

# Intro

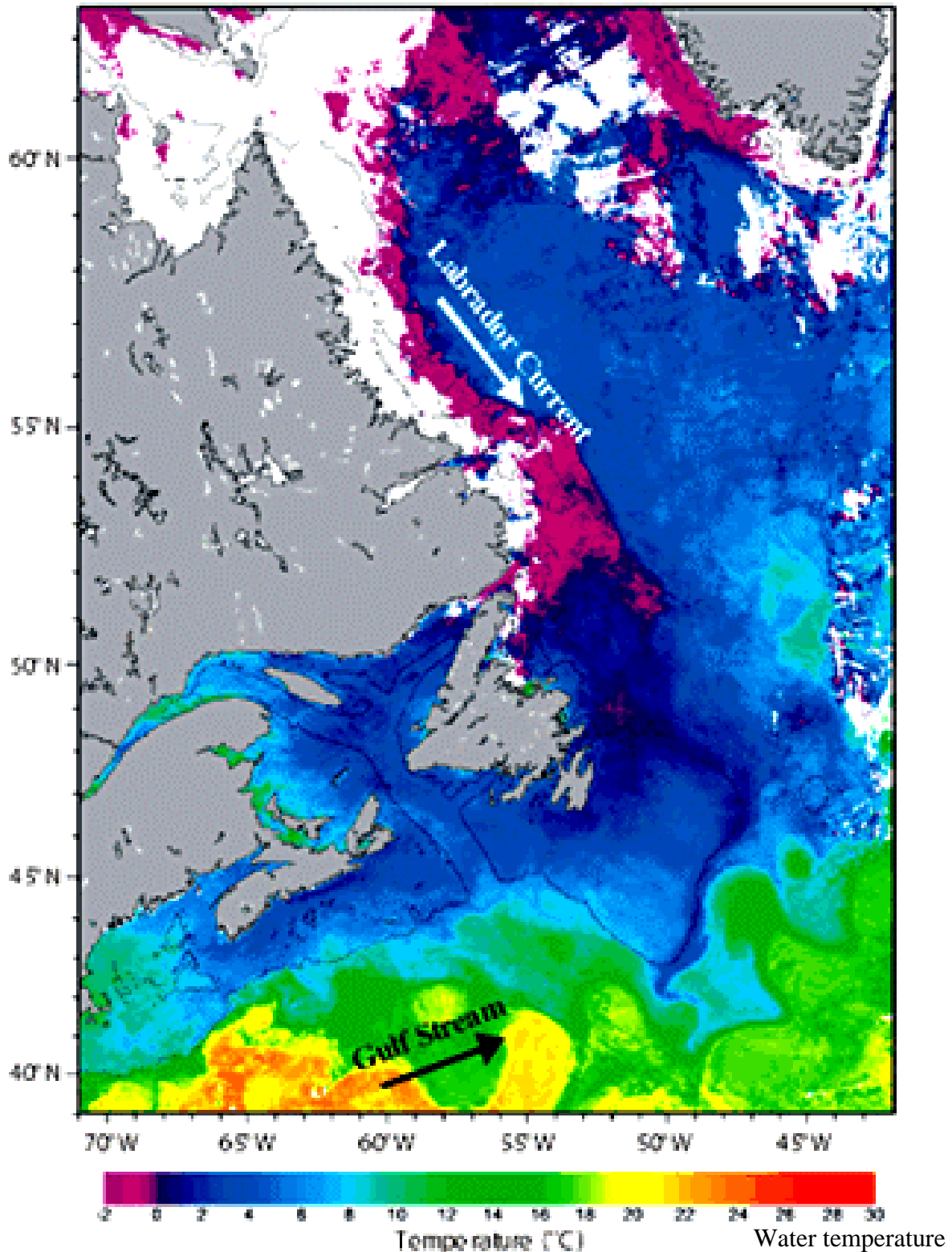
In this report I am going to illustrate the influence water, i.e. surrounding seas, freshwater, rain and subsoil water, has on the climate of Atlantic Canada, and what possible changes this might have upon the environment. I will also get a local perspective on the problem. In addition to this I will, of course, focus on the ways global warming can affect the water, and, in turn, the environment, i.e. the destructive powers of water in this area.

First it would probably be a good idea to confirm that there actually are changes, and that there is a problem. Scientists of Natural Resources Canada claim that natural and man made changes to the climate are de- and increasing water temperatures. These temperature changes can affect the volumes, speed and course of Atlantic Canada's currents and ultimately, could cause severe climate changes for the entire region. In fact, scientists predict more changes than ANY OTHER region in the entire world. I quote: "*Canada may experience more temperature change over the next several decades than most regions of the world.*" The preliminary temperature changes won't be very drastic in the area, but the effect that this can have on seawater will cause the currents to heat up, and due to this, the weather and climate in general will become more severe, potentially causing great amounts of damage to the area. So, yes, the problem exists and is developing.

## **THE CURRENTS AND THE OCEAN**

The three different currents that meet in Atlantic Canada are one of the major reasons for the severe weather they sometimes have in the area. The East Greenland Current meets the Labrador Current and the Gulf Stream on the Grand Banks, just off the coast of Newfoundland. During the centuries this has been a favoured spawning ground for the Atlantic cod, because of the water temperature, which is very high because of the Gulf Stream. Even though the East Greenland current affects Atlantic Canada, it is not as important for the climatic changes as the two others. Ocean currents in general have a major influence on climate. The Gulf Stream carries 55 million cubic meters of water past Atlantic Canada every second at speeds up to 15 km/h. The Labrador Current transports cold Arctic water southbound at a rate of 6 million cubic metres per second, at an average speed of only 1 km/h. When the icy waters from the Arctic, with temperatures ranging between -2 and +6 degrees Celsius, and the cold air it brings with it, meet the warm water from the Gulf, with temperatures varying between +15 and +25 degrees, and the warm air, it is

