



Discussion Paper on the Impacts of Climate Change for Mount Pearl

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Introduction

In recent years, there has been an increasing focus at all levels of government on climate change and its implications on the environment, both natural and built. More recently, a number of local workshops and conferences have been held on climate change and in particular climate change implications on municipalities. As a result of interest that has been raised as to the effects that climate change is having on the City of Mount Pearl, the Planning Department decided to undertake a research project on climate change. In order to assist the research of climate change in Mount Pearl we have collaborated with Dr. Norm Catto from the Memorial University Department of Geography and as well with Mr. Bruce Whiffen from Environment Canada. Dr. Catto is a professor at Memorial University where some of his own personal research is based on the climate change impacts of municipalities. The other contact Mr. Whiffen gave great assistance in finding and explaining how to use the climatological data that set the research in motion. Until now there has been no documentation of the implications of climate change in Mount Pearl, if any, and a growing need for research into the subject has been highlighted.

Methodology

Climate change as a topic has a very broad radius and, often, defining the scope at which to study climate change can be a challenge. Since climate change incorporates a range of ideas, this report has been broken down into two research steps. First, climatological data has been gathered for the City of Mount Pearl since its incorporation in 1955: the date range of the data runs from January 1955 to December 2007. Secondly, a survey was designed for, and distributed to, City department heads to determine the level of climate change awareness for those city service providers. Working with this data to show climate change relationships was a challenge. The scale of the data did not provide solid evidence to suggest that climate change was a factor for the City. The reason that the data did not give such evidence was due to the yearly range of the data, comparing variables based on the timeline of a

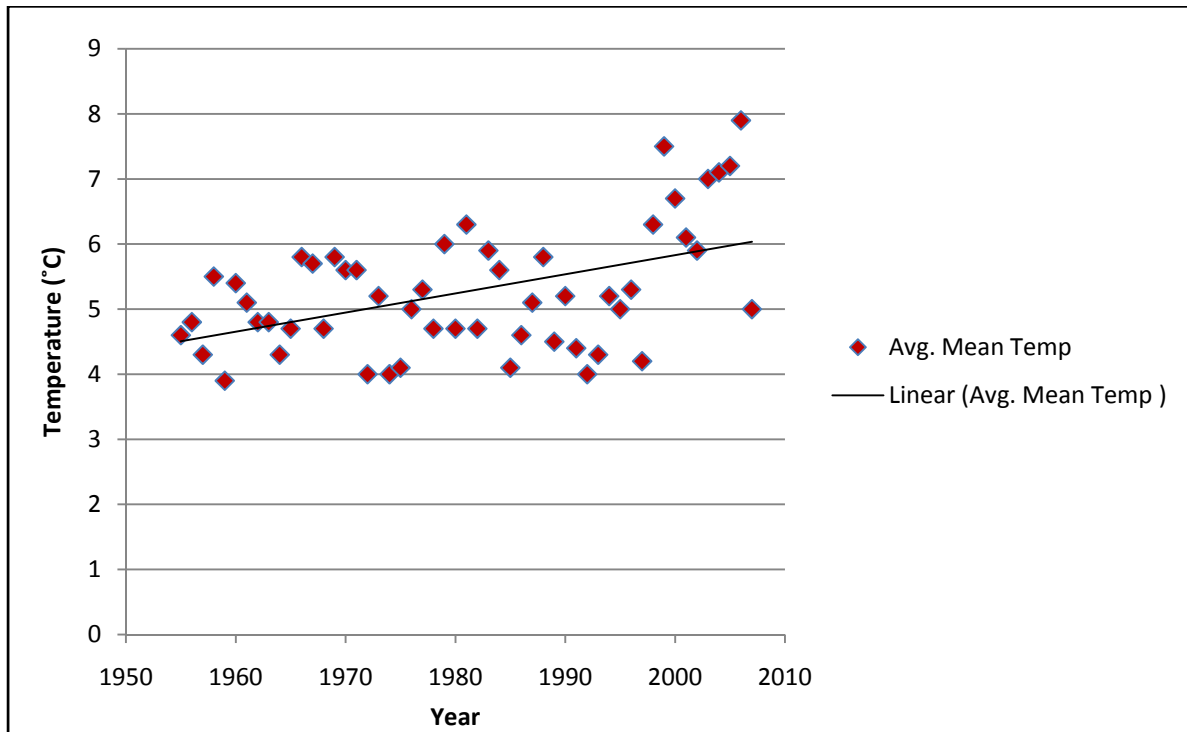
year did not provide definite data trends. Comparing the data according to seasons provided a much clearer picture pertaining to the effects of climate change on the city. This was the method taken, the data was broken down into the four seasons according to months and not actual days; winter includes January, February, and March, spring includes April, May, and June, summer includes July, August, and September, and fall includes October, November, and December. After deciding to use the data on a seasonal level, variables of climate were selected to compare the data. For this report the climate variables chosen were temperature, precipitation, and extreme events. All graphs created for this report were done using Microsoft Excel. The data was entered manually and the graphs were drawn using the automatic features of the program. The trend lines for the data were calculated by the program using an automatic linear equation.

The second research step conducted for this report was the development and distribution of a survey for City Department Heads. The purpose of this survey was to determine the perspectives of senior management staff that provide municipal services within the City. The survey was not conducted to judge particular people on their climate change awareness, but to obtain a larger picture of climate change impacts in Mount Pearl. Studying climatological data can provide information about the general trends that may be happening in the area, however, obtaining the views of service providers allows us to see how these changes are actually impacting the people and operations of the City. The questionnaire included 17 questions discussing attitudes and perceptions towards climate change impacts (Appendix B). Due to the two step nature of the climate change research done for this report, the report itself will also be divided into two sections. The first section will discuss the climatological data and the outcomes of the research, while the second will discuss the findings of the climate change questionnaire distributed to department heads. Once both sections are fully discussed some conclusions will be made pertaining to the impacts of climate change in Mount Pearl.

