshwater exchange between the interior and boundary regions of the bay. The mean Ekman components import freshwater to the interior in spring and summer, and export in fall. Residence times of discharge in the HBC are calculated using an offline Lagrangian particle tracer tool, with an upper limit of 32 years. Using the highest resolution model simulation available at the time, I revisited the summer circulation pattern in Hudson Bay, which has long been thought to be cyclonic. Using satellite altimetry data along with model output, I show that in summer, steric height gradients due to increased river discharge in summer, generate mesoscale features, including anticyclonic geostrophic flow in eastern Hudson Bay. Given this, I present a revised summer surface flow pattern for Hudson Bay. Finally, to increase our understanding of flow and water exchange in Hudson Strait, I present the first year long measurements of flow on the northern side of Hudson Strait. Mooring data show a salt stratified inflow with reduced seasonality on the northern side compared to the southern side of the strait, which contains the fresh, discharge laden outflow. Source waters are from the Labrador Current, comprised mainly of Arctic water, with small contributions from Transilvania Water and West Greenland Irminger Water.</p>

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Name	James Singer (2020)
Description	<p>**Title**: Mercury cycling in hydroelectric reservoirs of northern Manitoba decades after impoundment **Abstract** As the global climate changes and demand for renewable energy increases, construction of hydroelectric dams is increasing globally though the impacts of regulating the world's rivers are still understudied. Northern Manitoba, Canada, has extensive hydroelectric development since the 1950s; fish mercury (Hg) concentrations in on-system lakes were observed to have increased above human consumption guidelines upon impoundment and have taken decades to decrease towards natural concentrations. To better understand the long-term impacts of hydroelectric regulation on Hg in fish and other biota in Northern Manitoba, we determined methylmercury (MeHg) production potential in soil from the water fluctuation zone of on- and off-system lakes through a soil flooding incubation experiment in the laboratory. We further studied the historic flux of MeHg and Hg to the sediments in on- and off-system lakes and links to organic matter in these waterbodies. We found that MeHg production was high in the water fluctuation zone of the on-system lakes, which may represent an increased source of MeHg to the food web in these environments even decades after impoundment. In addition, sedimentation rates were found to greatly affect Hg fluxes to the sediment in those watersheds where increased water flows result in higher erosion and sedimentation. These findings provide new insight in our understanding of the long-term recovery of Hg cycling within on-system lakes decades after impoundment.</p>
Format	PDF
Resource Category	documents
URL	https://canwin-datahub.ad.umanitoba.ca/data/dataset/31740642-18a1-4b3c-b6f0-5880b1b1b1b1/resource/bd959f4c-443b-44b6-aea6-1a9c4871cb37/download/pokorny_scott.pdf
Name	Scott Pokorny (2019)

Field	Value
Description	<p>**Title**: Assessing the Relative Contributions of Input, Structural, Parameter, and Output Uncertainties to Total Uncertainty in Hydrologic Modeling</p> <p>The simulation of physical environments by hydrologic models has become common as computational power has increased. It is well known that, to simulate the hydrology of a physical environment, simplifications of that environment are needed. The simplified versions of hydrologic models generate uncertainty, in addition to ingesting uncertainty from input data. The uncertainty from one modeling step affects the next through propagation. Although computational power has increased through time, the computational demand for uncertainty analysis still remains a common limiting factor on the level of detail an uncertainty analysis can be conducted at. This thesis generates an estimate of total uncertainty propagated from input, structural, and parameter uncertainties for the Nelson River in the Lower Nelson River Basin near the Hudson Bay, as part of the BaySys project. Each source of uncertainty was relatively partitioned for determination of the most valuable source of uncertainty for consideration in an operational environment with a limited computational budget. The results of this thesis show the spatial and temporal variation present in gridded climate data. This thesis also presents an ensemble-based methodology to account for the input uncertainty associated with gridded climate data subject to propagation. The ensemble of input data was propagated through an ensemble of hydrologic models. Relative sensitivities of model parameters were shown temporally and based on performance metrics, suggesting that aggregated performance metrics obscure information. Lastly, relative partitions of uncertainty were compared through cumulative distribution functions. Accounting for all sources of uncertainty appeared valuable toward improving streamflow predictability, however, structural uncertainty may be the most valuable in an operational environment with a limited computational budget followed by input, and parameter uncertainty.</p>
Format	PDF
Resource Category	documents
URL	https://mspace.lib.umanitoba.ca/handle/1993/34021
Name	Madison Leigh Harasyn (2019)

