Homogenization of daily Essential Climatic Variables with Climatol 3.1 within the INDECIS project

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Outline

Introduction

- After the successful inter-comparison of methods for the homogenization of climate series carried out in the COST Action ES0601 (HOME), many of them kept improving their algorithms and new ones emerged, suggesting the need of performing new benchmarking exercises.
- The Spanish project MULTITEST (http://www.climatol.eu/MULTITEST/) provided updated results for those methods that could be run in a completely automatic way, but the focus was still placed on monthly series of temperature and precipitation.
- However, a growing interest is being directed to the homogenization of daily series, which is more challenging due to their lower signal/noise ratio. After some first attempts by the end of the HOME Action, Killick (2016) coordinated some blind inter-comparisons on simulated daily temperature series.

Introduction (2)

- The European project INDECIS (Integrated approach for the development across Europe of user oriented climate indicators for GFCS high-priority sectors: agriculture, disaster risk reduction, energy, health, water and tourism) needs quality controlled and homogenized daily series of Essential Climate Variables (ECV) to produce climate indices for their target economical sectors.
- Therefore, the Work Package 3 team of the project is devoted to provide these high quality series from their raw versions stored at the European Climate Assessment and Dataset (ECA&D).
- This communication presents preliminary results of the homogenization of these variables with Climatol 3.1.

Methodology

The chosen ECV (and their units, as stored in ECA&D) are:

1. CC : Cloud Cover (oktas)
2. FG : Wind Speed (0.1 m s^{-1})
3. HU : Humidity (1 %)
4. PP : Sea Level Pressure (0.1 hPa)
5. RR : Precipitation Amount (0.1 mm)
6. SD : Snow Depth (cm)
7. SS : Sunshine (0.1 hours)
8. TN : Minimum Temperature (0.1 °C)
9. TX : Maximum Temperature (0.1 °C)

Methodology 2

- The homogenization R package *Climatol* V. 3.1 (Guijarro, 2018) was applied to both the monthly aggregates and the original daily series of the chosen ECV on two different datasets:
- 1. On real 1981-2010 daily series from Slovenia and Sweden stored at ECA&D.
- 2. On the breaks-only benchmark for Slovenia developed within the INDECIS project to compare different daily homogenization methodologies (Pérez-Zanón *et al.* in this EMS meeting).

Results on ECA&D 1981-2010 series

Number of ECAD stations:

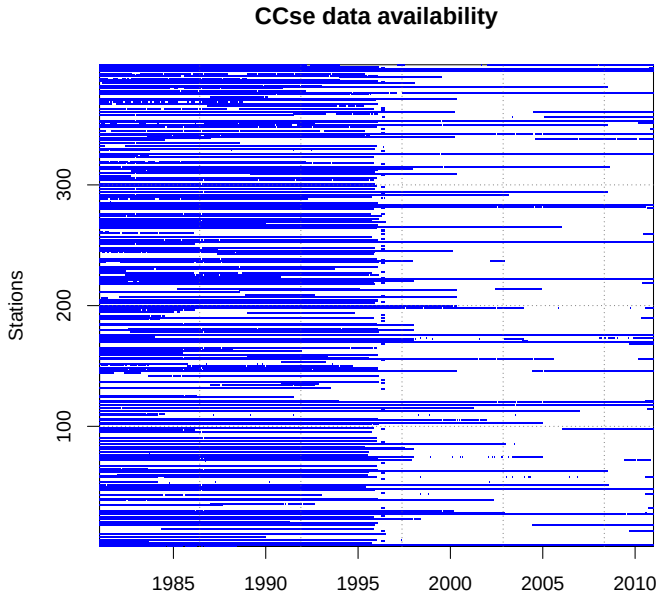
Country	CC	FG	HU	PP	RR	SD	SS	TG	TN	TX
Sweden	399	216	150	324	1566	1352	13	780	772	772
Slovenia	19	19	19	13	19	19	15	19	19	19

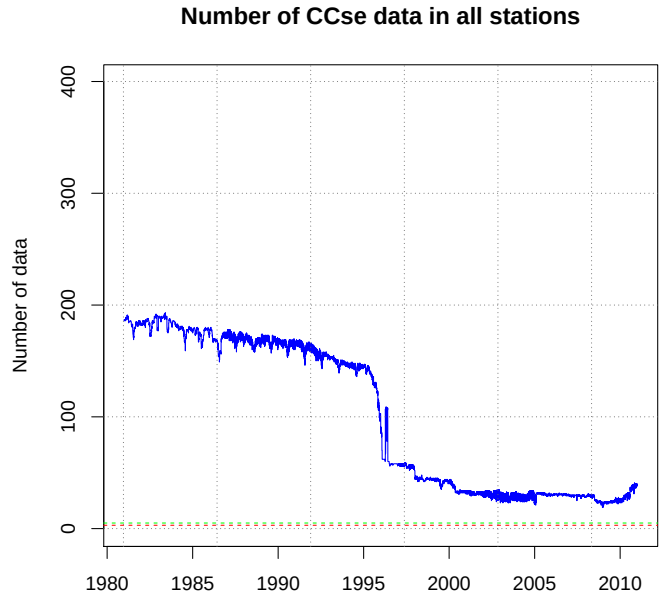
Break-points found by Climatol on monthly aggregates:

