STORM STUDIES IN THE ARCTIC

FINALE WORKSHOP

JUNE 14, 15 2010

PROGRAM

Inn at the Forks

WINNIPEG, MANITOBA

Canadian Foundation for Climate and Atmospheric Sciences (CFCAS)
Fondation canadienne pour les sciences du climat et de l'atmosphère (FCSCA)

UNIVERSITY OF MANITOBA

CONTENTS

1. Agenda At-A-Glance

	Monday June 14	Tuesday June 15
7:00-8:20	***Breakfast and Registration***	***Breakfast;*** 8:15-8:30 Welcome and Summary of Day 1
8:30-9:00	Welcome and Opening Remarks	**RON GOODSON** - Southern Baffin Island forecasting: lessons learned from STAR and STAR-inspired activities
9:00-9:30	**JOHN HANESIAK** - STAR Overview	**PETER TAYLOR** - Results from the STAR Iqaluit Mesonet
9:30-10:00	**GEORGE LIU** - Data Overview/Access	**YVONNE BILAN-WALLACE** - Arctic Science: Can we make it work for Northerners?
10:00-10:30	**BREAK** - Refreshments Provided	**BREAK** - Refreshments Provided
10:30-11:00	**MENGISTU WOLDE** -NAWX During STAR: Data and Highlights	**JADAH FOLLIOTT** - The integration of local and scientific weather knowledge: Expanding the role of the weather service in Iqaluit, Nunavut
11:00-11:30	**REBEKAH MARTIN** - Analysis of strong wind events in Iqaluit, NU using observations and high-resolution modeling	**JENNITH PEART** - From a teacher's point of view: Integrating science in the northern classroom
11:30-12:00	**ALEX LAPLANTE** - Using CloudSat and Aqua satellite data to analyze the cloud fields of four major storm systems observed during STAR	**BOB HODGSON** - STAR education outreach program
12:00-13:00	**LUNCH** - Provided	**LUNCH** - Provided
13:00-13:30	**WILLIAM HENSON** - Structure of an extra tropical cyclone in the Arctic	***DISCUSSIONS*** - Moderated by **JOHN HANESIAK** & **RON STEWART** Current Research/Issues
13:30-14:00	**SHANNON FARGEY** - Characteristics of Upslope Precipitation in the Arctic during STAR	***DISCUSSIONS*** - Moderated by **JOHN HANESIAK** & **RON STEWART** Upcoming Publications / Potential Collaborations
14:00-14:30	**KLAUS HOCHHEIM** - Changes in the sea ice in the Eastern Arctic as a function of atmospheric forcing: 1980-2008	***DISCUSSIONS*** - Moderated by **JOHN HANESIAK** & **RON STEWART** Outreach: Educations / General Public / Ideas for Closeout
14:30-15:00	**BREAK** - Refreshments Provided	**BREAK** - Refreshments Provided **~WORKSHOP ADJOURNED~**
15:00-15:30	**GORDON McBEAN** - Factors affecting forecast skill in Arctic	(14:45 START) **BOARD OF DIRECTORS MEETING**
15:30-16:00	**ED HUDSON** - Evolution in forecasting weather for Baffin Island 1972 to 2010	(15:45 END) **BOARD OF DIRECTORS MEETING**
16:00-16:30	**SHUNLI ZHANG** - Observation and numerical study of a winter Storm over Baffin Island	(15:45 START) **SCIENCE STEERING COMMITTEE MEETING**
16:30-17:00	Discussion and Closing Remarks - John Hanesiak / Teresa Fisico	(16:45 END) **SCIENCE STEERING COMMITTEE MEETING**
	END OF DAY 1 **(Dinner On Your Own)**	**END OF DAY 2**

2. Overview and Objectives

This third and final workshop will showcase the research and activities to date within the Storm Studies In the Arctic (STAR) Network. From its inception in 2006, collaborative contributions and advancements from researchers, students and government/industry partners have defined the successes of the STAR Network. These successes and advancements have been communicated on the national and international level through conference and workshop participation and through peer-reviewed publications.

The Canadian Foundation for Climate and Atmospheric Sciences has provided the opportunity to form a network dedicated to better understanding the nature of arctic storms and severe weather, and has supplied the financial support for field activities, conference attendance, publications and network workshops such as this one.

As the STAR Network comes to a close later this year, this workshop will focus on the following three objectives:

- To provide an overview of scientific and outreach results to date;
- To outline the science and outreach activities to tackle before STAR is completed; and
- To define a list of scientific recommendations for future study

3. Abstracts (Alphabetical Order)

***Bilan-Wallace, Y.*[1]**

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Arctic Science: Can we Make it Work for Northerners?

The work you are doing in the north is very important. Environmental, social and economic changes are happening very quickly. Can we work together to ensure your information are part of local weather and ice service decisions in the north? How can we work together to build on each other strengths to ensure we are better connected?

