Overview

The authors document the frequency and duration of near 0°C conditions (defined as -2.0°C ≤ T_a ≤ 2.0°C) along with the frequency of various precipitation types at a selection of research sites in Canada. They also evaluate whether statistically significant trends were observed for various air temperature and precipitation metrics over the 1981–2011 time period. Overall, they found spatial variability in the occurrence of near 0°C conditions and few significant trends in the various indicators they explored.

Although it is well-written and appropriate data and methods are used, the current paper reads too much like a case study of near-freezing precipitation in Canada, making it not suited to the high scientific standards of HESS. The authors even note themselves that: "The objective of this study is therefore to develop a Canada-wide perspective on near 0°C conditions with a particular focus on its associated precipitation types." In order to move towards acceptance the science will have to be expanded upon significantly and the international scope broadened. I offer some suggestions below, but the authors will need to take it upon themselves to determine what primary scientific questions are driving this research. I therefore suggest significant major revisions be undertaken or rejection if the authors do not increase the scientific merit of the paper.

Major issues:

1. Lack of scientific content:
    a. The authors present a possible scientific research question in Sect. 5.3 and the last paragraph of Sect. 6. Relating the sigmoidal curve of annual temperature variation (particularly where it reaches its minimum and how long it is near 0°C) to trends in near 0°C conditions would be interesting. For example, do sites with winter air temperatures near freezing express trends more frequently than those with winter air temperatures well below freezing. This could also be tied into trends in precipitation type (e.g., shifts from snow to rain or occurrences of freezing rain/drizzle/ice pellets). Additionally, such a quantitative approach could be connected to international work (major issue 3 below) by noting areas with similar hydroclimatic characteristics. I feel this could be relatively easily done by the authors through making their qualitative discussion section into a quantitative analysis.
    b. How sensitive are the trends and evaluated quantities to the selection of the admittedly non-physical -2°C to 2°C air temperature range? For example, precipitation is almost always snow at and below 0°C (e.g., Auer Jr, 1974; Dai, 2008; Kienzle, 2008). In the representative stations results (Sect. 4), snow is presented as the dominant precipitation type at all stations but St. John's. This is likely due to the selected air temperature range. Examining a different range (e.g, -1°C to 3°C) might yield different results.
    c. The authors argue how important near 0°C conditions are but do not make quantitative comparisons to other temperature ranges except in Figure 1. It would be particularly useful to compare the near 0°C range to the ranges above and below. Is precipitation of any type more common near freezing than other temperature bands? Is there spatial variability in this result?

2. I probably mention this in too many reviews, but please tell your colleagues: Stop using the jet/spectral/rainbow color ramp (http://www.fabiocrameri.ch/endrainbow.php, https://betterfigures.org/2015/06/23/picking-a-colour-scale-for-scientific-graphics/, etc.). The figures were adequate in general, but could use significant touching up. The color ramps are the most significant issue, especially considering many figures would be difficult to parse out for colorblind individuals. I would also use point size to denote magnitudes in figures 3 and 4 as was done in 5. To me, red does not suggest more near 0°C days than blue. Size, color, and shape should tell a cohesive, intuitive story when making figures.
3. HESS has a larger international audience, but few connections to previous international work were made. The authors need to significantly bolster the amount of non-Canada research they cite in order to make this study suitable to HESS and its readers.

Line-by-line comments:
Line 14: I assume near-surface air temperature is meant here. Please correct all instances throughout paper.

Lines 18–19: I'm not clear what this sentence means. Do the Atlantic Stations more commonly have precipitation with near 0°C conditions or they have higher fractions of the listed types in parentheses?

Line 20: Please remove this line unless systematic warming was shown for these stations over the 1981–2011 time period.

Lines 22–24: Clarify this is only for some stations (a separate peak in the near 0°C bin is shown in Figs. 1 a, e, f, g, i).

Lines 30–32: A significant amount of research has been devoted to these items. Please cite the associated authors.

Line 77: Note explicitly that these are visual reports of precipitation phase if so.

Line 95: Adverbs ending in -ly are not followed by hyphens.