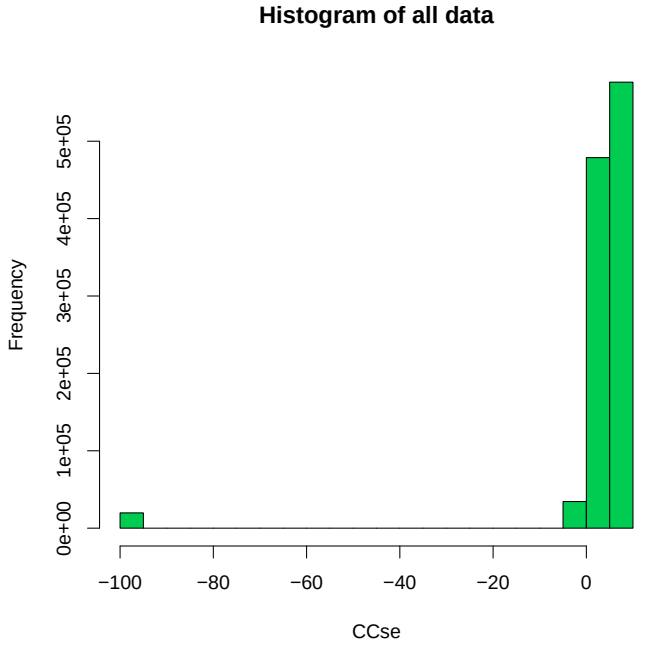
Country	CC	FG	HU	PP	RR	SD	SS	TG	TN	TX
Sweden	(Re-running after a first failed trial)									
Slovenia	8	43	31	–	0	–	–	8	6	3

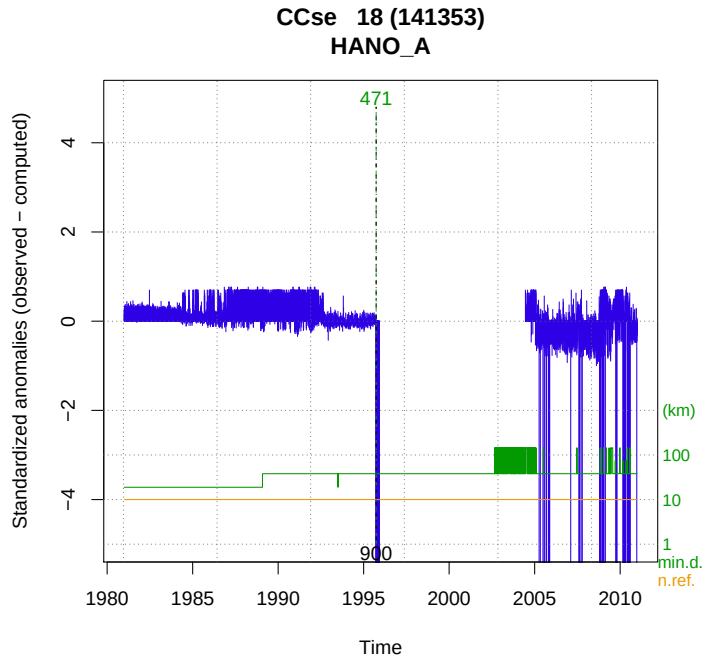
Failure reasons: days completely void of data, lack of convergence (CC), possible server reset (Sweden runs).