Temperature

Often when discussing climate change, temperature is the first variable that comes to mind, therefore temperature was the starting point for the initial data comparison of this report. In the beginning the data was compared on a yearly basis from 1955-2007. Average data was compiled from Environment Canada for each month from each of the 53 years. Comparing this initial data a general trends based on the yearly averages can be seen, but mostly the charts show a lot of variability in the climate of Mount Pearl. According to Dr. Norm Catto, it is this climate variability in Newfoundland that makes climate change for this province so hard to explain. However, temperature is one of the yearly comparisons that produced a trend. In the last 10 years, Mount Pearl has experienced 6 of the highest average temperatures for the 53 year timeline. The rate of increase between 1955 and 2006 was 71%, from 4.6°C in 1955 to 7.9° in 2006 (the hottest year). However, a very good indicator of the variability that still exists in the Newfoundland climate, Mount Pearl experienced a very moderate average temperature last year, falling in the direct temperature norm for the area with a yearly average of 5°C. As previously indicated climate change does not always refer to an increase in temperature but can also indicate possibility for lower temperatures as well. Figure 1 below shows the trend for average yearly temperature for the last 53 years. The trend line clearly indicates a positive correlation between year and temperature, meaning that as the date increases the average temperature does as well. Despite the positive trend line, consistent variability can also be seen in average yearly temperatures since 1955.

Figure1: Yearly Mean Temperature 1955-2007



Temperature changes can also be seen on the seasonal level as well. In order to compare seasonal changes data was manipulated according to year and months, the different seasons were calculated for each year and then totals and averages were calculated. Since overall yearly temperatures are increasing a similar trend should be visible in seasonal data. During spring, summer, and fall average seasonal temperatures are increasing (see Figure 2, 3 and 4), however, average temperatures in winter are decreasing (see Figure5). This means that summer, spring and fall are getting warmer and winter temperatures are getting colder. A trend like this indicates that there is an overall climate change taking place in the Mount Pearl area suggesting a more continental climate (with warmer summers and cooler winters) than has been seen in previous years.

