Responses to RC1 comments:

1) I found a couple of things lacking in Section 3 (Data collection) that should be addressed. The most significant is the lack of discussion about the data quality control. I found a remark somewhat buried in the README file on the repository stating that "most" files have not been processed but it is unclear if this means that no quality control has occurred in "most" files. This needs to be better stated in the manuscript, either as a general paragraph, or in the sections that describe the individual instruments/systems. Another useful piece of information that should be included where possible and where appropriate is the description of the accuracy and/or uncertainty of the measurements. These have substantial value to data users.

All data files have not been processed and no quality control has been performed by the authors, except for the MRR-2 files, which have been processed using Maahn and Kollias (2012). The following sentence was added to section 3.1: "Only the MRR-2 files were processed and quality controlled using the Maahn and Kollias (2012) algorithm. All other data files have not been processed nor quality controlled by the authors, and are the output of the instrument or manufacturer's software.

Thank you for the comment in regard to the accuracy and/or uncertainty of the measurements. It has been added in a supplementary Table in Appendix A, Table A2. A sentence was added in section 3.1: "The appendix also includes a table giving the uncertainty of each instrument (Table A2).". The Table is reproduced below. Also, the information in section 3.1 is now the introductory paragraph of section 3. The sub-section numbering is used for the instrument descriptions.

Table A2: Summary of the instruments' accuracy. They were found in the user's manual of each instrument. For all instruments except the LiDAR, only the variables found in user's manual are listed. For the LiDAR the information is from the user's manual as well as from Mariani et al. (2020).

Sensor	Model	Measurements	Accuracy
Doppler LiDAR	Halo Photonics Streamline XR	Doppler velocity	< 0.3 m s^{-1} (uncertainty)
		Backscatter coefficient	SNR-dependent
		Intensity	SNR-dependent
		Depolarization ratio (ice/water)	SNR-dependent
		Vertical wind profile (u,v)	0.27 m s^{-1} (uncertainty)
Optical Disdrometer	OTT Parsivel 1	Size of falling particles	±1 size class (0.2 to 2 mm), ± 0.5 size class (>2 mm)
		Speed of falling particles	±1 size class (0.2 to 2 mm), ± 0.5 size class (>2 mm)
	OTT Parsivel 2	Size of falling particles	±1 size class (0.2 to 2 mm), ± 0.5 size class (>2 mm)

		Speed of falling particles	±1 size class (0.2 to 2 mm), ± 0.5 size class (>2 mm)
Micro Rain Radar	Metek MRR 2	Doppler raw spectra	0.53 dB
		Reflectivity (Ze)	0.53 dBZ
		Doppler Velocity (W)	0.109 m s^{-1}
		Spectral Width (σ)	0.09 m s^{-1}
	Metek MRR Pro	Doppler raw spectra	0.25 dB
		Reflectivity (Ze)	0.25 dBZ
		Doppler Velocity (W)	0.09 m s^{-1}
		Spectral Width (σ)	0.09 m s^{-1}
Weather Station	Vaisala WXT 520	2.65 m wind speed	± 3% at 10 m s^{-1}
		2.65 m wind direction	± 3°
		Atmospheric pressure	± 0.5 hPa (0 to + 30°C), ± 1 hPa (-52 to +60°C)
		Temperature	± 0.3°C (at +20°C), ± 0.25°C (at 0°C)
		Relative humidity	± 3% (0 to 90% RH), ± 5% (90 to 100% RH)
		Accumulated rainfall	better than 5%
	Vaisala HMP155	Temperature	0.226 + 0.0028×reading (-80°C to +20°C), 0.055 + 0.0057×reading (+20°C to +60°C)
		Relative humidity	-20°C to +40°C of ± D40(1.0 + 0.008×reading)
	Hobo pro V2 Temp/RH U23-001	Temperature	± 0.21°C from 0°C to 50°C
		Relative humidity	10% to 90% of ± 2.5%, and of ± 5% above 90%
	HC2-S3-L	Air Temperature (Average)	± 0.1°C at 23°C
		Relative Humidity	± 0.8% at 23°C
	RM Young 5103AP-10-L	3 m Wind Speed (Average)	± 0.3 m s^{-1} or 1%
		3 m wind direction	± 3 °
	T109	Temperature -17 cm (Average)	± 0.25 °C (–10 to 70 °C)
		Temperature +15 cm (Average)	± 0.25 °C (–10 to 70 °C)
		Temperature +33 cm (Average)	± 0.25 °C (–10 to 70 °C)
	CS106	Air pressure (sampled)	± 0.6 hPa (@ 0° to 40°C)
	SR50	DT	± 1 cm or 0.4%
		TCDT	± 1 cm or 0.4%
		DBTCDT	± 1 cm or 0.4%

Precipitation Gauge	Geonor T-200B Vibrating Wire Weighing Gauge	Geonor depth (average)	± 0.1%
	OTT Pluvio 1	Precipitation intensity	± 1.0% or ± 6 (whichever is larger)
		Precipitation amount	±.1.0% or ± 0.1 (whichever is larger)
	OTT Pluvio 2	Precipitation intensity	± 1.0% or ± 6 (whichever is larger)
		Precipitation amount	± 1.0% or ± 0.1 (whichever is larger)
	Onset RG3-M Tipping Bucket	Precipitation	±1.0%
	Davis Tipping Bucket 7852	Precipitation	± 4% of total or ± 1 tip of the bucket (0.2 mm)

Mariani, Z., Crawford, R., Casati, B., and Lemay, F.: A Multi-Year Evaluation of Doppler Lidar Wind-Profile Observationsin the Arctic, Remote Sens., 12, 323, https://doi.org/10.3390/rs12020323, 2020.

2) An instrument\site table would be useful in Section 3 indicating which instruments are installed at each site and an indication as to what each instrument measures.
This information is included in Appendix A, Table A1. A sentence was added in section 3.1. "A complete list of all instruments used and their locations is given in Appendix A, Table A1."

