

Review of “Atmospheric and surface observations during the Saint John River Experiment on Cold Season Storms (SAJESS)” by Hadleigh Thompson et al.

This paper presents a dataset of winter- and springtime measurements in the upper Saint John river basin, on the border of Maine, Quebec and New Brunswick. The data include a collection of surface observations of precipitation and atmospheric variables, as well as certain surface state variables and radar measurements.

The authors provide a clear description of the various instruments and a mostly good overview of how the data were processed. They also discuss shortcomings and challenges that were encountered. The dataset itself is very well documented.

The campaign is interesting and the data will likely foster research on cold season precipitation and snowpack evolution. The manuscript is clearly written. I do have a few concerns regarding how the data are presented and am missing some important information in the manuscript. As a reader, I am still unsure of how much was collected in terms of usable information (see major comment #1), and I feel the authors should provide more perspective on the dataset along this line. I think my comments will be addressed easily, but I do believe they should be taken into account to increase the impact of this study.

Major comments:

1. I am missing an overview of the dataset in terms of the precipitation events that were observed. Somewhere in the manuscript the reader should be able to understand how many precip events were observed / how many hours of precip / how many hours of each precip type (rain, snow, mixed, melting snow...) / number of rain-on-snow events / total precip amount /... If not all of these items, at least several. Including this type of information will help the user understand what possibilities the dataset opens up.
2. Along the same line, the only “overview” figure of the data (Fig. 7) is quite basic (and could probably have been derived from measurements of a usual weather station). It would be helpful to have a more specific overview figure from the campaign (e.g., from the IOP) that illustrates some of the unique features of the dataset. I can understand if the data have not all been processed to the point that statistics can be derived from them – and this paper is not intended to present a scientific analysis –, but I believe the authors could still give more flavor to the data overview (e.g., with another timeseries or a pie chart from a relevant instrument). For example, in the introduction, the authors mention the relevance of the campaign for the study of how precipitation impacts the snowpack evolution, but this is not put forward in any of the first results / data preview sections. Other example: measurements of precipitation phase seems to be a crucial aspect of the campaign, but are barely put forward (except in half a sub-panel of Fig. 8).
3. In the data description section, nothing is said about the SRS and CoCoRaHS observations. There is only a sentence in the last section to highlight the challenges that were encountered – even though the abstract highlights them as an important element of the setup. It would be nice to have more information on the data that were collected through these platforms, even if they are not perfect. Consider including another figure (or subpanel to an existing figure) showcasing these measurements. Sec. 3.4 introduces nicely the set-up and suggests that bi-dimensional precipitation fields can be reconstructed, and that information on liquid content is available, so I was disappointed not to find any follow-up on these aspects in the later sections.
4. The introduction would benefit from a broader perspective – were similar set-ups deployed somewhere else in the world? l. 58 “no studies of storms and precipitation (...) have been conducted in this region” - how about in other regions? This could also be the place to highlight possible specificities of the SAJESS campaign (in terms of objectives, instrumentation, strategy...)

besides the geographical location, in comparison with previous field deployments (e.g., GCPEX, OLYMPEX...)

5. I am slightly confused with the processing of disdrometer data (Sec 3.1.4, 4.2.4, Fig. 8, Table 2). Did you implement a particle type classification on your disdrometer data? This is not mentioned in the text and does not seem to be in the dataset, but you show it on Fig. 8. In the description of Fig. 8 (either in the text or in the caption), include which classification algorithm was used. If the info on particle type is not shared in the dataset, I find misleading the sentence of the Data processing section 4.2.4 “Our primary use of Parsivel disdrometer data concentrates on the diagnosis of hydrometeor phase and type”. Also, in the dataset I find the variables “Intensity of precipitation” and “Snow intensity” - is the former only liquid? What processing is applied here to derive these variables, is this the built-in software? As the disdrometer is an essential component of the setup, the variables shared in the dataset deserve a more clear description in my opinion.

6. Sec. 3.2 Macro photographs: please explain the strategy adopted here. In Fig. 9 you mention a felt pad, this would be worth including in the text. Also, mention if the pad is wiped after taking a picture, if the camera is always at the same position, etc.

7. This may be less critical, but the summary section is very short. It would be beneficial to end with some more insights on the scientific questions which the dataset allows addressing.

8. I believe that during campaigns aiming at studying the snowpack evolution, it is frequent to measure the snow water equivalent (SWE). This is not the case here, perhaps for practical reasons or because no such instrument was available. It may be worth discussing this in the manuscript, perhaps in the “Challenges” section?