Figure2: Average Summer Temperatures 1955-2007

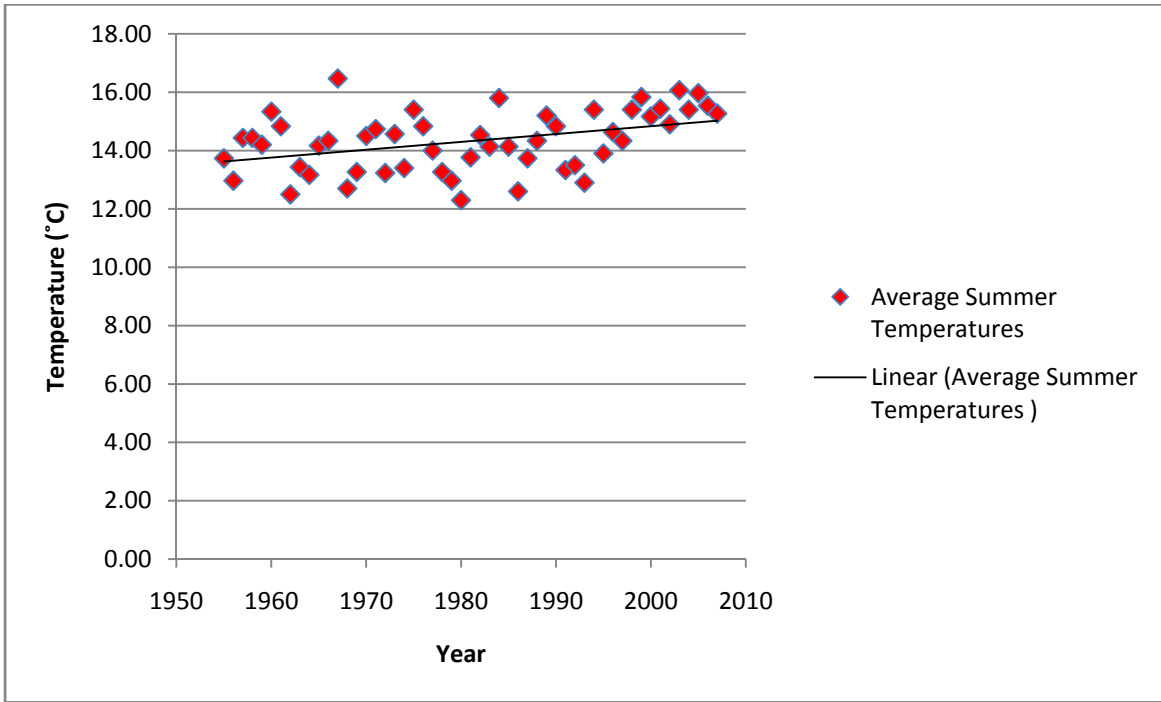


Figure 3: Average Spring Temperature 1955-2007

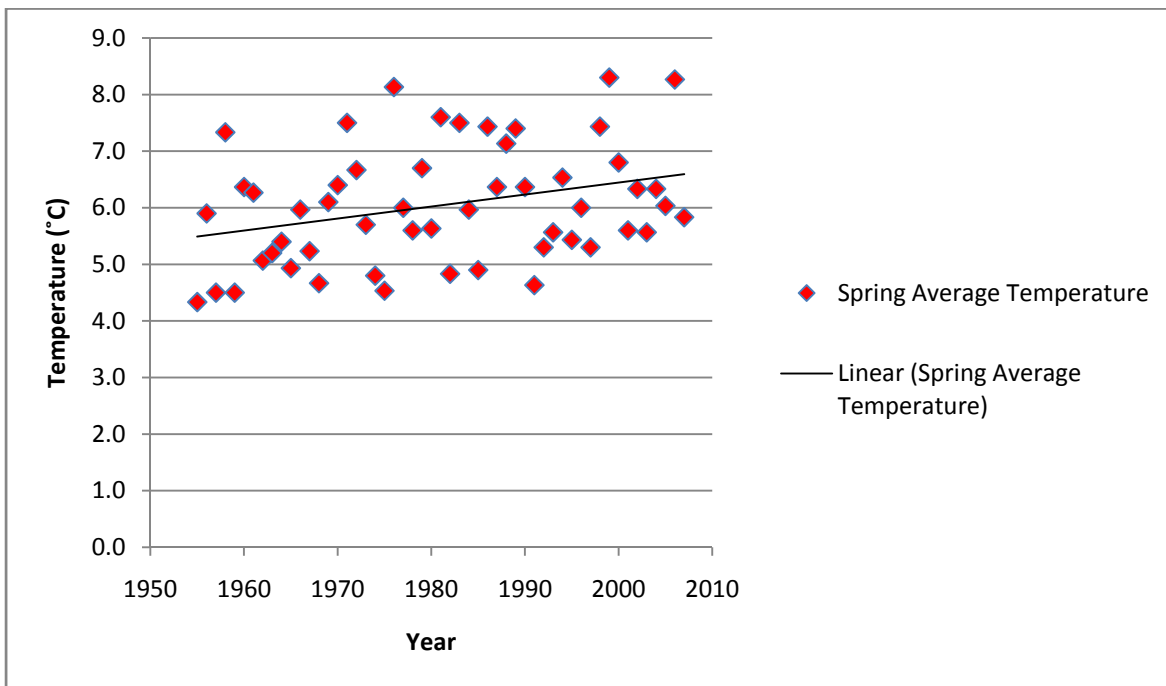


Figure 4: Average Fall Temperature 1955-2007

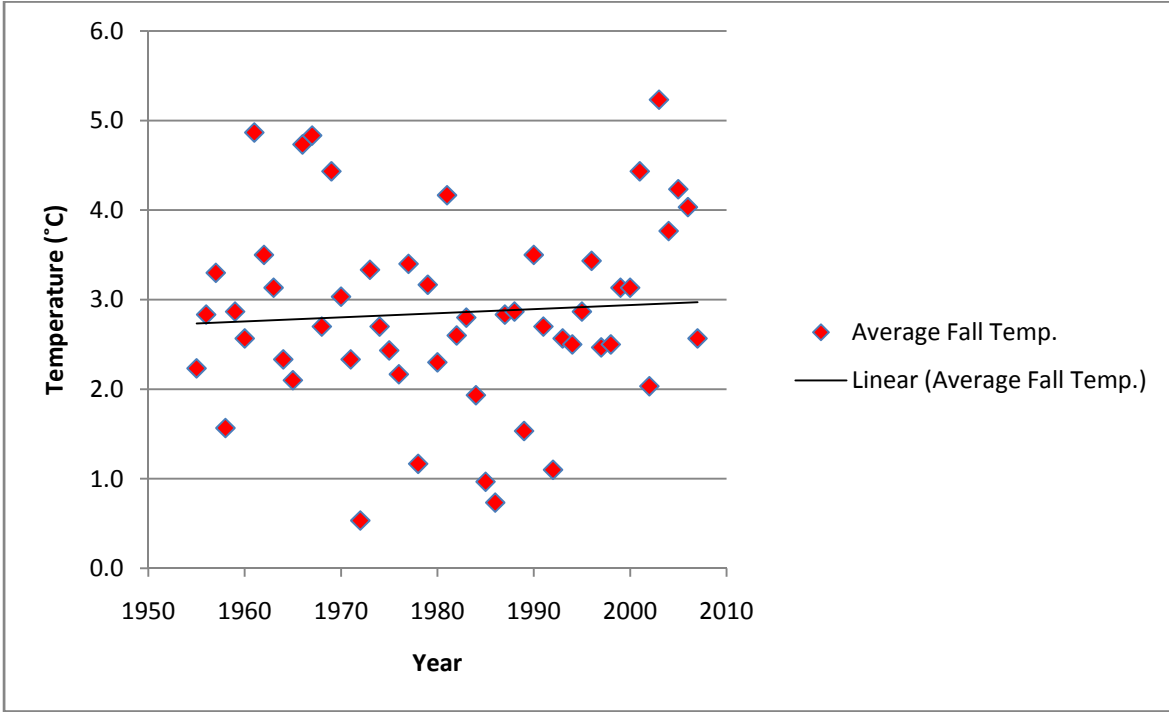
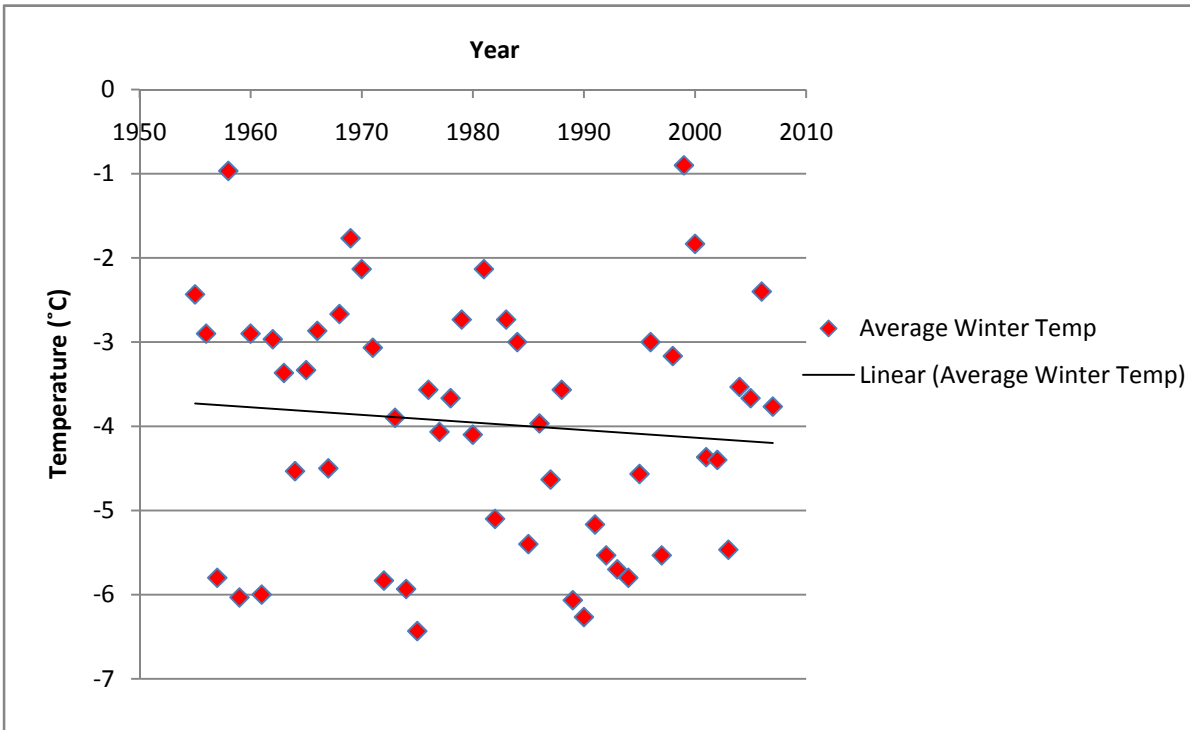