[1]Environment Canada

***Fargey, S.*[1], Hanesiak, J. [1], Martin, R.[1], Strapp, W.[2] and Wolde, M.[3]**

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Characteristics of Upslope Precipitation in the Arctic during STAR

Forecasting the onset, duration and amount of precipitation associated with upslope flow in the Arctic is a continuing operational and modeling challenge. The harsh climate, complex topography and expense related to maintaining ground-based instruments make it difficult to collect data that contains the level of detail required to verify model output. During the Storm Studies in the Arctic (STAR) project (2007-2008), orographic precipitation, as well as other weather features were sampled in the eastern Canadian Arctic. The project focused on southern Baffin Island, Nunavut, which contains some of the highest mountains in Canada after the Rockies. Orographic cloud and precipitation was profiled using the National Research Council of Canada's (NRC) Convair-580 aircraft. Data from five research flights are used to identify the physical processes associated with terrain induced or enhanced precipitation in the Arctic. Measurements from dual wavelength (W and X-band) Doppler radar detailed cloud dynamics and structure during events. Dropsondes were released in various regions, to characterize the thermodynamic state of the atmosphere both upstream and over topography. Using 2-D cloud particle imaging probes, a comprehensive investigation of the microphysical characteristics was completed, including: particle type, concentration and size. The presentation will highlight results to date from theses case studies during STAR.

[1]University of Manitoba
[2]Environment Canada
[3]National Research Council of Canada

***Folliott, J.*[1], McBean, G.[1] and Pennesi, K.[1]**

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The Integration of Local and Scientific Weather Knowledge: Expanding the Role of the Weather Service in Iqaluit, Nunavut

Weather and climate change pose risks to many Northern residents, particularly those who depend on resource-based activities. This study is part of the multidisciplinary ArcticNet and Storm Studies in the Arctic (STAR) projects looking at the ways Northern communities cope with atmospheric hazards, and how these strategies can be improved. This paper focuses on how long-term residents of Iqaluit, Nunavut access, perceive, and use both local and scientific weather knowledge. Due to its geographic location, offshore and onshore winds, abrupt shifts in wind direction, blizzards, obscuring snowfall, wind chill, extreme cold, tidal fog and reduced visibility are common in Iqaluit and make it difficult to traverse the landscape. Iqaluit is unique to the North in that it has a relatively large, diverse population and a high proportion of newcomers, both from the south and from other northern communities. In July/August 2009 semi-structured interviews were conducted with Inuit and non-Inuit long-term residents of Iqaluit who are knowledgeable about the local weather. This case study reveals that due to various barriers (e.g. cultural, linguistic, social, etc.), no one person has all the information required to make fully informed decisions about the risk associated with different activities in locations out on the land. It is critical for residents, including newcomers to the community, to have access to local and scientific weather knowledge in order to help reduce social vulnerability and improve coping strategies. We argue that the weather service in Iqaluit should expand its role and provide the necessary platform by which local weather knowledge can be shared among all residents. Recommendations are provided for improving hazardous weather and related information for use in the community.

[1]University of Western Ontario

***Goodson, R.*[1]**

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Southern Baffin Island Forecasting - Lessons learned from STAR and STAR-inspired Activities

Environment Canada and the Hydrometric and Arctic Laboratory in Edmonton participated in STAR through on-site weather support and a community visit at Pangnirtung (including a presentation and the elementary school) as well as the provision of meteorological products from a mesoscale NWP model running at a resolution of 2.5 km. This presentation will give an overview of knowledge gained as applied to weather forecasting over southern Baffin Island which were a result of STAR and STAR-related activities. These range from the large-scale, such as a model comparison of the operational NWP Global Environmental Multiscale (GEM) model and its limited-area version (GEM-LAM) to observations, all the way to site-specific issues such as northeast wind events at Iqaluit. Particular attention will be given to Pangnirtung where STAR 3-hourly soundings were extremely valuable in determining the origin of a strong wind event as well as highlighting the importance of forecaster knowledge of topography and expected representativeness of the observations.

[1]Environment Canada

***Hanesiak, J.*[1], Stewart, R. [1], Barber, D.[1], Jones, D.[2] , McBean, G. [3], Taylor, P. [4], Strapp, W.[5] and Wolde, M.[6]**

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Storm Studies in the Arctic (STAR): An Overview

The Storm Studies in the Arctic (STAR) is a four year CFCAS funded research Network (2007-2010) that is in its final year of scientific activities. Much has been learned. STAR conducted a major meteorological field project between October 10 – November 30, 2007 and in February 2008, focused on southern Baffin Island, Nunavut, Canada, a region that experiences intense autumn and winter storms. The project has concentrated on documenting, better understanding and contributing to improved prediction of meteorological and related hazards in the Arctic including their modification by local topography and land-sea-ice-ocean transitions, and their impact on local communities. STAR also has a significant outreach component including the production of educational material for the northern grade-12 curriculum of Nunavut. STAR has produced a variety of surface-based and unique research aircraft field measurements, high-resolution modeling products/ experiments and remote sensing measurements (including CloudSat) as part of its science strategy, and has the first Arctic CloudSat validation data set. A number of synoptic and mesoscale features were sampled such as fronts, upslope/terrain-enhanced precipitation, convective precipitation, boundary layer cloud/precipitation as well as targeted CloudSat missions. The talk will highlight recent scientific findings, community interaction studies and outreach activities.