Minor comments

1. 1.16 Mention in the abstract where the St John River basin is in the world
2. 1.31 Already in the abstract you could include a brief statement to show the outcome of the campaign (e.g., number of precip hours ...)
3. Fig. 1 :
 - Include a scale in the zoomed box (Edmunston)
 - Operational weather radars are shown but never mentioned in the text. This is misleading since you have MRRs in the two main sites.
4. 1.63 To improve clarity, I recommend ending the introduction with a brief outline of the structure of the manuscript. Otherwise it is not very clear that you choose to first describe the sites, then the instrumentation.
5. Sect 2.1 It would be interesting to put some perspective here to explain the choice of the location. At least, a brief description of the winter climatology in these sites would be beneficial.
6. 1.98 “The identification of precipitation phase was achieved by the installation of a K63 Hotplate...”. Unless I am mistaken, the K63 hotplate measures the liquid-equivalent precipitation rate and accumulation, but does not discriminate phase. In the “Precipitation phase observatory”, only the disdrometer is able to provide information on precipitation phase at the ground, correct? (The MRR somehow indirectly, I suppose). This sentence is somehow misleading.
7. 1.125 “At several sites” → state how many sites.
8. Sect. 2.4 and Sect. 3.5: Since the CoCoRAHS measurements are not included in the dataset you provide but should be accessed from the website, consider including in Appendix or in the dataset the list of station numbers / names from SAJESS. As there are numerous stations available on the website, it is cumbersome for the user to look for those of the campaign

without more detailed info. I tried filtering the names with “SaJESS” but this did not seem to work.

9. Sec. 3.1.3 Mention that the hotplate measures equivalent liquid precip
10. Sec. 3.1.6 Mention that the MASC cameras capture images of a particle from different angles. Also, the last sentence of this paragraph is a bit ambiguous as to whether or not these algorithms were implemented on your data, or if the user should implement them.
11. Sec. 3.1.7 Out of curiosity, would it be possible to identify the times when this happened from the altitude sensor on the instrument? Or are the measurements too noisy?
12. l. 219 “Lachapelle and Thériault, 2021a” : reference is missing.
13. Sec. 3.3 It would be interesting to show the dates when radiosoundings are available (e.g., in Fig. 6 or 7), if not too heavy.
14. l. 339 Are these dates flagged somewhere in the dataset or readme files? I couldn’t find.
15. Fig. 6: It is hard to see the dates (where is the beginning of April?), the reader has to count days from beginning of March.
16. Sec 4.2.5 You mention comparisons with Caribou. In Fig. 1 you also show another upper air station SE of Fredericton, did you use measurements from this station? Otherwise you may consider removing it from Fig. 1
17. Sec 4.3.1 This could be the place to expand on the conditions that were observed during the campaign (see major comment #1). You could also include the dominant synoptic conditions during the winter and spring, ...
18. Sec. 4.3.3 Include a few words on the context of this snowfall event (similar to the beginning of 4.3.2). You may for instance mention temperatures at the site, precip rates, ...
19. Fig. 9 – 10. It is a pity that those not very quantitative figures are the only data shown from the IOP (cf. major comment #2), which has a very nice setup.
20. Table 2 and 3: for the instruments that require calibration (e.g., on the met or flux tripods, radars,..) it would be good to include some information on the quality of the calibration (e.g., date of the last calibration, ...)
21. Table 2 and 3: What should be in the “Variable” column? Raw variables measured by the sensor, or processed variables available in the files? There seem to be some inconsistencies (e.g., only 2 variables for the Parsivel, but 4 variables for the MRR).
22. Table 2 and 3, MRR
 - Resolution: include range resolution + velocity range (min and max vel) + vel. resolution
 - Accuracy: include sensitivity information (e.g., min. reflectivity detected at 1km range)
23. Table 3, Met tripod SR50: “snow depth”. If I understood correctly, snow is removed after a snowfall event, so perhaps “fresh snow depth” would be more accurate.

Technical corrections

- l. 29 Should be “Thompson et al., 2023”
- l. 37 “Bay of Fundy (Fig.1)”: add the Bay of Fundy to Fig. 1
- l. 37 “It covers...”: unclear what “it” refers to. Replace with “The SJ river watershed” / “The basin”...
- l. 54 Budhathoki et al. (2022): reference is not included
- l. 101 “information on the atmospheric conditions aloft”: this is not very precise and slightly misleading, the radar informs on precipitation aloft (not all atmospheric conditions)
- l. 119-120 “focus on observations, rather than instrumentation”: unclear
- l. 205 “Garrett”
- l. 220 “SLR”: don’t think the acronym was defined.
- l. 280 “in-situ”: not sure this is the best word.
- l. 321 “Although”: I don’t understand the use of this word here.
- l. 329 “SR50A”: this was not defined.
- l. 373 “GEONOR”: not defined.

l. 377 is the bias with the T5 or the T1 data? Unclear from the phrasing.

Fig. 8b: A narrower color scale would be relevant as all the data seems to be within 5 dBZ and 30 dBZ. Perhaps a continuous colorbar would also be helpful (as in panel c).

Comments on the dataset

I would like to acknowledge the efforts put into the documentation of the data. The Readme files are extremely clear and this is of great help to a new user of the dataset. Below is a list of minor issues:

- there are some discrepancies in the naming of the files inside the readme files (for example in the SJ_FS_FLUX_readme, l. 134 – 136)
- OTT Parsivel: I could not find values of the diameter and velocity bins
- MRR-PRO: I may have missed but could not find values of the velocity bins of the spectra (if they are indeed missing, one possibility would be to include the bounds + velocity resolution in the readme file so the user can reconstruct this array).
- Macrophotography: Can the user find a scale for the pictures?