Figure 5: Average Winter Temperature 1955-2007



Precipitation

Precipitation is not an uncommon word to use when discussing the climate issues of Newfoundland and Labrador. Therefore it seems inevitable that any possible changes in precipitation as a result of climate change are of interest to the City of Mount Pearl. Once again the overall yearly changes in precipitation for the last 53 years were varied, and the major trend that could be taken from the graphs was that precipitation in the Mount Pearl area has experienced constant variation through the last 53 years. However, seasonal changes in precipitation provide a much clearer indication of climate change effects in Mount Pearl. Possibly two of the most important seasonal changes in precipitation are an increase in spring rain (see figure 6) and a decrease in summer rain. Due to the warming of temperatures in the area, Mount Pearl is experiencing, during the spring season, an increase of precipitation falling as rain and a decrease of precipitation falling as snow. As an example of the increasing temperatures and decreasing snow in spring data was collected on snowfall during the month of June (see figure 7). In the 26 years from 1953-1980, there was 63cm of snow that fell in the month of June, that is an average of 2.42cm of snow each June for the 26 year period. In the last 27 years since 1980 there has been a June Snowfall of 4.2cm, an average of 0.0014cm each June in the last 27 years. This clearly indicates that temperatures in the spring season have been rising, changing the precipitation characteristics of the season. Likewise, figure 8 shows that the hottest months of the summer, July and August, are experiencing less rainfall. Summers in the City are becoming hotter and drier.

