

30N_rmarkdown - Analyzing trends in Canadian glacier mass

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Introduction

The data used in study is taken from <http://open.canada.ca/en/open-data>¹. 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:

```
levels(glacier$GEO)
```

```
## [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 3.4.1) and an appropriate statistical test called *t-test*:

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

The workflow is as follows:

1. Read file
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 demonstrate the effect.

Analysis

¹Here is the [direct link](#) 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

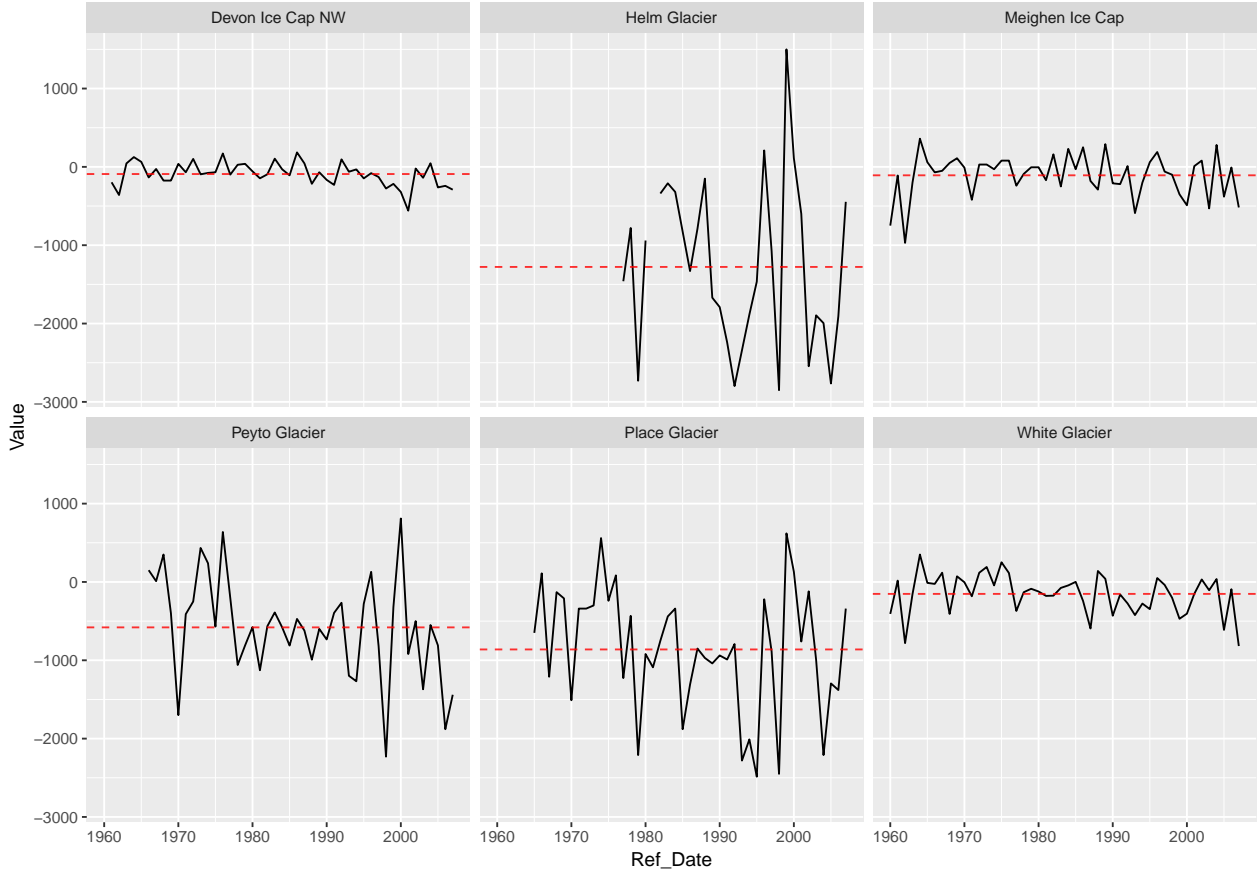


Figure 1: Annual dynamics of glacier's mass

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).