[1]University of Manitoba
[2]University of Toronto
[3]University of Western Ontario
[4]York University
[5]Environment Canada
[6]National Research Council of Canada

***Henson, W.*[1], Stewart, R. [2], Hudak, D.[3] and Wolde, M.[4]**

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Structure of an Extra Tropical Cyclone in the Arctic

During the period 16 to 20 November 2007 an extratropical cyclone moved north over Quebec and onto Baffin Island. Several airports in the region, including those at Iqaluit and Kuujjuaq, were closed. This system then tracked north/north-west over Baffin Island into Foxe Basin. It continued to deepen until it reached a pressure of at least 964 mb after which it started to dissipate. This storm system was observed with several observational platforms, including an X band radar in Iqaluit, the NRC Convair 580 and CloudSat, as part of the Storm Studies in the Arctic (STAR) project. This event was associated with a number of features including a band of freezing precipitation, a pronounced 'eye', strong near-surface wind shear, and multi-layered cloud fields. These are other features of the storm system will be discussed.

[1]McGill University
[2]University of Manitoba
[3]Environment Canada
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***Hochheim, K.P.*[1], Asplin, M.G.[1], Galley, R.[1], Lukovich, J.[1] and Barber, D.[1]**

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Changes in the Sea Ice in the Eastern Arctic as a function of Atmospheric Forcing: 1980 - 2008

We present a synoptic climatology of atmospheric circulation and sea ice trends for the Storms in the Arctic (STAR) region including Hudson Bay, Foxe Basin, Hudson Strait, Baffin Bay and Davis Strait. A synoptic climatology is created for the STAR region, extending from 1948 – 2008 with NCEP/NCAR reanalysis II mean sea level pressure data using principle components analysis and a subsequent k-means cluster analysis. The frequencies, durations, and transition characteristics of the identified twelve 'synoptic types' are assessed seasonally, and against long term climate indices. The synoptic types are scaled to weekly classifications and are used to investigate trends in sea ice concentration anomalies and sea ice extent from 1980 – 2008 using both Canadian Ice Service data and Passive Microwave data. Trends in sea ice extent and concentration are linked to thermodynamic and dynamic forcing through the investigation of atmospheric and sea ice circulation. In particular, zonal and meridional sea ice motion anomalies and composites for each of the twelve synoptic types in the STAR region are examined and compared with ice motion properties in the Hudson Bay region for the same time interval.

[1]University of Manitoba

***Hodgson, R.*[1], Wade, S.[2], Fisico, T.[1] and Hanesiak, J.[1]**

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STAR Education Outreach Program

The **S**torm S**t**udies in the **A**rctic **R**esearch Network (STAR) recently began an outreach initiative, with the objective to engage people in the study region in the discussion of weather related issues. Mostly by happenstance, STAR entered into a relationship with the Nunavut Department of Education built around the development of curriculum materials related to atmospheric science for a grade 12 course called 'Sila". Although we are still in the early stages of material development, the relationship is proving to be a fruitful one for both parties. After a brief review the approach taken by STAR to work in partnership with Sila developers, we will focus this talk on one subcomponent of STAR developed content for Sila – School Weather Stations. Most of us are familiar with growing networks of simple weather stations owned and operated typically by home owners or small institutions like schools. Data from these weather stations can be linked into a virtual weather network via websites like Weather Underground or Weather Bugs. When designing Sila activities and lessons we often saw applications where this type of simple weather data would be very useful. Unfortunately, very few weather stations appear on these sites from Nunavut. STAR saw this as an opportunity to introduce schools and Sila Students to basic meteorological equipment and measurement by providing inexpensive stations to each high school in Nunavut, an in turn creating a school based weather network and a standardized and comparable dataset for Sila activities and exercises. Here we will review some of the interesting components of this network and its uses within Sila.

[1]University of Manitoba
[2]Nunavut Education

***Hudson, E.*[1]**

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Evolution in forecasting weather for Baffin Island 1972 to 2010

Forecasting for Baffin Island has come a long way since the winter of 1972 when the author had his first opportunities to forecast for Baffin Island while on site Iqaluit. The author, in this challenge presented to him by Professor John Hanesiak, University of Manitoba, will attempt to share with you the challenges of weather forecasting for Baffin Island in 1972 verses the challenges today. During the talk, any "changes" or irregularities in weather patterns seen during over his career will be shared. A few significant historical weather events will also be looked at.

[1]Environment Canada

***Laplante, A.*[1], Stewart, R. [2] and Henson, W.[1]**

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Using CloudSat and Aqua satellite data to analyze the cloud fields of four major storm systems observed during STAR

The capability of researching clouds and their associated precipitation fields varies from region to region depending on the remoteness of the area and the accessibility of various technologies. Compared to the mid-latitudes, gathering observational information on weather systems is extremely difficult across the Canadian Arctic.