Figure 6: Spring Rainfall 1955-2007

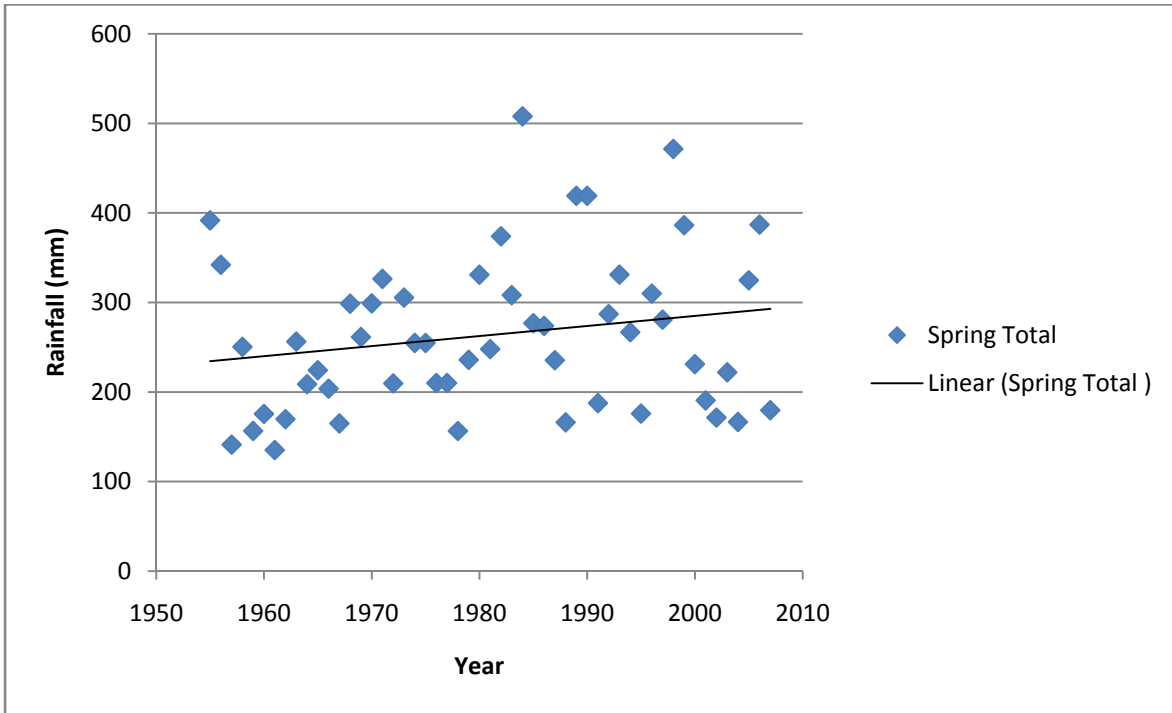


Figure 7: Snowfall in June 1955-2007

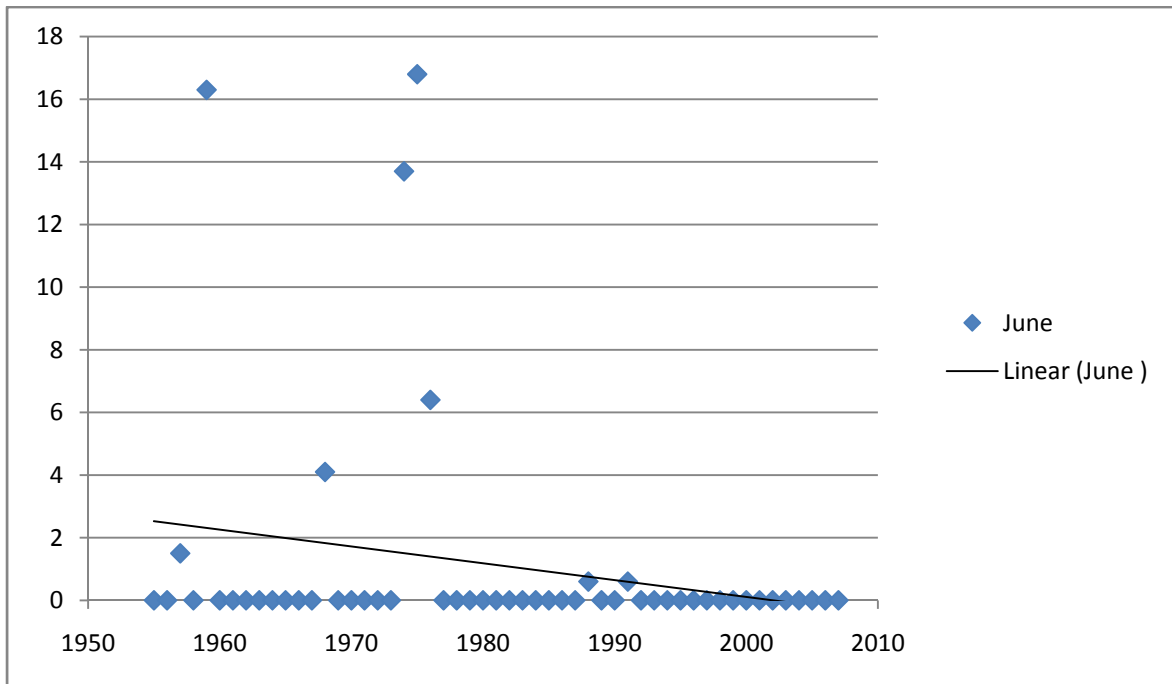
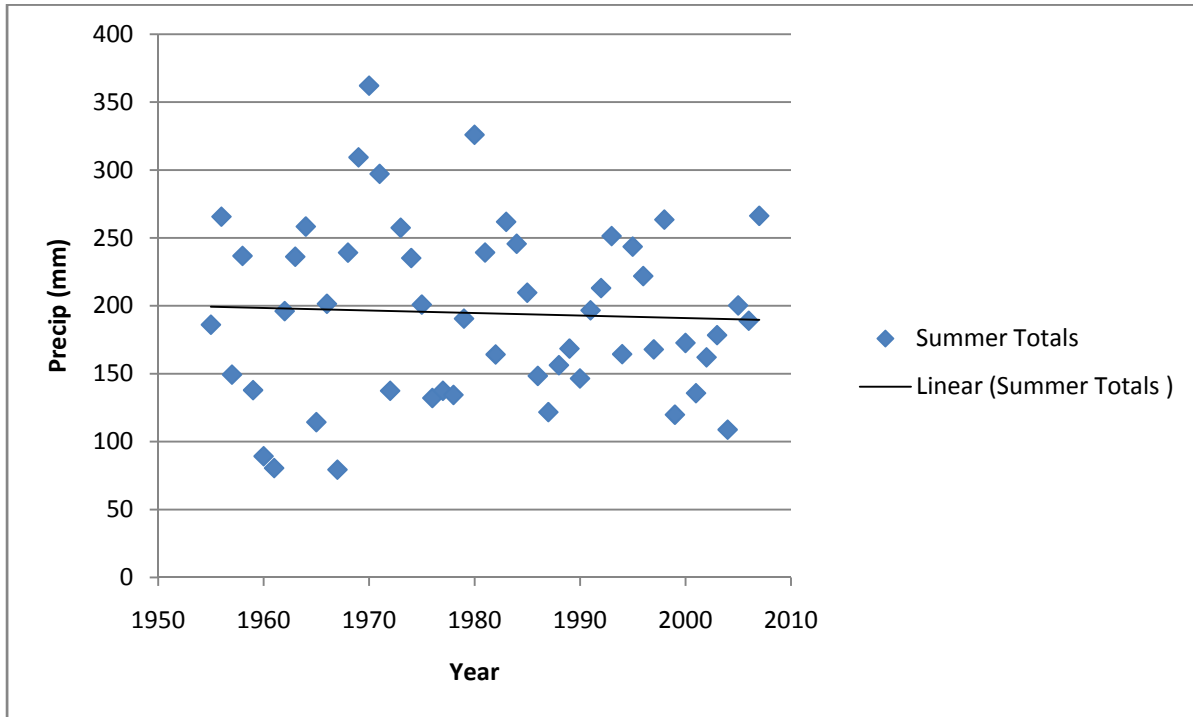
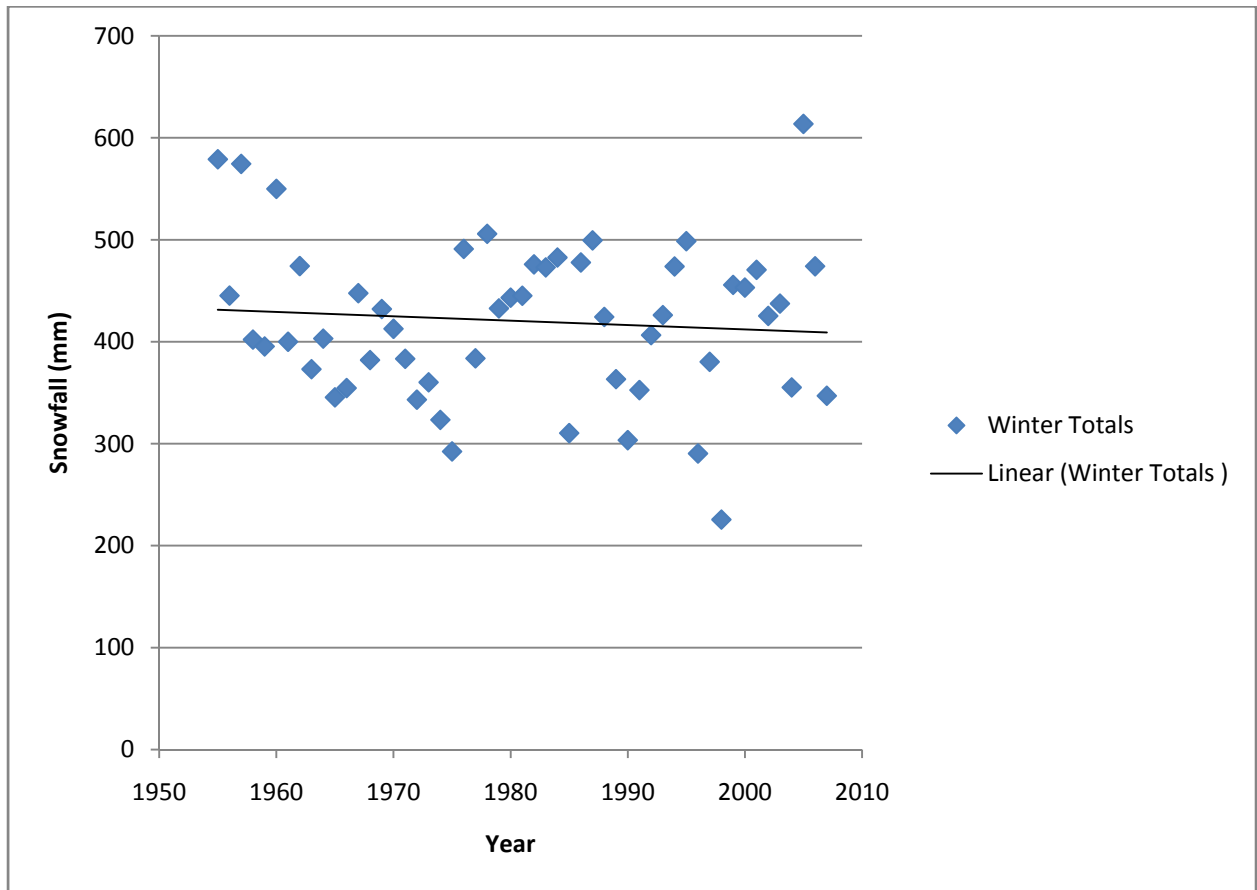