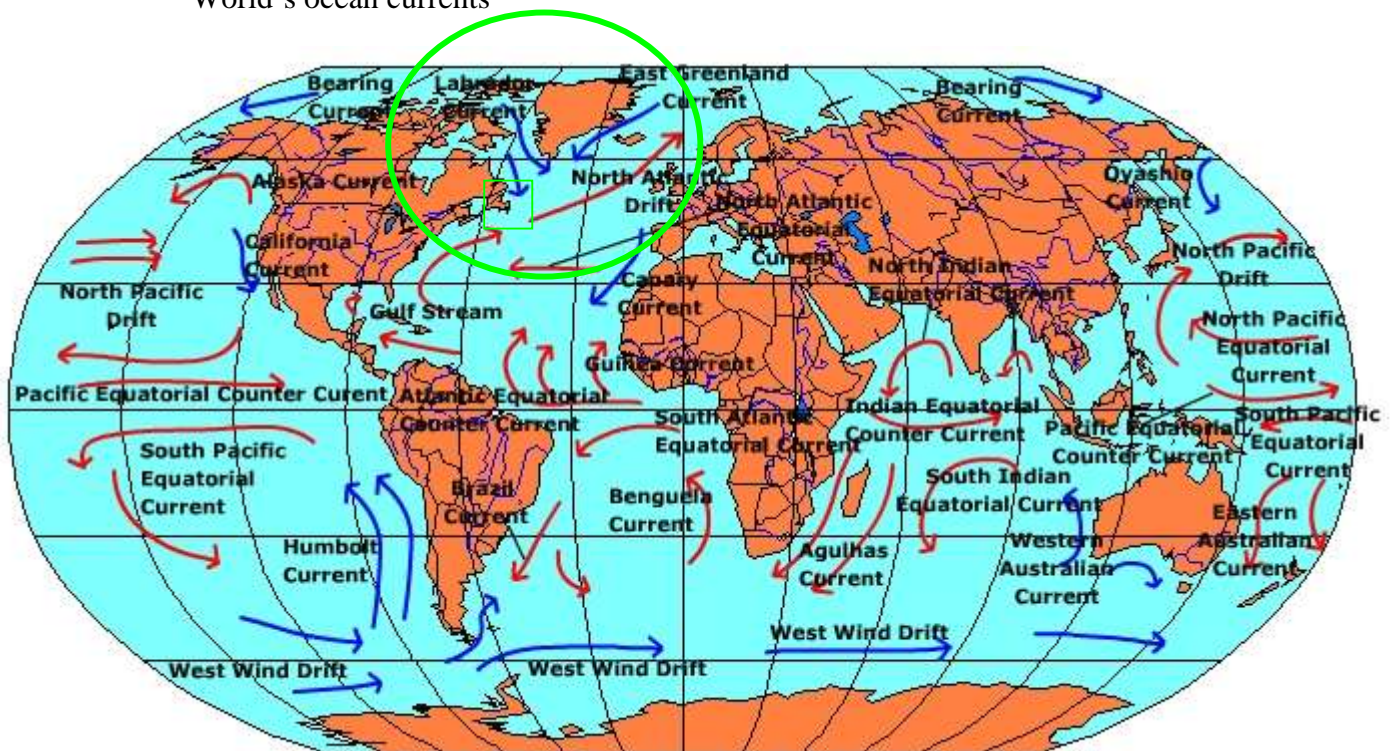
prone to create heavy storms, endless fogbanks, and other weather abnormalities.



Had it not been for the Gulf Stream, the other currents would have put this entire area in **an ice age scenario**, or it would have been a part of the Arctic. Just as in countries such as Norway, the Gulf Stream also heats up the surrounding land

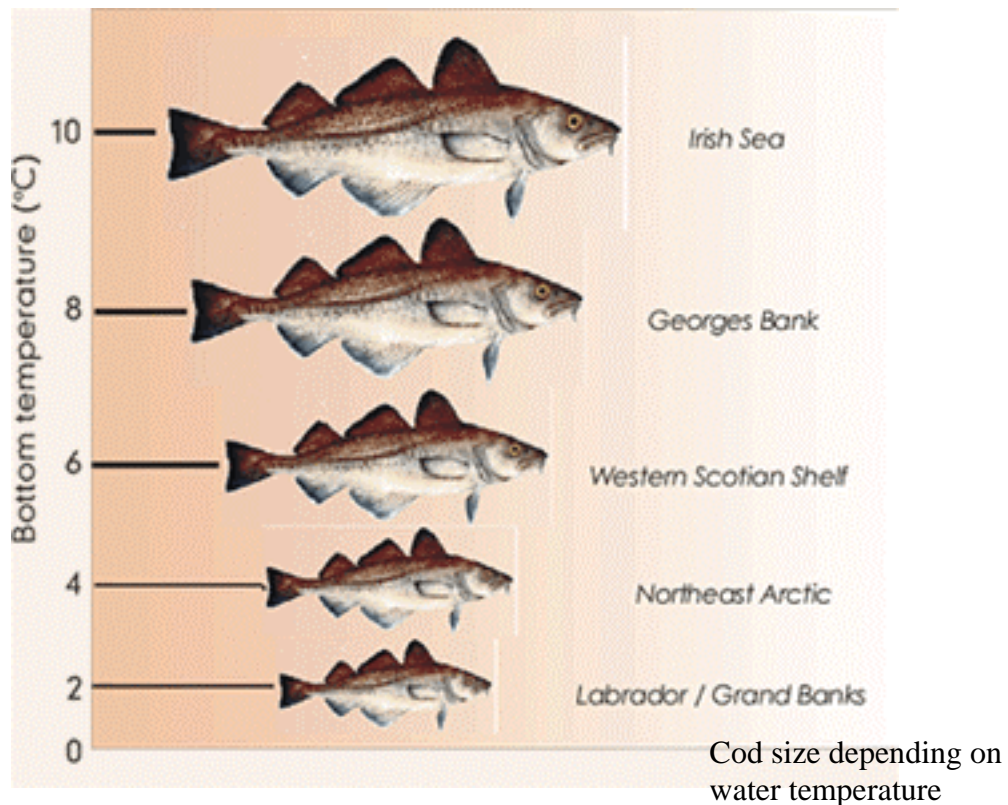
mass, and even though it is considered unstable, this is vital for the survival of most living organisms, including humans. As I mentioned, this conflict between hot and cold causes very unpredictable situations. But, it could also result in warm summers, and icy winters. Labrador City is a magnificent example of this, because here the summers are nice and warm, up to 35 degrees Celsius, and winters are ICY, temperature dropping to -40 degrees occasionally. Elements such as these are decided by the location, and how well mountains etc. protect from surrounding environment. Take L'Anse Aux Meadows in Northern Newfoundland for instance, where snow sometimes lies on the ground as late as July. Icebergs are a common sight, as the town is located on one of the most northerly points of Newfoundland, where the Labrador Current is divided into two. During my visit I tried to go for a swim, but the water was so cold that my skin started to turn blue after only a short while. This was in July.

