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Trend analysis of snow water equivalent in the Alps

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Introduction

- Snow water equivalent (SWE) is the depth of water that results if the whole snowpack melts
- Monitoring SWE is important for:
  - Water supply
  - Hydropower industry (forecast of the discharge)
  - Safety of buildings/snow load (maximal SWE)
  - Flood forecasting

Aim of this study:
Are there significant changes of SWE in the Alps concerning different dates (1st of January and 1st of April) and time periods (30, 40, 50 and 60 years)?

Methods

- Gaps are filled with a parameterisation based on total snow depth (HS)
- Mann-Kendall trend test indicates whether a significant trend is existing or not (significance level used for this study: 90%)

Data

- 66 stations are situated between 518 and 2945m
- Time series have between 34 and 76 years of data
- Different methods used for measuring SWE

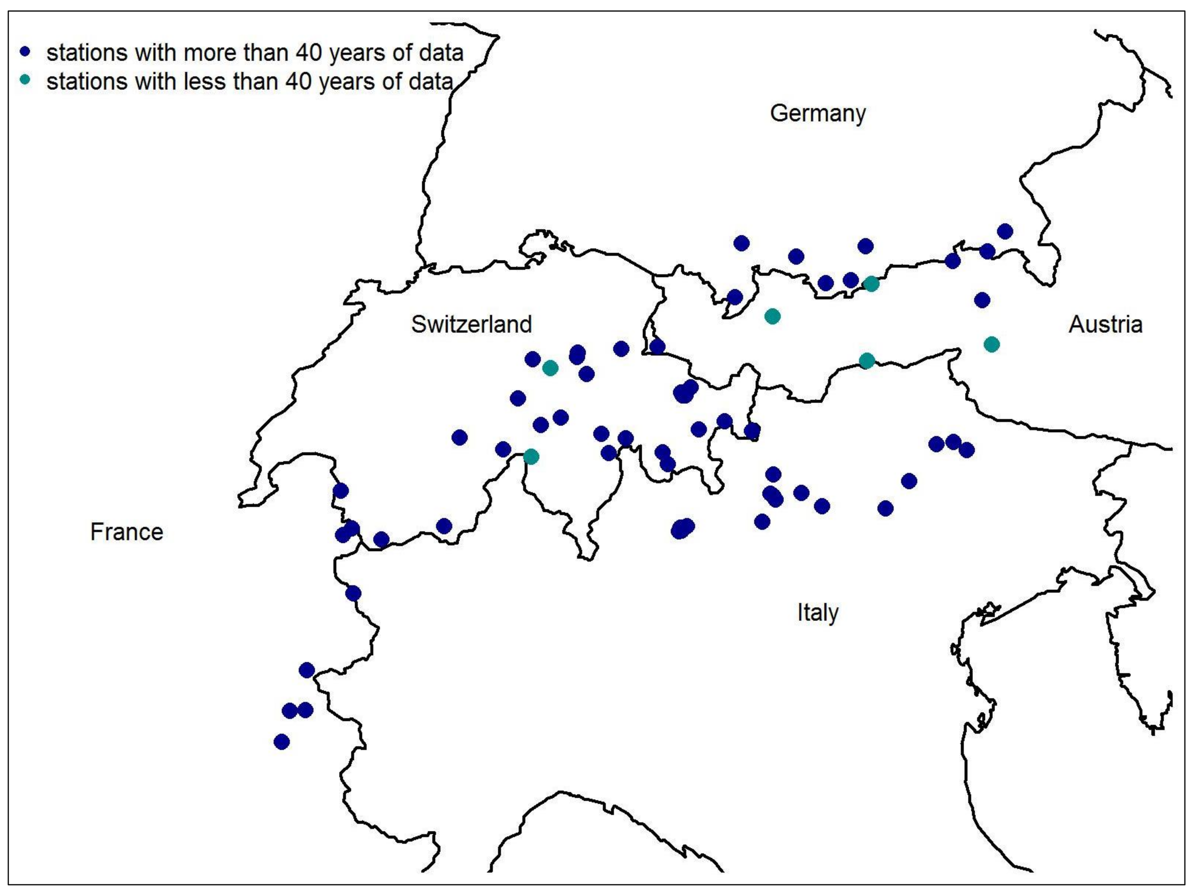

Fig. 1: Map of used stations

Results

SWE on 1st of January (mid-winter)