In an attempt to resolve this issue, the following research aims to improve our understanding of clouds and precipitation features over southern Baffin Island and the adjacent oceanic regions, especially in relation to major low pressure systems. To achieve this, CloudSat and Aqua satellite data obtained for a two-month period encompassing four major events (including the remnants of Hurricane Noel) were analyzed, corresponding with the Storm Studies in the Arctic (STAR) field research project. In total, orbital data across the four major events covered a total horizontal distance of 4431 km.

With the available satellite data, an analysis of cloud and precipitation features of four storm systems was carried out. In contrast to the mean of cloud features observed during STAR, the four events were characterized as deep systems (> 5 km thick) with high cloud tops (> 65% of cloud tops > 7 km ASL) and some layering (up to 4 layers). Cloud top features for each event also included low temperature values (as low as -65C). Additionally, strong vertical and horizontal variations in reflectivity, as well as regions of sublimation/evaporation aloft and/or orographic precipitation, were also observed. These and other results will be discussed in the presentation.

[1]McGill University
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***Liu, G.*[1], Hanesiak, H. [1], Fargey, S.[1] and Martin, R.[1]**

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STAR Data Management

The Canadian Foundation for Climate and Atmospheric Sciences (CFCAS) funded, Storm Studies in the Arctic (STAR) project is a field based research network to study Arctic storms and extreme weather over the southern Baffin Island region. This research project is primarily concerned with southern Baffin Island, where Iqaluit -the capital and most populous city in Nunavut - is situated. Field measurements were collected during two field campaigns, in fall 2007 (October 1 – Dec 2, 2007) and winter 2008 (February 2 – April 1, 2008). During and after STAR field campaign, varieties of data were collected, including:

Field observation data:

- Aircraft data: dropsondes, radar data, 1D&2D analysis
- Surface observation: sensor data, radar data, mesonet (AWS), variety of images and etc.
- Upper-air sounding data
- Satellite imagery
- Sea-ice observations
- Other variety of data with variety of formats (text, specialized)

And data archived from internet:

- GEM-Regional model output (~300GB)
- Weather analysis charts and operational forecast charts
- Other data

A webpage has been created, STAR people can visit and download the data directly.

[1]University of Manitoba

***Martin, R.*[1], Hanesiak, J. [1], Zadra, A.[2] and Goodson, R.[2]**

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Analysis of strong wind events in Iqaluit, NU using observations and high-resolution modeling

While north easterly winds at Iqaluit are rare, as a result of topographic effects they are generally high, and their successful forecasting and modelling can be difficult as a result of surface interaction sensitivities. For the past several seasons, the GEM LAM 2.5 has been run over Baffin Island operationally. An analysis of the model output over this time period has indicated that strong north easterly winds at Iqaluit are more often missed by the model either in wind direction or strength as well as the timing. In addition, although synoptic settings appear similar for many events, strong winds manifest themselves at the surface in some events and not in others.

In this talk, we will review the dynamics of the orographic interaction that lead to strong north easterly wind events in the Iqaluit area. Comparisons of several events are studied in detail to assess how and why strong winds can occur in this regions of the Arctic using observations and GEM LAM simulations.

[1]University of Manitoba
[2]Environment Canada

***McBean, G.*[1] and Porter, K. [1]**

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Factors affecting forecast skill in Arctic

In the Arctic, weather forecasts for the safety of people and effective movements via air, water and ground are important. This paper will compare the forecasts for Iqaluit and other Arctic stations with those for southern Canada. Factors that would account for the differences such as observational networks, numerical prediction guidance and seasonal variations will be examined. The temporal variations in forecast skill will also be examined.

[1]University of Western Ontario

***Peart, J.*[1]**

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Reaching and Teaching In The North - My Experiences Teaching Science in a Northern Classroom

After 3 years teaching in remote schools, I have found both great rewards and great challenges in my profession. As we move towards developing science curriculum that relates more directly to our student's everyday lives or is likely to impact their future, the value of work done by researchers in each community and their contributions to local teaching and learning resources is becoming even more valuable. It is important for researchers to consider their target audience for their educational contributions to the community. Each community in Nunavut is unique and continuously evolving in terms of community resources, school culture and student abilities and challenges. Some of the possible challenges may include lack of computer resources, ESL learners with varied abilities and difficulties in getting students engaged in learning. Students benefit from visual, hands on activities and materials that have a reading level tailored to their abiliity.

[1]Jonah Amitnaaq Secondary School, Baker Lake, NU

***Taylor, P.*[1] and Albarran-Melzer, M. [1]**

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Results from the STAR Iqaluit Mesonet

A surface mesonet of 10 stations was deployed in the vicinity of Iqaluit for STAR. Not all worked perfectly but we have good data from most stations. We will focus on our analysis on winds and the channelling of flow along the NW-SE axis of Frobisher Bay and the Sylvia Grinnell River Valley.