3) Unless I missed it, I don't see mention anywhere in the manuscript or on the repository about the time zone for the date timestamp. I realize that discussion of date ranges, etc in the manuscript are stated in UTC but the time zone of the timestamp should be explicitly stated in both the manuscript and the metadata on the repository.
All data that have been submitted to FRDR are in UTC, which is explicitly stated within the data files as well as the attached readme file. The following sentence was added at the end of section 3.1: "All data available in the repository are in UTC.".

4) Comments from supplement:

Line 21: "In other storms" seems a little vague. How about "Often, storms propagating across the divide results in significant precipitation on both sides".
It has been modified accordingly.

Line 38: The sentence is: "This dataset will serve as a baseline for future work on atmospheric conditions over major orographic features by comparing the varying conditions on either side of a large topographic feature."
It has been rewritten as: "This dataset will be used to study atmospheric conditions associated with precipitation events documented simultaneously on either side of a continental divide.".

Line 69: This section seems a bit out of context here. I understand the need but it seems out of place to introduce the previous study and results before introducing the study area. In fact, you may want to move this discussion to the introduction to serve as the impetus for the current study.

Thank you for the suggestion.

- *Sub-sections 2.1 and 2.2 have been moved to the introduction before the paragraph stating the objective of the manuscript.*
- *Section 2.3 is now the only information in Section 2, which is called 'Site description".*

Line 82: Maybe "Study Region and Climatology" would be more appropriate? That would also differentiate this section more from the more descriptive discussion of the study "sites" in the subsequent section.

Thank you for the suggestion. As mentioned in the previous comment, Sub-sections 2.1 and 2.2 have been moved to the introduction before the paragraph stating the objective of the manuscript.

Line 90: Good word :)

Thank you.

Line 93: Delete "in the high mountains"

It has been deleted.

Line 102: I found this sentence just a little awkward. How about "Whitfield and Pomeroy (2016) showed that flooding due to rain-on-snow events occurred more frequently in the late 19th and early 20th centuries than it does in the more recent period."

It has been modified accordingly.

Line 106: This might read better as "The study region consisted of two main areas separated by the continental divide."

It has been modified accordingly.

Line 107: Just a note on a bit of confusion that a reader might encounter in these two paragraphs. You say here that there were two field sites on the eastern side, but there were actually four. Perhaps here is where you need to call these "primary sites". In the 3rd paragraph in this section, you say that there were four sites, but your table lists 5. I think you just need to clean this up a bit.

The section was re-organized to present the main and secondary sites on the eastern side and the main site on the western side. It also takes into account the follows five minor comments. It now reads as follows:

"The study region consisted of two main areas separated by the continental divide. Table 1 summarizes information on the SPADE field sites. On the eastern side, there were two main field sites and two secondary sites. The main sites were: (i) Fortress Mountain Powerline (FMP) at 2076 m ASL and (ii) Fortress Junction Service (FJS), located in a high elevation valley (1580 m ASL) along Alberta Provincial Highway No. 40 (Fig. 1). FMP was chosen as it is the primary field site in the Canadian Rockies Hydrological Observatory (https://research-

groups.usask.ca/hydrology/science/research-facilities/crho.php#Overview), operated by the University of Saskatchewan Centre for Hydrology, and is already well instrumented with hydrometeorological equipment. It is the site of long-standing research (Smith et al., 2017; Conway et al., 2018; Schirmer and Pomeroy, 2020). A maintained road from FJS up to FMP allowed researchers to collect meteorological data during a precipitation phase transition along the mountainside. The frequent phase transition between FJS and FMP justified having two main sites located at valley floor and at higher elevation. Select data were also gathered on an intermittent basis at two secondary sites but not simultaneously. These were (i) from the University of Calgary Biogeoscience Institute (BGI) at 1418 m ASL located on the eastern side of the continental divide, off Alberta Highway No. 40, ~25 km north of FMP; and (ii) from the Storm Mountain Lodge (SML) at 1723 m ASL that was used temporarily on 7 June 2019 in anticipation of a forecasted significant precipitation event. SML is located approximately 5 km east of the continental divide, near the midway point between the Fortress Mountain and NMR sites, along BC Highway 93 (Fig. 1).

The Nipika Mountain Resort (NMR) site was located in a valley on the western side of the divide and was chosen to be comparable to FJS on the eastern site of the divide (Fig. 1). It approaches the latitude of the Fortress Mountain area and has an elevation of 1087 m ASL. NMR is easily accessible via an active logging road off the Banff-Windermere Highway (BC Highway 93). This area has a paucity of active meteorological stations and basic weather instruments were deployed on 21 September 2018, well before the start of the field experiment, to collect baseline data."

Line 113: new sentence
The sentence was: "well instrumented with hydrometeorological equipment and is the site of long-standing research (Smith et al., 2017; Conway et al., 2018; Schirmer and Pomeroy, 2020)."

The text now reads as follows: "well instrumented with hydrometeorological equipment. It is the site of long-standing research (Smith et al., 2017; Conway et al., 2018; Schirmer and Pomeroy, 2020)."

Line 114: Delete "Moreover"
It has been deleted.

Line 115: What does this mean?
The text was "A maintained road from FJS up to FMP allowed researchers to collect meteorological data during transition regions along the mountainside".

It has been changed to the following sentence for clarity: "A maintained road from FJS up to FMP allowed researchers to collect meteorological data during a precipitation phase transition along the mountainside. The frequent phase transition between FJS and FMP justified having two main sites located at valley floor and at higher elevation."

Line 116: This needs clarification

The following has been removed for clarity. "FJS and FMP were chosen to collect wind flow data that would allow the comparison of precipitation amounts from the valley floor to above ridgetop."

Line 121: This sentence is a bit awkward. Since you only have one site on the western side of the divide, how about "The Nipika Mountain Resort (NMR) site was located in a valley on the western side of the divide and was chosen to be comparable to FJS on the eastern site of the divide (Fig. 1)."
The sentence has been changed accordingly.

Line 131: You should add site abbreviations here somewhere
The abbreviations were added to Table 1.