CCse

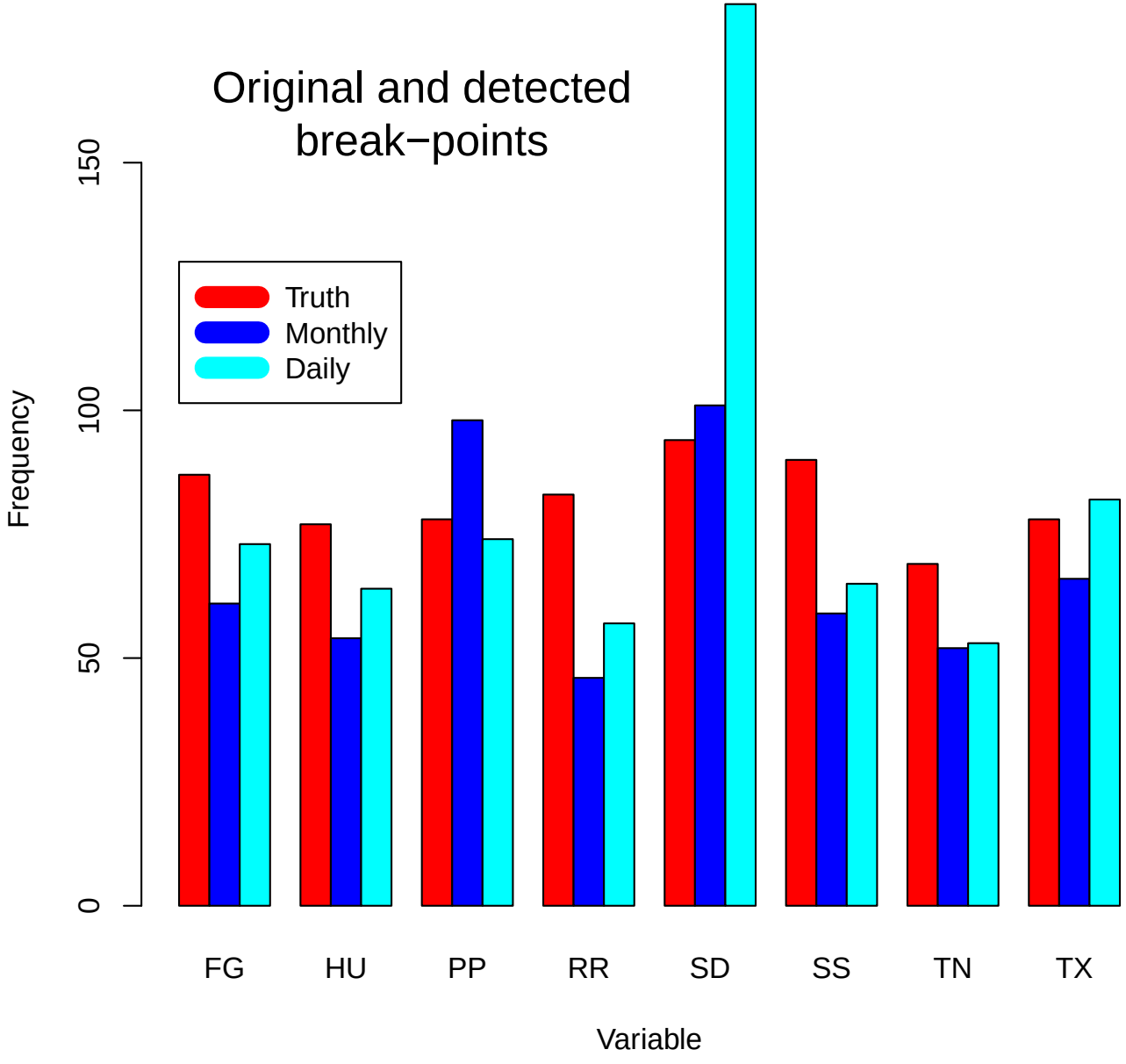

CCse data availability
Stations
100
200
300
1985
1990
1995
2000
2005
2010


Number of CCse data in all stations
Number of data
0
100
200
300
400
1980
1985
1990
1995
2000
2005
2010

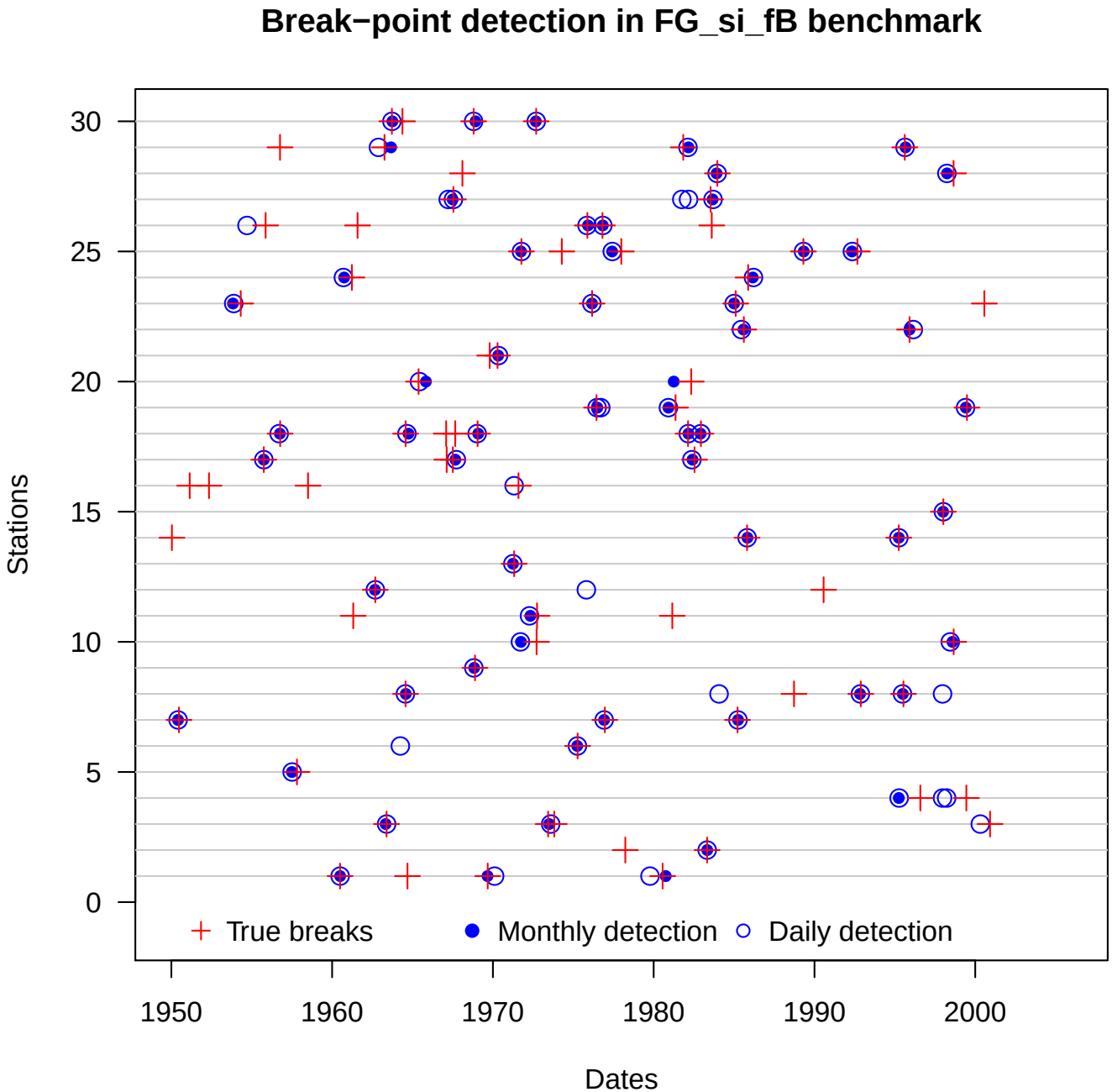

Histogram of all data
Frequency
0e+00
1e+05
2e+05
3e+05
4e+05
5e+05
−100
−80
−60
−40
−20
0
CCse


CCse 18 (141353)
HANO_A
Standardized anomalies (observed − computed)
471
900
−4
−2
0
2
4
1980
1985
1990
1995
2000
2005
2010
Time
(km)
100
10
1
min.d.
n.ref.

