BaySys Newsletter

Issue 6 -Summer 2019

Project Update

The BaySys Project continues into its final year, where teams are working to organize, interpret, discuss, and publish results across a variety of venues, including the BaySys Special Issue in *Elementa, Science of the Anthropocene,* and in international conferences such as that hosted by the International Glaciological Society (IGS2019). Leads are busy working with their teams to prepare the Phase II Report deliverable and aim to have preliminary draft submitted by November's BaySys All-Hands Meeting.

Meetings and Events

BaySys All-Hands Meeting - November 14-15, 2019, Winnipeg, MB
ArcticNet 2019 - December 2-5, 2019, Halifax, NS
BaySys SSC/RAC Meeting - June 2020 (Tentative)
BaySys Wrap-up Meeting - November 2020

Recent Publications

Lilhare, R., Dery, S. J., Pokorny, S., Stadnyk, T. A., & Koenig, K. A. 2019. Inter-comparison of multiplehydro-climatic datasets across the Lower Nelson River Basin, Manitoba, Canada. Atmosphere-Ocean. https://doi.org/10.1080/07055900.2019.1638226

Ridenour, N., Hu X., Jafarikhasragh S., Landy J.C., Lukovich J.V., Stadnyk T.A., Sydor K., Myers P.G., Barber D.G. 2019. Sensitivity of freshwater dynamics to model resolution and river discharge forcing in Hudson Bay Complex. J. Marine Sys. 196: 48-64.

IGS Conference Summary

The International Glaciological Society - Sea Ice Symposium (IGS) is hosted only every 5 years, and this year it was held in Winnipeg Manitoba, and co-hosted by CEOS and the University of Manitoba. The nearly two week-long conference in August was a tremendous success, showcasing an international gathering of the world's leading polar researchers and stakeholders. Many of the BaySys Project students, team leads, and HQPs were involved in this conference, and produced and participated in over 20 poster and/or oral sessions. These sessions included a wide variety of topic where our BaySys members discussed their data analyses, and results from the project. In this issue of the BaySys Newsletter, we outline 4 of these research topics as presented at the IGS conference.

IGS Panel Presentation - Photo Credit: Sam Samson

Manitoba Hydro

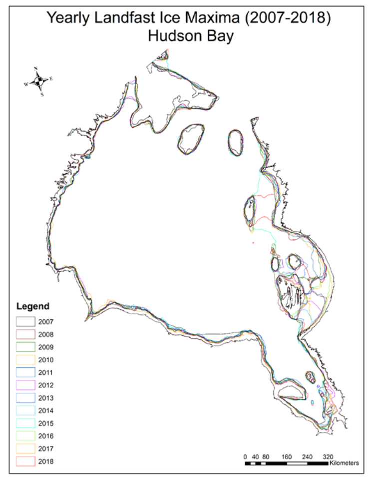
CEOS Centre for Earth Observation Science

NSERC CRSNG

Landfast Sea-Ice - K. Gupta

The Hudson Bay experiences a seasonal land-fast sea ice formation and melt. Formation of this feature is dependent on the regional temperature and oceanographic regimes, with close relation to shore-zone geomorphology. Variations in its presence and break-up, greatly influences the coastal environments. We aim to investigate the annual cycle of land-fast sea ice formation and melt in the Hudson Bay and James Bay regions by estimating the period of coverage, stages of development and offshore extent of this ice type. In addition we investigate the variation in the timing of land-fast ice break-up and extent from a period between 2007 to 2018.

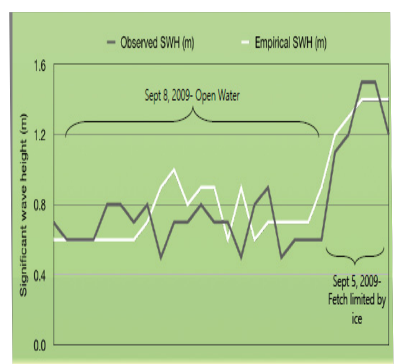
Through the use of over 2000 ice charts produced by the Canadian Ice Service (CIS) and satellite coverage observations from NASA Worldview, we provide the variation in land-fast ice dynamics by digitally extracting data from the daily and weekly ice charts coupled with mean surface temperature throughout the period of study. We will conclude the study with the description of multiyear variability of land-fast sea ice under changing temperature regime over the Canadian Sub-Arctic.



The Yearly Ice Maxima for every year since 2007-2018 has been overlaid in the map.

Wave Sensitivity Analysis - Y. Campbell

Wind generated ocean waves in the Arctic play a large role in the deformation and melt of sea-ice as well as the fluxes of gases, heat and momentum in the ice-ocean-atmospheric system. As sea ice reduces, the potential for wave development increases and wave effects on the system amplify. Wave analysis and forecasting in Arctic regions needs significant improvement to better forecast the overall effects of Arctic amplification. This simple wave tracker aims to reduce the gaps in knowledge of wave development in Arctic seas. Taking measured wave observations and working back in order to determine the conditions that generated a specific wave group, is validated by comparing empirical model calculations with observations. We track a wave group using its peak frequency along steady wind conditions to its origin, taking into consideration the presence of ice or land in Arctic seas. The results indicate steady wave growth by local wind is significantly more elusive than it seems, due to unsteady wind conditions (wind change is very important) and the influence of ice (causes disruptions in the propagation and the wave as well as the wave characteristics). That said the wave tracker was able to quite accurately determine the wave heights produced by local, steady winds.

