Analyzing trends in Canadian glacier mass

Anton Antonov

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Introduction

The data used in this 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:

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[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"
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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*:

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

The workflow is as follows:

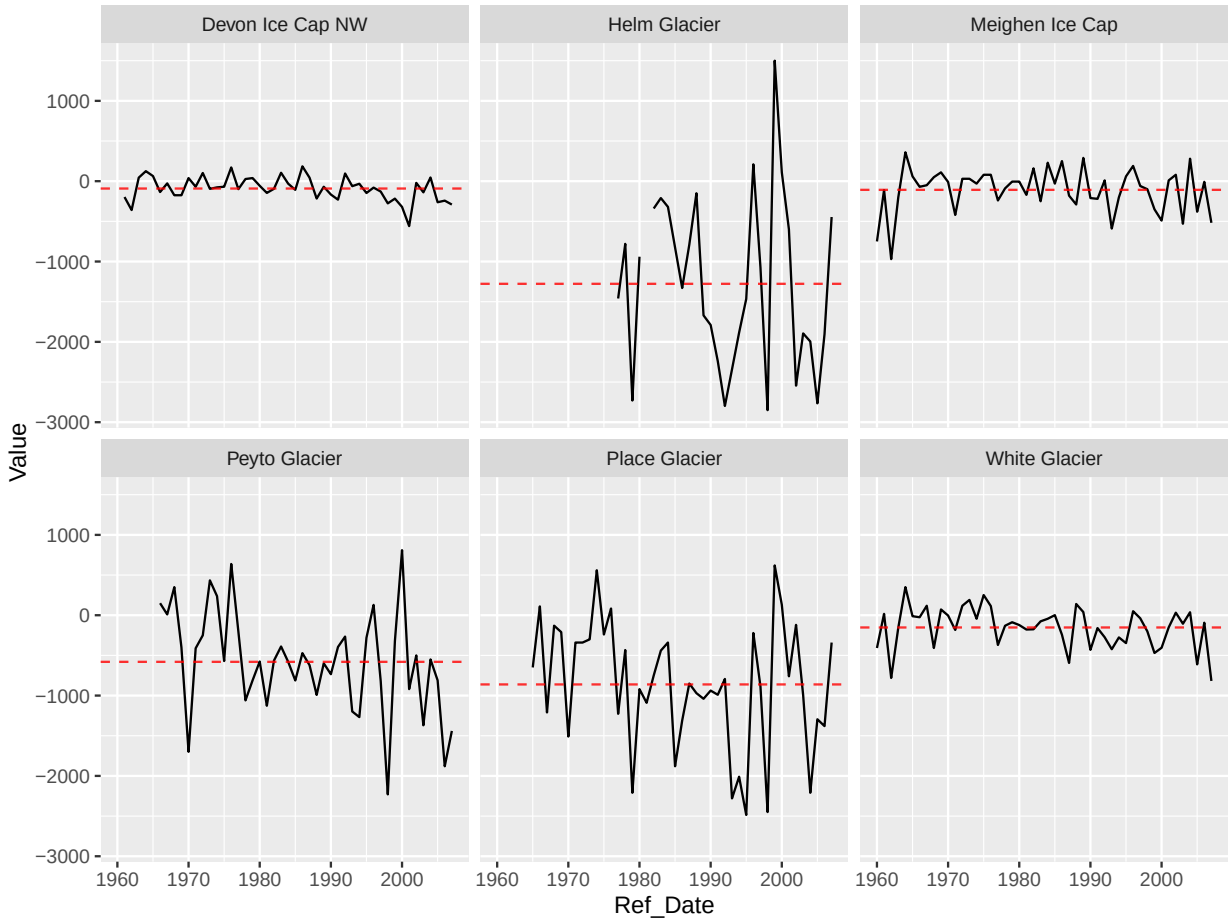
1. Read the file and run data validation;
2. Run t-test for each glacier and collect p-values;
3. Support the evidence with
    - a table of results;
    - a plot that could help compare different glaciers.

Analysis

[1] Here 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



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.