Overview

The authors present a revised manuscript detailing the seasonal evolution of cold content at four sites in the Boreal forest of Québec, Canada. This version is markedly improved, particularly the introduction and results/discussion. The methods are easier to follow, making the paper more accessible to a wider audience. I recommend publication after a couple minor revisions. These are shown in the list below and detailed more thoroughly in my line-by-line comments.

Minor revisions

1. Lines 313–325. Persistently negative net fluxes often translate into cold content magnitudes that are too high. Please check the numbers here and the allocation of energy losses in CLASS.
2. Lines 410–442: Please move novel results to results section and save this space for your discussion text of the energy balance differences.

Line-by-line

Line 11: Change “Estimating the cold content” to “Measuring cold content”
Line 16: Add “modeled” before time series
Lines 25–27: Please clarify that CLASS output is compared to bulk values and that the empirical scheme is compared to layered values (unless I misread)
Lines 36–37: Not important, but you can typically strengthen sentences by removing words (i.e., “improved decision-making in the area of water resources management” becomes “improved water resources decision-making”)
Line 95: Please modify to note SSA is a property of snow grains
Line 99: Although I appreciate the shout-out, you can remove Jennings et al. (2018) as you’ve done novel, independent research
Line 140: Change “it was opted” to “we opted”
Line 145 (Figure 2): The schematic makes the process much easier to understand. The only suggestion I have is that directional arrows in a flowchart typically denote the creation of a new variable from a previous variable. In this context, arrows ps, HS, and Ts in the lefthand box would point to a new variable called cold content (not snowpit). Given these measurements are all from the snowpit, the lefthand box can be annotated to say weekly snowpit. I think the flowchart is probably fine as-is, but can be improved for clarity.
Line 247 (Figure 4): There’s no light blue shading
Line 269: You can also cross-reference your methods subsection here
Line 275: Change “structured” to “summarized”
Line 290 (Figure 8): We’ll agree to disagree here (if you change your mind, please remove the shading and make this a table as the shading provides no additional info past the numbers shown)
Line 306: Should Fig. 8 be 10?
Lines 313–325: I am suspicious about the persistent negative flux in the WA period. In general, cold content is a small proportion of the total energy required to warm, ripen, and melt a snowpack. Therefore, persistently negative Q_m values over long periods are often improbable because they lead to impossibly low cold content values. For example, if we assume a WA

period of 90 days, which is a conservative assumption, the low Q_m value of -6.6 W m^{-2} at Sap1 would produce -51.3 MJ m^{-2} of cold content (it's not clear whether cold content added by snowfall is included in Q_m or if CLASS adds it separately). Perhaps the duration of rain-on-snow events with high positive energy fluxes is enough to counteract this effect, but I'm still skeptical. If we take the December 17th to January 18th period (consistent CC development), CC goes from ~-1 MJ m^{-2} to ~-4 MJ m^{-2} at Sap1. This corresponds to an average flux of just -1.1 W m^{-2}, which may or may not include the CC added by new snowfall. Perhaps the persistent negative values of Q_m are "correct" but CLASS is using them to also cool the soil layer and not just the snowpack? No matter the cause, this discrepancy between the CC values and the negative fluxes needs further investigation and clarification. (One note: Subdaily net fluxes can be negative—e.g., nighttime cooling or cold, windy periods of high sublimation—but these would be balanced out over longer time scales so that the average net flux was near zero during the winter accumulation season.)

Line 327: Remove extra period

Line 328: Add clarification after "positive correlation" (i.e., "meaning cold content magnitude increased as air temperature and snowpack temperature decreased")

Line 341: The air temperature values are nearly identical. Please change

Line 343: Figure 13 does not show cold content

Lines 341–347: On closer reading, this paragraph and figure can be removed. The text is difficult to follow and it's unclear how the figure contributes to the discussion past the figures already displayed.

Lines 356–361: An alternative hypothesis is that a cold snap led to snowpack cooling. The more exposed site (Sap1) experienced greater cooling than the less exposed sites.

Lines 365–366: Change "Based on our findings, CLASS successfully estimated snow density and *CC*. Although CLASS 365 reasonably predicted *SWE*, one cannot deny the fact that it underestimated observations" to "Based on our findings, CLASS successfully estimated snow density and *CC*, while underpredicting SWE."

Lines 367–371: Are these sentences suggesting class *overestimates* sublimation, leading to an *underestimation* of SWE? If so, please clarify

Lines 380–407: This section should be shortened significantly. I think it is sufficient to say the new snow density formulations led to persistent underprediction errors for the top layers, even when compaction is considered. This is likely a shortcoming of both the fresh density and compaction due to metamorphosis equations.

Lines 410–442: I really like the inclusion of the energy balance analysis, but these sentences contain novel results. Please keep the discussion parts here while moving the quantifications to an additional results subsection. (Also, please limit the use of "indeed" to start sentences.)

Line 417: Remove "at" from in front of "canopy"

Line 419: My take on this is that the 0.1 MJ m^{-2} difference is negligible given the observation precisions and model biases.

Line 434: Please expand on this sentence. The canopy blocks incoming solar radiation (more CC) but also increases incoming longwave radiation (less CC) compared to an open site.

Line 437: Please cite peer-reviewed literature on energy fluxes during rain-on-snow (e.g., Marks et al., 1998): https://doi.org/10.1002/(SICI)1099-1085(199808/09)12:10/11%3C1569::AID-HYP682%3E3.0.CO;2-L