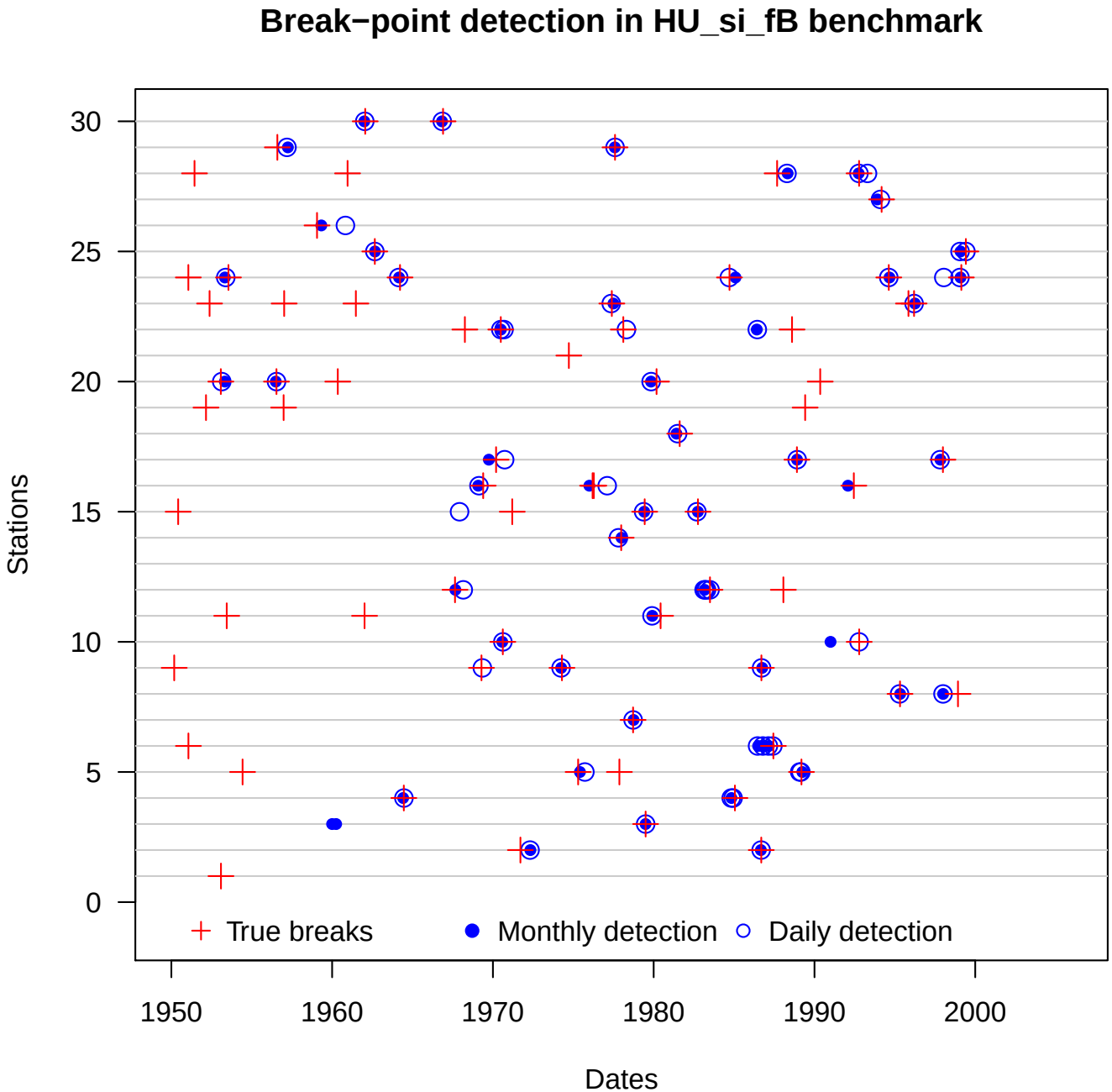
si_fB breaks histogram



si_fB break locations



si_fB break locations



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