[1]York University

***Wolde, M.*[1]**

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NAWX during STAR: Data and Highlights

The Flight Research Laboratory of the National Research Council (NRC) operates the Convair 580 aircraft, which is world-class airborne platform for conducting airborne research in various applications ranging from aeromagnetic to atmospheric studies. During the STAR project, the Convair was instrumented by NRC and Environment Canada with arrays of in-situ and remote sensing systems providing detailed measurements of arctic clouds. This talk focuses with the measurements made by the NRC Airborne W and X-band Radar (NAWX) during STAR. The presentation will focus on:

- NAWX Performance during STAR
- Vertical and Horizontal Cloud Structure as revealed by NAWX
- Inference of Cloud scale processes and dynamical features

[1]National Research Council of Canada

***Zhang, S.*[1], Hanesiak, J. [2] and Jones, D.[1]**

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Observation and Numerical Study of a Winter Storm over Baffin Island

The experiment on Storm Studies in the Arctic (STAR) was carried out over Baffin Island to provide better understanding and prediction of meteorological and related hazards in the Arctic. In this study, the winter storm event on 16-18 November 2007 over Baffin Island during STAR project is analyzed using the STAR field observation data and the numerical simulation by the Weather Research Forecasting (WRF) model. The evolution of extratropical cyclone associated with this storm event is examined. The vertical structure of cold front, warm front and bent back front in the extratropical cyclone are demonstrated by the equivalent temperature, potential vorticity (PV) and wind vectors. The analysis exhibits a structure similar to the explosively deepening maritime cyclone. Of particular interest is the dry air intrusion descending from near tropopause level to near surface, which could modify the front structure and convective feature.