Table 1: A summary of the field sites that were used during the field campaign including information about their location, elevation, access to AC power, and dates that instruments were operational.

Location	**Coordinates**		**Elevation**	**Access to AC Power**	**Dates**
	Latitude (° N)	Longitude (° W)	m ASL	Y/N	during field campaign
Fortress Mountain Powerline (FMP)	50.824	115.197	2076	Y	2019-04-26 to 2019-06-25
Fortress Junction Service (FJS)	50.786	115.161	1580	Y	2019-04-26 to 2019-06-25
Nipika Mountain Resort (NMR)	50.612	115.801	1087	N	2018-09-21 to 2019-06-22
Storm Mountain Lodge (SML)	51.253	115.999	1723	Y	2019-06-07 to 2019-06-08
Biogeoscience Institute (BGI)	51.027	115.034	1418	Y	2019-04-25 to 2019-06-05, 2019-06-09 to 2019-06-25

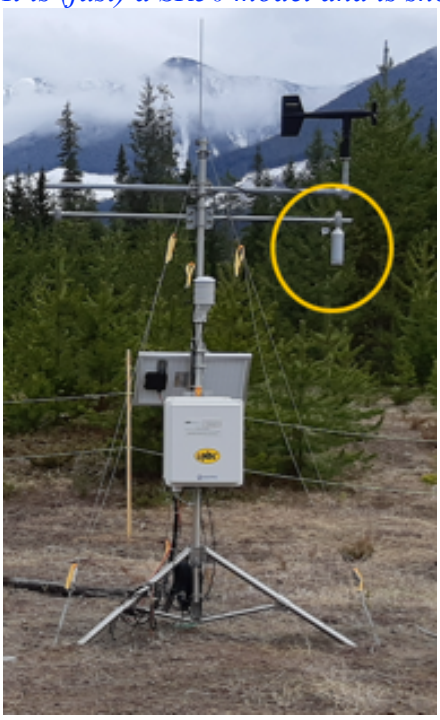
Line 136: Since you use site abbreviations in the text, it would be useful to add them to the figure caption text as well.
The site abbreviations were added to the caption of Figure 1. It now reads:
"Figure 1: Map of the SPADE field campaign domain in British Columbia and Alberta with the location of the field sites (white dots), which are Nipika Mountain Resort (NMR), Storm Mountain Lodge (SML), Fortress Mountain Powerline (FMP), Fortress Junction Service (FJS), and the University of Calgary Biogeoscience Institute (BGI), the major city of Calgary (grey dot), and the continental divide (red line). Local rivers are shown in blue and labelled. The inset map shows the SPADE field campaign area (red outline) in relation to western Canada."

Line 146: This sentence is a bit confusing. "The FMP site, also known as the Fortress Mountain Snow Laboratory within the regional Canadian Rockies Hydrological Observatory, and some of the instruments located at FMP, but not used in the SPADE campaign, are described in Smith et al. (2017), Conway et al. (2018), and Schirmer and Pomeroy (2020)." It may not be necessary

However, if you leave it here, it needs to be re-worded. Perhaps "The FMP site is also known as the Fortress Mountain Snow Laboratory and operates within the regional Canadian Rockies Hydrological Observatory. Other projects and instrumentation at this site are described in...".
The sentence has been changed accordingly.

Line 153: Besides the photos, and the descriptions below, I suggest a summary table list the instrument name, what sites that it is installed at (which might be redundant since I believe you state that the sites are identical except for the LiDAR), and what the instrument measures. This should probably match what is contained in the repository.
This information is contained in Appendix A, Table A1. See response to comment #2 for the Table.

Line 165: Is this just an SR50 or is it an A or AT model?
It is (just) a SR50 model and is shown in Figure 3a (see below).



Line 166: You need to be more specific as to the reference level. Is above ground + or - ?
The sentence has been clarified to "… soil and snow temperatures at a depth of 17 cm below ground (i.e. -17 cm) and heights of 15 cm and 33 cm above bare ground (T109).".

Line 190: Section 3.6: Precipitation gauges. "Just a note here. I don't see any discussion about adjusting solid precipitation measurements for systematic undercatch. I think at least the impact of this should be mentioned. »
A sentence has been added at the beginning of section 3.6. The sentence is as follows: "No adjustment for wind under-catch of solid precipitation was performed on the archived data. We acknowledge that this would affect the data and they should be used with caution."

Line 214: Technically, "B" should be superscript

It has been changed. It now reads "… $T200_B$)".

Line 212: Just wanted to confirm that this is true for both generations of Pluvio gauges: "every 6 s with a resolution of 0.001 mm (OTT, 2010)."
Thank you for the information.

Line 214: Pluvio 1, 1 should be subscript.
It has been corrected.

Line 215: My understanding is that the Pluvio1 output mimics a tipping bucket tip every 0.1 (?) mm while the Pluvio2 has several output options. Will you describe any of this? I think a knowledgable data user may be interested in what Pluvio2 output(s) you are archiving and if you do any data filtering.
We have archived the following outputs: Intensity (real-time), Accumulation (real-time/non real-time), Accumulation (non real-time), total accumulation (non real-time), bucket content (real-time), bucket content (non real-time). No filtering/processing has been applied to these data. A sentence has been added to sub-section 3.6.3.

Line 220: I know what you mean here but a reader may not. It somewhat implies that the orifice was at ground level. I think you want to say the "the orifice was levelled with respect to the ground".
The sentence has been revised to:"…lumber base and the orifice was levelled with respect to the ground…".

Line 222: delete frequencies to depth
The new sentence is: "The CR1000X data logger was configured to sample the period average frequency from each vibrating wire sensor, this frequency is used to compute the average amount of liquid equivalent precipitation of the three sensors and the standard deviation across them.".

Line 224: Are you archiving precipitation amounts as bucket weight differentials or are just archiving the bucket weights? Any discussion about data processing?