Figure 8: Precipitation during the Hottest Summer Months 1955-2007



Another precipitation indication of climate change for the Mount Pearl area is the fact that winter snow is decreasing (see figure 9). It was previously pointed out that temperatures during the winter months in the City are also decreasing, this can lead to less snow because temperatures can be too cold for precipitation to occur. It may seem as if we are getting more snow than ever in the province, but colder temperatures means that snow does not melt as fast, keeping the snow that falls on the ground for longer periods of time.

Figure 9: Winter Snow 1955-2007



Extreme Events

Extreme events is a very large topic and can include any type of extreme weather conditions, the most measurable option for this study was hurricanes. Hurricanes have a distinct affecting season, which in the Atlantic runs from July 1st to November 31st. For the City of Mount Pearl Hurricane Hortense in September 1996 was particularly extreme washing out the whole of Mount Carson Avenue. Due to the intensity of this event it became the starting point for the research on extreme events. For Hurricanes it seems that the Atlantic season has been experiencing more frequent and intense Hurricanes in the last 13 years from 1995 to 2008 (see figure 10). Historical data on the occurrence of Hurricanes is kept by the Canadian Hurricane Centre; from this website the dates of the provinces affecting Hurricanes since 1955 were compiled. Figure 11 is a graph that outlines the affecting hurricanes for the province since 1955. The trend line clearly indicates that the intensity of rainfall during hurricanes is increasing. This list of hurricanes affected the province at some location, not necessarily affecting the Eastern Avalon. Therefore, effects may be different for other areas for the same storm events. For example, in 5 hours on September 15th, 1996 Hurricane Hortense dropped 98mm of rain on the City of Mount Pearl. In contrast, only 32mm of rain fell at the St. John's Airport, a mere 15 minutes away. The storm brought extremely intense activity to the Mount Pearl area, and was relatively uneventful in St. John's.

