Near Real-Time Observations of Snow Water Equivalent for SIOS on Svalbard - SWESOS

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Project Aims

- Assess accuracy, spatial representativeness, applicability of **new automated monitoring technique** for measuring snow water equivalent (**SWE**) using a passive gamma ray sensor.
- Provide recommendations on potential to install more of these instruments in similarly remote environments in the future.

- Provide **unique, high quality, continuous, near-real time snow dataset** by linking existing snow datasets with new SWE measurements.
- It links soil (permafrost), snow, atmospheric and biological research fields and will be essential to develop snow, permafrost and hydrologic models in this data scarce region.

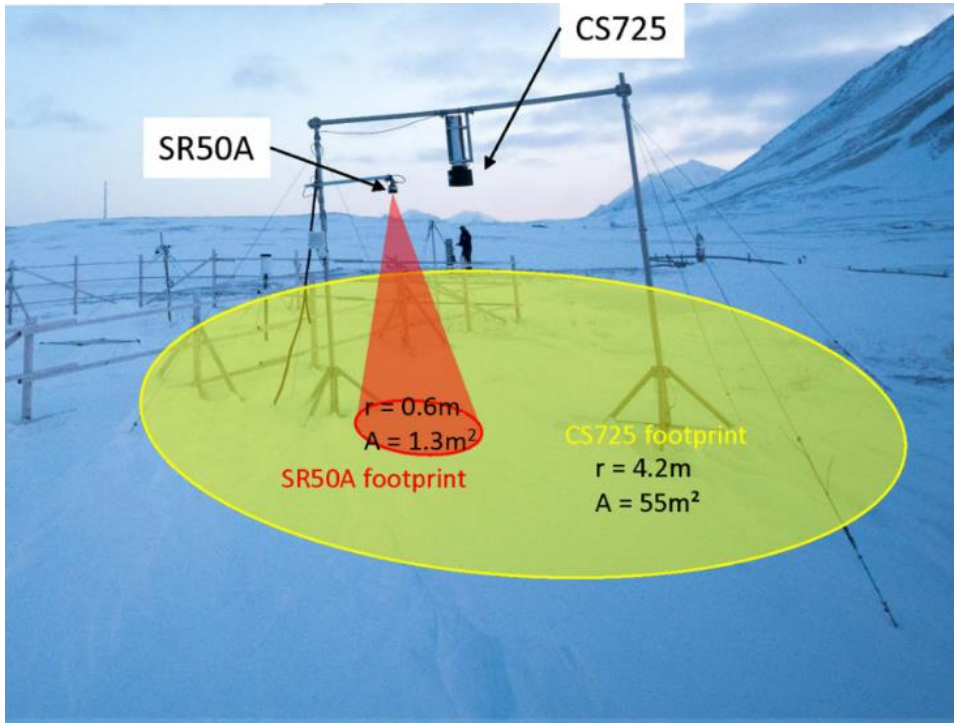
New and existing snow measurements at the Bayelva site

