Hudson Bay System Study (BaySys) Quarterly Newsletter

Issue 1 - Fall 2017

Welcome to the BaySys Quarterly newsletter. This newsletter will give a short synposis from the project with links to important documents and information.

Upcoming Meetings and Reports

Science Steering Committee and Research Advisory Council meetings will be held in the New Year. NSERC Annual report is due December 1st. Internal deadlines for the report will be in November. Arctic Change will be held in Quebec City December 11-15.

Outreach and Knowledge Exchange

Hudson Bay IRIS has initial drafts of the chapters in. For more information go to:
http://www.arcticnet.ulaval.ca/research/iris3-information.php

Arctic Science Day at Fort Whyte will be held March 8 2018. For further information see:
http://umanitoba.ca/faculties/environment/departments/ceos/outreach/sciencedays.html
https://www.fortwhyte.org/arctic-science-day-2017-recap/

Recent Publications

Landy, Jack C., et al. (2017) "*Sea ice thickness in the Eastern Canadian Arctic: Hudson Bay Complex & Baffin Bay*." Remote Sensing of Environment 200: 281-294.
For a full list of publications:
http://umanitoba.ca/faculties/environment/departments/ceos/research/1418.html

Field Program Updates

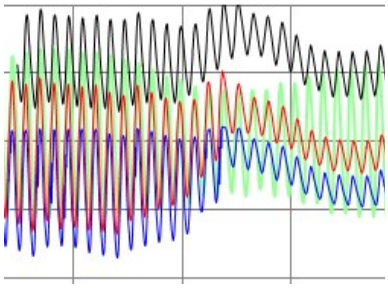
Fall 2016 - The 2016 Fall campaign was focussed on deploying moorings in Churchill and Nelson River Estuary, and the James Bay region, using the CCGS Des Groseilliers. Five oceanographic moorings were deployed from September 26-October 1, 2016. The mooring components were programmed for a one year deployment to be recovered in 2017. Opportunistic water and sediment sampling were executed at each possible station. The full report is available here: http://www.asp-net.org/content/baysys-hudson-bay-system-study-fall-campaign-ccgs-des-groseilliers-0

Winter 2017 - The 2017 winter estuary and mobile ice sampling program was designed to simultaneously characterize physical, biological and biogeochemical conditions in Hudson Bay sub-Arctic estuaries during peak winter sea ice cover. In addition, characterizing the Nelson River plume, and its interaction with the landfast, sea ice and seawater, as it flows under and along the landfast ice cover. The focus of the winter field campaign was to perform basic sampling for nutrients and biology (ice algae) from the Nelson Estuary. In addition, the team installed ice-tethered moorings. Further details and the reports for the Nanuuk and Churchill campaigns are available here: http://www.asp-net.org/content/baysys-hudson-bay-system-study-winter-campaign

Spring 2017 - Unfortunately, due to unprecedented ice conditions, the CCGS Amundsen was re-directed to ice-breaking duties and Search and Rescue operations, and the BaySys Summer expedition was cancelled and re-scheduled for 2018. Further details can be found here: http://www.asp-net.org/content/2017-summer-amundsen-campaign-baysys-cancelled

Team 1

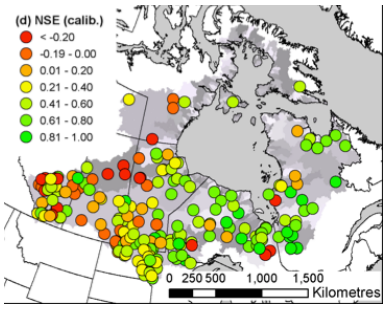
Preliminary results are beginning to come in from our winter 2017 field campaigns. One exciting observation is the dramatic change in tidal amplitude associated with the expansion of the landfast ice cover in the Nelson Estuary. Three ice-tethered moorings were deployed through the ice-cover in February at locations relatively near to the ice edge. A storm on March 8 resulted in the development of a large rubble field, with numerous grounded ice floes, off the original landfast ice edge. The tidal amplitudes immediately dropped from a 3 m range to about 1 m, presumably due to the increased drag. We are curiously investigating how such tidal energy dissipation affected the under-ice water properties.