World's ocean currents



The ocean temperature can, as mentioned, also affect the marine life. Warm waters make for larger fish, because the fish can use less energy to keep themselves warm, and more for growing. Only a few degrees difference can be magic for the size of fish such as cod. This is also because the amount of available food increases, leaving the fish with more nourishment. Warm water is

also a better solvent, and due to this, fish from warmer areas tend to be healthier, because minerals etc. that they need are more common. Due to the Gulf Stream heating the Grand Banks and other Atlantic Canadian fishing grounds, the fish here are rather large. This has been proved by observing the changes in the size of fish during years when water has been especially warm or cold. Since fishing has been and still is one of the region's greatest sources of income, this has proven to be one of the positive sides of the wrath of nature.



This shows that changes in currents will result in changes in sea temperatures, and furthermore, affect the economy and the climate in Atlantic Canada.

## **FRESHWATER ISSUES**

Atlantic Canada's main power source is hydroelectric power. It rains a lot, and mountains are plentiful. As most other places, the most severe need for power occurs in winter and summer, but especially in summer. Air conditioning and similar technologies drain lots of power. But global warming would cause a higher spring flow in the rivers, so much that the generators wouldn't be able to cope with it, and water would have to be let out of the dam. The amount of water would presumably remain the same, so the water flow in the summer and winter months would decrease, leaving a heavyset power shortage. The reason



for all of this is that the temperature is increasing in the beginning of the year, causing the spring runoff to come earlier and with greater force. In areas where water isn't used for electricity this could result in floods.



Flood in Ottawa,  
1996

## **RISING SEA LEVELS**

In Atlantic Canada sea levels have been rising for a long time, because a tectonic movement in the earth's crust causes this area to sink with a speed of 36 cm per Century. Due to this, the water levels are steadily increasing, but now scientists have proved that the levels are increasing more than normal. Some people think that glacial melt water is the reason for this. Newfoundland's proximity to the North Pole is such that this could actually be the case. A temperature rise of only a degree will cause an extra large amount of ice to melt off the glaciers in the Arctic during the summer. The heat also causes the water molecules to increase their thermonuclear movements, resulting in water expansion. This doesn't make much of a difference, but the coastline in the area is very sensitive to change, because there are several low-lying salt marshes, barrier beaches and other landscape that can easily be eroded away. Erosion already threatens the Pointe Verde lighthouse in Newfoundland, which is seated upon a mound of sand that is being torn away from beneath at a high speed. Some places 12 meters of coastline are eroded away every year, leaving huge gaps. The Intergovernmental Panel on Climate Change predicts that global sea level may increase 50 cm by 2100 due to warming of the oceans, melting of glaciers, and other effects. This would result in a large amount of land being completely covered in water, and much more vulnerable landscape to be eroded away.



Areas threatened by rising sea levels

In 1920 a pretty little island called Misener Island lay just off the coast of Halifax in Nova Scotia. Here there were a few farms, with good conditions for growing vegetables since the earth was full of minerals, having once been on the bottom of the sea. The island was really just a large mound of sand in the middle of a small inlet. Nevertheless, currents from the sea, rising sea levels and so on rapidly eroded the entire island away. Now there is nothing left, but a shallow bank.

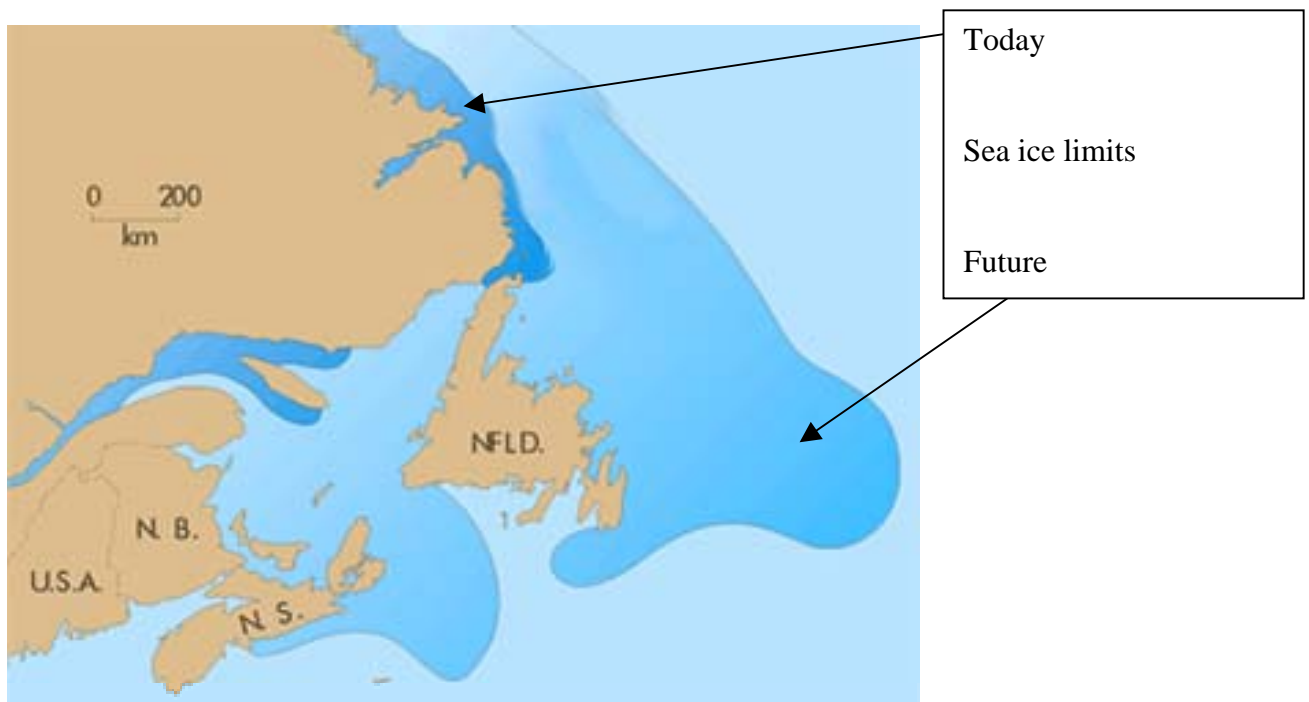


Misener Island, 1920

## **ICEBERGS AND SEA ICE**

When the global temperature increases, it affects the poles by melting more ice. This will cause a larger flow of cold water from the Labrador Current. The

higher concentration of cold water could possibly, some scientists at Natural Resources Canada claim, force the Gulf Stream further south. This would result in the warm waters disappearing from Newfoundland, and since warm water heats the surrounding area, a radically colder climate for the whole area. Arctic Sea Ice might reach as far down as to Halifax, nearly completely covering the coast of Atlantic Canada with ice in wintertime. The margins controlling this event are really small, and nobody can say for sure how much difference there will be, but it is a very possible scenario. Similar things could happen in Norway, but not with as severe results as here. Atlantic Canada would be counted as a part of the Arctic, leaving the fertile lands in a tundra-like state for most of the year. This is one of the worst case scenarios, and can come as a direct result of global warming.



