Supplementary materials for 'Can high-resolution convection-permitting climate models improve flood simulation in southern Quebec watersheds?'

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14 **Supplementary Materials S1 – Weather station information and histograms of Intensity-Frequency**

15 **distribution of hourly precipitation**

16 Figure 3 in the paper presents the intensity–frequency distribution of hourly precipitation (>0.1 mm/hour)

17 over a 10-year period at the Montréal-Trudeau airport weather station. The remaining stations exhibit similar

18 patterns, based on hourly precipitation data from the 2014–2023 period. Information about all weather

19 stations is provided in Table S1. The figures presented here show the intensity–frequency histograms for the

20 remaining weather stations.

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22   Table S1. Weather stations information

	Weather stations' name from Environment and Climate Change Canada website[1]	Latitude	Longitude
1	BEAUPORT	46.84ºN	71.20ºW
2	DESCHAMBAULT	46.69 ºN	71.97 ºW
3	LETAPE	47.56 ºN	71.23 ºW
4	STEFOYULAVAL	46.78 ºN	71.29 ºW
5	LEMIEUX	46.30 ºN	72.06 ºW
6	QUEBEC/JEAN LESAGE INTL	46.80 ºN	71.38 ºW
7	FRELIGHSBURG	45.03 ºN	72.85 ºW
8	MCTAVISH	45.50 ºN	73.58 ºW
9	NICOLET	46.23 ºN	72.66 ºW
10	STE-CLOTILDE	45.17 ºN	73.68 ºW
11	MONTREAL/ST-HUBERT	45.52 ºN	73.42 ºW
12	SAINT-GERMAIN-DE-GRANTHAM	45.83 ºN	72.54 ºW
13	SHERBROOKE	45.44 ºN	71.69 ºW
14	THETFORD MINES RCS	46.05 ºN	71.27 ºW
15	BEAUCEVILLE	46.21 ºN	70.79 ºW
16	STE-ANNE-DE-BELLEVUE 1	45.43 ºN	73.93 ºW
17	ST-ANICET 1	45.12 ºN	74.29 ºW
18	LACADIE	45.29 ºN	73.35 ºW
19	MONTREAL/PIERRE ELLIOTT TRUDEAU INTL [2]	45.47 ºN	73.74 ºW
20	CHARLEVOIX	47.28 ºN	70.64 ºW
21	CAP TOURMENTE	47.08 ºN	70.78 ºW
22	FORET MONTMORENCY RCS	47.32 ºN	71.15 ºW
23	LAPOCATIERE	47.36 ºN	70.03 ºW
24	RIVIERE DULOUP	47.81 ºN	69.55 ºW
25	SAINT MICHEL DES-SAINTS	46.82 ºN	74.09 ºW
26	LATUQUE	47.41 ºN	72.79 ºW