Lines 98–99: For the first metric, please clarify if the daily average temperature is used.

Line 103: What does "without the assurance" mean in this context?

Lines 106–108: Is the percentage calculated from all hours in a year or just hours near freezing?

Line 110: Please clarify that Sen is used to compute the magnitude and sign of the trend.

Line 116: How was hourly sky cover computed?

Lines 120–173: It would be useful to include additional quantitative results (i.e., attach numbers to the comparisons made in this section).

Lines 123–125: These are discussion points and not part of the results. Given there is a dedicated discussion section (Sect. 5), these lines and all subsequent ones not dealing with results explicitly covered in this project (e.g., lines 154–155) should be moved.

Line 128: Replace less with fewer.

Lines 160–162: Please rewrite to be more objective (i.e., remove "huge" and "enormous").

Lines 175–194: I would change the way the trends are discussed. It appears the values given are the differences between the beginning of the study period and the end, not the slope of the trend (e.g., days per decade, hour per year). This is inconsistent with the way trends are typically presented (change per time period) and should be changed. It would also be useful to include time series figures for the trends, perhaps in Sect. 4 where the representative stations are presented. I note below that figures 8 and 9 can be deleted, so there is room for more plots.

Line 201: Change least to fewest.

Lines 221–227: Remove.

Lines 228–234: Interannual variability is not quantified in this study. Relying on Figure 9 for this information is iffy at best. I note below this figure should be deleted anyway.

Lines 235–320: The discussion is generally well written and offers valuable information that complements the results. My main suggestions for this section are:

1) Reduce the amount of redundant results that are provided (for example, lines 279–283 are merely repeating results from the already-presented Figure 1).
2) Make greater connections to international work. What other regions are similar to these Canadian study sites? What connections can be made between the work here and other areas?
3) More rigorous citation of the proposed processes at work. Many of the hypothetical mechanisms are either lightly cited (e.g. lines 284–288) or not cited at all (e.g., lines 272–277). Please be sure to credit the authors whose work you are using to make this discussion section.

Lines 338–339 and 343–346: These are not conclusions based on results from this paper. Please rewrite or remove.

Line 350: Air temperatures were not presented for the 1981–2011 time period. Please rewrite or remove.

Table 1: Please be consistent in use of T, $T_{drybulb}$, surface temperature, etc. in this table and throughout paper.

Table 2: Av. or avg. are commonly used abbreviations for average, not aver. Also change the abbreviation for significance from sign to sig. Sign is confusing because it could be construed as

referring to the sign of the trend (i.e., positive or negative). Also, a unit for the trend must be given (is it hours per year, per decade, etc.?). These comments apply to subsequent tables and figures, as well.

Figure 1: Please note these are 4°C temperature bins.

Figures 3-4: Please see my major issues comment on figures.

Figure 5: Fortunately there is a second coding in the plot points to differentiate between positive and negative trends, but the coloring should be changed (it is difficult for many color blind people to tell green and red apart).

Figure 6: It is very difficult to tell the lines apart. Consider labeling the lines directly and change color ramp to one that is colorblind friendly.

Figure 7: Some precipitation types use different shadings of the same color (snow, rain) while others do not (ice, freezing). Ice pellet showers and rain showers are difficult to tell apart and the color ramp is not colorblind friendly.

Figure 8: This figure shows monthly occurrences of near 0°C conditions are more common when monthly average air temperature is near 0°C. This is quite obvious and does not require a figure. The stations are also impossible to tell apart due to the color ramp.

Figure 9: This figure can also be deleted.

Review references

Auer Jr, A. H.: The rain versus snow threshold temperatures, Weatherwise, 27(2), 67–67, 1974.

Dai, A.: Temperature and pressure dependence of the rain-snow phase transition over land and ocean, Geophysical Research Letters, 35(12) [online] Available from: http://onlinelibrary.wiley.com/doi/10.1029/2008GL033295/full, 2008.

Kienzle, S. W.: A new temperature based method to separate rain and snow, Hydrological Processes, 22(26), 5067–5085, doi:10.1002/hyp.7131, 2008.