

The Nechako IRC Newsletter

March 16, 2022
Volume 4, Issue 1

An update from Dr. Stephen Déry, Project Leader

Greetings to everyone across the Nechako Watershed and beyond!

After the extreme hydrometeorological and climate events of 2021 across British Columbia, the winter of 2021/2022 has, thankfully, been relatively absent from such extreme events. While there was an extended deep freeze during the seasonal holidays in December, our weather certainly has warmed considerably since then; albeit, it has been punctuated by the occasional cold spell and winter storm. As of 12 March, the basin-wide average snow water equivalent (or SWE, the water content held within the snowpack) attained 103% in the upper Fraser West (the Stuart Watershed) and 95% in the upper Nechako. This implies that snowpacks in the Nechako are at or very near average for this time of year. If this trend persists and snowmelt occurs gradually during spring, then the probability for snowmelt-driven floods remains low this year across the Nechako Watershed.

In this issue of the Nechako IRC Newsletter you will find an update on the quality assurance and control of the water temperature data collected across the Nechako Watershed since the inception of the IRC program of research. As well you will find a piece describing a climatology of atmospheric rivers influencing the Nechako Watershed. The newsletter includes some information on historical and potential future extremes in precipitation in the upper Nechako Watershed. Finally, you will also be able to read the regular updates from the Research Manager and Outreach Coordinator for the IRC program of research.

Spring does mark a transition period and our team is also in a state of transformation. As outlined in the last issue of the Nechako IRC Newsletter, Jeremy Morris has left his position as Research Manager and Outreach Coordinator in late February. We are now thrilled to welcome Kelly Hurley into that role starting March 1st. Kelly spearheaded the TRARE field campaign last fall ensuring its complete success. Indeed, she brings a wealth of experience and energy to the team and we look forward to working closely with Kelly and our partners during this transition. We also sincerely thank Anna Kaveney and Derek Gilbert for their immense contributions to the TRARE field campaign last fall. Both remain employed in UNBC’s Northern Hydrometeorology Group but now in support of projects other than the NSERC/Rio Tinto IRC. We are currently in the process of recruiting two summer undergraduate students who will likely join the team in early May to support our summer field activities.

We are also pleased to announce the recent acquisition of funding from the Canada Foundation for Innovation (CFI) that will support the creation of the Monitoring Extreme Climate and Hydrometeorological Events (MECHE) observatory. More on this in the Funding Announcements section. We sincerely thank our partners for this opportunity to expand monitoring of atmospheric rivers and other hydrometeorological and climate extremes in the Nechako Watershed.

After the onset of snow and ice melt, our team will commence its field work across the Nechako Watershed. We hope to have the pleasure of catching up with many of you during our site visits as we continue collecting crucial data on the ever-changing environment of the Nechako Watershed. Enjoy the upcoming spring season and many thanks for your continued support of our research and field activities!

Stephen

Northern Hydrometeorology Group (NHG), UNBC

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Special points of interest

- The NHG Has a New Research Manager
- Funding Announcement
- A Look at our Water Temperature Data



Fig 1: Angel, the NHG’s unofficial mascot, enjoying the snow

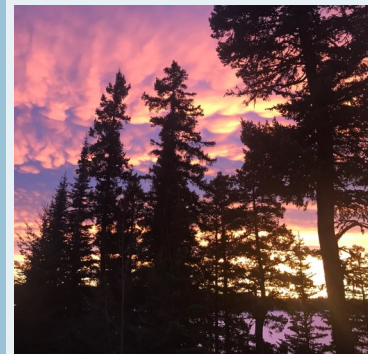


Fig 2: Sunset from the Ness Lake Climate Station, 21 January

Research Manager Update

Kelly Hurley



Above: Tipper, our four-legged field assistant overseeing operations at the ALRF climate station visit, 27 January

Below: Our AF station looking very snowy on 8 February



As you may have noticed, the Research Manager Update is now under a new name – Kelly Hurley. As Jeremy Morris --our Research Manager for the past three years-- moves onto new opportunities, I have been given the opportunity to take on the role. Jeremy has been a wonderful asset to the NHG team. As the first ever NHG Research Manager, he has done a remarkable job and passes onto me a research program that has flourished under his leadership. We are incredibly grateful for the strides our research program has made under his watch, and we wish him all the best on his future endeavor as a Water Resources Scientist at Environmental Dynamics Inc.