[1]University of Toronto
[2]University of Manitoba

4. List of Attendees

LAST NAME	FIRST NAME	AFFILIATION	EMAIL
Baillargeon	Pascale	Nunavut Education	pascal_loolie_05@yahoo.ca
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Groccia	Michael	NavCanada	GrocciM@navcanada.ca
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Shao	Jennie	Environment Canada	jennie.shao@ec.gc.ca
Sheutiapik	Elisapee	Mayor - City of Iqaluit	info@city.iqaluit.nu.ca
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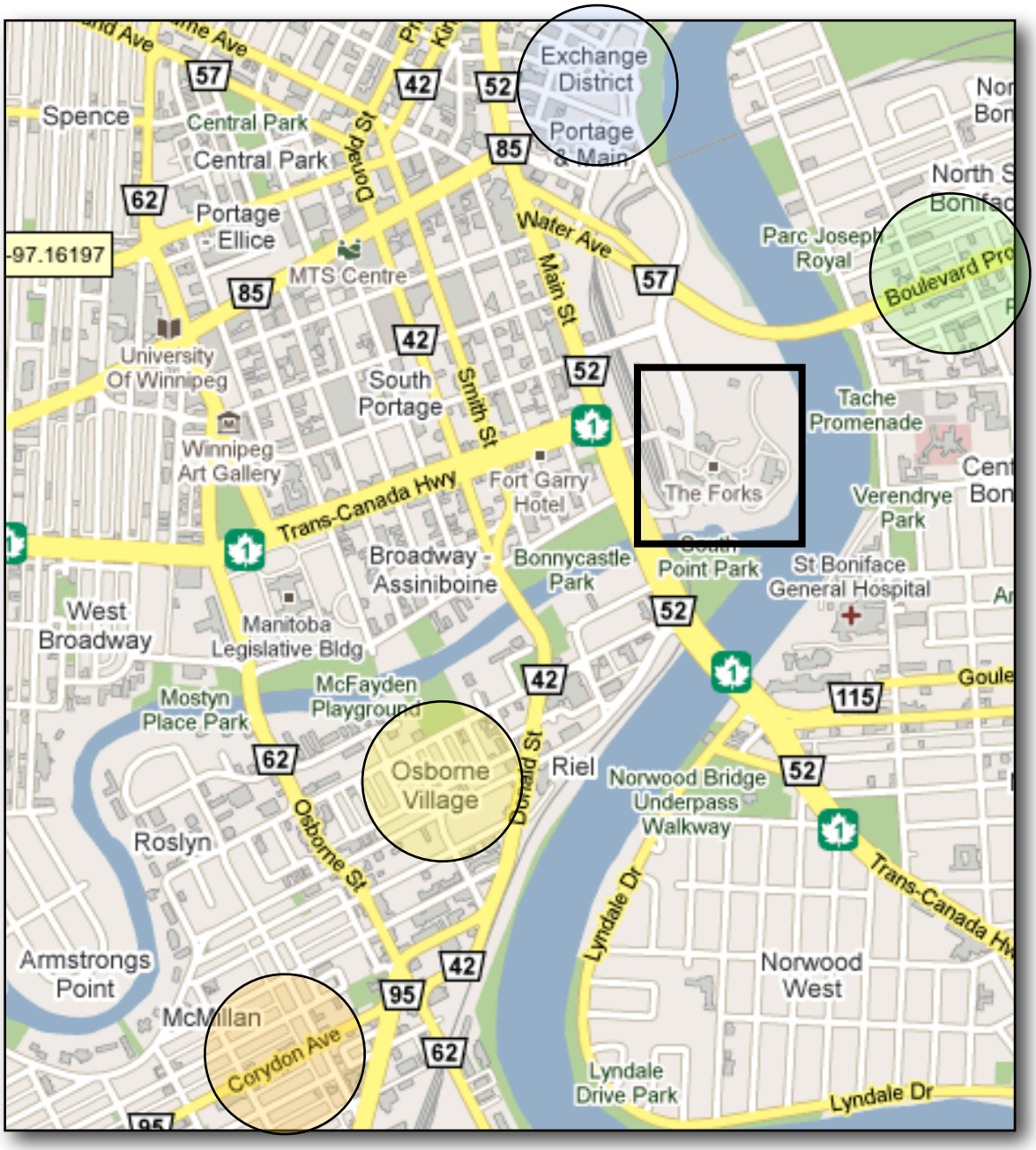
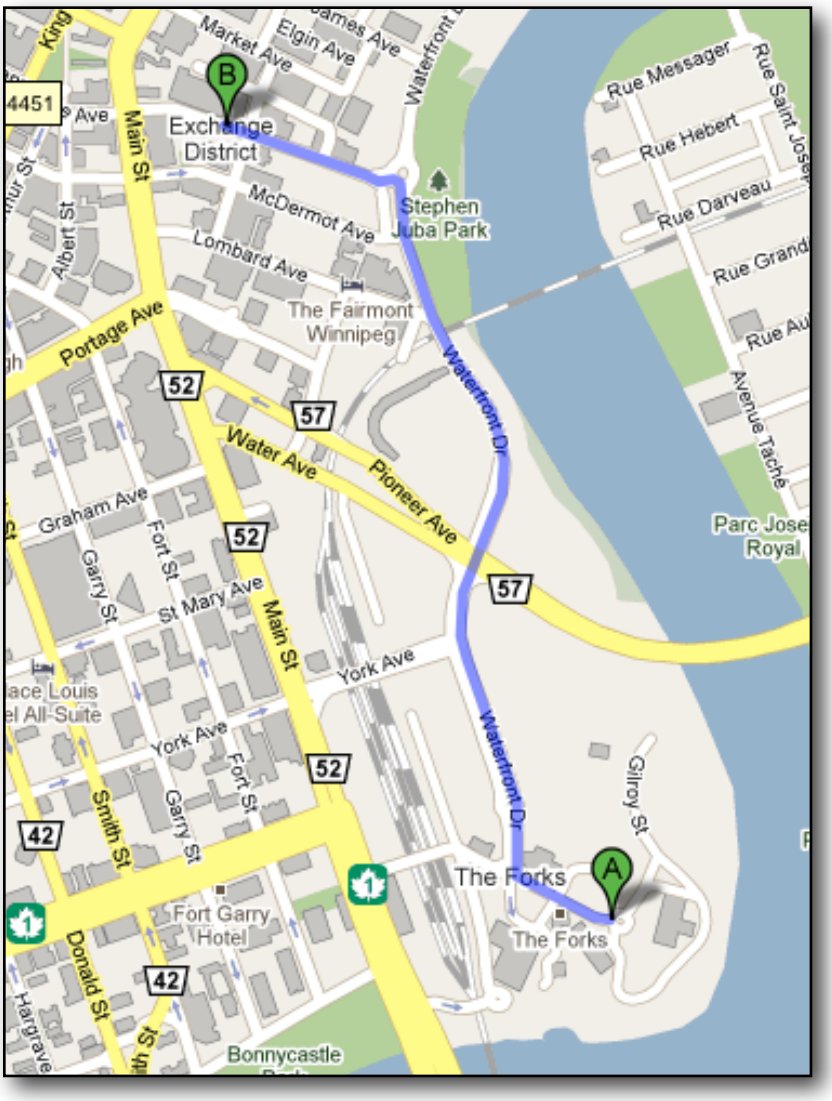
Wolde	Mengistu	National Research Council of Canada	Mengistu.Wolde@nrc-cnrc.gc.ca
Zhang	Shunli	University of Toronto	shunli@atmosp.physics.utoronto.ca

5. The Forks and Surrounding Areas

Without much time in the city and with dinner your own, narrowing down a place to explore can be difficult. You may simply just want to visit the Inn's own Current Restaurant and Bar or go to one of the many dining options at the Forks. The Inn can provide you with a list of restaurants right within the Forks Market and Terminal. If a change of scene is what you need, the following sections should help. The map provided below illustrates the trendy areas and great places to dine and wander which are all within walking distance to the Inn at the Forks.