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[1] https://climate.weather.gc.ca/historical_data/search_historic_data_e.html
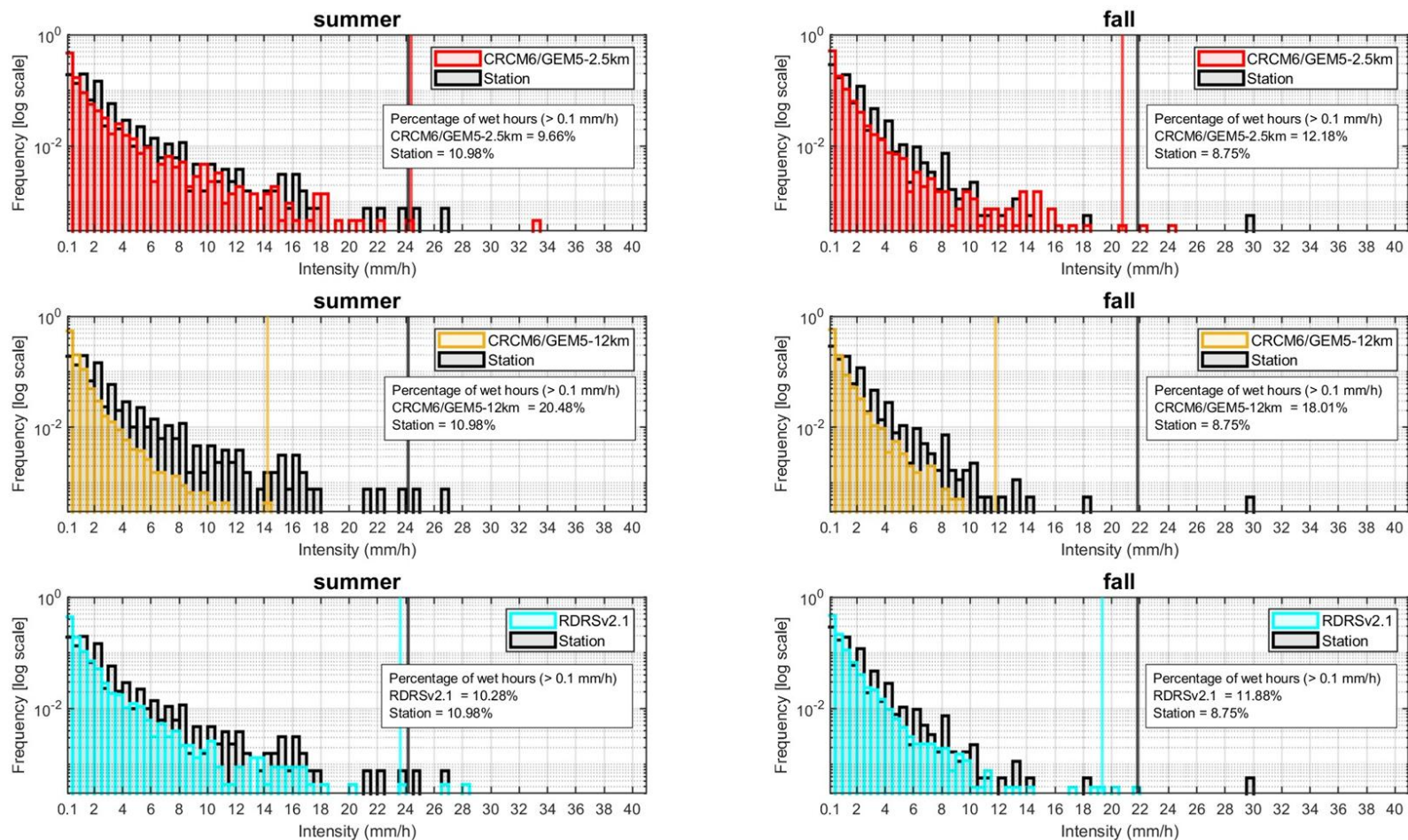[2] The station has been shown in main part of the paper

