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A quality control approach to better characterise the spatial distribution of snow depth over New Brunswick, Canada

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The last IPCC evidence that in Canada since the mid-20th century snow depth has decreased by 1.6% per decade, and in New Brunswick snow melt causes every year one third of the flood events. Since snow depth records can be affected by errors due to instrumentation, station relocation and so on. This study aims to provide support for the manual validation of snow data through the development of a methodology for the identification of suspect data. We will propose, from automatic daily snow depth series (NCDA), a standard methodology of quality control applied to manual snow cover series that are not recorded at daily scale. In this case we used biweekly snow depth (SDD) records applied in forecasting of the Saint John River flood events due to snow melt. A thirty-year (1981-2010) analysis of 60 weather stations belonging to the two independent meteorological networks in was performed. Three snow depth climatic areas were defined by means of two geostatistical methods (Kriging and Cluster analysis) applied on monthly snow depth, precipitation and temperature data series. The QC of the daily snow depth series was performed and for each cluster the daily thresholds (95 percentile) that characterise an extreme snow fall event were detected. The accuracy of the daily extreme episodes was tested and:
• sudden day-to-day changes in snow depth (ΔHS) were checked.
• liquid precipitation and temperature recorded during the untrusting event were compared with the daily snowing climatic condition previously observed.
Subsequently the detected daily snow depth thresholds (95th percentile) were applied to the manual SSD snow depth series in order to highlight any doubtful episode. Errors were detected comparing:
• distrustful snow depths values with those recorded in the nearby stations. The selection of the nearby stations was based on: the difference in elevation (<200m), the distance (20 km), the same exposure and the same position area (open, mixed or forest).
• temperature and liquid precipitation values recorded in the surrounding stations during the untrusting events were compared with the daily snowing climatic condition.
Finally, for both automatic and manual series we flagged the doubtful episode as error, and replaced with NA, if both the QC steps revealed an error, on the other hand we flagged it as suspicious.
The results evidenced that for the daily snow depth series all the doubtful episodes were recorded in March and April during the negative values of the ENSO. The episodes were flagged as suspicious and were assumed as snow mixed with rain events. While the QC performed on the manual series, highlighted snow depth error randomly distributed in the series. Finally, the QC application evidenced no significant trend changes in the snow depth series, but a decrease of the monthly mean values was detected.