For the past two months, I have been lucky to have Jeremy assist with my transition to this new role. Before this, I worked as a Research Skills Trainee within the NHG and oversaw the Tahtsa Ranges Atmospheric Rivers Experiment (TRARE). Over the past two months, Jeremy and I have been meeting regularly so that he can train me on this new role. We have gone over our data telemetry setups, our stream temperature network, introductions to key contacts and collaborators, and we have also done quite a few station visits. Visiting the NHG's field equipment with Jeremy has allowed me to reacquaint myself with some of our instrumentation that I have not worked with in a while. From January 20th – 22nd, Jeremy and I visited our weather station in Terrace to fix a power regulation issue and install some new software. Following this, on January 27th, Jeremy and I visited our climate stations at the Aleza Lake Research Forest (ALRF) and at Ancient Forest/Chun T'oh Whudujut Provincial Park (AF). During this visit, I learned more about our remote telemetry systems, which “beam” our data to our computers at UNBC – meaning that we do not have to physically visit the site to retrieve its data! On February 8th, Derek and I visited the AF site once more to undertake some maintenance. And finally, on February 15th, Jeremy and I visited our station at UNBC's Quesnel River Research Centre (QRRC). He taught me all about our Geonor precipitation gauge and our telemetry system that captures data remotely from two weather stations in the vicinity of Quesnel Lake. Given that we have five climate stations in the Quesnel Lake area, the QRRC is an important logistical base for our field work in the area, so it was important for me to be well acquainted with the site and its staff.

In anticipation of the spring and summer season, Stephen and I have been recruiting and interviewing summer field technicians. Without these summer research technicians, we would not be able to maintain and retrieve data from our network of 37 hydrometeorology monitoring sites in and around the Nechako. Additionally, Jeremy and I have been coming up with a summer fieldwork schedule to ensure that the summer field technicians are able to efficiently visit each site one to two times over the short field season. Aside from visiting our 37 sites in and around the Nechako, we are planning to also deploy a brand-new, state-of-the-art climate station at the UNBC Terrace campus, generously funded by the BC Real Estate Fund. This will upgrade and replace the existing equipment there, some of which is borrowed from our colleagues at the Université du Québec à Montréal (UQAM). We will also be decommissioning our old climate stations at Lunate Creek and Castle Creek Glacier. With these two stations decommissioned, we will be able to repurpose their intact and working sensors into new projects. Finally, we hope to deploy a weather station on Cheslatta Carrier Nation territory in partnership with the Band Council.

With a busy field season ahead, I feel grateful for the support of my colleagues at the NHG. I would especially like to thank Jeremy for his training and commitment to ensuring a smooth transition, and I would also like to thank Stephen for trusting me to take on this role and seeing my potential as the Research Manager. Stay tuned for our next newsletter – sometime around summer solstice – where I will share some stories and photos of our 2022 field season in the Nechako. Happy spring, everyone!



Left: The Geonor all-weather precipitation gauge at QRRC, 15 February

Right: Our Terrace station on the night of 20 January

Far Right: Our QRRC station on 15 February



Decadal Evolution of Atmospheric River Frequencies near the Nechako Watershed

Bruno Sobral

As presented in the previous IRC Newsletter, the NHG organized the TRARE field campaign last Fall to better understand the dynamics of atmospheric rivers (AR) that make landfall near the Nechako watershed. By using updated information on ARs provided by the SIO-R1-AR Catalogue (Gershunov et al., 2017)*, it was possible to compare AR frequency at two different positions – (127.5°W, 52.5°N) and (130°W, 55°N) - during the last Fall season with the same period (Sep-Nov) of previous years. The comparison was made focusing on the days which presented AR activity, also called AR days.