Table 1 Existing snow datasets at Bayelva

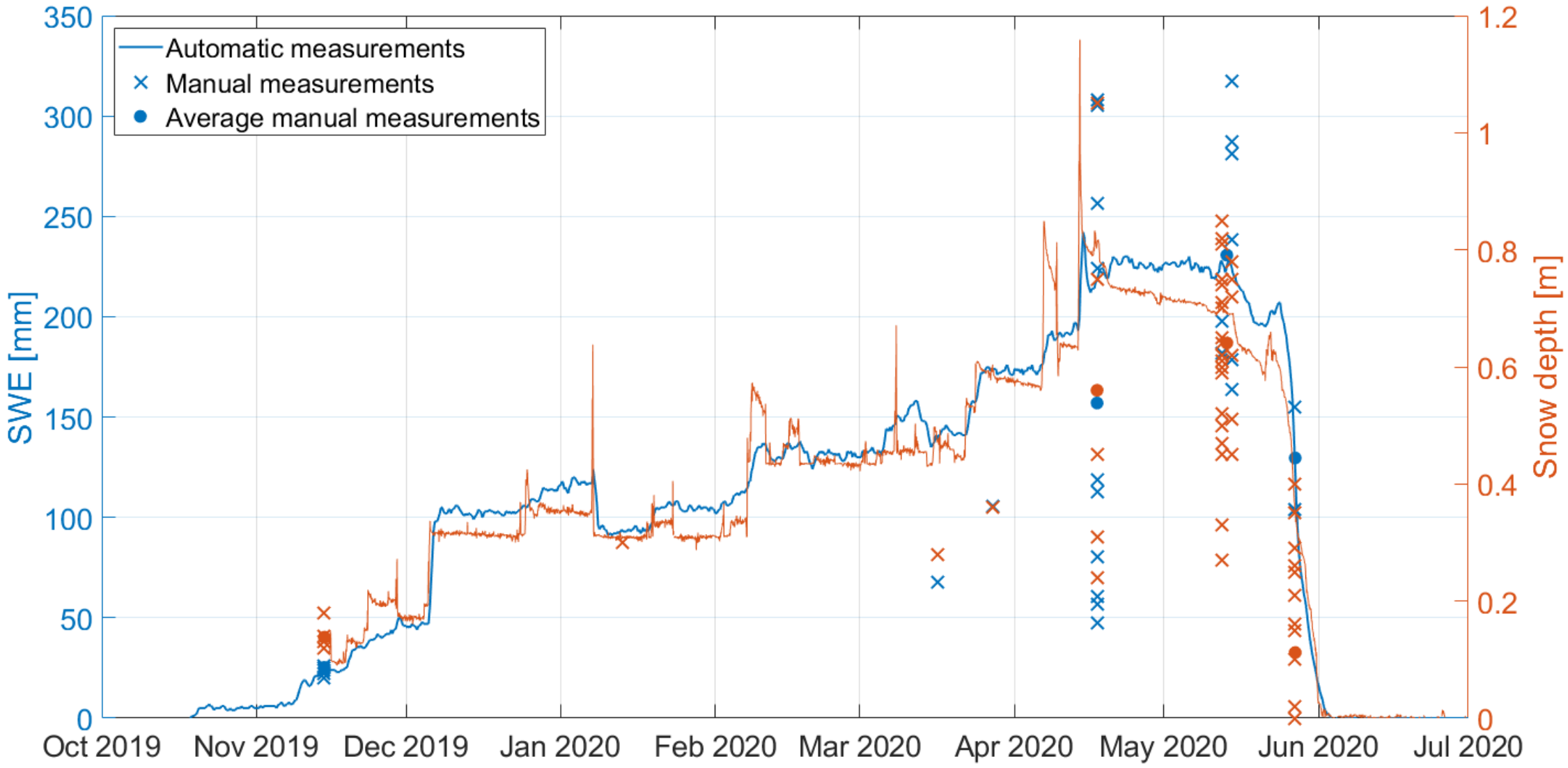
Parameter	Sensor
Snow depth	CS SR50 ultrasound Jenoptik SHM30 laser distance
Snow temperature	2xPT100
Snow dielectric number	TDR100, vertically installed
Snow distribution	Time lapse cameras (m^2 scale) Time lapse camera overlooking entire Bayelva catchment (km^2 scale)