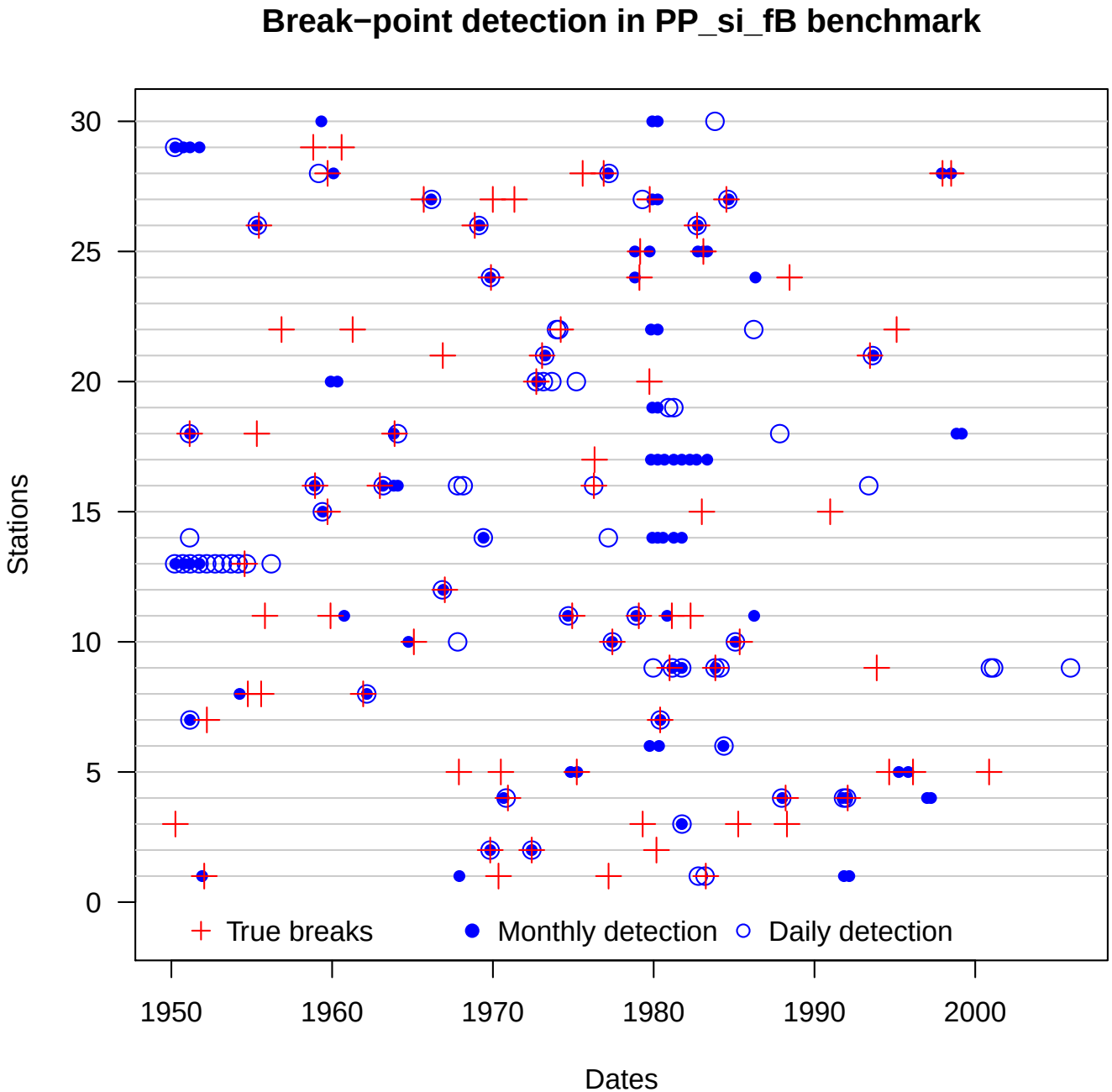

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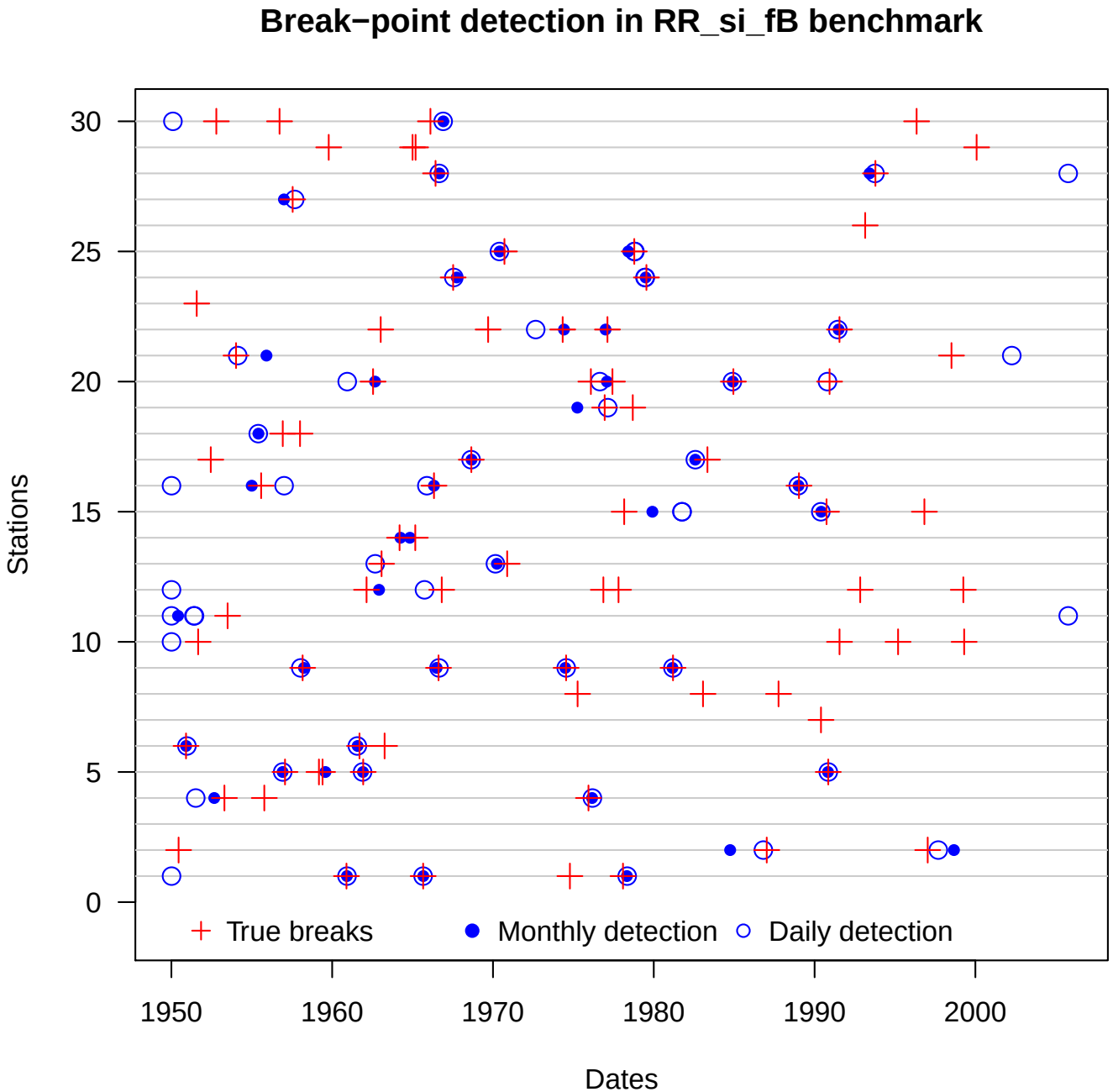