Of course, the entirely opposite thing could happen, and this is a much more likely. The global heating could cause the sea ice to become thinner and thinner gradually, causing the water to remain at the same temperature. This would also affect the extension of the ice. Changes such as these are looked upon as positive, because the climate will get warmer, oil cheaper since platforms won't need iceberg protection, extended shipping season and so on. However, a decrease in the winter sea ice and in the expansion of icebergs would mean that the coast would be much more exposed to the winter storms. Barriers of ice protect the land from erosion, and it takes the heaviest blows from the storms.

Scientists also predict that the storms could be given new fury if the waters heat up sufficiently, resulting in extensive destruction to the coastline and man-made materials.



Pack-ice

Nowadays icebergs drift south with the Labrador Current down to the Grand Banks where they melt in the warmer waters. If the waters become warmer, and the Gulf Stream stronger, the range of the icebergs would be decreased, so that oil production would become cheaper and simpler, and the fishing and shipping seasons could be extended. It would also simplify other matters, such as once when an iceberg was about to block the entrance to the harbour in St. John's, Newfoundland.

If the climate grew colder the icebergs could become larger and more numerous, it would have the opposite effect on the oil and fishing industry, and it would also threaten shipping, etc. further south. This would, of course, also affect general weather conditions further south by making it colder and more hostile.



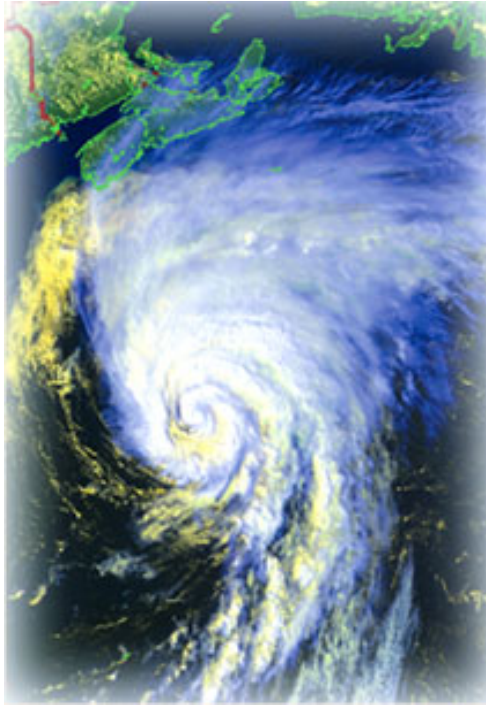


Iceberg in  
Newfoundland

## **STORMS AND FLOODING**

Every year, a few large storms batter the coast and inland areas of Atlantic Canada. These aren't hurricanes like the ones seen further south, but still very powerful. They usually bring a lot of rain or snow and plenty of wind. People can live with wind and rain or snow, at least to a certain extent. In this area storm surges are the largest problem. A storm surge is when a low pressure is combined with strong onshore winds, pushing the water upwards towards land and raising the sea level dramatically over a longer period of time, with as much as a meter above the normal levels.

This is especially dramatic when you get storms during tides higher than normal. Even during normal situations, storm waves that occur upon the storm surge can wreak great damage, because the waves suddenly, when they get closer to land, can get much higher than normal. This is, as I mentioned, a lot worse during a high tide, but what if you put rising sea levels into the equation? Lands never before flooded would experience sudden floods, and areas that sometimes are flooded even as it is today, will experience floods that come more often and are much fiercer.



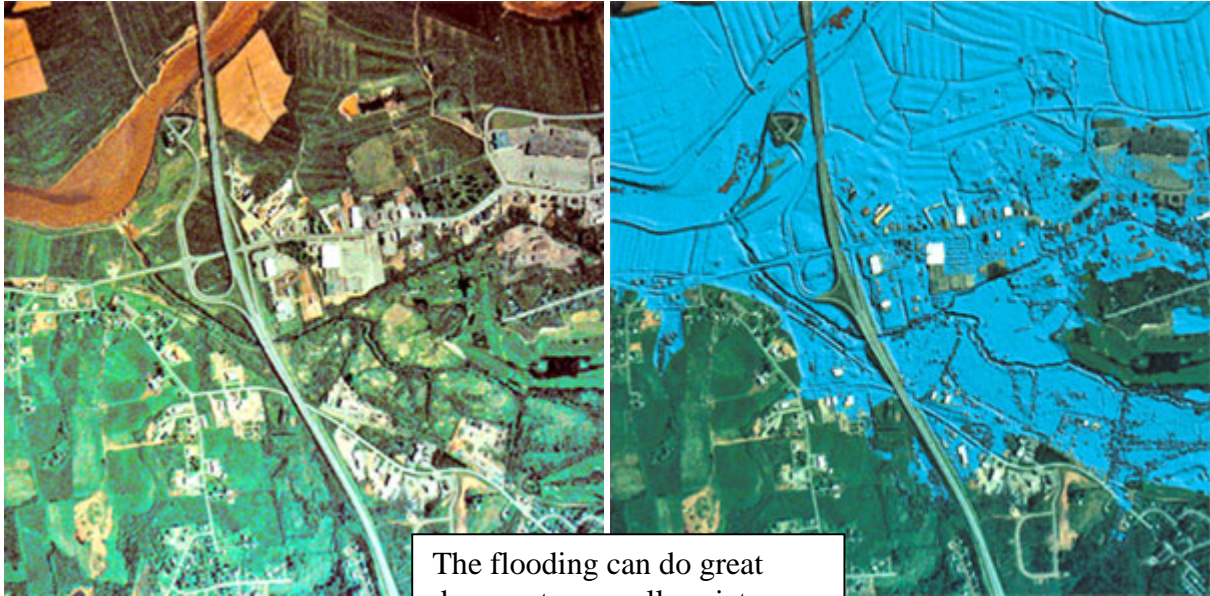
Storm over Atlantic  
Canada

In case I failed to mention, the differences between high and low tide in parts of Atlantic Canada are among the highest in the world, with certain locations having an average difference of 12 meters, and with extreme conditions, up to 16 meters. The combined forces of a tidal wave, a storm surge and a storm wave...can make it rather rough!