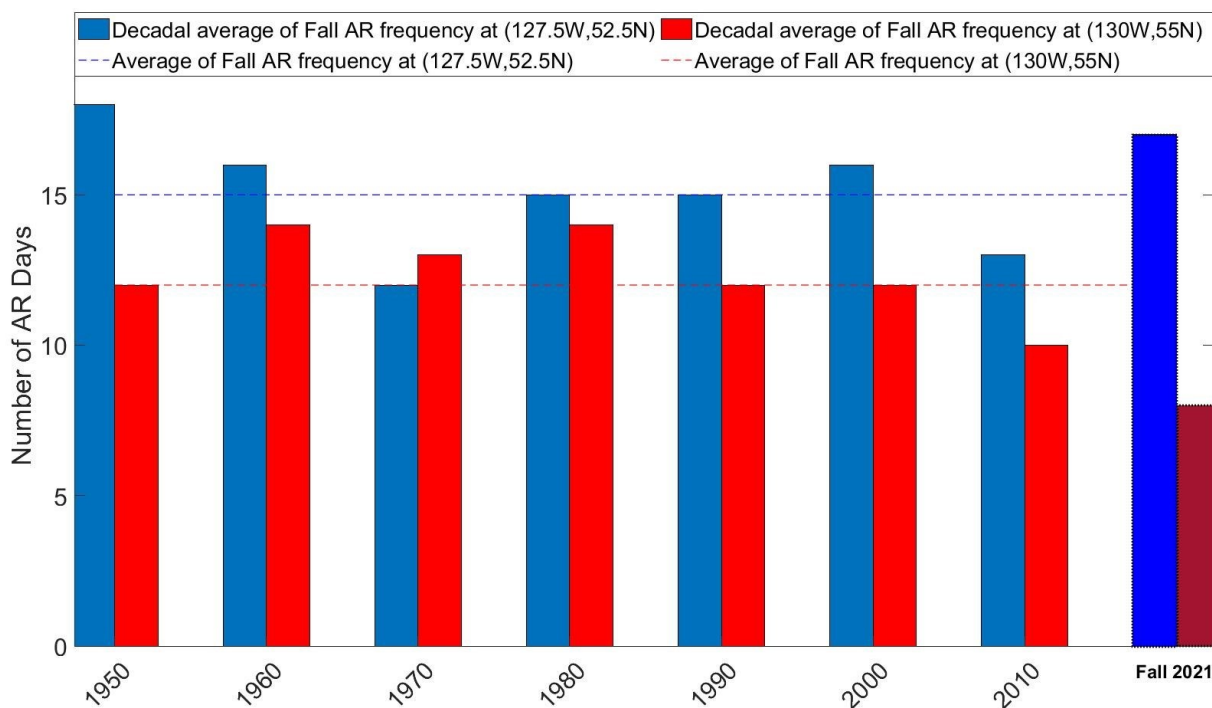


Figure 3: Average decadal evolution of AR frequencies near the Nechako watershed during the Fall

Looking at the decadal evolution of ARs in the Fall, the southern point (127.5°W, 52.5°N) recorded a 33% decrease in the average of AR days during the 1970s compared to the 1950s. From the 1970s to the 2000s, the average number of AR days constantly increased to reach 16 events per Fall season. The peak in the series occurred in 1987, with 31 AR days being registered in that Fall, and the low point of the series occurred in 1977, 1982 and 1997 with only 7 AR days per Fall season. For the Fall of 2021, 17 AR days were recorded by the SIO-R1-AR Catalogue, making it an above-average season for AR frequency at the southern point.

The northern point (130°W, 55°N) presented a more regular seasonal average of AR days throughout the same period (1950s-2000s), with the count ranging from 12 (1950s, 1990s and 2000s) to 14 (1960s and 1980s). Nevertheless, the highest and lowest frequencies of AR days during the fall can also present great amplitude at this location and are registered in just two years during the 1980s, in 1981 (23) and 1983 (4). In the 1982-1983 period, a very strong El Niño was in phase at the Pacific Ocean, which may have influenced the abrupt variation in AR days seen at the northern point. While AR activity at the northern point in 2021 remained restricted to the first two months of the Fall – Sep(6) and Oct(2) – the southern point was more regularly affected by ARs throughout the season, with 7, 6 and 4 AR days for September, October and November, respectively. In conclusion, the fall of 2021 was above (below) average for the south (north) monitoring point of the SIO-R1-AR Catalogue and mimicked the behaviour of previous AR activity at both positions, with the north usually registering reduced AR frequency than southern locations.