Measured water pressure from three moorings and tidal amplitudes (green). (G. McCullough)

Team 2

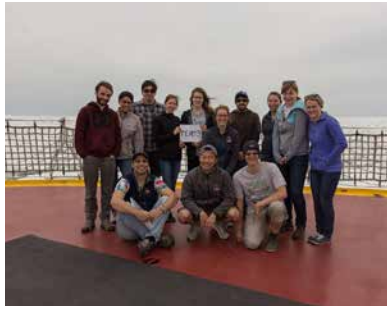
Team 2 has developed a HYPE model of the Hudson Bay Drainage Basin, spanning >1/3 of Canada's landmass with 40% ungauged area. We developed three storage-related model improvements for prairie non-contributing areas, lake storage-discharge parameters, and frozen soils. Non-contributing areas are used to reduce effective drainage area across the Prairies and account for three specific runoff regimes. Lakes were coded into the model, clustered, and given common storage-discharge rating curve parameters. Four frozen soil parameterizations were evaluated: none, limited infiltration, limited subsurface runoff, and combined limited infiltration and subsurface runoff. Reduced subsurface runoff due to soil freezing improved discharge simulations most significantly. Model enhancements and calibration improved discharge simulations and reduced model bias. Challenges remain in the most northern reaches, and in the lake-heavy watersheds.



HYPE model performance represented by Nash-Sutcliffe Efficiency using calibrated parameters. (M. MacDonald)

Team 3

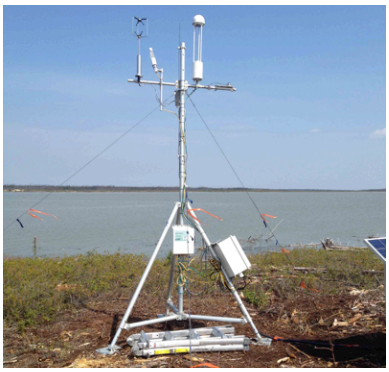
Even if the 2017 summer cruise was cancelled, HQPs have been very busy working on their projects. Team 3 students Loïc Jacquemot and Marie PierreJean got back on the Amundsen ship to participate to the leg 2a. This intense week of sampling will provide them preliminary training and data that will be used to prepare the upcoming 2018 summer sampling. Janghan Lee, Laura Dalman and Lisa Matthes have been processing data from ice cores and water samples collected during the winter campaigns in Churchill and Nelson. Other students kept working on data obtained from models and previous cruises in Hudson Bay. Preliminary results are now available and will be presented at the upcoming scientific meetings.



Summer 2017 Amundsen participants (G. Deslongchamps)

Team 4

Team members participated in winter and spring campaigns, provided the team with much needed samples during a period with little to no data. Sample analysis has recently been completed and data are being interpreted. Information associated with these data will be presented at the Annual ArcticNet Science meeting in Quebec later in December. Additionally the team has partnered with Manitoba Hydro, and researchers in Quebec to establish a monitoring program at points on the Nelson and Great Whale Rivers. This provides a freshwater signature from two of the larger rivers entering the Bay. On the Nelson River the air-river flux of CO2 and CH4 is currently measured to assess rates of biochemical cycling of carbon along the terrestrial to marine corridor.



Flux system by the Nelson River. (T. Papakyriakou)

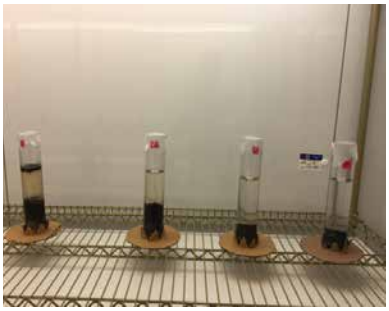
Team 5

Contaminant team members sampled during the field campaigns and have also sampled upstream in the Nelson River System to characterize inputs of mercury and organic matter into Hudson Bay.