The people of Nova Scotia get quite a few gWh's out of wave power plants. These plants harvest electricity from the enormous tidal forces that are inflicted upon the coast. The people of Nova Scotia can actually "feel" the tide rising.



Low tide in the Bay of  
Fundy



The flooding can do great damage to a small society.

Waves and water are more than just a source of electricity, and something to surf on. It can be ferocious and wild, and very dangerous for human life. Newfoundland and Nova Scotia have several good examples of this. On November 18, 1929 there was an earthquake that measured 7,2 on the Richter scale on the Grand Banks just outside Newfoundland. The quake was so extensive that it could be felt by people as far West as Ottawa, and as far South as Claymont, Delaware. The quake was actually caused by an underwater landslide on the continental shelf. All over Newfoundland and Atlantic Canada things were shaking for a good many seconds, closer to two minutes, and some material damage occurred, but it wasn't before a few hours later that the real damage came. 2,2 hours later, a huge tsunami wave came crushing in towards the Burin Peninsula in Southern Newfoundland. My great grandmother was a child at the time, and lived in one of the coastal villages here. At the time the Burin Peninsula was without any communication. When the wave was forced into the shallow coves, it suddenly rose to new heights due to the shallow waters and the narrow coves. The people of the village could only see a wall of water rising before them. Screams were uttered, before total panic. My great grandmother was grabbed by her father and together they ran to safety. But lots of people weren't that lucky. Some people were by the wharves, others in their boats repairing the nets for the next day's excursion. When the wave hit they were helpless. Boats were crushed on the rocks and houses and buildings were just swept away.

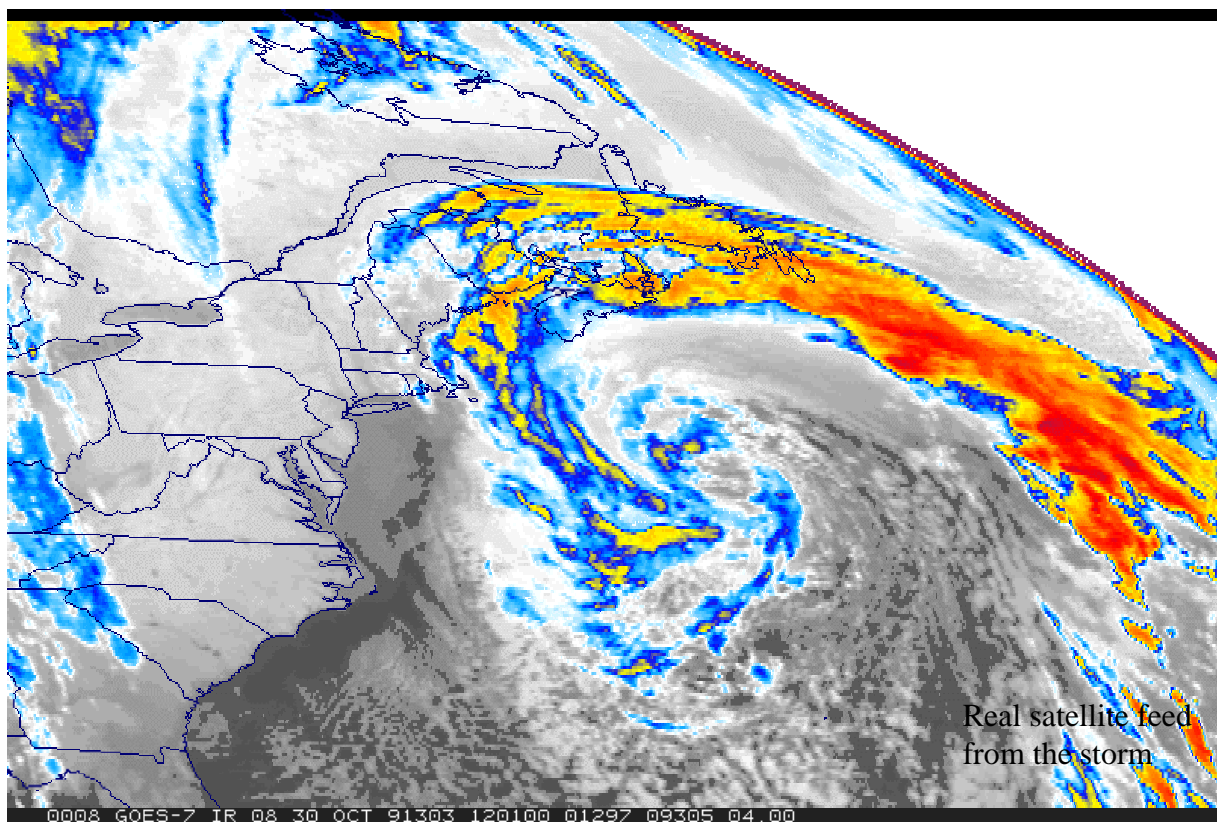


House washed away by the waves



A total of 28 people were killed during this horrible event, all of these from the Burin Peninsula. In addition to this, \$25,000 (1929 dollars) worth of salt cod was washed back to where it came from, to sea that is. This was a major economic loss to the region, in addition to the material damage and the harm to human lives. This is one example of the wrath of water, but there are others.