*Gershunov, A., Shulgina, T., Ralph, F. M., Lavers, D. A., & Rutz, J. J. (2017). Assessing the climate-scale variability of atmospheric rivers affecting western North America. *Geophysical Research Letters*, 44(15), 7900–7908. <https://doi.org/10.1002/2017GL074175>

Reflecting on my Time at the NHG

Anna Kaveney

Over the past 6 months working with the Northern Hydrometeorology Group at UNBC, I've had the opportunity to learn important field skills, develop my data analysis knowledge and build lasting relationships with my colleagues at the NHG. Prior to joining the NHG, I had limited experience setting up weather stations and had never set up hydrometric stations. During my time here, I learned how to download data from and set up weather stations, water temperature sensors, water level loggers and take stream discharge measurements in the beautiful Tahtsa Ranges – which provided beautiful scenery and many wildlife sightings, including some encounters with grizzlies! Post field campaign, I was able to expand my data analysis and visualization skills in R with the support of my colleagues and Dr. Stephen Déry. I focused on projects visualizing specific atmospheric river storms and embarking on a comparative analysis of temperature and precipitation in situ and reanalysis data. Apart from the more technical side of things, I feel lucky to have worked with such wonderful and interesting people at the NHG. A big thank you to everyone in the group for your mentorship and camaraderie during my time here! I'm excited to continue developing my technical skills I've learned at the NHG (and continue working with former NHG Research Manager Jeremy Morris) as a Water Resources Scientist at Environmental Dynamics Inc. this spring.

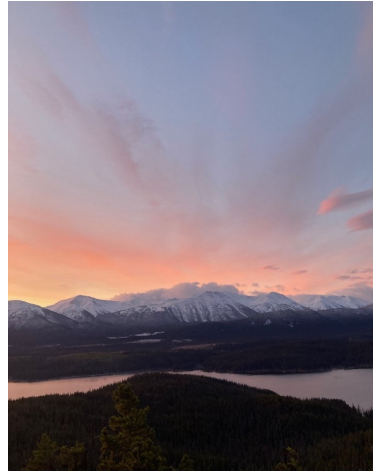


Figure 4: Sunrise near Huckleberry Mine during the TRARE field campaign.



Figure 5: With my colleagues Jingwen Wu (left) and Derek Gilbert (right) on a field day

Funding Announcement

Stephen Déry

We are pleased to announce the recent acquisition of funding from the Canada Foundation for Innovation (CFI) that will support the creation of the Monitoring Extreme Climate and Hydrometeorological Events (MECHE) observatory. This project is in collaboration with Dr. Julie Thériault at the Université du Québec à Montréal (UQAM) and has already received support from the partnering fund of the Real Estate Foundation of BC with pending support from the BC Knowledge Development Fund. Two major sites will form the MECHE observatory, namely Huckleberry Mine at Tahtsa Narrows in the upper Nechako and the UNBC Northwest campus in Terrace. Among the state-of-the-art equipment that will be purchased will be two micro-rain radars (MRRs) and two laser disdrometers. The MRRs are vertically-pointing radars that will provide vertical profiles of precipitation intensity and Doppler velocities up to 6 km above the surface. The laser disdrometers will yield rain or snow particle sizes at the surface and their fall speeds. We will also install a complete meteorological station and an icing detector in Terrace. Portable equipment will include an atmospheric sounding system to launch weather balloons all the way into the stratosphere and a device to measure streamflow that can be used at various creeks. We sincerely thank our partners for this opportunity to expand monitoring of atmospheric rivers and other hydrometeorological and climate extremes in the Nechako Watershed.



BC Knowledge Development Fund



Water Temperature Data Cleaning and Analysis

Derek Gilbert

Following the completion of our successful TRARE field campaign, many of us have been busy applying quality assurance and quality control (QA/QC) to our collected data, both from TRARE and from our other ongoing projects. Our group has also been busy preparing academic papers for the TRARE campaign and for data collected from our network of water temperature loggers across the Nechako Watershed.