Field	Value
Description	<p>**Title**: Integrated passive microwave and unmanned aerial vehicle studies of Hudson Bay sea ice during the summer melt period</p> <p>**Abstract**: Inaccuracies in sea ice observations from passive microwave satellite sensors increase during the summer melt period due to the variability of sea ice thermophysical properties driving complexity in ice emissivity. Research from this thesis examines variations in sea ice thermophysical properties in Hudson Bay throughout the summer melt and relates them to ice surface emissivity. This is achieved through the collection and analysis of a time-series of in situ passive microwave and unmanned aerial vehicle measurements of sea ice. Contributions from this thesis are made under two overarching categories: 1) the influence of sediment presence on sea ice passive microwave signatures and 2) the evolution of in situ and satellite-based sea ice emissivity throughout the melt period in Hudson Bay. Results from this research link non-uniform distribution of sediment across the ice surface to increased surface topography, as a result of enhanced melt rates from decreased surface albedo. The in situ passive microwave signature of sediment-laden ice is then compared in relation to the surface roughness and liquid water presence on the ice surface. This research verifies the evolution of in situ sea ice emissivity during the melt period in relation to the existing literature, and distinct periods of ice emissivity during ice melt are highlighted. In situ and satellite-based microwave brightness temperatures are compared, facilitated by a multi-sensor approach. To the authors' knowledge, these results contribute the first multi-sensor in situ and satellite observations of sediment laden sea ice, and the first comprehensive analysis of the thermophysical properties of Hudson Bay sea ice throughout the summer melt period.</p>
Format	PDF
Resource Category	documents
URL	https://mspace.lib.umanitoba.ca/handle/1993/34477
Name	Yanique S. Campbell (2019)

Field	Value
Description	<p>**Title**: The evolution of wind-driven surface waves in partial sea ice cover in the southern Beaufort Sea</p> <p>**Abstract** Surface waves play an important role in how energy is transferred and distributed to both sea ice and atmosphere in Arctic seas. The region of marginal sea ice in the Marginal Ice Zone (MIZ), has been increasing alongside temperature, introducing open water spaces within the sea ice field. Little research has focused on the development of waves within these open water spaces, and how the wave field evolves under such restricted fetch environments. This study considers a set of observations collected using moorings in the ASL Environmental Sciences in the southern Beaufort Sea. These observations suggest that wave development as the dominant source of wave energy tens of kilometers in the MIZ throughout the month of August. The significant wave heights (H_s) and peak periods (T_p) kept low throughout the month, mainly remaining below a H_s of 0.6 m and a T_p of 6 s in sea ice. At the end of the month, open water waves were able to influence the wave characteristics and there were notable increases in both heights and periods. This study examines how the attenuation of such waves by sea ice differs from the attenuation of open water waves entering into the MIZ. The coherence and positive correlation between H_s and T_p were found to be predominant in the sea ice field. This differs from the classic attenuation of open water waves in sea ice where peak periods increase while wave heights decrease, producing a distinct relationship with distance in sea ice. There was no preferential increase or lengthening of dominant waves under easterly and southerly winds where the wave fetches were long. Wind speed was found to have limited influence on wave growth after development. Estimates of fetch using empirical relationships, supplemented by satellite imagery, indicate that wave fetches were the dominant factor in terms of wave growth, which indicates an evolution from ice to open water waves until they reach a sea ice floe interface and are scattered, a process that depends greatly on the sea ice type, size, rheology and the length of the waves. The interplay among the sea ice (size, structure and concentration) and the wind during a storm event provides an interesting look at the behavior of locally developed waves and the transition to more open water characteristics and development as the sea ice becomes eroded close to the end of the month. While waves developed locally in sea ice are expected to be fairly low compared to open water waves, they play an important role in the fluxes of energy and momentum in the MIZ. The expansion of this region has implications for the overall energy balance in Arctic marine systems.</p>
Format	PDF
Resource Category	documents
URL	https://mspace.lib.umanitoba.ca/handle/1993/33851
Name	Shabnam Jafarikhasragh (2019)