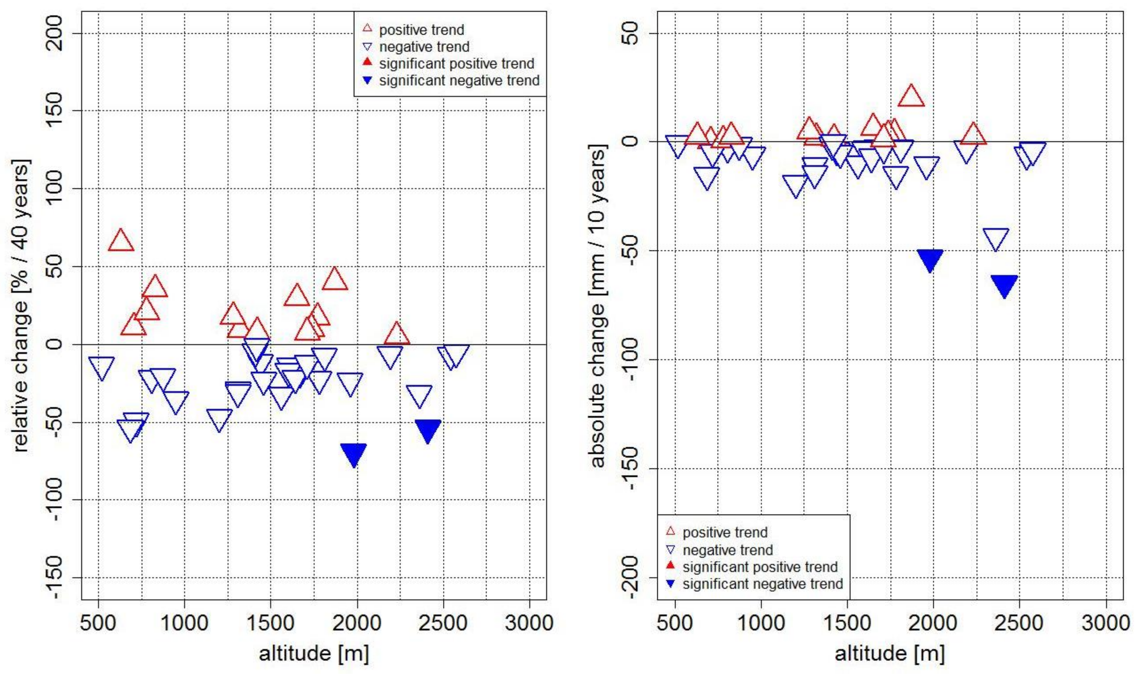

Fig. 2: Altitude dependence of the relative and absolute change of SWE over the last 40 years (1973 – 2012) on 1st of January

