# Term Project

My term project  is done with the third option:

Choose a favourite glacier and examine the temperature changes in the area around it. Compare the temperature change the area has seen so far with forecasts for the future under the optimistic and pessimistic (RCP2.6 and RCP8.5) scenarios.

## Introduction

Greenland is a large island located in the north-Eastern part of North America, between the Atlantic Ocean and the Arctic Ocean, and politically constituted as an autonomous region within the Kingdom of Denmark. More than 84% of its surface is covered with ice and is considered the largest island in the world. Its capital is Nuuk.

Greenland lies between latitudes 59° and 83° N, and longitudes 11° and 74° W and is the third largest country in North America. The Atlantic Ocean borders Greenland's south-East; the Greenland Sea is to the east; the Arctic Ocean is to the north; and Baffin Bay is to the west.

The average daily temperature of Nuuk, the capital city,  varies over the seasons from −8 to 7 °C

The Greenland ice sheet is 3 kilometres thick. The ice is so massive that its weight presses the bedrock of Greenland below sea level. Recently, scientists believe that Greenland might actually be three islands under ice sheet.

The glacier that I have selected for my term project is called Akuliit.
Akuliit is located at west of island, exactly in Qaasuitsup which is a new municipality in Greenland, operational from 1 January 2009.
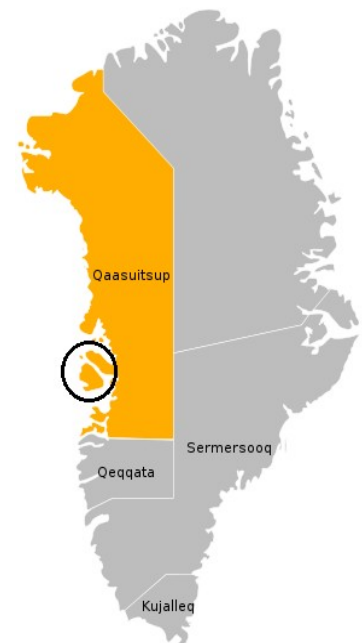
## Methods

For doing this work I used two climate models: Climate Time Series Browser and AR5 Climate Model Mapper which are available in the course website

## Results

Let's start with Climate Time Series Browser model to obtain information. Firstly, I started to see the evolution of mean temperature and extension ice.

The first graphic shows how global temperature has increased. We can see how temperature is about 0.7ºC higher than years ago.



AR5 Global Mean Temperature Estimate

2011
Global Temp: 0.71622
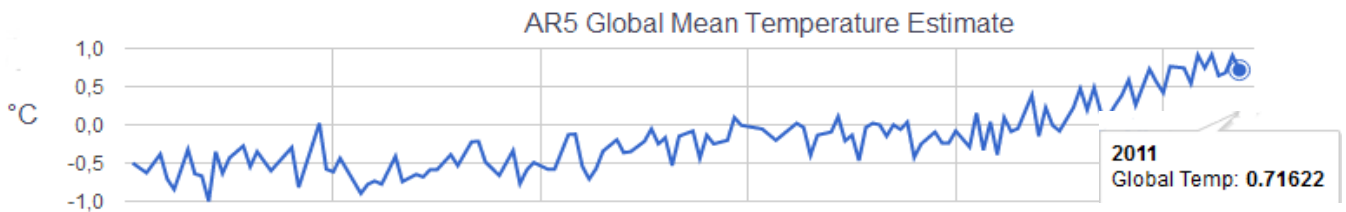
The second graphic shows extension ice. We notice that ice sheet is melting since 1979. Although there are some peaks, nowadays, the result is that area ice is smaller.



Arctic September Ice Extent

1979
Arctic Sea Ice: 7.2

All these events are increasing the amount of atmospheric CO2. Its concentration is nearly 400 ppm which increases faster and faster.