The Geonor_Depth_Average has been archived and is the average of bucket weight from the three sensors and the StdDev corresponds to that average. It is indeed unprocessed aside from using the sensor calibration factors to convert raw frequencies to weights (in mm water). A sentence has been added for clarity. It reads: "The resultant time series obtained from the bucket weight describes cumulative precipitation, including the average and standard deviations of the three sensor depths".

Line 267: This sentence gets awkward and needs to be broken up. The sentence is "Three MRR-2 instruments were used in this study and were deployed at FMP installed at a height of z = 533 cm above bare ground; vertical resolution of Δz = 200 m), prior to the field campaign, FJS (z = 235 cm; Δz = 35 m) on 24 April 2019, and at NMR (z = 273 cm; Δz = 200 m) on 1 May 2019 for the duration of the field campaign (Fig. 3j)."

The sentence has been updated as follows: "Three MRR-2 instruments were used in this study and were deployed at the 3 main sites: 1) at FMP installed at a height of 533 cm above bare ground with a vertical resolution of 200 m, 2) at FJS installed at 235 cm above bare ground with a vertical resolution of 35 m, and 3) at NMR installed at 273 cm above bare ground with a vertical resolution of 200 m (Fig. 3j)."

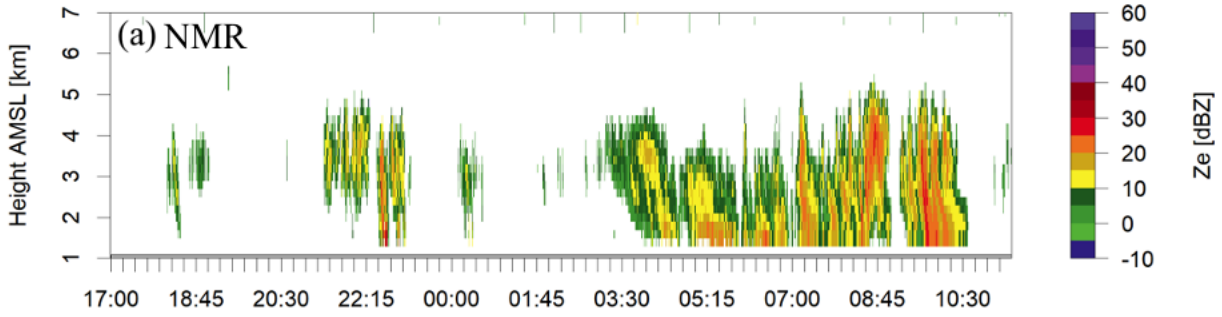
Line 272: You need to clarify what this means. I think you can just say that the output is in NetCDF format.
Yes, that is correct. The sentence has been clarified to: "… and available in NetCDF format".

Also the section has been re-organised for clarity as requested in comment #1. We moved the following sentence before introducing the MRR-PRO. "The MRR-2 retrievals were processed with a noise removal algorithm (Maahn and Kollias, 2012) to increase the instrument sensitivity to -14 dBZ and, therefore, enhancing the detection of light solid precipitation." Then, the MRR-2 is discussed, followed by the MRR-PRO.

Line 323: measured with?
It has been clarified that these data were measured with an OTT Pluvio[1]. The new sentence is: "During this time, a total of 15.3 mm of precipitation was collected at FMP by the Pluvio[1],…".

Line 324: Measured with?
It has been clarified that these data were measured with a Geonor. The new sentence is: "…this is in contrast to the 1.4 mm of precipitation collected at NMR by the Geonor with an average…"

Line 347: It would be useful to label the plots with the site abbreviations. Ditto for Figure 6
The abbreviations were added directly to the plots in Figures 5 and 6. The new figures are:



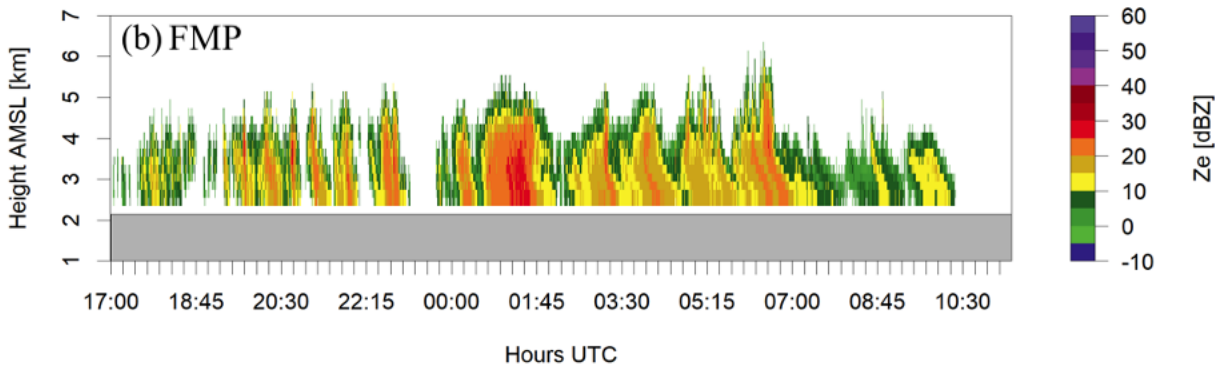
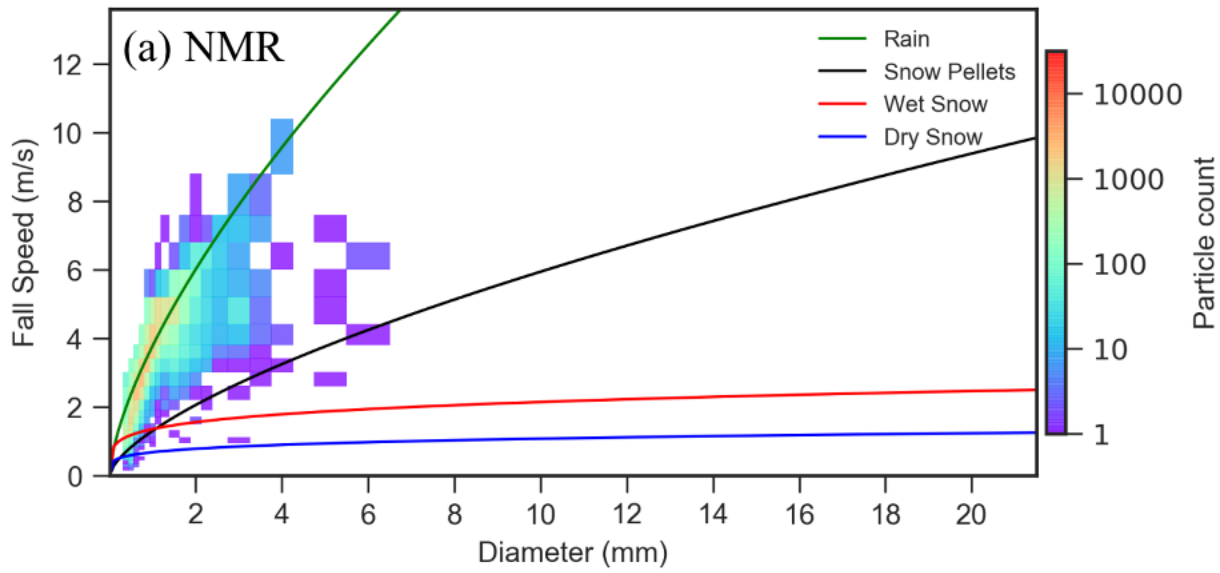