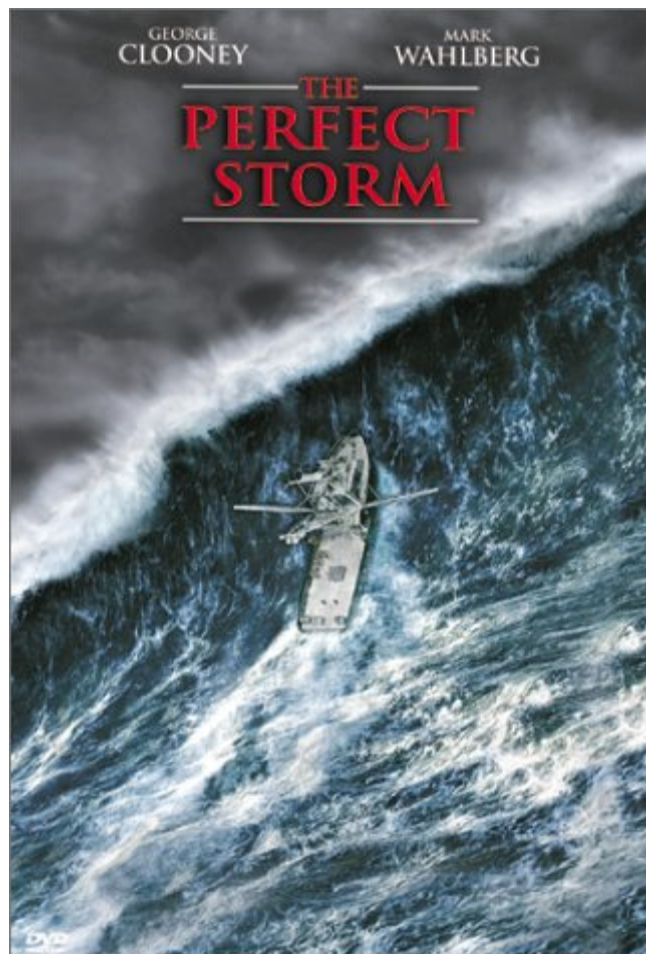
In late October 1991 a hurricane called hurricane Grace swept across the USA, leaving a path of devastation behind it. Further North, just outside the coast of Atlantic Canada, a low pressure system of immense size was building up, a nor'easter of dimensions. The storm itself would have been a bad thing, but then cold air from the Canadian mainland began to flow into the low pressure area, intensifying the whole situation. Two powerful storms met, and melted into the storm of the century. But further South, hurricane Grace was steadily headed for this same area. Later, Grace collided with the two other giants, who had just begun to build up their force as a proper storm. Instead of being consumed by each other, all three of the storms melted together into one ultra-storm, the storm of the century, *the Perfect Storm*. This was the name it was given. It was one of the largest systems ever seen, and definitely one of the most ferocious.



When the storm reached the peak of it's power winds up to 100 mph weren't uncommon at all, waves reaching heights between 30 and 40 meters in the deep

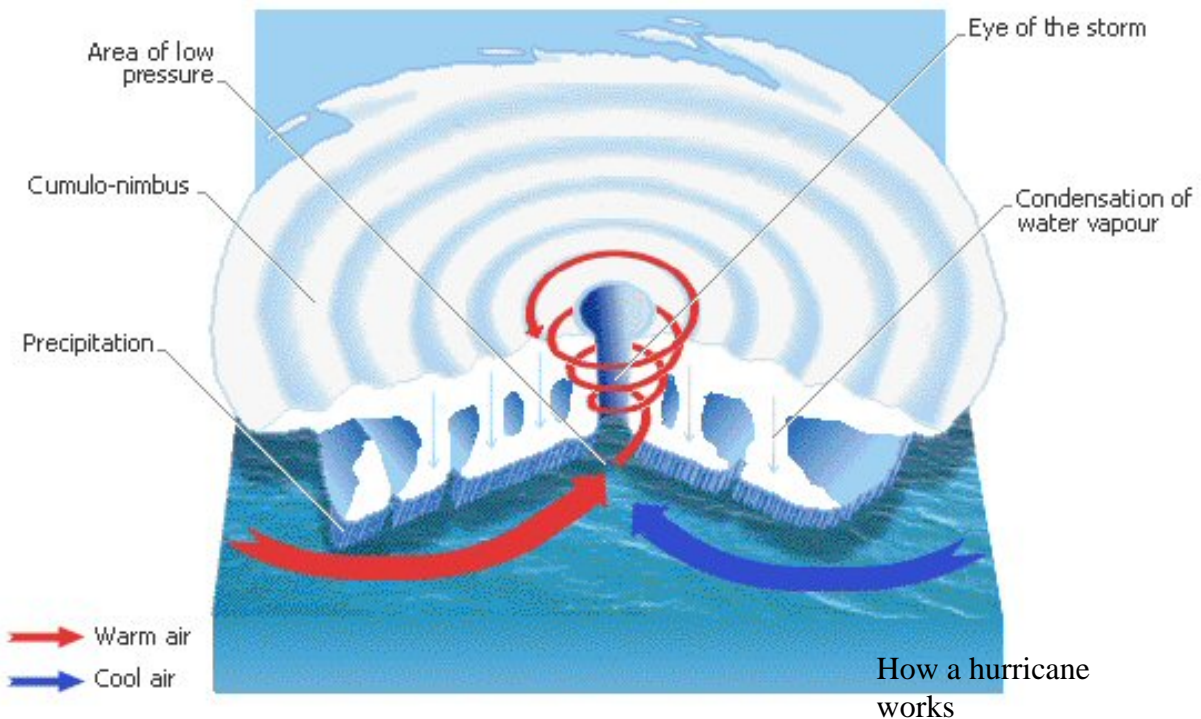


water and so on. Thousands of boats were damaged or sunk, lobster traps in uncountable numbers destroyed, areas flooded, roads eroded away, communication lines broken and so on. The waves in Florida, far away from the centre, the eye, of the storm, could reach 15 feet. This storm has even been made into a film with George Clooney, based on a book by Sebastian Junger. The book features the true story about the fishing boat Andrea Gail that becomes succumbed by the power of the waves and wind. This, is possibly an even better example of the immense power of water. Water is the fuel of hurricanes and storms.



Nowadays hurricanes aren't such a large threat to Atlantic Canada, even though the Grand Banks and the Gulf Stream has a temperature of about 20 degrees Celsius in summer. A hurricane however, also called a tropical cyclone or a typhoon, forms when all of the following conditions occur: sea temperature higher than 27 °C, atmosphere saturated with moisture, convergence of cold airstreams. Under these conditions, hot air cannot escape outwards and instead whirls upwards in a column, creating the hurricane. Hurricanes may reach diameters of more than 500 km. Around the periphery of the column, the whirling winds can reach 300 km/h. In the centre of the column, called the eye of the hurricane, there is a zone of subsidence, characterized by weak winds and

a clear sky. The humid air rises more than 10,000 m and forms cumulonimbus (anvil-shaped clouds). Cooled water vapour then condenses and falls as rain. So if the temperature in the water increased sufficiently tropical hurricanes could occur in Atlantic Canada. As I mentioned above, the interference of cold air/water is necessary for the hurricane to occur at all, and the Labrador Current provides a constant flow of it, and icy cold as well, which might intensify the hurricane. And since these right conditions apply for most of the time, this could be a tough situation to deal with.



Just think of the hurricane Katrina that hit New Orleans and the surrounding area, and the damage it did to that huge city. This was an extreme situation, but still it provides us with almost firsthand experience of the forces of water and nature. Hurricanes gather their enormous amount of energy from the temperature in the water, so their existence is provided by water. This is another example of the immense force hidden in what we drink every day, that we never seem to think about.