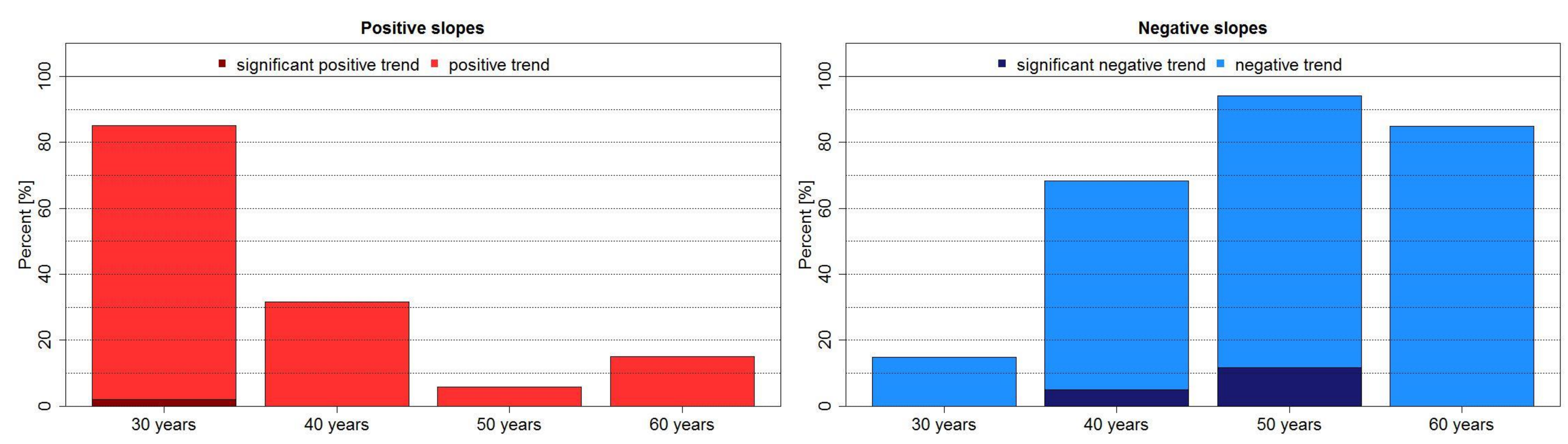

Fig. 4: Percentage of significant and non-significant trends for the last 30/40/50/60 years on the 1st of January (significance level: 90%)

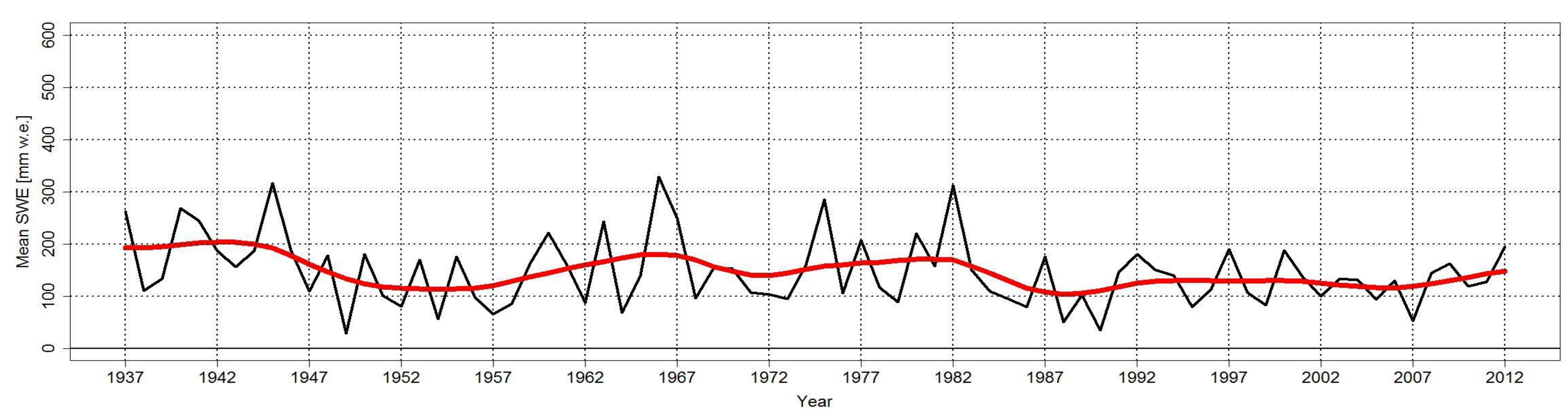

Fig. 6: Mean SWE over all stations on the 1st of January

SWE on 1st of April (spring)