Figure 5: MRR-2 vertical profile of reflectivity (Ze) from 1700 UTC 4 May–1130 UTC 5 May for (a) NMR and (b) FMP. The grey shading is below ground level. Data from the MRR-2 has been processed using Maahn and Kollias (2012).



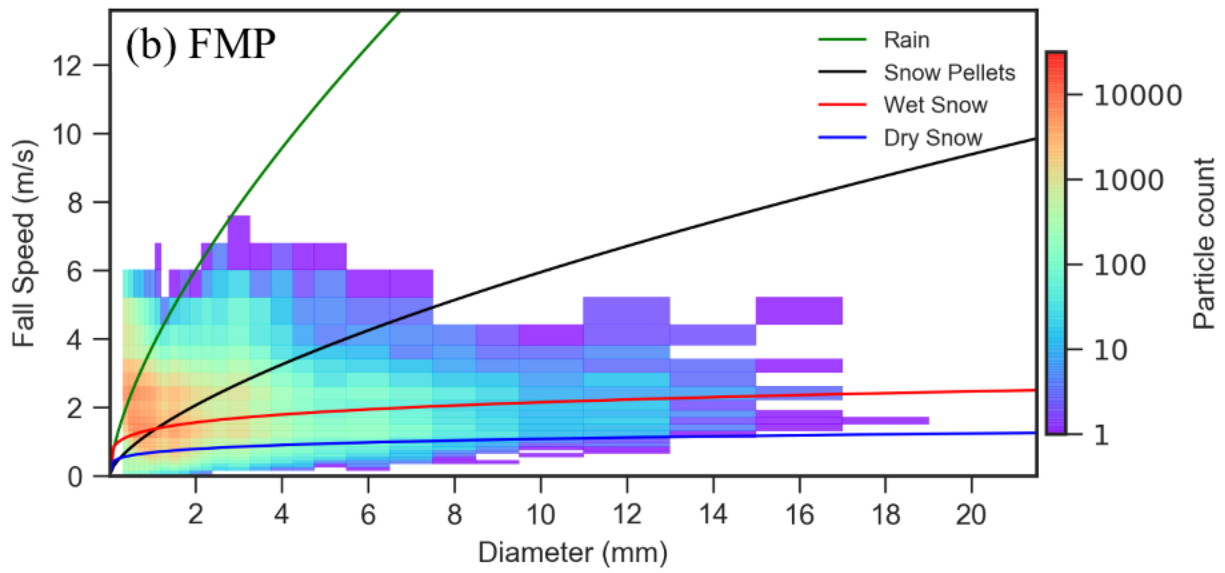


Figure 6: The particle diameter and fall speed distribution of hydrometeors from 1700 UTC 4 May–1130 UTC 5 May at (a) NMR and (b) FMP. Rain (green line), wet snow (red line), dry snow (blue line), and snow pellets (black line) particles. The rain fallspeed-diameter relationship is from Atlas and Ulbrich (1977) and the solid precipitation from Rasmussen et al. (1999). The number of particles that fall in each fall speed- diameter bin is indicated by the colour.

Responses to Reviewer #2 comments

1. The SPADE was carried out by using existing weather instruments along with the setting up of new ones. As the focus of this experimental campaign is to monitor extreme precipitation events in areas of complex topography, I am particularly interested about why different types of rain gauges were chosen. I am wondering about this issue because it is well-known that tipping bucket rain gauges underestimate extreme rainfall intensities. Moreover, the response and uncertainty of both the HOBO and Davis is different, and also present biases when compared to e.g. Hellmann rain gauges. OTT and Geonor are more accurate as measure continuous precipitation quantity both in rain and ice form. Therefore, the authors should better discuss why different brands (HOBO vs. Davis; OTT vs. Geonor) are used, instead of only one for data consistency.

More remote locations on the western side of the divide were furnished with tipping bucket rain gauges instead of weighing gauges due to logistical challenges of installing such gauges on steep sloping terrains,additional weighting-type gauges as well as the lack of battery or AC power. Mainly liquid precipitation was reported where the tipping buckets were installed, which reduces the issue of wind undercatch of solid precipitation.

We were aware of potential discrepancies between tipping bucket rain gauges and weighing gauges, so the HOBO tipping bucket rain gauge was deployed alongside the Geonor at the Nipika Mountain Resort field site for 8 days to conduct a comparison study. This period

coincided with one of the more intense precipitation events at Nipika Mountain Resort. Cumulative precipitation amounts between the HOBO tipping bucket rain gauge and the Geonor were very similar over this period (difference of ±3 mm) as shown in Figure A.