Moana Loa Annual Mean $CO_2$
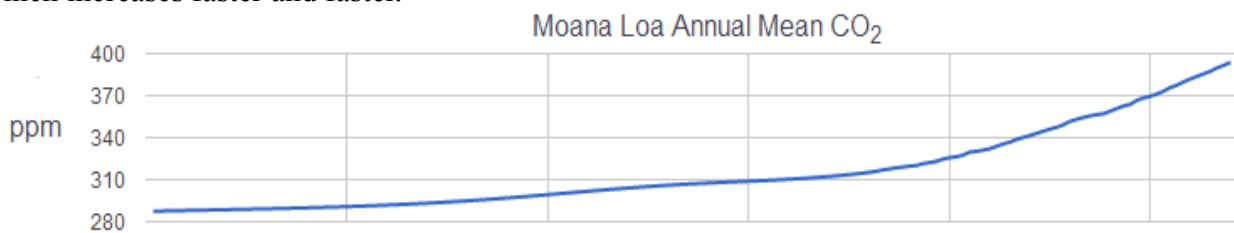
<u>My glacier</u>

The glacier is called Akuliit which is situated in the Arctic, North Pole. It is represented by a red point in the below maps. The URL where you can see this is:

http://climatemodels.uchicago.edu/timeseries/#Hvl
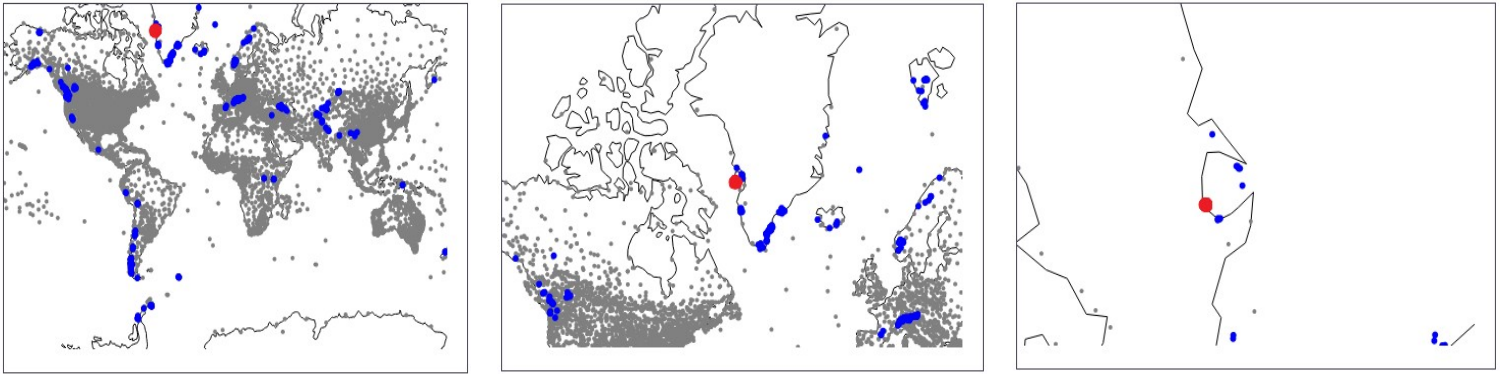


With the same model, we are going to know more parameters.
This is the length of glacier from year 1851 to 2010. We can see how decrease the amount of ice.
For this reason, we can claim that climate change cause consequences in all world.