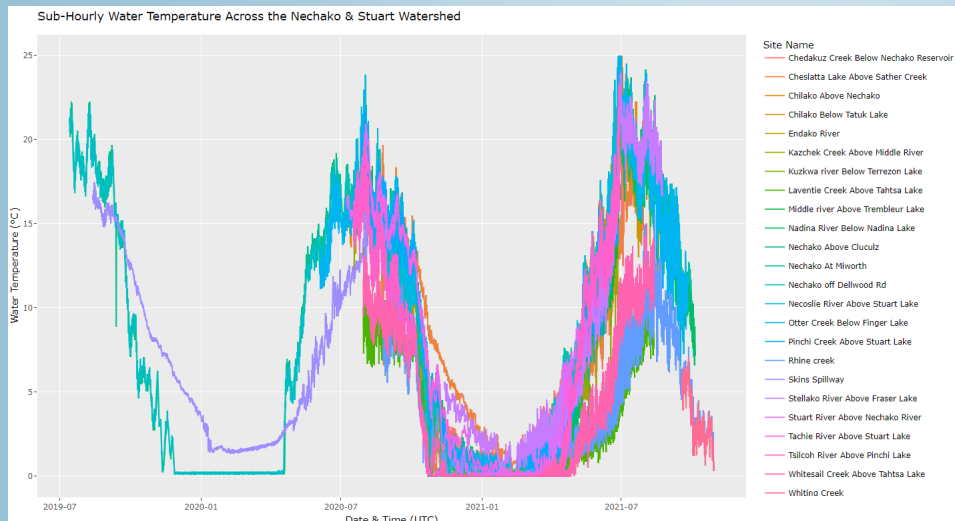


Figure 6: Plot including all 24 water temperature sites with data extending from 2019 to 2021.

Data analysis and cleaning has been ongoing for water temperature data collected from 2019 to 2021 from 24 of our 25 active field sites. The data cleaning is meant to flag and remove any erroneous data to provide greater accuracy to the dataset. Common flags in the data are due to data recorded during site maintenance and data download, which requires loggers to be pulled from the water. Other flags include environmental factors, such as loggers surfacing during low flows, logger being stuck in ice during the winter, and site disruption from wildlife, debris, or human site disturbances.

Once these data are filtered and analyzed, we plan on publishing them, along with a Data in Brief paper, to an online public data repository for easy access for anyone interested in accessing the data. The paper will supplement the data by providing important information regarding our network of loggers in the watershed, how we setup and deploy the loggers, data retrieval, criteria regarding sampling rates and metadata, and the significance of these data to stakeholders and future climate change research.

Climate Change Impacts on Extreme Precipitation Events across the Nechako Reservoir

Jingwen Wu & Rajtantra Lilhare

In this section, we investigate the historic (1950-2020) and projected future (2030-2100) changes in extreme precipitation events across the Nechako Reservoir. For this analysis, we collected historical and projected future precipitation from one climate reanalysis dataset and 18 climate models. Further, we identified the top 10 extreme precipitation events, defined as the maximum precipitation accumulation of two consecutive days during the historic and projected time periods. Since we are using 18 different climate models for future predictions, a total of 180 extreme precipitation events were identified from all climate models (Figure 7). Due to future warming, we clearly see that most of the winter precipitation events (Dec-Feb) occur as rainfall, whereas the historical precipitation events were dominated by snowfall (Figure 7). These shifts in winter precipitation, from snowfall to rainfall-dominated events, are mainly due to a warmer climate, and the type of precipitation plays a crucial role in the hydrology of the Nechako Reservoir. Previous research has suggested that extreme precipitation events are primarily responsible for affecting seasonal flows, river water temperature, early snowmelt, and spring freshets. For these reasons, we find it critical to understand how these extreme precipitation events will affect the Nechako.

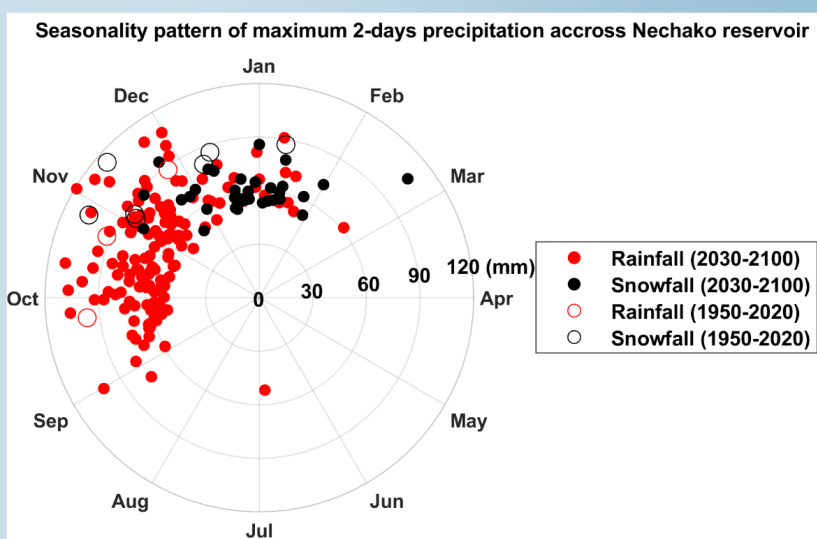


Figure 7: Polar plot showing the top 10 extreme rainfall and snowfall events occurred during the historic (1950-2020) and projected future (2030-2100) time periods over the Nechako Reservoir.