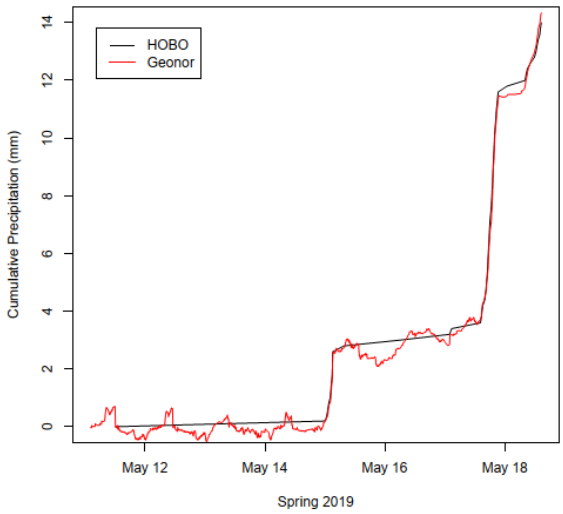


Figure A. *Comparison between precipitation accumulation at a HOBO tipping bucket rain gauge and a Geonor weighing gauge at Nipika Mountain Resort, 11-19 May 2019.*

We were not able to do a direct comparison of the two types of tipping buckets in the field as well as a comparison with the Davis tipping bucket and the Geonor at Nipika Mountain Resort; however we did not record any discrepancies between the two brands of tipping buckets during our calibrations and our experiments. All of our tipping buckets tipped at increments of 0.2 mm and had the same operating temperature range. To avoid brand-related differences, we only included one brand of tipping bucket in our gauge transect (Davis Tipping Buckets). HOBO data from this paper were only acquired at the Storm Mountain Lodge site and were used to verify MRR returns during one precipitation event which lasted approximately 25 hours.

As for the Geonor and OTT Pluvio, they have the same configuration for catching precipitation and very similar rates of wind induced undercatch (Milewska et al., 2018). These gauges are so similar in their performance that Environment and Climate Change Canada uses the same transfer functions to adjust accumulated precipitation.

A few sentences were added at the beginning of section 3.6 for clarity: "Several types of precipitation gauges were installed and used during the field campaign. At our three main field sites, we used shielded weighing gauges (OTT Pluvio and Geonor). These shielded-gauges are well-known for their accuracy and have been used interchangeably by Environment and Climate Change Canada (Milewska et al. 2018). Tipping bucket rain gauges were installed at our "secondary" field sites (HOBO and Davis tipping bucket rain gauges) due to the remoteness of the locations, logistical and power constraints. The HOBO tipping bucket had been previously tested and showed good accuracy when compared to the Geonor for rain. Additional efforts were made to reduce wind induced undercatch by placing the gauges in sheltered areas and to reduce evaporative losses by removing the debris screens."

Additional reference:
Milewska, E. J., Vincent, L. A., Hartwell, M. M., Charlesworth, K., & Mekis, É.: Adjusting precipitation amounts from Geonor and Pluvio automated weighing gauges to preserve continuity of observations in Canada, Can. Water. Res. J., 44, 127-145, https://doi.org/10.1080/07011784.2018.1530611, 2019.

2. In relation to the first comment, did the authors apply a calibration of tipping bucket rain gauges in the lab? It is also well-known that the precision of these instruments is not 100% accurate when delivered from the factories; i.e., not always 0.2 mm tip-1. Therefore, it is mandatory to test the rain gauge calibrations before setting up them in the field. Moreover, data from the HOBO and Davis rain gauges was collected by means of dataloggers. However, this is not described in the manuscript.
We implemented a testing procedure whereby we ensured that each rain gauge tipped at 0.2 mm over several repetitions and that each datalogger successfully recorded accurate amounts of water accumulation. These tipping buckets were not factory-issued, they were on loan from the BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development where they had been previously used.

Thank you for drawing attention to missing information regarding dataloggers. Odyssey rain gauge loggers were used to record precipitation accumulation from the Davis tipping buckets and Onset HOBO data loggers were used to record precipitation accumulation from the HOBO rain gauges.

A sentence has been updated in the manuscript in Section 3.6.1: "The HOBO tipping bucket rain gauge (RG3-M) measures liquid precipitation at a resolution of 0.2 mm tip^{-1} and was recorded using an Onset HOBO data logger."