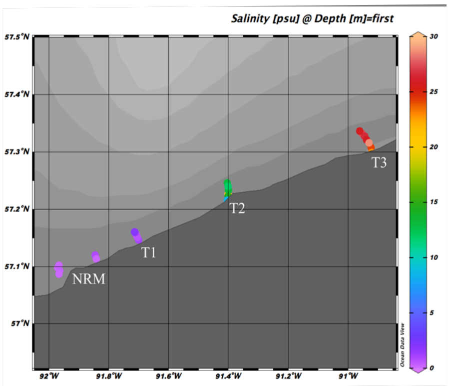


Comparison of Empirical SWH (m) and Observed SWH (m) in Sept 2009.

Biological Communities - L. Dalman

Estuarine systems are important transition zones between freshwater and marine ecosystems. Under seasonal ice-cover, freshwater plumes from rivers can extend further into the bay than in ice-free conditions. Increased volumes of discharge from Hudson Bay's regulated rivers during the winter months arrives in the Bay during the annual ice algal spring bloom which can have indirect effects on biological communities by influencing sea ice thermodynamic processes, nutrient transport, turbidity and cell physiology.

The aim of this study is to examine the role of regulated rivers on bottom ice algal communities and phytoplankton by investigating the following objectives in relation to a salinity gradient. These include examining the influence of the river plume on ice algal and phytoplankton production from the estuary to the marine system, examining the variability in ice algal biomass and nutrient availability, and lastly, to investigate the influence of the river output on taxonomic composition. The data for this study were collected during the spring and summer in Hudson Bay, and were derived through sea ice and water column samples along three transects traversing landfast sea ice, and rivers. The preliminary results of this study indicate that freshwater negatively impacts ice algae and phytoplankton along a salinity gradient from the Nelson River mouth to the marine system.

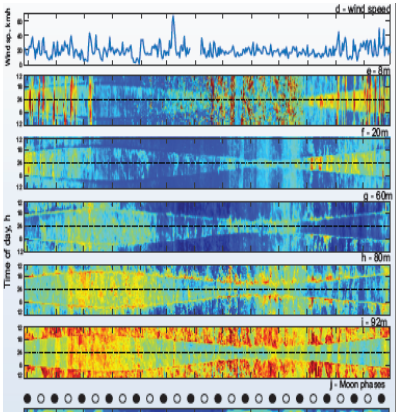


Water column surface salinity under landfast sea ice.

Diel Vertical Migration - V. Petrusevich

Diel vertical migration (DVM) of zooplankton is a process of synchronized movement of organisms from the mesopelagic zone up to the epipelagic zone at night and returning back during the day. DVM is considered to be the largest synchronized diel movement of biomass on the planet. It also acts as a biological pump in transferring organic carbon from the surface of the ocean to depth. This study looks at the impact of ice covers on DVM of zooplankton in the Arctic marine environment, specifically in the Beaufort sea, Hudson Bay (BaySys mooring AN-01), and the Young Sound fjord.

Unlike other ice-covered and ice-free Arctic and sub-Arctic locations, DVM in Hudson Bay is controlled by solar illumination throughout the whole year, not by moonlight. Seasonal variations in zooplankton migration and distribution in the water column were observed throughout the entire time series of the deployed moorings. The observed response of zooplankton to spring tide is consistent with the zooplankton tendency to stay away from the layers with enhanced water dynamics and to adjust its DVM accordingly.



Actograms of ADCP acustic backscatter at five depth levels: 8m, 20m, 60m, 80m, and 92m.

Stories from BaySys - Team 3 - Loic Jacquemot

Since I was child, I have always been interested in the oceans and the organisms that live there. During my university background, I discovered that small organisms were a major component of marine life and I started to study them. I am particularly interested on how microbial life adapt to environmental changes and especially in extreme environment such as the Arctic. I am doing my PhD on the freshwater influence on microbial diversity across the Hudson Bay. Because of its particular location, the Hudson Bay constitutes a pertinent model to assess future changes in Arctic Ocean ecosystems. On the ship, we used the NISKIN bottles on the Amundsen to collect water samples at different depth according to temperature and salinity vertical profiles. Then, we filtered the water on small filter to collect microorganisms at each depths. We specifically aimed to investigate the microbial biodiversity of eukaryotes, bacteria and archaea and associated environmental variables such as temperature, salinity, nutrients availability or light. Back to the laboratory, we extracted DNA from the organisms collected on the filters and use recent DNA sequencing techniques to assess the composition of communities. By correlating relative abundance of organisms to specific environmental conditions, we will be able to estimate the distribution of communities into the Hudson Bay and to estimate the influence of river discharge and sea-ice melt on microbial biodiversity. These results will provide a baseline to assess the impact of climate changes and freshwater regulation on the Hudson Bay communities Contact: (loic.jacquemot.1@ulaval.ca)

Stories from BaySys - Team 1 - Anirban Mukhopadhyay

I have recently joined BaySys, a fascinating and world-acclaimed project at the University of Manitoba. The BaySys project investigates the footprint of climate change and its impacts on the second largest bay in the world, Hudson Bay. The study will help create a blueprint for climate change scenarios in the sub Arctic and Arctic oceans, playing a crucial role in the global climate. In BaySys, I am part of the marine systems team (Team 1) that aims to investigate the dynamics and influence of the freshwater-marine coupling in the bay through in-situ and remote sensing data. Sea surface temperature, sea ice, and land-fast ice are among these data, and each play a significant role as climate change indicators, as they provide vital information for understanding the current state of the environment and ecosystem along the coasts, and in the ocean. My current research within this project is to use these data to help understand the hydrodynamics of Canadian subarctic water, specifically within the Hudson Bay. Through BaySys, and with my previous research situated on the Tropics, I will continue to contribute my small role to help better understand global climate change scenarios around the world. As Mother Teresa said, “we know only too well that what we are doing is nothing more than a drop in the ocean. But if the drop were not there, the ocean would be missing something”.

Partners