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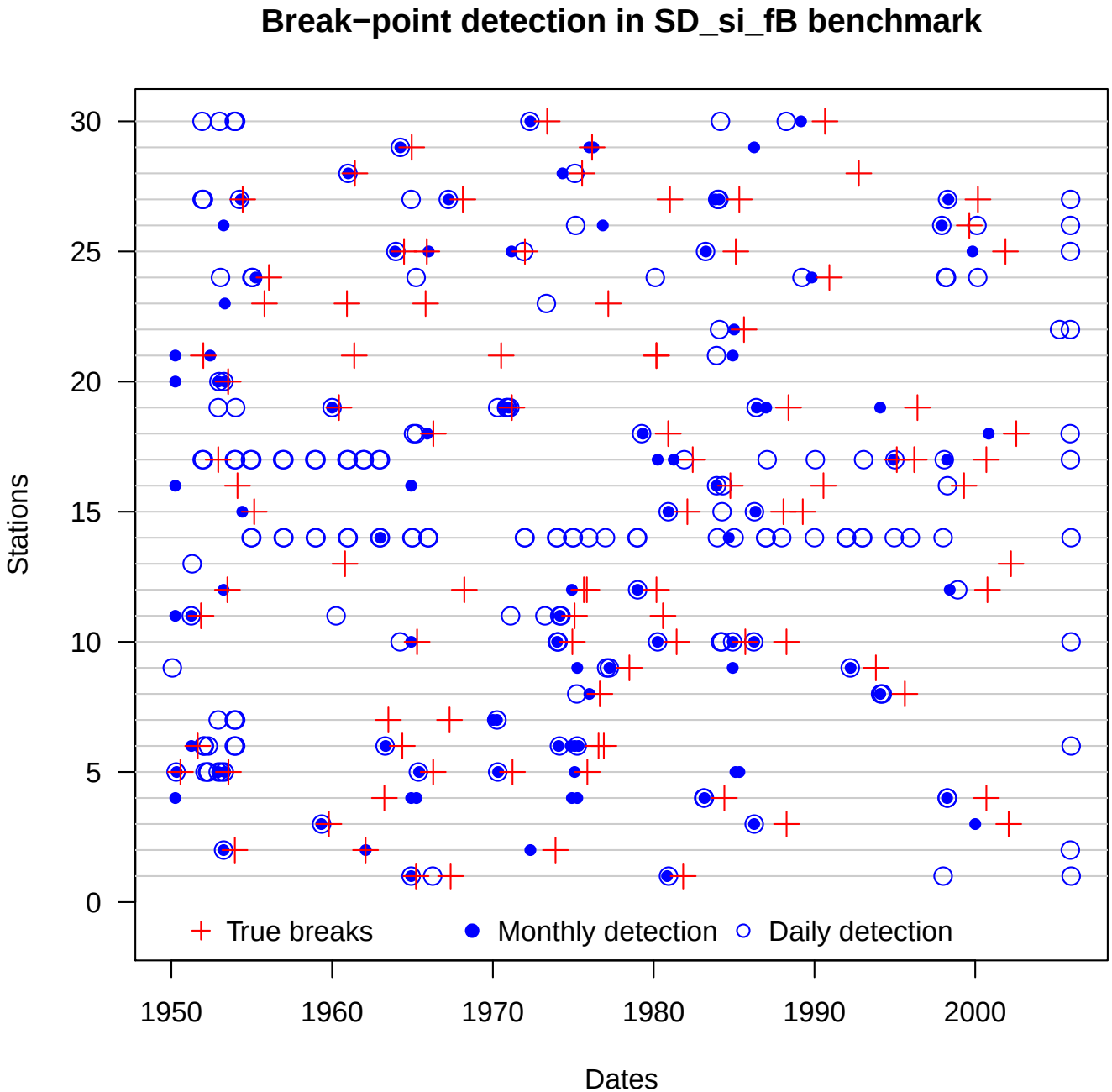