Figure 10: Atlantic Hurricane Frequency 1855-2005

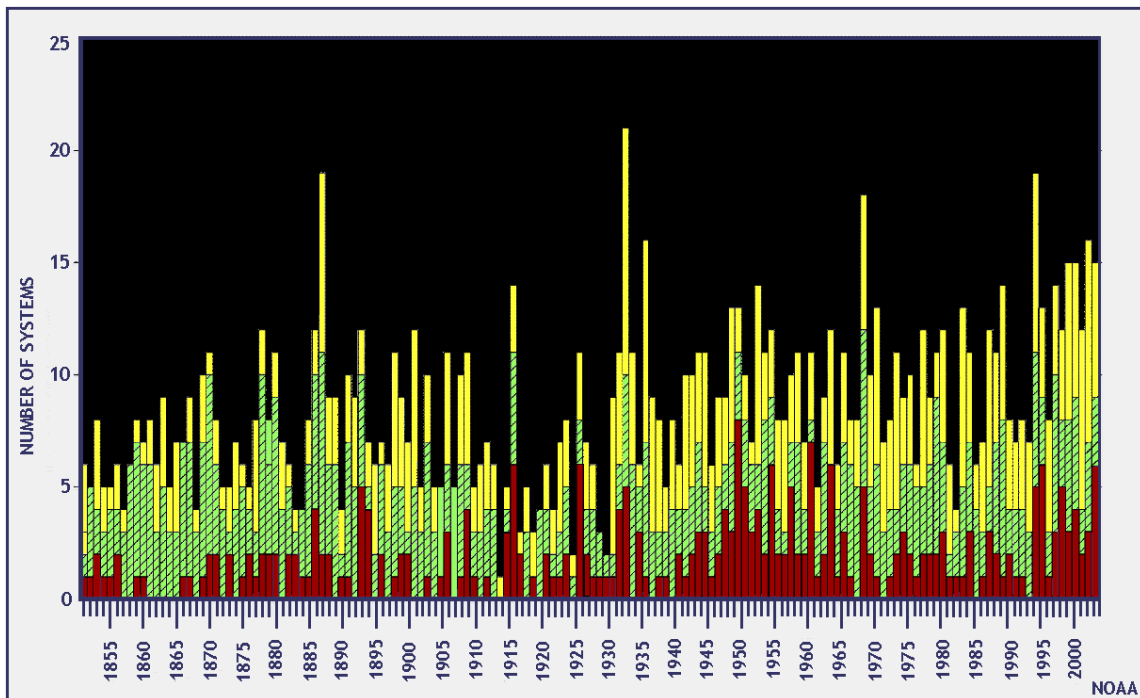
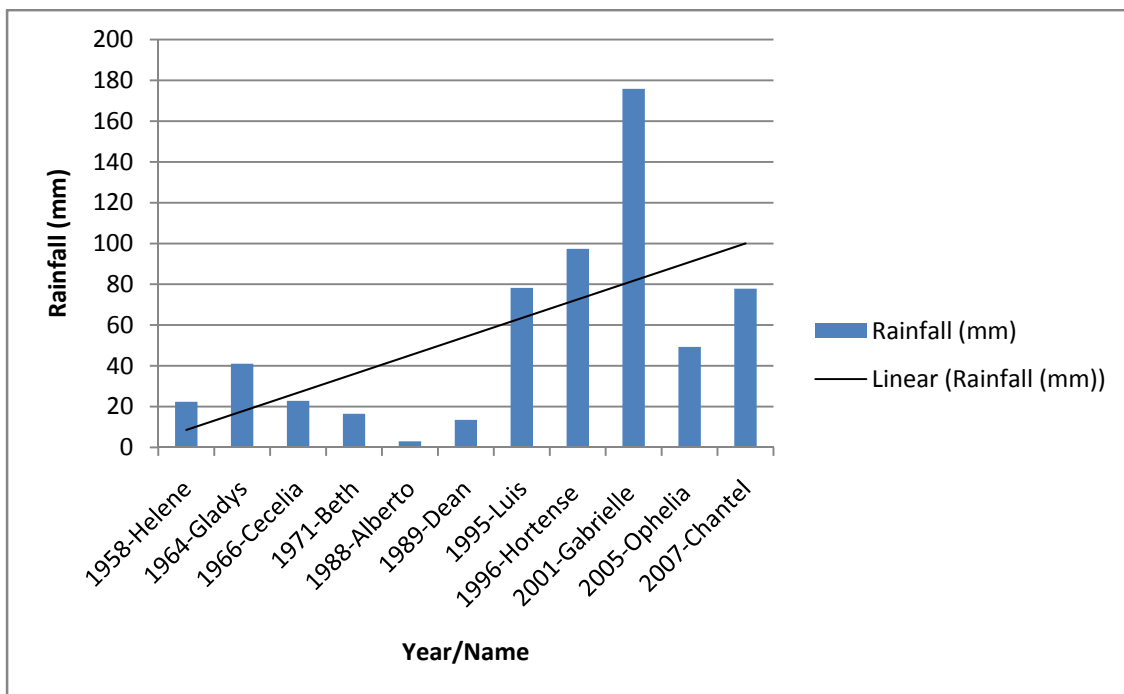


Figure 11: Affecting Hurricanes for Newfoundland 1955-2007



Survey Responses

The views of the department heads of city services toward climate change are varied. They range from beliefs that indicate climate change as an issue of popular culture that will lose popularity, to beliefs that outline the potential for major updates to city services in order to accommodate climate change. Some points have outlined very noticeable changes to climate in Mount Pearl, while others have barely noticed the effects. The survey indicates that everyone has different experimental relationships with climate change and its impacts.

One of the main concerns outlined by city department heads is increased flood activity in the City. A major contributor to flooding in the city is increased hurricane frequency. As shown in the section on extreme events, Mount Pearl has been experiencing increased hurricane activity during the Atlantic season through the last 15 years. Rain that falls during these events is usually more intense and concentrated than normal rainfall for the area, therefore causing increased runoff and flow in water bodies which leads to flooding and increased damage to infrastructure. Other impacts of flooding for the City of Mount Pearl can be increased need for emergency manpower and equipment, along with increased insurance claims due to the expanding flood plain.

Different departments experience the impacts of these affects in a variety of ways; however, it is easy to see how one issue can influence many different areas. This variety in experiences is a key reason for climate change research, awareness, and adaptation. Many people do not realize how climate change can affect them, they believe that temperatures are warming and that green house gases are an issue, but they may be unaware of the real impacts that climate change can have on a city. One survey

respondent outlined public education as a tool to combat climate change, while this may seem cliché it may be a key factor in climate change adaptation. People are not going to prepare for something they do not know about, or believe is happening.

All department survey respondents believed that some action should be taken with respect to climate change in the city. 5 respondents gave the most popular response that the municipality should try and prevent losses before they start. 3 more responses said that changing activities that are not sustainable in the new climate was a good adaptive solution, while 3 others thought that enhancing adaptive capacity was the answer to adaptation needs. Respondents were able to circle more than one choice for this question; therefore the number of responses is not equal to the number of surveyors. However, despite recognition of adaptation needs for the city, there are no departmental adaptation responses beyond research underway in the city.