Exchange District
(~ 20 min walk)

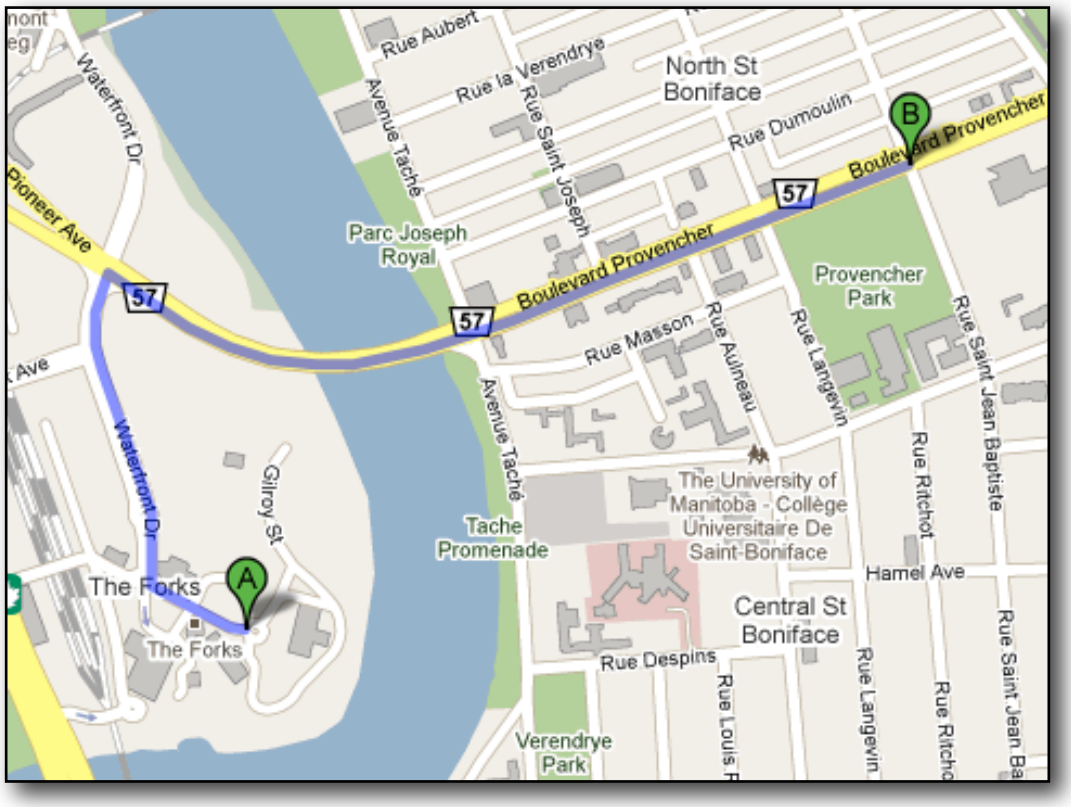


A walk along shores of the Red River (the River Trail can be accessed by the Forks Dock) leads you into the historic Exchange District, once a major financial centre. Much of the original architecture can still be seen, and nestled within are numerous cafes, shops and restaurants.

For a list of restaurants in this area, visit:

http://www.exchangedistrict.org/biz/

Provencher/St. Boniface
(~ 15 min walk)



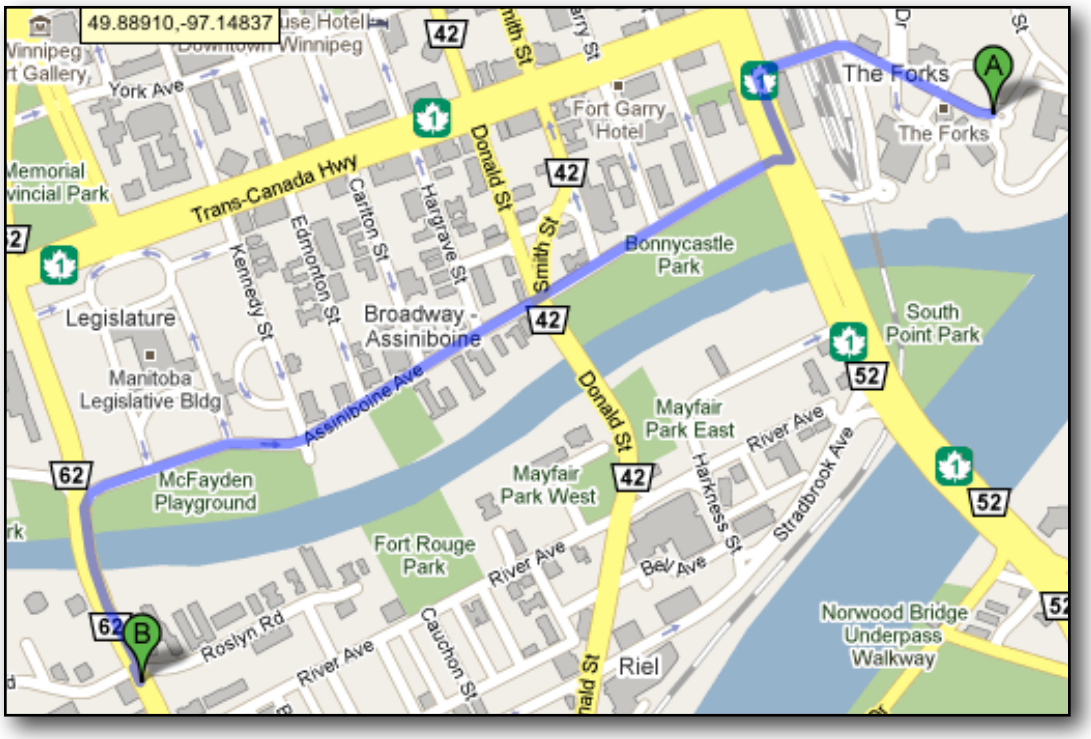
A stroll across the pedestrian bridge that spans the Red River leads you into St. Boniface. Take a right and continue down Tache Promenade for fantastic views of the city skyline and a look at the remains of the St. Boniface Cathedral.

