

# Analyzing trends in Canadian glacier mass

*Anton Antonov*

## Contents

Introduction . . . . .	1
Hypothesis . . . . .	1
Analysis . . . . .	1
Bibliography . . . . .	2

## Introduction

The data used in this study is taken from <http://open.canada.ca/en/open-data><sup>1</sup>. The algorithm is taken from Antonov and Ermakov (2015).

The data set contains 518 measurements of 6 Canadian glacier mass balance, collected from 1960 till 2007. Namely, the file includes these glaciers:

- [1] "Devon Ice Cap NW - Devon Island, Nunavut"
- [2] "Helm Glacier - southern Coast Mountains (Garibaldi Provincial Park), British Columbia"
- [3] "Meighen Ice Cap - Meighen Island, Nunavut"
- [4] "Peyto Glacier - Rocky Mountain eastern slopes (Banff National Park), Alberta"
- [5] "Place Glacier - southern Coast Mountains, British Columbia"
- [6] "White Glacier - Axel Heiberg Island, Nunavut"

## Hypothesis

We are interested in finding out whether there is a statistically significant change in mass balance over the observed time period. For these purposes we use **R** (version 3.3.1) and an appropriate statistical test called *t-test*:

$$t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}.$$

The workflow is as follows:

1. Read the file and run data validation;
2. Run t-test for each glacier and collect p-values;
3. Support the evidence with
  - a table of results;
  - a plot that could help compare different glaciers.

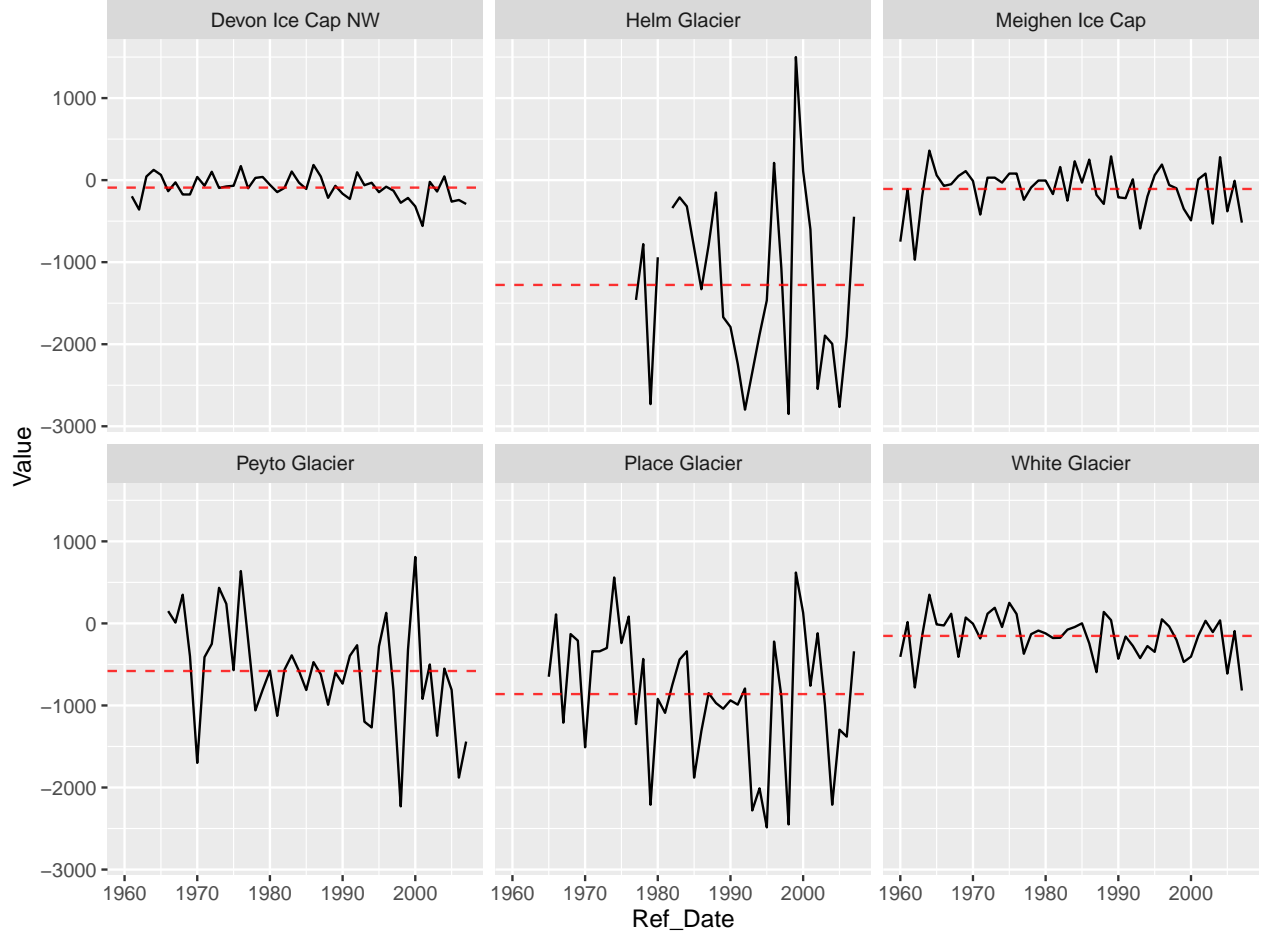
## Analysis

---

<sup>1</sup>Here is the [direct link](http://open.canada.ca/en/open-data) to data download.

Table 1: Descriptive statistics and confidence intervals

Name	YearsObserved	MeanChange	WorstChange	WorstYear	PValue	ConfidenceLimit
Devon Ice Cap NW	47	-91.2	-559	2001	5.81e-05	-39.0
Helm Glacier	31	-1277.3	-2850	1998	1.73e-07	-798.0
Meighen Ice Cap	48	-107.6	-970	1962	4.51e-03	-12.5
Peyto Glacier	42	-579.9	-2230	1998	3.62e-07	-339.7
Place Glacier	43	-861.4	-2486	1995	3.70e-09	-572.3
White Glacier	48	-152.4	-818	2007	6.56e-05	-64.3



## Bibliography

Antonov, A.A., and S.M. Ermakov. 2015. "Random Cubatures and Quasi-Monte Carlo Methods." *Monte Carlo Methods and Applications* 21 (3): 179–87. doi:[10.1515/mcma-2015-0102](https://doi.org/10.1515/mcma-2015-0102).