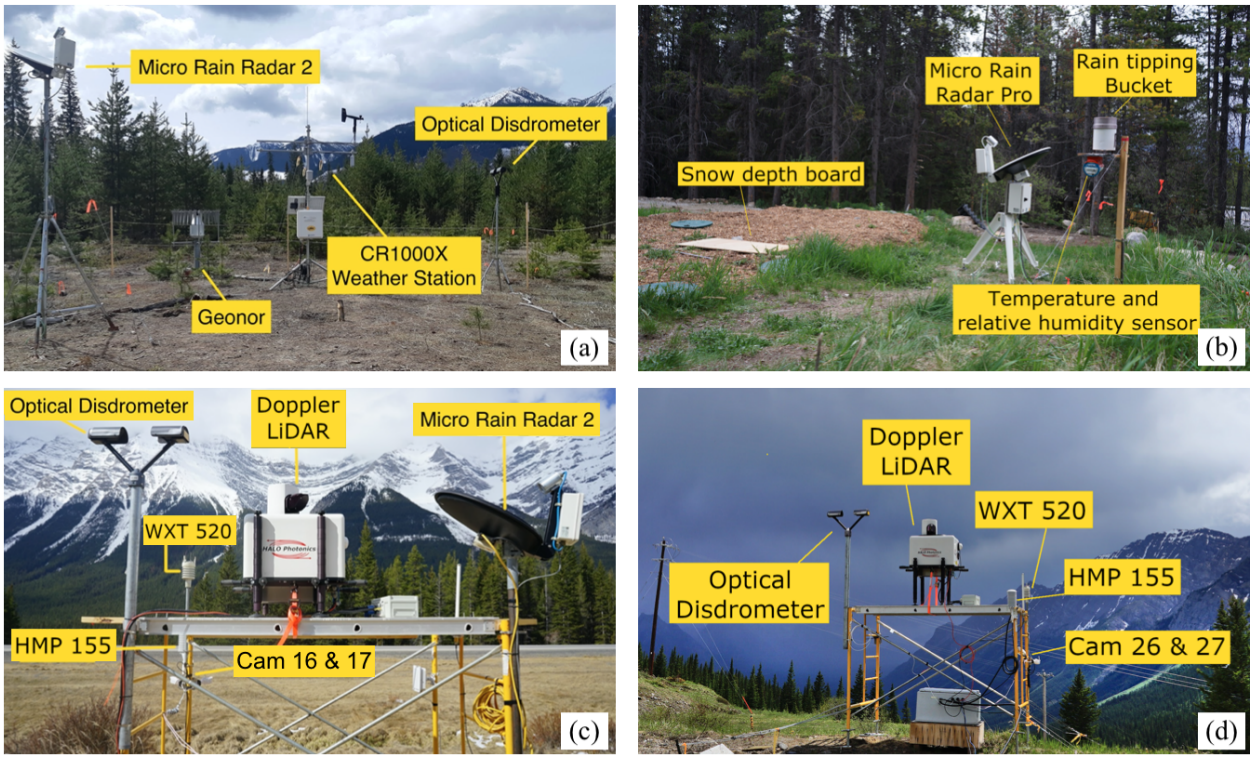
A sentence has been updated in the manuscript in Section 3.6.2: "Liquid precipitation was measured at a resolution of 0.2 mm tip^{-1} and recorded using Odyssey rain gauge data loggers."

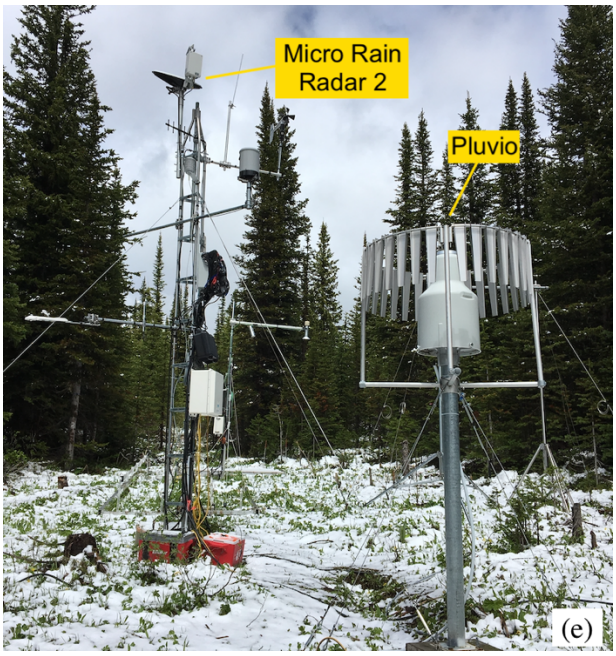
3. Precipitation has a strong dependence to wind speed in mountain areas. In this experiment, the research team used them without single alter shields (tipping bucket rain gauges). This wind screen can strongly minimize the losses of precipitation due to wind, which is commonly moderate to strong (downburst, outflows, etc.) under deep convection or heavy orographic precipitation. The underestimation of precipitation due to wind can directly affect not only the monitoring of these events, but also the climatology / hydrology.
Thank you for this comment. Indeed, precipitation gauges are susceptible to wind undercatch in windy environments and so are often installed with an Alter or other type of wind shield. This is particularly an issue with solid or mixed precipitation rather than rainfall. Alter shields were installed for the two Pluvio^2 and the Geonor precipitation gauges but not the tipping bucket rain gauges; however, the latter were placed in clearings near groups of trees to provide shelter and reduce wind in the area. Temperatures at these sites remained above freezing and only liquid precipitation likely fell during the measurement campaign. In addition, the tipping bucket rain

gauges were not installed in alpine terrain where winds would be a more significant factor. As such, we believe the tipping bucket rain gauges provide an accurate account of the rainfall that occurred along this longitudinal transect where other in situ precipitation data are absent. The intercomparison between the cumulative precipitation recorded by the shielded Geonor and the unshielded HOBO tipping bucket rain gauge at Nipika Mountain Resort (see Fig. A) also suggests the latter operated reasonably well at catching liquid precipitation. Nonetheless, additional precautions are needed in the use and application of the data recorded by the tipping bucket rain gauges.

4. Figure 2 shows the instrumentation set up of the stations. I miss two things:
(i) all instrument should be labelled in each picture; and (ii) a layout of the weather station(s) with the distance between instruments would be very informative. For instance, in (a) it looks like the weather mast is higher than the Geonor, so depending on the distance between both could be (or not) impact on the precipitation measurements.

(i) We believe that all instruments are shown in Figure 2. However, the shielded Pluvio located at Fortress Junction Service (FJS) is shown in Figure 3f. We also noticed that a picture of the Fortress Mountain Powerline (FMP) MRR and Pluvio are missing. A picture has been added to Figure 2e showing them.





ii) In Figure 2a, the Geonor is located approximately 10 m from the weather station mast. They are located at this distance to ensure that there is no interference between the sensors. Additionally, the placement of the instruments was constrained due to cable length and the remote nature of the Nipika Mountain Resort field site. A Pluvio was also used at FJS (Figure 2c) and was located approximately 7 m from the other instruments on the scaffold. The instruments in Figure 2d are located approximately 200 m from the instruments in Figure 2e. Only the Pluvio and the MRR-2 from Figure 2e were used in our research. All other instruments in the photo are not part of SPADE.

5. Authors published the collected meteorological data freely. However, they should better discuss the quality control checks they applied.
The following sentence was added to section 3.1: "MRR 2 files were processed using the Maahn and Kollias (2012) algorithm. All other data files have not been processed nor quality controlled by the authors, and are the output of the instrument or manufacturer's software.".