Then, We are going to check the effects of climate change. To do this, I studied the snow cover with CCSM4 model (AR5 Climate Model Mapper). The URL from my study is:
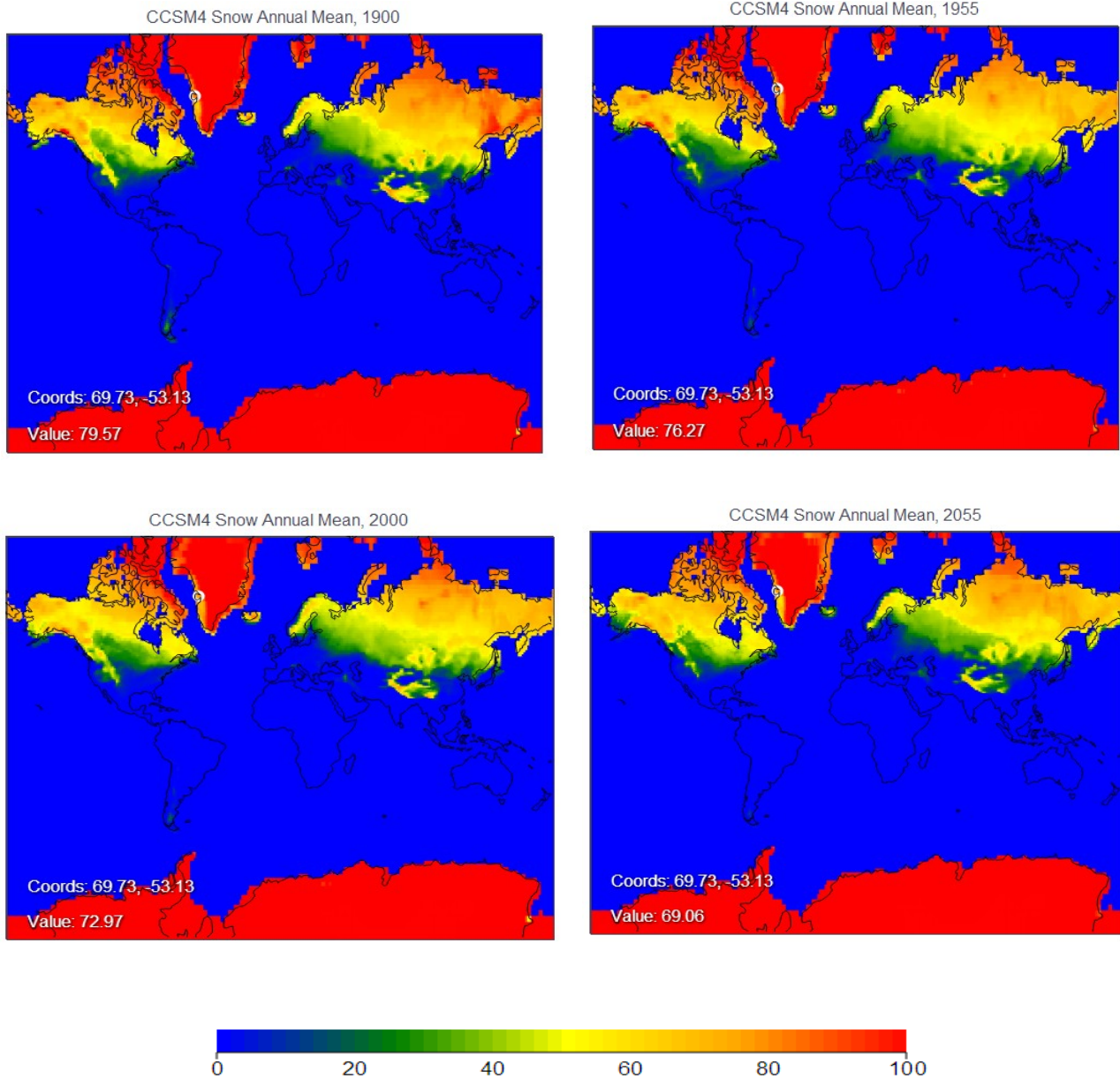
We can check the decline of snow cover from year 1900 to 2055. The snow cover has a value of 79.57 in 1900 and this value is 69.06 in 2055. We can claim that there has been a significant loss of ice and a sea evel rise

On the other hand, I evaluated the temperature trend in the years of my study with different models. The results are:

| Temperature Trend, °C / Decade | | Temperature Trend, °C / Decade | |
| --- | --- | --- | --- |
| Time Range: 1900 - 2010 | | Time Range: 1900 - 2055 | |
| Sdr. Stromfjo | -0.00 | Sdr. Stromfjo | -0.00 |
| - CanESM2 RCP2.6 for Sdr. Stro | -2.13 | - CanESM2 RCP2.6 for Sdr. Stro | 0.51 |
| - CanESM2 RCP8.5 for Sdr. Stro | 0.93 | - CanESM2 RCP8.5 for Sdr. Stro | 0.70 |
| - CanESM2 Hist for Sdr. Stromf | 0.07 | - CanESM2 Hist for Sdr. Stromf | 0.07 |
| - CanESM2 HistNat for Sdr. Str | 0.04 | - CanESM2 HistNat for Sdr. Str | 0.05 |

We can observe how each model gives us different information. The optimistic model, RCP2.6, predicts an temperature increasing not more than 0.51 ºC per decade meanwhile the pessimistic one, RCP8.5, predicts an temperature increasing nearly one centigrade degree.