Another survey highlighted issue was the need for an updated Emergency Response Plan for the city. Many department heads outlined that their departments were unprepared for the damaging effects of an extreme weather event. They also indicated that the existing emergency response plan would not offer adequate instruction in an extreme situation. Concerns from the finance department outlined the need for a new emergency response plan, but also highlighted that funding for such an undertaking is not available. Emergency response planning is a key step in adaptation for climate change, particularly in Newfoundland and Labrador, due to the increased possibility for extreme weather conditions. According to Dr. Norm Catto, emergency response planning is important in minimizing losses due to climate change. Municipalities must not only implement new plans, they must also enforce the procedures outlined within them by holding practice drills for hypothetical emergency situations.

There is another common trend among the differing survey answers. It seems that outside departments, those dealing with activities outside, and inside departments, those dealing with activities mainly on the inside, have very differing perceptions of climate change. Commonly, outside departments, engineering, parks and recreation, and public works, provided more detailed answers to questions and were able to provide specific examples of climate impacts in the City. However, inside departments, economic development, planning, finance, and administration, gave more general descriptions and showed less knowledge of the climate change impacts for their departments or the city.

Possibly one of the most interesting parts of this study on climate change impacts in Mount Pearl is that fact that some questionnaire responses coincided with the trends outlined in the climatological data. For example, the Parks and Community Services Department noted that hotter, drier summers are occurring in the City. Likewise, many departments noticed that snow is beginning earlier in winter and ending earlier in spring, a trend discussed in figure 9. Also, many survey respondents indicated that rainfall events were more frequent and more intense; both trends were shown in the data for spring rain and hurricane events. One issue that did seem to have some discrepancy with the data and the surveyors is the issue of winter snow. Overall, Mount Pearl is experiencing less snow in the winter months (indicated in figure 7); however, survey answers indicated that respondents felt there was more snow occurring during winter months. This discrepancy may be explained by the fact that winter temperatures are cooler and storms are more intense and closer together. The cooler temperatures are keeping snow on the ground longer by not providing a chance for existing snow to melt before new snow falls. Therefore, perceptions indicate that there is more snow when really there is not.

Conclusion

It would appear from the data that climate change is occurring in the City of Mount Pearl. The changes may be subtle but they are occurring. It is important to note that this report is a baseline report for climate change information for the City. As a starting point, more comprehensive research can be taken in the future to look at individual impacts and how they may be solved if they ever become persistent. That said it seems that there are a few recommendations that can be taken from this report. First, emergency response planning for the City is an issue outlined by all department heads, as well as an issue that is highlighted in many adaptation texts; therefore it may be worth more research and attention for Mount Pearl in the near future. Also, another key recommendation that was also outlined in the survey is the need for further education for city staff. This is outlined in two different ways, first it is actually recommended in questions by many staff, and second it is evident in the variation of understanding represented by the different departments. It would be beneficial if all senior staff could have baseline understanding of the topic in general, but also more about its influences. This could possibly be achieved through increased literature or workshops.

It is evident from the attention that the issue of climate change is receiving world wide that it is a very intriguing topic. It is interesting to see how something that is seen as a global issue can affect smaller places. Due to the world wide coverage of the issue people often put climate change off as an issue that does not affect Newfoundland and Labrador, but affects the major world cities. Climate change may not have the extreme effects here that it has in other places, but there are still key indications that climate change is a factor for the City of Mount Pearl.

Appendix A

Climate Change Terminology

Adaptation: Adjustment in natural or human systems in response to actual or expected climate change stimuli or their effects that moderate harm or exploit beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, and autonomous and planned adaptation.

Climate Variability: Climate variability refers to variations in the mean state and other statistics of the climate on all temporal and spatial scales beyond individual weather events. Variability may be due to natural internal processes within the climate system or to variations in natural or anthropogenic external forcing.

Source: Bano Mehdi, "Adapting to Climate Change: An Introduction for Canadian Municipalities"

Appendix B

Questionnaire on the Impacts of Climate Change in Mount Pearl

1. Do you feel that climate change is an issue within the City of Mount Pearl? Yes or No (Please Circle)
2. Do you feel that climate change is an issue within your Department? Yes or No
3. Do you feel that climate change is an issue of popular culture that will lose popularity? Yes or No
4. In recent years, have you noticed any general changes to the climate in the Mount Pearl area? Yes or No

If yes, can you describe the changes you have noticed?

5. Have you noticed any climate change impacts on the natural environment? If yes, please explain.

6. In certain other jurisdictions there has been a relationship between a change in climate and the introduction of new or invasive species. Have you noticed any new species introduced to Mount Pearl in recent years? If yes, please explain.

7. What do you feel the impacts of climate change are on the services and operations of the City?

8. Can you give any specific examples of how climate change has affected your operations?

9. In your view how will climate change affect the operations of your department in the future?

10. What extreme weather events have affected your operations? (Name and year, if possible)

11. Are you prepared for an extreme weather event (hurricane or flood)? Please explain.

12. Has there been an extreme weather event where the Emergency Response Plan has been or should have been implemented? If yes, please explain.

13. Climate change impacts are not always negative. Are there any positive impacts for your department and/or the City of Mount Pearl?

14. Has your department made any adaptations to respond to the impacts, or potential future impacts, brought on by climate change?

15. Does your Department have any policies that relate to climate change?

16. Are there any measures that the municipality should consider in adapting for climate change?

17. Natural Resources Canada outlines a series of adaptations that municipalities can work with in order to prepare for climate change. What action(s) do you feel Mount Pearl should take against climate change? (Please Circle)

1. Do nothing
2. Try to prevent losses before they start
3. Spread out the loss by implementing different systems (ex: food insurance)
4. Change activities that are not sustainable in the new climate
5. Change location of affect infrastructure
6. Enhance adaptive capacity
7. Other