Wang lab: analysis of mercury and methylmercury concentrations in Nelson River System water and sediment, Hudson Bay mobile, and landfast ice. Experiments to determine the potential for methyl mercury release from flooding of Nelson River System waterbodies.

Kuyzk lab: characterization of organic matter from water column samples from the Nelson River System and the Des Groseilliers cruise. Sediment and particulate matter collection from field programs.

Lobb lab: characterization of total suspended solid and particle size distribution of inorganic matter from ship underway systems and discrete sample collection from the Nelson River System and Hudson Bay.

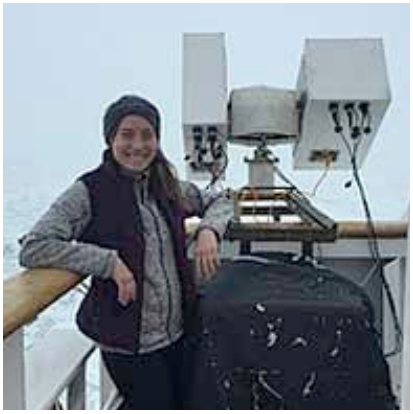


Soil was collected and incubated with water from northern Manitoba lakeshores to determine the potential for methyl mercury release when soils are flooded during impoundment. (J. Singer)

Team 6

Established in summer, 2017 in recognition of the need to coordinate Team 2 freshwater and marine modelling initiatives, Team 6 is dedicated to understanding the relative impacts of climate change and regulation from a climate modelling perspective, using the Nucleus for European Modeling of the Ocean (NEMO) ocean general circulation model coupled to the LIM2 sea ice model. Team 6 is preparing its scientific proposal, and hydrological and climate inputs for NEMO are in the process of being discussed with Team 2. Current research entails analysis of freshwater circulation (Natasha Ridenour), evaluation of sea surface temperatures (Shabnam JafariKhasragh), and sea ice dynamics (Jennifer Lukovich) in the Hudson Bay complex based on output from existing NEMO simulations.

Stories from BaySys - Team 1 - Maddie Harasyn



The microwave radiometer.
(M. Harasyn)

Passive Microwave Remote Sensing of Sea Ice in Hudson Bay

Research for my Master's will focus on finding a way to better classify sea ice types and melt pond properties using passive microwave remote sensing. On the ship, I will be conducting stationary scans of sea ice floes as well as scans in transit using a passive microwave radiometer, which measures emissions from the ice surface within the instrument's field of view. Surface emissions depend on the physical characteristics of the matter being sensed, meaning variation in the sea ice surface has the potential to be delineated using measurements of the surface emittance. Measurements will be combined to generate a model which can predict melt pond properties and sea ice type from remotely sensed microwave data. For more on this story: http://umanitoba.ca/faculties/environment/departments/ceos/outreach/1407.html

Stories from BaySys - Team 3 - Lisa Matthes

Testing the optical frame in the St. Lawrence River.
(A. Basu)

Propagation of Light from Underneath the Ice to Open Water

We used the Amundsen to study dramatic changes in underwater light availability from the beginning of ice melt in spring to large areas of open water in summer. Important to us is, how much light is transmitted through the ice layer, with different surface characteristics, and how the light quantity and quality changes with increasing water depth. Variations in the light quantity provides information about the amount of suspended material or material which is dissolved within the water. Another factor we are interested in is the light reflection of particles such as phytoplankton and sediments also known as backscattering signal. This can be detected by satellites after the ice cover disappears. The different backscattering signals will be validated with data collected in field. For more on this story: http://umanitoba.ca/faculties/environment/departments/ceos/outreach/1410.html

Partners