### SO...

Now I've been talking a good deal about the influence water has on the climate of Atlantic Canada, and what changes it has in its power to deliver, but most of the scenarios that are merely hypothetical. Now I'm going to grab a hold of the situation as it is today, and summarize the text above concerning the recent condition, shortly:

- The Gulf Stream pumps warm water from the Gulf of Mexico up towards the coast of Newfoundland and Nova Scotia, rendering the climate warmer and more comfortable. The Labrador Current brings cold air and water from the Arctic to the area, but in smaller quantities than the Gulf Stream. This causes unstable weather, but it also makes the area inhabitable. Newfoundland is just as far south as central France, but because of the Labrador Current, it is much colder. Hadn't it been for the Gulf Stream it would have been a very cold and chilly place, with a tundra-like climate.
- Hydroelectric power is the most important energy source in Atlantic Canada. Today the situation with rivers and similar are controlled and provide the power needed for the different seasons.
- Rising sea levels is a problem in this region today, because the entire area is as a matter of fact sinking, due to tectonic movements in the earth's crust, where it is making a bowl like figure, with Atlantic Canada at the centre of it. Today the levels rise with 0,36 cm per year, in average, but some places more and others less. But global heating and melting glacial ice is also contributing to that the sea levels are growing. Global heating causes the water molecules to expand. Erosion is a common problem that is caused by this. The Grand Banks used to be (during the ice-age) an island, even though it now lies 100 meters below sea level. That was approx. 10 000 years ago.
- Sea ice today is common on the Labrador coast, but usually not as far south as Newfoundland, but pack ice sometimes fills up bays and coves. On the Labrador coast the ice makes shipping impossible before the beginning of June some years. Icebergs are more common, and can be seen all over the East coast of Newfoundland and Labrador, and all the way down to Grand Banks.
- Storms and flooding has always been a great problem on the Atlantic Canadian coastline, because of the lowlands and the frequent storms, causing the water to rise extra much, and the choppy waves to break in over land. When you have a high tide, which is common, combined with a storm surge flooding is very common. A storm surge is to cut a long story short when the winds and low pressure of a storm, possibly combined with the force of a current and a tidal wave, and water is pushed up around landmass, so that the sea levels rise drastically.

In Atlantic Canada the word water can bring up several negative associations; stormy weather, floods, rising sea levels, icebergs and much more. But how about the positive effects of water? What do the locals think about it? How much do the locals know about problems concerning water and climate? All of this I'm going to find out in this interview with my grandmother:

### **Is water a plentiful resource in Newfoundland?**

The island portion of Newfoundland is blessed with an abundance of water. Glacial action has left many lakes and streams in the land's interior.

Newfoundland is home to more than 11000 ponds and over 200 large rivers, some of which can only be accessed by air.

### **What do people in general know about water and its effect on the climate?**

I would imagine that most people realize that being near water has a cooling effect in summer and the opposite in winter. They would also have to be aware that they experience more fog and precipitation than those who live remote from any large bodies of water.

### **Do you know of anything water can do to the climate in Newfoundland?**

Newfoundland is an island bordered on the west by The Gulf of St. Lawrence; the north by The Strait of Belle Isle while the east and the south coasts are on the Atlantic Ocean. As a result, water plays an all important role on the island's weather. The island portion of Newfoundland has a temperate marine climate. No place on the island is more than one hundred kilometers from the sea. Every part of the island is then subject to year-round modifying influences of the encircling cold waters. The open sea keeps winter air temperatures a little higher and summer temperatures a little lower on the coast than inland. The marine climate means generally more changeable weather such that a traveler in late fall or early spring might experience sun, fog, sleet, sun, snow and rain in the space of three hundred kilometers. There is ample precipitation in a variety of forms (sometimes all at once) higher humidity, lower visibility, more cloud, less sunshine and stronger winds than a continental climate.

### **Can you describe a typical winter and summer?**

Winters are usually mild with normal temperatures of 0 degrees Celsius. While the first snow may appear as early as October no accumulation of the white fluffy stuff is expected until late January. Until then the weather varies and any weather or combination of same can be the order of the day. Usually the weather settles in January and outdoor winter enthusiasts get a chance to enjoy their winter sports. Throughout the winter months periods of heavy wind-blown snow (blizzards) pose a threat to personal safety outdoors and on isolated highways especially when accompanied by air temperatures well below freezing. Blizzards may occur in any part of the island from late fall through early spring. Freezing precipitation causes ice build up at times causing hazardous driving and walking conditions with serious consequences usually only when the episodes are prolonged causing power outages. When winter settles in it seems it doesn't want to leave. There are years when there have been school closures due to snow in May. Summer days range from cool to hot with a



normal temperature of 16 degrees Celsius. It is always best to be prepared for all kinds of weather since cool breezes...oft times cold breezes and showers can appear suddenly. Unlike most earthlings a beautiful sunny, warm day on the Island is not our due but a gift. No one enjoys such a day as much as a Newfoundlander. No wonder it is often said of this area that there are two seasons...winter and summer. No wonder, too, that the locals' favorite topic of conversation is the weather.

**Mention the first positive things that come to your mind when you hear the word “water”.**

I think of : life; quenching thirst; bathing; showering; brushing teeth; swimming; fishing; kayaking; boating; sprinklers; puddles; ponds; rivers; lakes; oceans; glaciers; cooking; baking

**Mention the first negative thing that comes to your mind when you hear the word “water”.**

Pollution; flooding; breeding grounds for mosquitoes

**What do you know about hydroelectric power in Newfoundland?**

It was introduced in the early twentieth century initially to light St John's, drive street railway power mills. Virtually all power in Newfoundland comes from hydro plants. Because it is created from the force of running water which is storable and renewable it is the perfect solution for Newfoundland energy. The fact that it is inexpensive and emission free is a bonus.

**What water-related changes do you think would be good for you and Newfoundland?**

Water covers nearly three quarters of the earth's surface. Ninety percent of that water is seawater. Two percent of the earth's water supply is locked in icecaps and glaciers. Just one percent of the earth's water is available for drinking. I would then like to see this precious resource which is essential to our survival used wisely. Studies have shown that for the average household, reductions in water use as high as forty percent or more are feasible and could be done with no change in life style. I would like to see contaminants from pesticides, fertilizers, herbicides, runoffs from farmlands, and harmful emissions eliminated or at least reduced to prevent further pollution of our water. I would also like to see more forms of legislation passed to try and control water pollution.