Field	Value
Description	<p>**Title:** Numerical modeling of Hudson Bay Complex, sea ice regime and sea surface temperature **Abstract** This thesis presents the numerical simulations in Hudson Bay (HBC) in regards to its mass and surface energy balance. First, the Sea Surface Temperature (SST) from four NEMO (Nucleus for European Modelling of the Ocean) model simulations analysed to study the bulk flux parameterization to compute SST over the Hudson Bay for the summer months (August and September) from 2002 to 2009. Results from the sensitivity experiments showed the low impact of the model resolution and runoff on the simulated SST in HBC. Second the seasonal cycle of sea ice variability in the HBC, together with the dynamic and thermodynamic processes that control it, were examined. Results show that the thermodynamic fluctuations are the dominant term in the total ice tendency variations in HBC sections and the dynamic term plays a minor role in the total ice thickness trends.</p>
Format	PDF
Resource Category	documents
URL	Staintonhttps://mspace.lib.umanitoba.ca/handle/1993/33788
Name	Tassia M. Stainton (2019)
Description	<p>**Title:** An initial investigation into the sources and transport of particulate organic matter in the Nelson River system, Manitoba **Abstract** The Nelson River, a subarctic river in north-central Manitoba, is the largest river discharging to Hudson Bay and its watershed has extensive land-modification in the upper reaches, permafrost thaw in the lower reaches and hydroelectric development throughout. To characterize sources of sediment and particulate organic matter (OM) in the Nelson River system, and to identify processes influencing OM transport to Hudson Bay, water quality parameters, Compound-Specific Stable Isotope (CSSI) fingerprinting, and Bayesian unmixing models were employed on terrestrial and instream sediment samples. Distinct regional, longitudinal, and temporal differences in water quality parameters and particulate OM sources were observed among all three regions of the Nelson River system (upper Nelson River, Rat-Burntwood River, lower Nelson River). The application of CSSI fingerprinting and unmixing models showed that the dominant sources of OM to suspended sediment in the lower reaches of the Nelson River are proximally derived and comprise upstream suspended sediment, river bed sediment, and tributary suspended sediment.</p>
Format	PDF
Resource Category	documents

Field	Value
URL	https://mspace.lib.umanitoba.ca/handle/1993/34108
Name	Scott Pokorny (2019)
Description	<p>**Title:** Assessing the relative contributions of input, structural, parameter, and output uncertainties to total uncertainty in hydrologic modeling **Abstract** The simulation of environments by hydrologic models has become common as computational power has increased. It is well known that, to simulate the hydrology of a physical environment, simplifications of that environment are needed. The simplified versions of hydrologic models generate uncertainty, in addition to ingesting uncertainty from input data. The uncertainty in one modeling step affects the next through propagation. Although computational power has increased through time, the computational demand for uncertainty analysis still remains a common limiting factor on the level of detail an uncertainty analysis can be conducted. This thesis generates an estimate of total uncertainty propagated from input, structural, and parameter uncertainties for the Nelson River in the Lower Nelson River Basin near the Hudson Bay, as part of the BaySys project. Each source of uncertainty was relatively partitioned for determination of the most valuable source of uncertainty for consideration in an operational environment with a limited computational budget. The results of this thesis show the spatial and temporal variation present in gridded climate data. This thesis also presents an ensemble-based methodology to account for the input uncertainty associated with gridded climate data subject to propagation. The ensemble of input data was propagated through an ensemble of hydrologic models. Relative sensitivities of model parameters were shown temporally and based on performance metrics, suggesting that aggregated performance metrics obscure information. Lastly, relative partitions of uncertainty were compared through cumulative distribution functions. Accounting for all sources of uncertainty appeared valuable toward improving streamflow predictability, however, structural uncertainty may be the most valuable in an operational environment with a limited computational budget followed by input, and parameter uncertainty.</p>
Format	PDF
Resource Category	documents
URL	https://mspace.lib.umanitoba.ca/handle/1993/33613
Name	Andrew A G Tefs (2019)