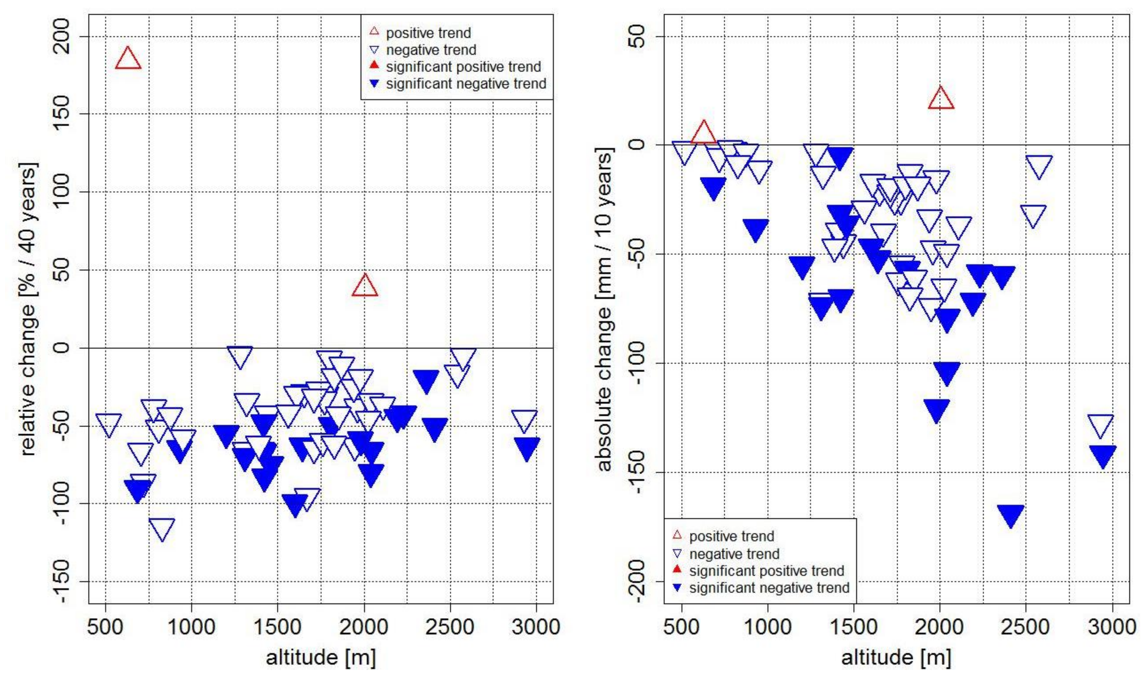

Fig. 3: Altitude dependence of relative and absolute change of SWE over the last 40 years (1973 – 2012) on 1st of April