6. The manuscript lacks of a discussion section about the "state-of-the-art". They concluded that their dataset is "valuable and unique", however, why? For instance, they do not compare their uniqueness against other field experimental campaigns conducted in other regions. This must be further improved in a revised version of the manuscript; it should be described in the Introduction, and discussed in a final discussion section.
Thank you for the comment a paragraph was added to the introduction and in the discussion.

New paragraph in the introduction reads as follows:
"Past field experiments focused on cold season precipitation such as rain-snow transitions and snowfall were held in mountainous regions around the world. In North America, the occurrence of rain-snow transitions has been studied in the Western Cordillera of the United States for many decades. This includes research in the Sierra Nevada Mountains (Marwitz, 1986) in Washington

State called Improvement of Microphysical Parameterization through Observations Verification Experiment (IMPROVE, Stoelinga et al., 2003) as well as the Olympic Mountains Experiment (OLYMPEX, Houze et al. 2017), and in the Idaho Mountains to study orographic precipitation and weather modification (Tessendorf et al. 2018). Other projects around the world were also held to study cold season precipitation processes such as in the Swiss Alpes (Steiner et al., 2003) as well as in China, where a recent field study occurred in the Haituo Mountains north of Beijing (Ma et al., 2017). Nevertheless, none focused specifically on collecting high-resolution automatic and manual precipitation data simultaneously across a major continental divide. In particular, the combination of sophisticated instruments such as the Micro Rain Radars, disdrometers and microphotography located on both sides of the continental divide as well as Doppler lidars measuring air flow at two elevations in mountainous terrain.

Additionally, a sentence was added at the end of the paragraph stating the goal of the paper: "It fills in the gaps in the well-instrumented hydrometeorological measurements and long-standing research conducted at Fortress Mountain, a Canadian Rockies Hydrological Observatory (https://research-groups.usask.ca/hydrology/science/research-facilities/crho.php#Overview)*."*
A few sentences were added in the discussion (Section 6) that now reads as follows:
"A valuable dataset was collected during the Storms and Precipitation Across the Continental Divide Experiment that was held in April–June 2019 in the Canadian Rockies. SPADE was initiated to enhance our knowledge of the atmospheric processes leading to storms and precipitation across a large orographic feature by gathering meteorological data. This leads to a unique dataset to specifically address this critical issue of water redistribution and availability over North America. Furthermore, it augmented the large effort in monitoring hydrometeorological conditions in the Canadian Rockies."

7. The SPADE monitored 13 storms over a two-month period, and authors concluded that these events occurred under varying atmospheric conditions. Even though this is a paper focused on a description of the data, a brief summary (maybe in a table) of the triggers and atmospheric circulation (upslope vs. downslope flows) of these events should be described.
Thank you for the suggestion but this information will be included in a publication about the scientific findings. The manuscript is currently in preparation.

8. Weather station was powered by a 12V battery; what is the AH of the battery?
The weather station at Nipika Mountain Resort was powered by a BP42 12V 42AH battery supplied by Campbell Scientific Canada. The battery was continuously recharged during daytime by a 30 W solar panel (see Fig. 2a). A sentence was added to the revised manuscript for clarity in Section 3.2: "A CR1000X data logger powered by a 30 W solar panel and 12 V 42 AH battery was used to operate sensors and collect data."

9. Another concern is about the time intervals of the average, which was changed by the beginning of May from 15 to 5 min averages. However, the SPADE field campaign was initiated on April 24th. Moreover, there are inconsistencies in the measuring intervals among instruments. For instance, WXT520 collected data at 1-minute resolution. A better justification and a table with a summary of the sample and average intervals used should be included and discussed.
As outlined in Section 3.2 of the submitted manuscript, the weather station at Nipika Mountain Resort was deployed on 21 September 2018 to collect baseline data during the fall and winter seasons preceding the

SPADE intensive observation period. Given the lack of AC power at this site and a reliance on a 12V battery recharged by a 30 W solar panel, a 15-minute interval was selected as a compromise between high temporal resolution and a limited power supply.

Once a team of researchers returned to the site in early May 2019, we increased the temporal resolution to 5-minute intervals for better comparisons with the data collection effort on the eastern side of the continental divide. This is possible at the time because daylight hours are much longer. In contrast, this was not an issue at Fortress Mountain sites (FMP and FMJ) because of the access to AC power.

We acknowledge that it would have been optimal to also collect data at 1-minute intervals at Nipika Mountain Resort but this could have led to power interruptions and loss of critical data. For our purposes, the 5-minute intervals provide sufficiently high temporal resolution data on atmospheric conditions on the western side of the continental divide, complementing the data collection efforts at Fortress Mountain.

A sentence was added in the manuscript in Section 3.2 "Given the reliance on a solar-charged battery, the 5-minute interval was chosen as a compromise between high temporal data and a limited power supply to ensure that there were no outages and resulting losses of critical data."

10. I am wondering about the use of the "improvised radiation shield attached to a wooden post". How reliable these air temperature and relative humidity measurements are? In principal, they are not protected against long- and short-wave radiation, precipitation, etc., as it is mandatory following the guidelines to methods of observations of the World Meteorological Organization. Can you please discuss and include a picture of this radiation shield?

The radiation shield is pictured in Fig. 3d and it provided protection from precipitation and incoming solar radiation while allowing for sufficient air flow around the sensor. This sensor was primarily used for the Storm Lodge deployment as a means to differentiate whether air temperature was below freezing during a storm event, not to explicitly record high accuracy temperature and humidity values. As such these data are secondary to the primary data collection objectives of the deployment.

The word 'improvised' was replaced by 'temporary' and a sentence was added in section 3.6.1 for clarity. "The instrument was housed in a temporary radiation shield attached to a wooden post at 120 cm AGL in a clearing and was level to the ground. This sensor was primarily used for the Storm Lodge deployment as a means to differentiate whether air temperature was below freezing during a storm event, not to explicitly record high accuracy temperature and humidity values."