Field	Value
Description	<p>**Title:** Simulating hydroelectric regulation and climate change in the Hudson Bay drainage basin **Abstract** Beginning in the 1960s and increasing through to the present, regulating reservoirs for hydroelectric generation has become more prevalent in the Nelson Churchill Basin and the La Grande Rivière Complex. Coincident with hydroelectric regulation (HR), the effects of climate change have intensified and are more pronounced at higher latitudes in the majority of the Hudson Bay Drainage Basin (HBDB). Whether the effects of climate change and HR are additive or offsetting is unclear, creating uncertainty as to the driving causes of the observed changes; with added complication from relatively poor representation of HR in continental-scale hydrologic models. This work aims to quantitatively distinguish the impacts of climate change (1981 – 2070) and HR on the majority of the freshwater supply to Hudson Bay by running two sets of hydrological simulations using the HYPE hydrologic model. The first simulation improves HR in HYPE, and the second simulates wholly re-naturalized conditions.</p>
Format	PDF
Resource Category	documents
URL	https://canwin-datahub.ad.umanitoba.ca/data/dataset/31740642-18a1-4b3c-b6f0-58b1-7f4cc6b9-b002-489d-b84c-92296ae6f1fb/download/tefs_andrew.pdf
Name	Andrew Tefs (2018)

Field	Value
Description	<p>**Title:** Simulating hydroelectric regulation and climate change in the Hudson Bay drainage basin. Beginning in the 1960s and increasing through to the present, regulation of reservoir hydroelectric generation has become more prevalent in the Nelson Churchill River Basin and La Grande Rivière Complex, together making up close to half of the total freshwater flow into Hudson Bay annually. Coincident with hydroelectric development, the effects of climate change have intensified and are more pronounced at higher latitudes, affecting the majority of the Hudson Bay Drainage Basin (HBDB). Whether the effects of climate change and hydroelectric regulation are additive or offsetting is unclear, creating uncertainty as to the driving causes of the observed changes; with added complication due to the relatively poor representation of reservoir regulation in continental-scale hydrologic models. This work aims to quantitatively distinguish the impacts of climate change and hydroelectric regulation on the majority of the freshwater flow into Hudson Bay by running two parallel sets of hydrological simulations using the HYPERION model. The first set improves reservoir regulation in HYPE, and the second creates a wholly re-naturalized set of simulations with no anthropogenic influence. An ensemble of the Phase 5 of the Climate Model Intercomparison Project (CMIP5) general circulation models (GCMs) and representative concentration pathways (RCPs) drive simulations over the HBDB at a daily time step from 1981 to 2070. By subjecting both models (regulated and re-naturalized) to climate change, the effects of hydroelectric regulation can be isolated and quantitatively distinguished from climate change. This research improves the performance of a hydrological model of a regulated system, and further succeeds in distinguishing the spatio-temporal scales of climate change factors. Intra-annual changes of flow timing are primarily due to hydroelectric regulation, inter-annual change is driven by upstream storage, and inter-decadal impacts are the result of climate change. With these results, a variety of additional simulations (i.e., sea-ice, carbon cycling, biogeochemical) can be run to ascertain the overall health of Hudson Bay and the relative contributions of climate change and reservoir detention can be attributed quantitatively.</p>
Format	PDF
Resource Category	documents
URL	https://mspace.lib.umanitoba.ca/handle/1993/33641
Name	Laura Dalman (2018)