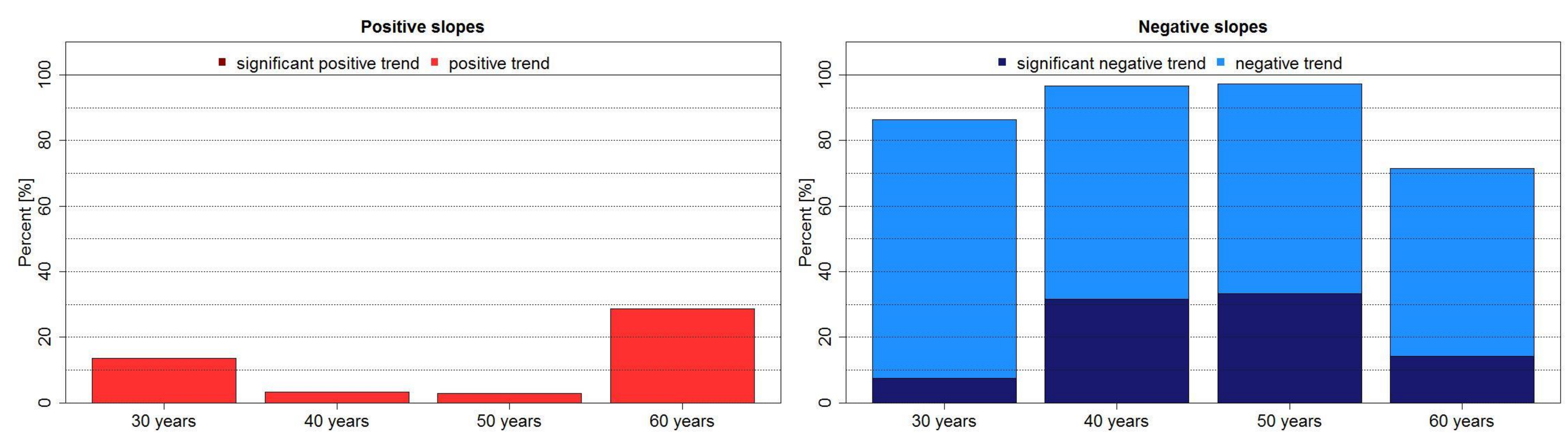

Fig. 5: Percentage of significant and non-significant trends for the last 30/40/50/60 years on the 1st of April (significance level: 90%)

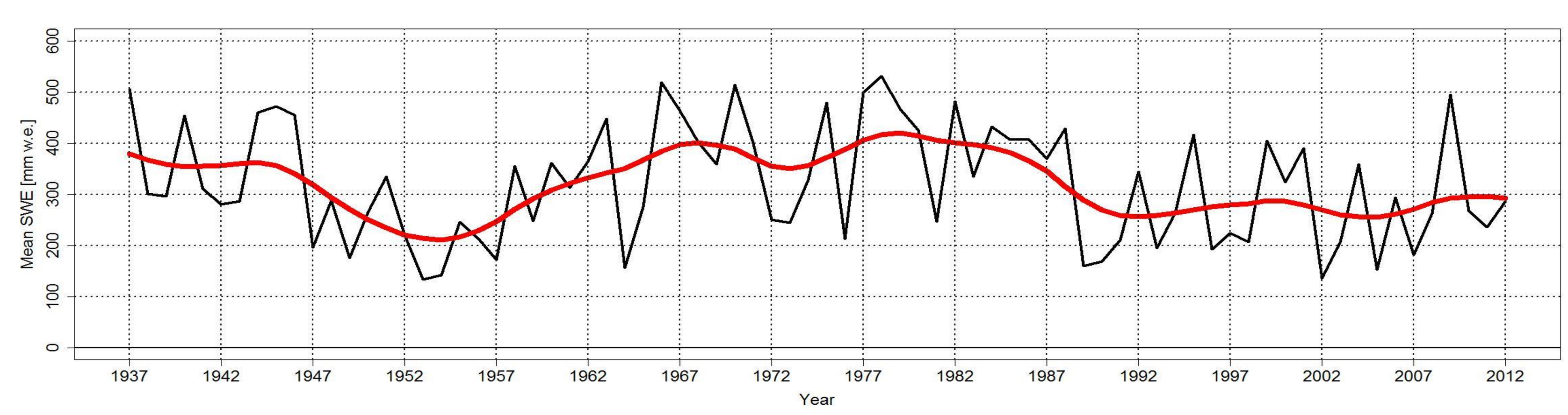

Fig. 7: Mean SWE over all stations on the 1st of April

Conclusion

- SWE mainly decreased over the last 60 years
- Percentage of significant negative trends is higher for spring SWE (1st of April) than for mid-winter SWE (1st of January)
- Majority of the non-significant trends indicate also decreasing SWE values
- Relative decreases of significant trends are stronger for low-elevated stations than for higher stations
- SWE trend is independent on region and altitude of the station

Acknowledgements

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