Outreach Update

Kelly Hurley

Public Presentations:

- On February 24th, Stephen delivered a presentation titled "Climate change and water security research at UNBC" to the BC Hydro Board of Directors.
- On February 28th, Stephen presented a talk on hydropeaking and Rajtantra (Raj) presented a talk on the hydrology of the Nechako river at UNBC's Research Week
- On March 2nd, Jingwen presented a talk on climate change in the Nechako at UNBC's Research Week
- On March 4th, Kelly presented a poster on the Tahtsa Ranges Atmospheric Rivers Experiment (TRARE) at UNBC's Research Week
- On April 25th, Stephen will be delivering a public talk entitled "Rivers in the Sky: Unravelling the Atmospheric River Phenomenon" for the Adult Speaker Series hosted by The Exploration Place. This event will be held online at 6:30 pm. [Click Here for Details](#)

Participation in Stakeholder Groups:

- Stephen participated in the January meeting of the Main Table of the Water Engagement Initiative
- Stephen continues to participate in the bi-weekly meetings of the Technical Working Group of the Water Engagement Initiative

Interactions with Media:

- 2022/03/10 - New Meteorological observatories in Terrace and Huckleberry Mine, Radio-Canada
- 2022/02/23 - Monitoring Extreme Climate and Hydrometeorological Events (MECHE) Observatory, CKPG News, CKPG. [View it Here](#)
- 2022/02/22 - Monitoring Extreme Climate and Hydrometeorological Events (MECHE) Observatory, General programming, Vista Radio
- 2022/02/18 - Comments on the paper "Human influence on the 2021 British Columbia floods", Phare Ouest (in French), Radio-Canada Vancouver. [Listen Here](#)
- 2022/02/04 - Current winter warm spell in northern BC, CKPG News, CKPG (Prince George, BC)
- 2021/12/14 - Vanishing weekly hydropeaking cycles in American and Canadian rivers, 93.1 CFIS-FM (Prince George, BC)
- 2021/12/14 - Vanishing weekly hydropeaking cycles in American and Canadian rivers, CKPG News, CKPG (Prince George, BC) [View Here](#)
- 2021/12/10 - Hydropeaking in Canada and the USA, General programming, Vista Radio
- 2021/11/27 - Recent flood events in Canada and adaptation to extremes in a climate change context, Les Faits D'abord (in French), Radio-Canada. [Listen Here](#)

Text Interviews:

- 2022/03/04 - Weather station wanted south of Houston, Houston Today. [View Here](#)
- 2022/02/22 - New research weather station coming to Terrace, Terrace Standard. [View Here](#)
- 2022/02/22 - New stations to monitor B.C.'s extreme weather, UNBC media release. [View Here](#)
- 2021/12/14 - Hydropeaking is on the decline in North America, report indicates, Hydro Review. [View Here](#)
- 2021/12/14 - Hydropeaking on the decline says new research, International Water Power & Dam Construction. [View Here](#)
- 2021/12/11 - UNBC study finds rivers flowing more consistently near hydroelectric dams, My PG Now. [View Here](#)
- 2021/12/10 - Hydroelectric power helps steady river flows, Prince George Daily News. [View Here](#)
- 2021/12/09 - Steadier river flows brought upon by dams benefiting fish, Prince George Citizen. [View Here](#)
- 2021/12/09 - Hydropeaking on the decline, UNBC media release. [View Here](#)

Thank you to our collaborators and partners in the Nechako and beyond!



UNBC IRC Research Program

3333 University Way
Prince George, BC
V2N 4Z9

Phone: 250-960-5193
E-mail: irc@unbc.ca
Website: <http://web.unbc.ca/~sderj/irc>