Table 2 New automated snow sensors installed 29.08.2019

SWE	CS725
Snow depth	CS SR50/AT ultrasound

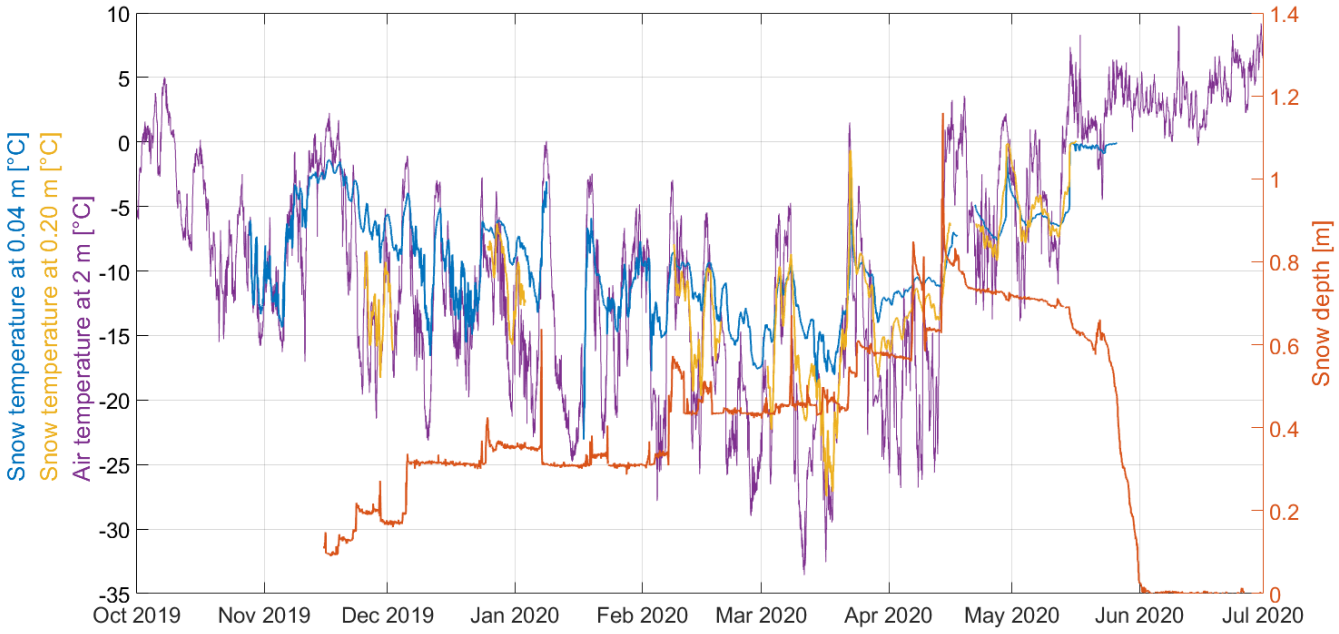


Automated and manual SWE and snow depth measurements

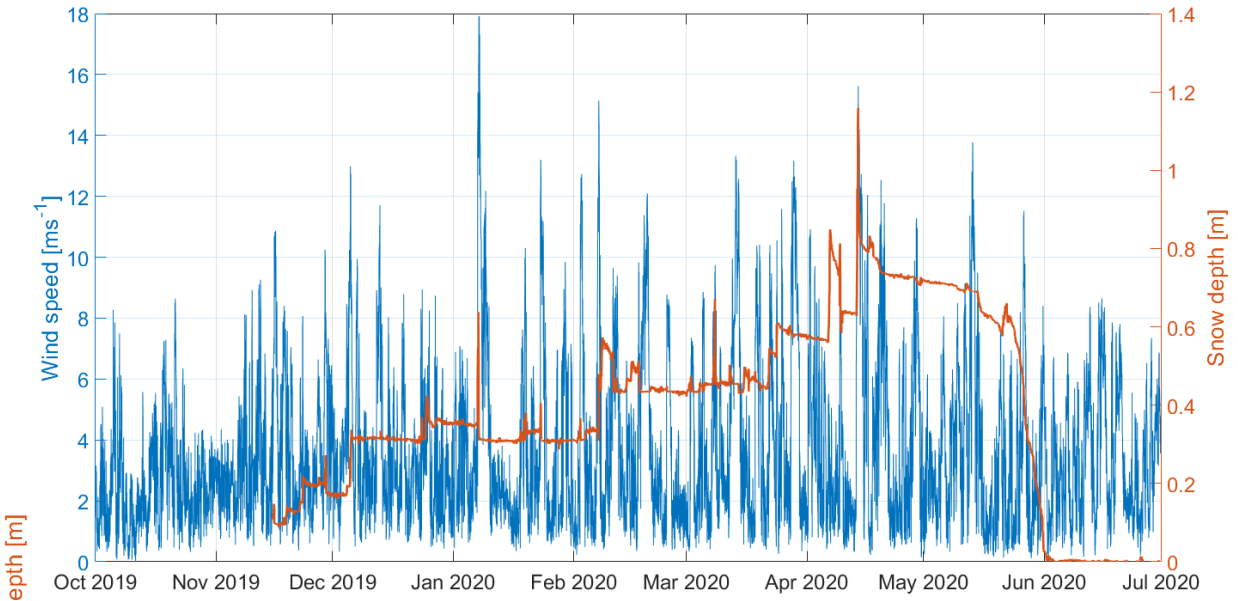


Validation of snow depth measurements, using…

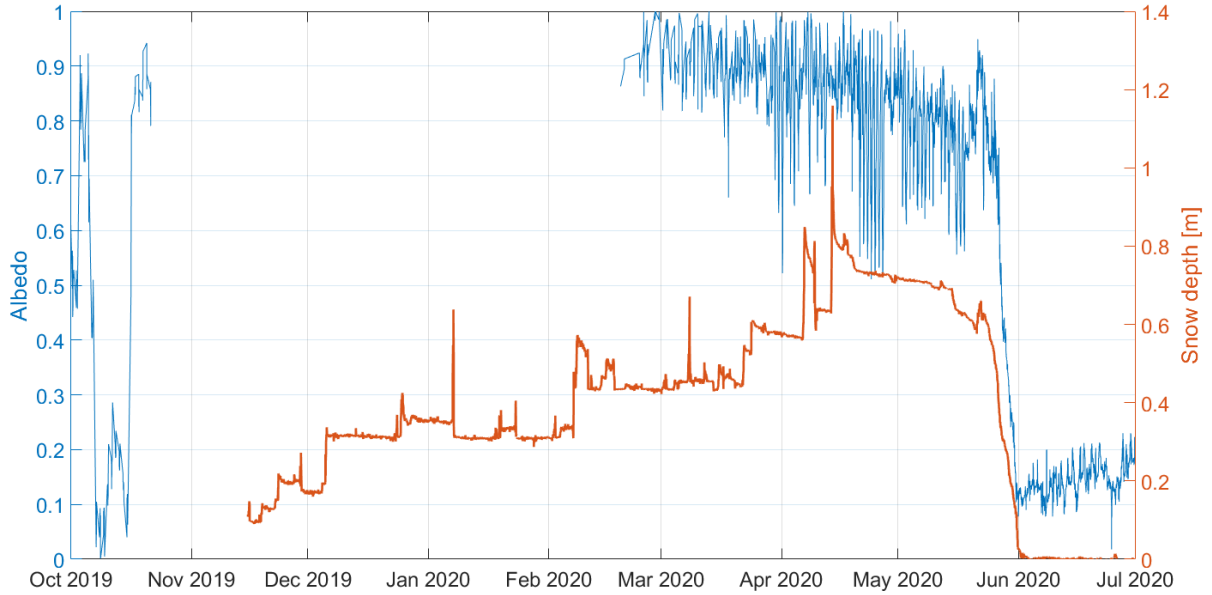
…air and snow temperature



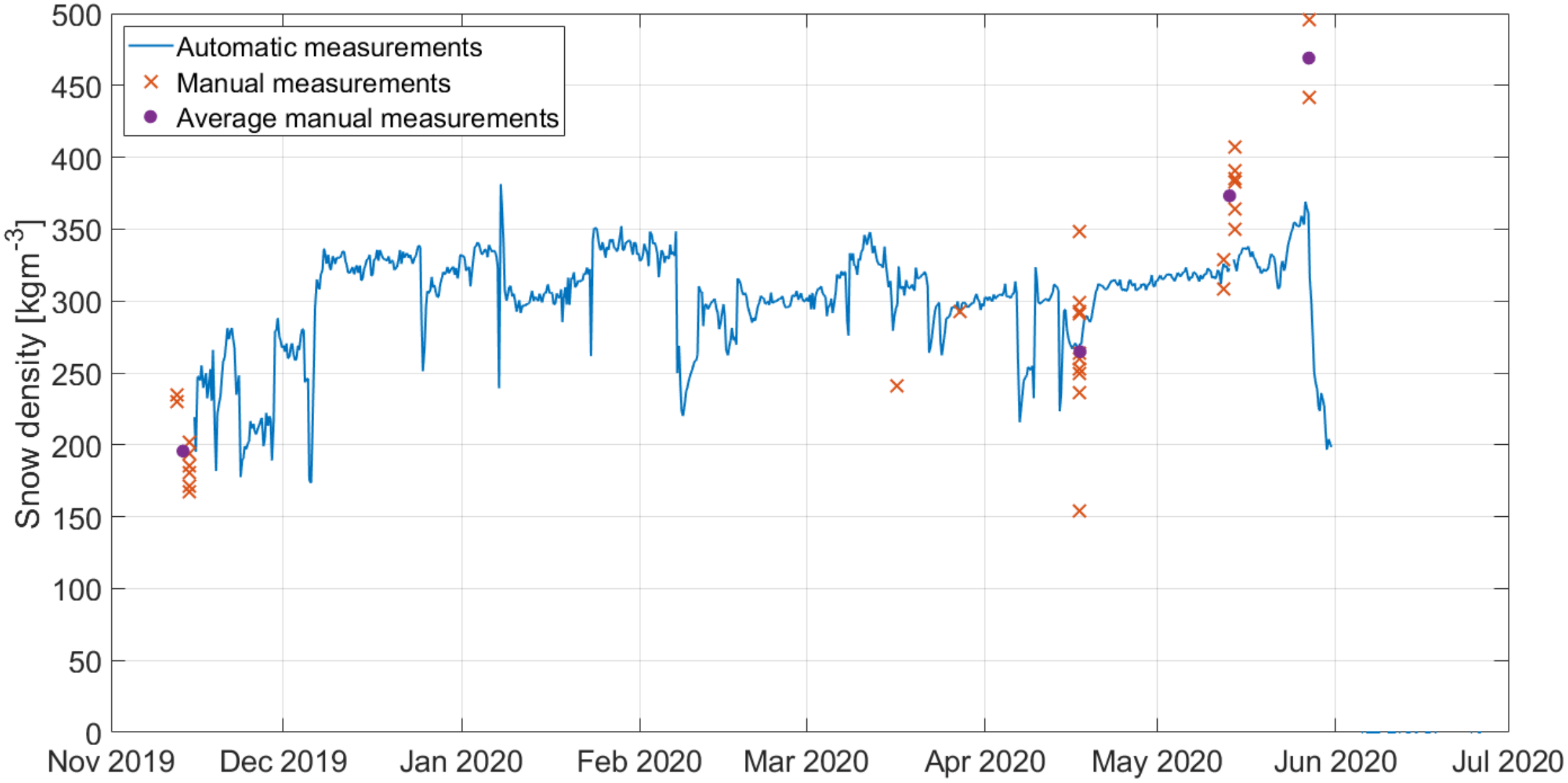
…wind speed



…surface albedo



Snow density as calculated from automated and manual SWE and snow depth measurements



Summary & Conclusions

- Independent manual snow pit measurements, wind, temperature and radiation data from the nearby climate station verify general course and strong changes of snow depth and SWE as well as onset and end of the snow-covered season as indicated by the new automated sensors.

→New automated measurement system reliably captures the overall evolution of SWE and snow depth over the snow-covered season

- Difficulty: high spatial variation of SWE and snow depth within footprint area of the automated sensor due to uneven snow cover (uneven terrain, wind drift, discontinuous snow cover due to patchy snow melt)

→ Automated measurements expected to best represent snow conditions inside their footprint area at sites with an even snow cover (flat surface, no large obstacles, low wind speeds)

Further information

Short project report

- https://sios-svalbard.org/SWESOS_2020

Detailed project report

- https://zenodo.org/record/4146835#.YBp0wXkxmM8

Snow dataset

- Automated data
  - https://doi.pangaea.de/10.1594/PANGAEA.925357
- Manual data
  - https://doi.pangaea.de/10.1594/PANGAEA.925350

Acknowledgements

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