**What is the most extreme situation that you have encountered concerning water?**

On Tuesday, September 27, hundreds of people in western Newfoundland were evacuated from their homes and a state of emergency declared in downtown Stephenville (*Two of my father's Aunts live here*). Rain-filled rivers flooded the

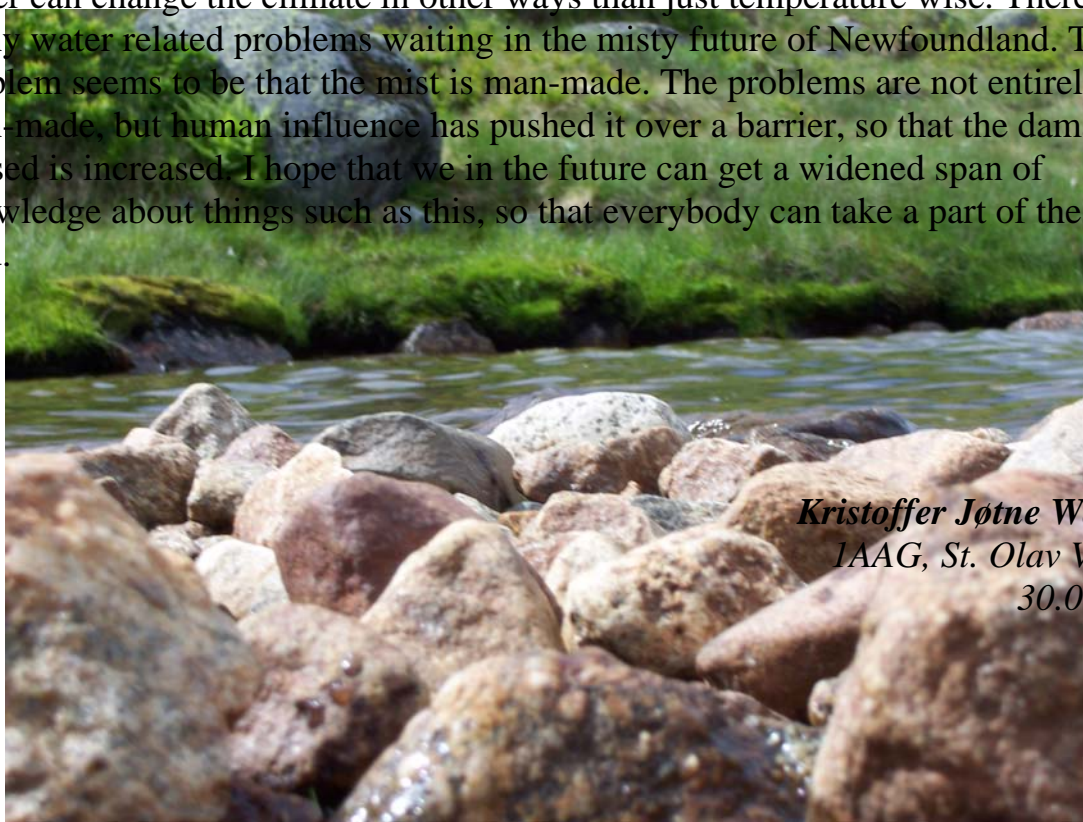
town causing millions of dollars worth of damages. More than 110 millimetres of rain fell on the region by mid-morning, as a result of a regular low pressure system. Some 80 houses were flooded, some with water up to the kitchen windows. Some of the 200 residents of these houses were rescued with a front-end loader while others with zodiacs. With the roads flooded and washed away in many places the whole town was brought to a complete standstill.

### **How much water does an average Newfoundland/Canadian household use per day/year?**

Every human needs about 2.4 liters of water each day to survive. An additional 5 liters per person is required for basic needs such as cooking and washing. Per year this would total 2,701 liters. The average Canadian uses up to 300 liters of water per day. That's a whopping 109,500 liters a year !!

### **CONCLUSION**

After getting an insight into the recent situation, what might happen in the future and a statement from a local, it is easy to notice that water's influence on the climate and people of Atlantic Canada is tremendous. The same situation can probably be found all over the world. The research also shows that the changes brought to us by global warming are also fronted by water, and that it through water can change the climate in other ways than just temperature wise. There are many water related problems waiting in the misty future of Newfoundland. The problem seems to be that the mist is man-made. The problems are not entirely man-made, but human influence has pushed it over a barrier, so that the damage caused is increased. I hope that we in the future can get a widened span of knowledge about things such as this, so that everybody can take a part of the load.

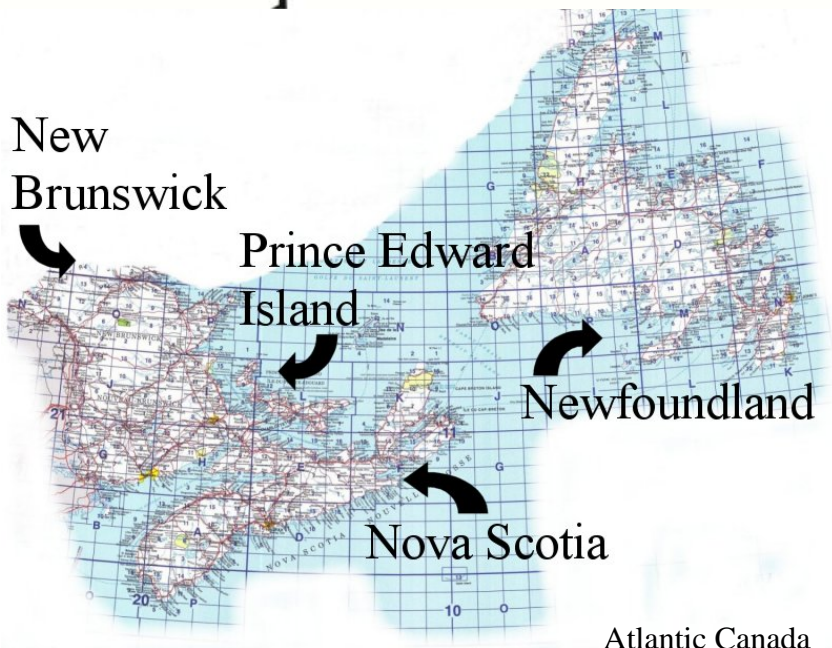


*Kristoffer Jøtne Walsh  
IAAG, St. Olav VGS.  
30.01.05*

Water



WATER in Atlantic  
Canada,  
the effect global  
warming can have upon  
WATER and  
a local's  
perspective on the  
problem



New  
Brunswick

Prince Edward  
Island

Newfoundland

Nova Scotia

Atlantic Canada