Moreover, I normalized the data and I obtained these results. We can check the previous information. The images show RCP2.6 and RCP8.5 models. The purple line is RCP8.5 and the blue line is RCP2.6.
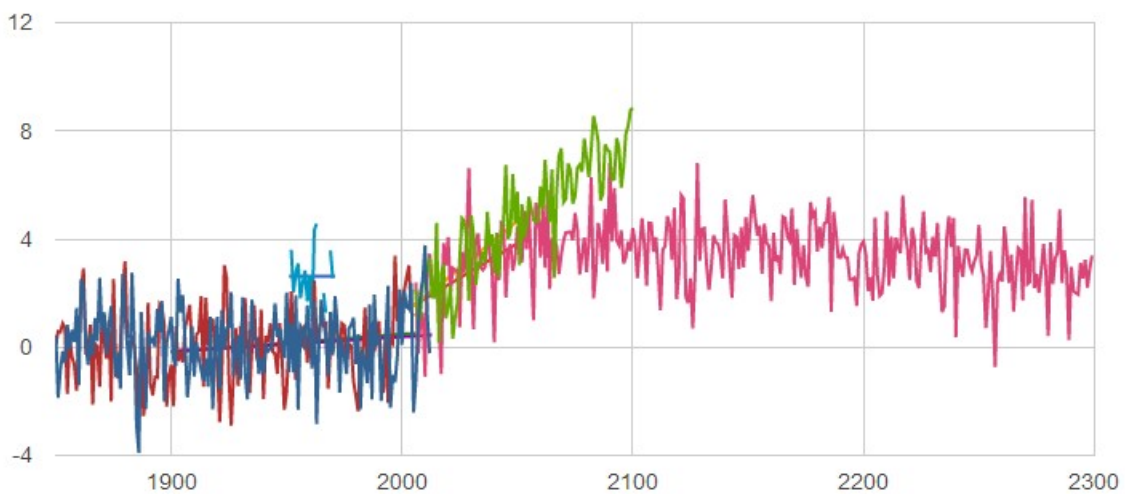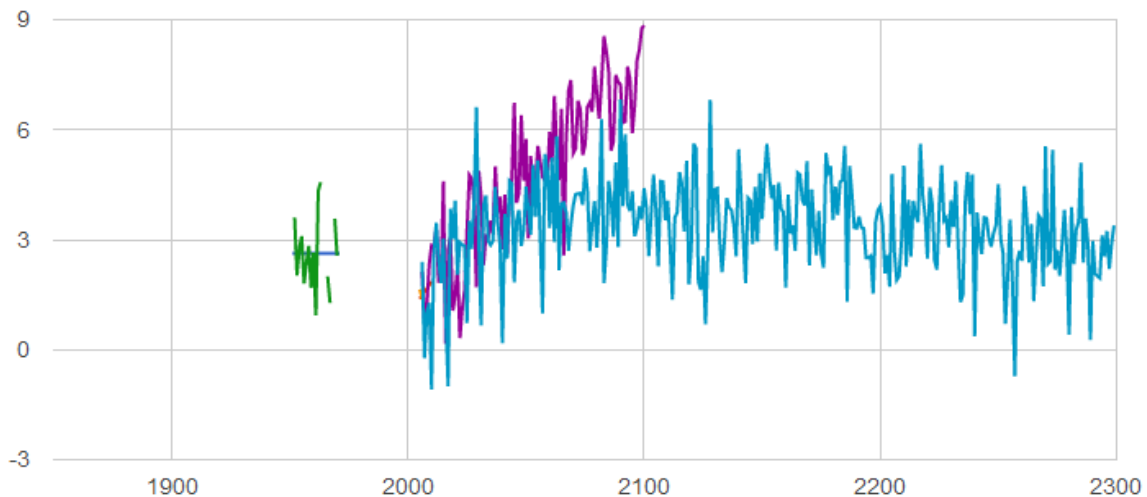
## **<u>Conclusion</u>**

To conclude, we can say that everything is related. A small local change can have consequences for the rest of the world and that's what happens with climate change. The greenhouse effect does increase the temperature, the mass loss of ice, rising sea levels and this, thanks to the accumulation of large amounts of $CO_2$ in the atmosphere.

In particular, the glacier is going to decrease significantly the next years. Also the human action helps to produce more damage to the Earth planet. Therefore, we have to reduce the greenhouse gases to avoid global warming.

We can do it all together. Save the planet!