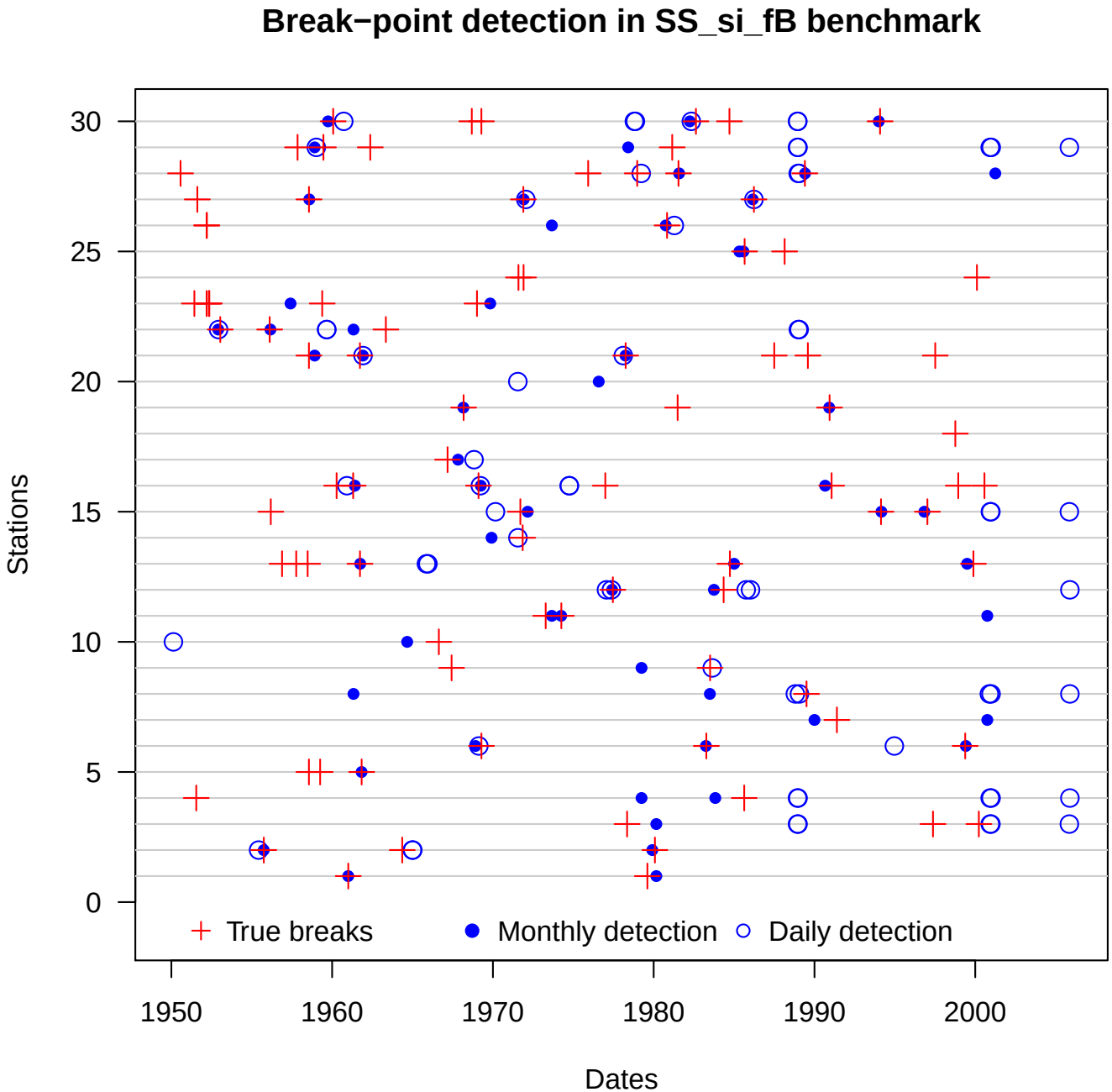
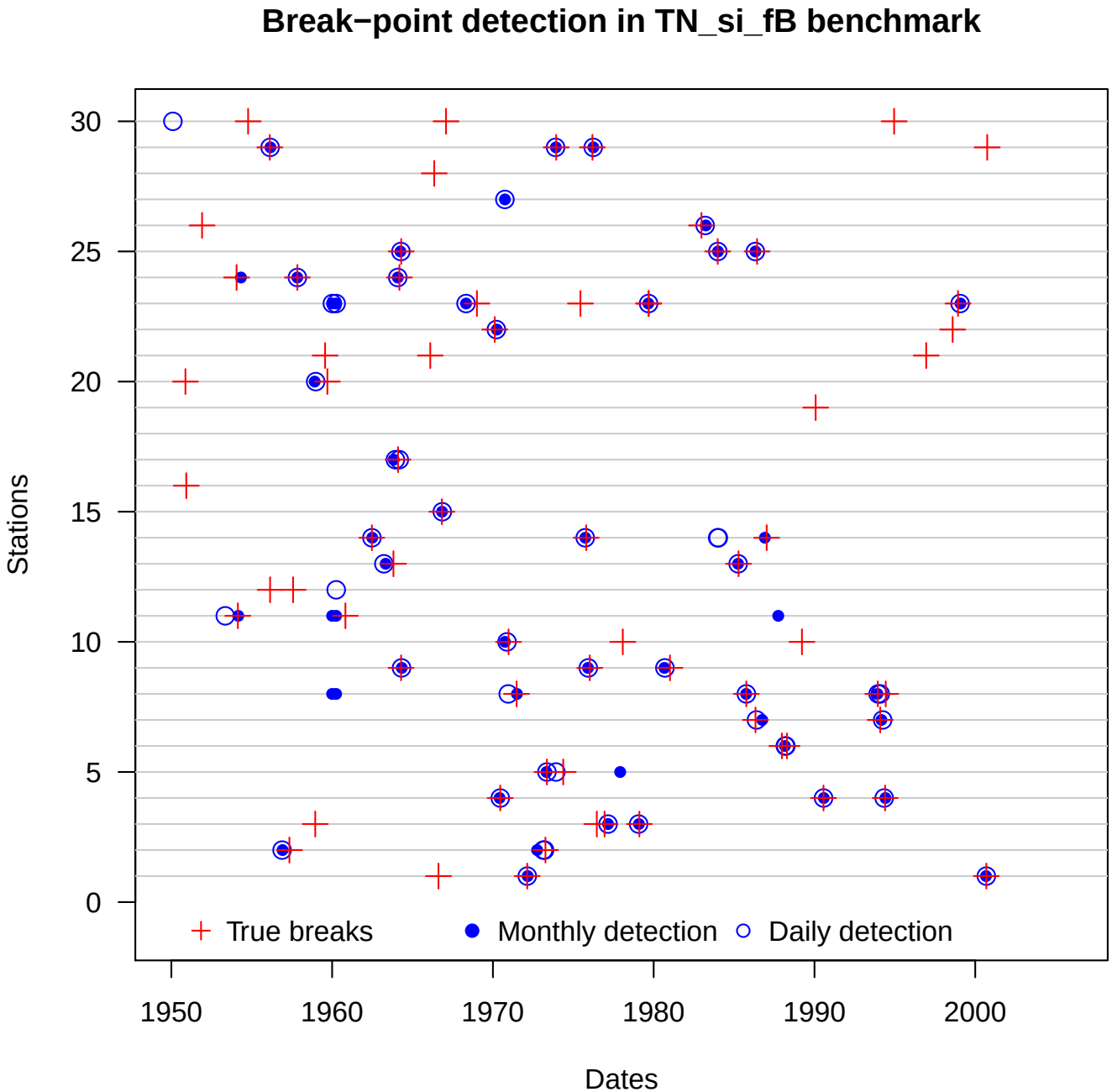