There are many restaurants with french cuisine, cafes and shops to choose from on Boulevard Provencher.

For a directory listing please visit:

http://www.provencherbiz.ca/

Osborne Village
(~ 20 min walk)



You can actually take the Assiniboine River trail all the way into Osborne Village, climbing the steps at the Manitoba Legislative building and crossing the bridge across the Assiniboine River. If you're in a hurry, you can hop the River Spirit Water Bus (leaves about every 15 minutes from the Forks Docks) for $3.00. While in Osborne you'll see many boutique-style shops and every type of fare you can imagine, from sushi, to Italian to Australian!

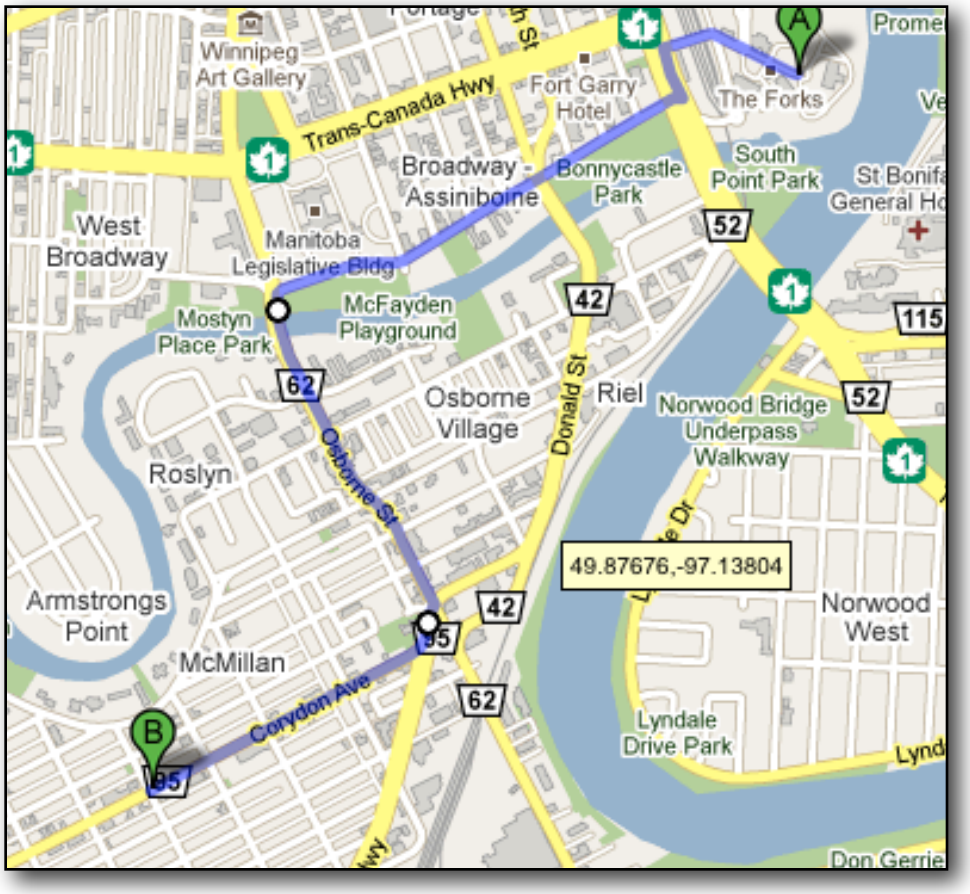
For a listing, please visit:

http://www.osbornevillage.com/

For Water Bus Info/Schedules:

http://www.splashdash.ca/

Corydon Village
(~30+ min walk)



You'll want to have some good walking shoes to make this trek. While a little far, it does pay off. If you are a gelati fan, you will be rewarded greatly. A cute village atmosphere with mainly Italian fare, Corydon is the people-watching, patio center of the city. Not only for the pasta-lovers, you will find Indian, sushi, and normal pub grub. Hopping the Water Bus on the way back might be a nice cap off to the night!

For a listing, please visit:

http://www.corydonbiz.com/

For Water Bus Info/Schedules:

http://www.splashdash.ca/

6. Partners

Canadian Foundation for Climate and Atmospheric Sciences (CFCAS)

Fondation canadienne pour les sciences du climat et de l'atmosphère (FCSCA)

Environment Canada Environnement Canada

UNIVERSITY OF MANITOBA

Nunavut Arctic College

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June 14, 15, 2010
Inn at the Forks
Winnipeg, Manitoba