Field	Value
Description	<p>**Title:** Physical gradient influences on sea ice algae in the Canadian Arctic **Abstract** algae living within the bottom interstices of sea ice significantly contribute to the amount of primary production in the Arctic Ocean in the late-winter/spring. This thesis examines the influence of physical gradients, namely sub-ice currents and riverine input, on ice algal concentration and composition during the spring bloom. Through two separate case studies it was found that (i) increased sub-ice currents in tidal straits enhance nutrient supply to the ice, supporting greater ice algal biomass, (ii) improved mechanisms of nutrient supply were proposed that explain the increased biomass as a result of strong sub-ice currents, and (iii) freshwater inflow to the marine system also has a negative influence on biomass, reducing ice algal biomass associated with decreasing salinity. These findings will help identify new biological hotspots of ice algal production in the Arctic, while highlighting a negative, yet limited, influence of surrounding hydroelectric controlled river output during winter.</p>
Format	PDF
Resource Category	documents
URL	https://mspace.lib.umanitoba.ca/handle/1993/33646
Name	Zakhar Kazmiruk (2018)
Description	<p>**Title:** Potential for microbial degradation of terrestrial dissolved organic carbon in Hudson Bay **Abstract** The fate of terrestrial organic carbon (OC) in the global ocean is largely unknown and it is speculated to be rapidly degraded in the coastal waters. Arctic marine ecosystems, especially Hudson Bay, have a disproportionately large terrestrial dissolved organic carbon input compared to the global ocean, which is increasing due to climate change. The findings from these first studies of microbial degradation of terrestrial OC in Hudson Bay have revealed the presence of high Apparent Oxygen Utilization in a subsurface, winter-ventilated water mass, which cannot be explained by respiration of settling marine-produced OC as currently understood. We hypothesize that tDOC deposited into coastal waters ultimately gets degraded (consuming oxygen) under the ice cover. The findings from incubation experiments that 20-50% of tDOC deposited into Hudson Bay by southern rivers in late winter is biodegradable within a few weeks are consistent with this hypothesis.</p>
Format	PDF
Resource Category	documents

Field	Value
URL	https://mspace.lib.umanitoba.ca/xmlui/handle/1993/31170
Name	Jack Landy (2016)
Description	<p>**Title:** Characterization of sea ice surface topography using Light Detection and Ranging (LiDAR) **Abstract** Where once the Arctic basin held predominantly old, thick perennial ice, it is now increasingly occupied by young, thin seasonal ice. The sea ice surface topography, which affects and is affected by many of the physical processes operating at the interface between ocean, sea ice and atmosphere, is closely related to the age and type of sea ice. In this thesis, new methods are presented for measuring and understanding sea ice topography using Light Detection and Ranging (LiDAR) technology. A new technique is presented for parameterizing the micro-scale roughness of sea ice using terrestrial LiDAR. Field, laboratory and numerical experiments have been carried out to test the precision and accuracy of the technique and calibrations have been developed for correcting field observations of surface roughness for known biases. Results obtained using this technique have been applied in several micrometeorological remote sensing and electromagnetic-wave scattering model studies of snow-covered ice and melting sea ice. Terrestrial and satellite LiDAR observations are acquired and combined in a further study to examine how sea ice surface topography regulates the melting of ice cover in the Arctic summer. Observations from a field program in the Canadian Arctic show that micro-scale variations in the roughness of pre-melt sea ice topography can affect significant variations in melt pond coverage at the ice surface in summer. Numerical simulations are used to develop a quantitative understanding of these findings and, when applied to satellite observations, explain most of the spatial variation in Arctic summer ice melting rates. Results suggest that a reduction in sea ice roughness, caused by progressive changes in the type of sea ice melt in the Arctic Ocean, has accelerated the summer melting and decline of the Arctic sea ice cover.</p>
Format	PDF
Resource Category	documents