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Evaluation of break detection methods for snow data series

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Measurements of snow depth and snowfall can vary dramatically over small distances. However, it is not clear if this applies to all derived variables and is the same for all seasons. Almost all meteorological time series incorporate some sort of inhomogeneities. Complete metadata and existing "parallel" stations in close proximity are not always available.
First, we analyse the impacts of local-scale variations based on a unique set of parallel manual snow measurements for the Swiss Alps consisting of 30 station pairs with up to 70 years of parallel data. Station pairs are mostly located in the same villages (or within 3km horizontal and 150m vertical distances).
Seasonal analysis of derived snow climate indicators such as maximum seasonal snow depth, sum of new snow, or days with snow on the ground shows that largest differences occur in spring and the smallest ones are found in DJF and NDJFMA. Relative inter-pair differences (uncertainties) for days with snow on the ground (average snow depth) are below 15% for 90% (30%) .
Second, in view of any homogenization efforts of snow data series, it is paramount to understand the impacts of inhomogeneities. Using state-of-the-art break detection algorithms, we strive to investigate which method works best for detecting breaks in snow data series. The results can then be used on time series with insufficient metadata or no neighbouring stations in order to include them in future homogenization processes.
Furthermore, the knowledge about inhomogeneities and breakpoints paves the way for new applications such as the reliable combination of two parallel series into one single series.