Figure S1. Black bins represent weather station data (2014–2023), yellow bins correspond to CRCM6-12 km (2011–2020), red bins correspond to CRCM6-2.5 km (2011–2020), and cyan bins correspond to RDRS (2009–2018). The vertical line represents the 99.99th percentile for each dataset. Left-side panels correspond to summer seasons (a, c, e), and right-side panels correspond to fall seasons (b, d, f). The bin size is 0.5 mm.
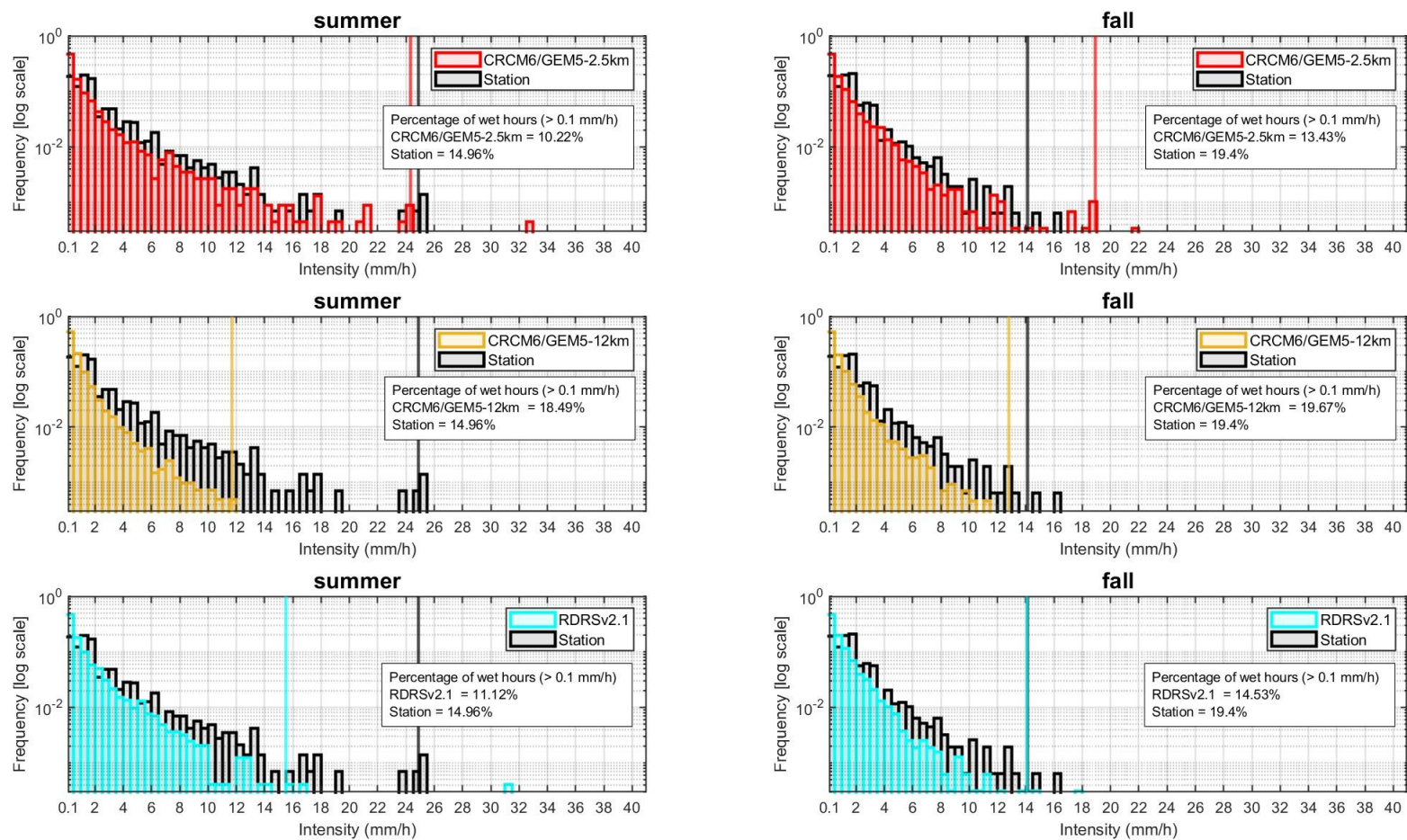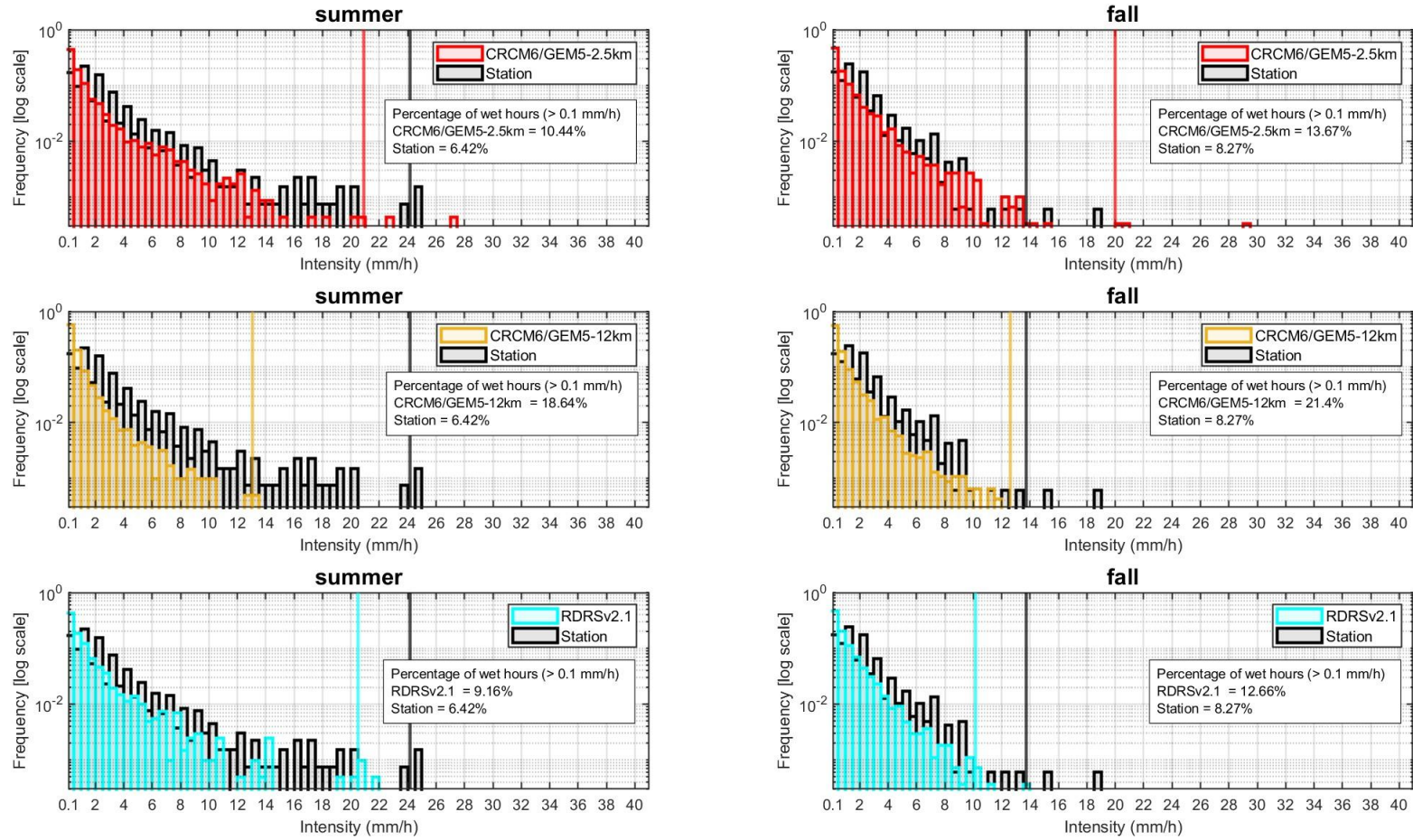
BEAUPORT Station