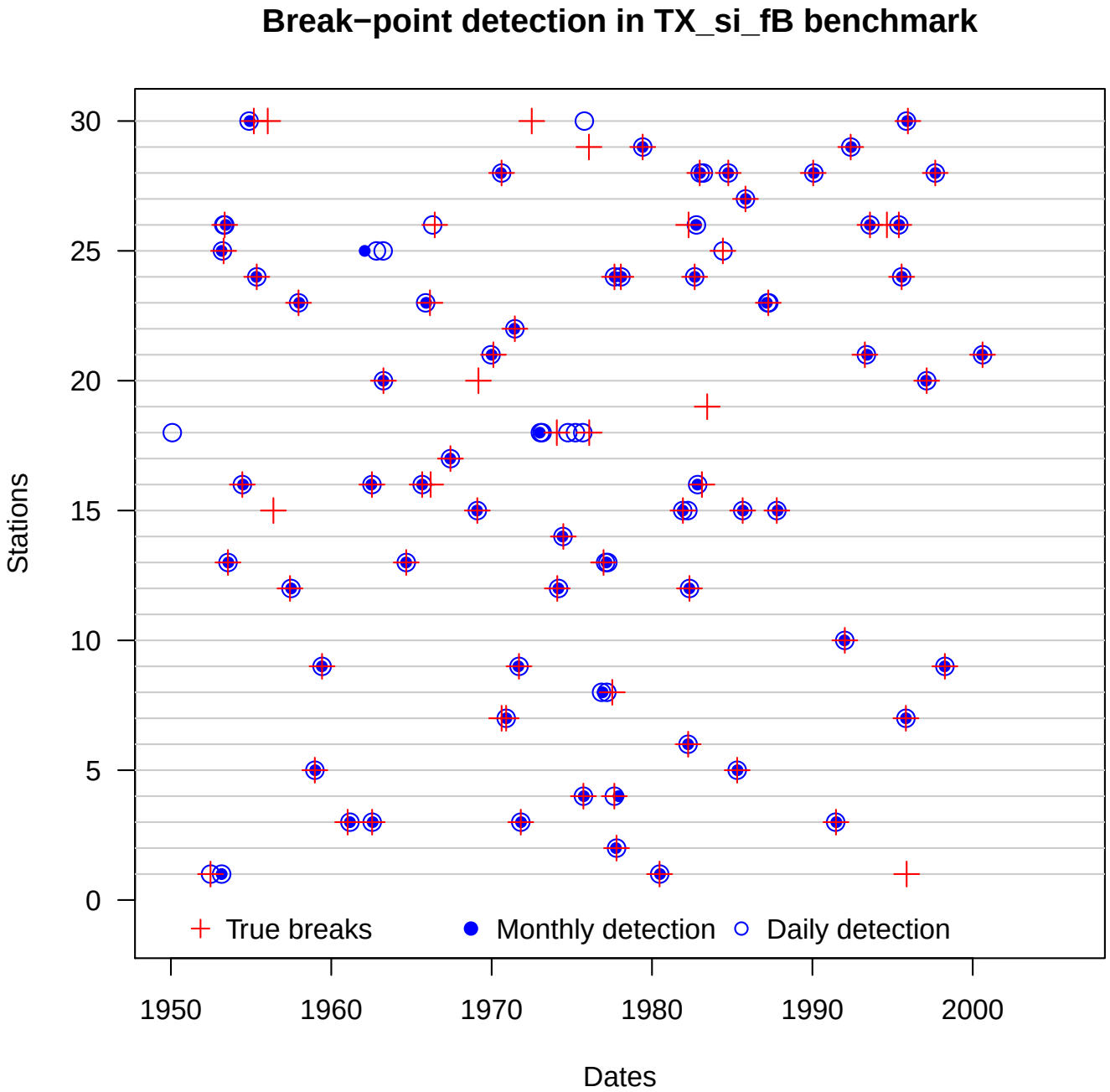
si_fB break locations



si_fB break locations



si_fB break locations



Discussion and future work

- Quality control will be needed on ECA&D series before attempting their homogenization
- Some variables have proved more difficult to homogenize than others, but *Climatol* seems to be a useful method in general
- Direct homogenization of daily series should not be disregarded (good results here and in Killick, 2016)

Future work:

- Homogenize other benchmark flavors (foreseen difficulties with database –not data– quality issues)
- Homogenize South-Sweden benchmarks also
- Evaluate corrections with proper metrics
- Homogenize INDECIS-needed ECA&D series

Acknowledgments and references

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References:

Killick RE (2016): *Benchmarking the Performance of Homogenisation Algorithms on Daily Temperature Data*. PhD Thesis, University of Exeter, 249 pp.

Guijarro, JA (2018): https://CRAN.R-project.org/package=climatol and http://www.climatol.eu/