Figure S2. Black bins represent weather station data (2014–2023), yellow bins correspond to CRCM6-12 km (2011–2020), red bins correspond to CRCM6-2.5 km (2011–2020), and cyan bins correspond to RDRS (2009–2018). The vertical line represents the 99.99th percentile for each dataset. Left-side panels correspond to summer seasons (a, c, e), and right-side panels correspond to fall seasons (b, d, f). The bin size is 0.5 mm.
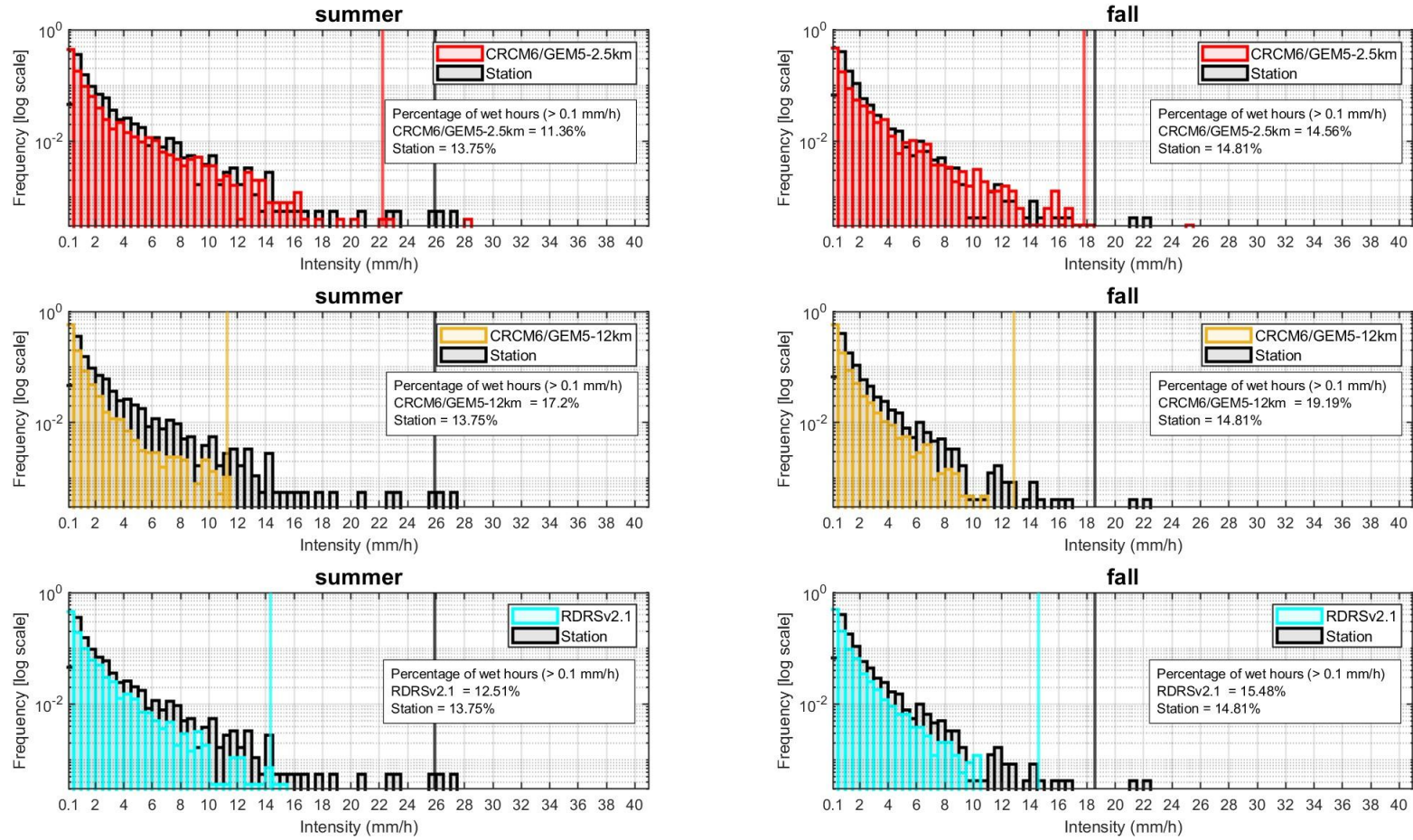
CAP TOURMENTE Station

Figure S3. Black bins represent weather station data (2014–2023), yellow bins correspond to CRCM6-12 km (2011–2020), red bins correspond to CRCM6-2.5 km (2011–2020), and cyan bins correspond to RDRS (2009–2018). The vertical line represents the 99.99th percentile for each dataset. Left-side panels correspond to summer seasons (a, c, e), and right-side panels correspond to fall seasons (b, d, f). The bin size is 0.5 mm.
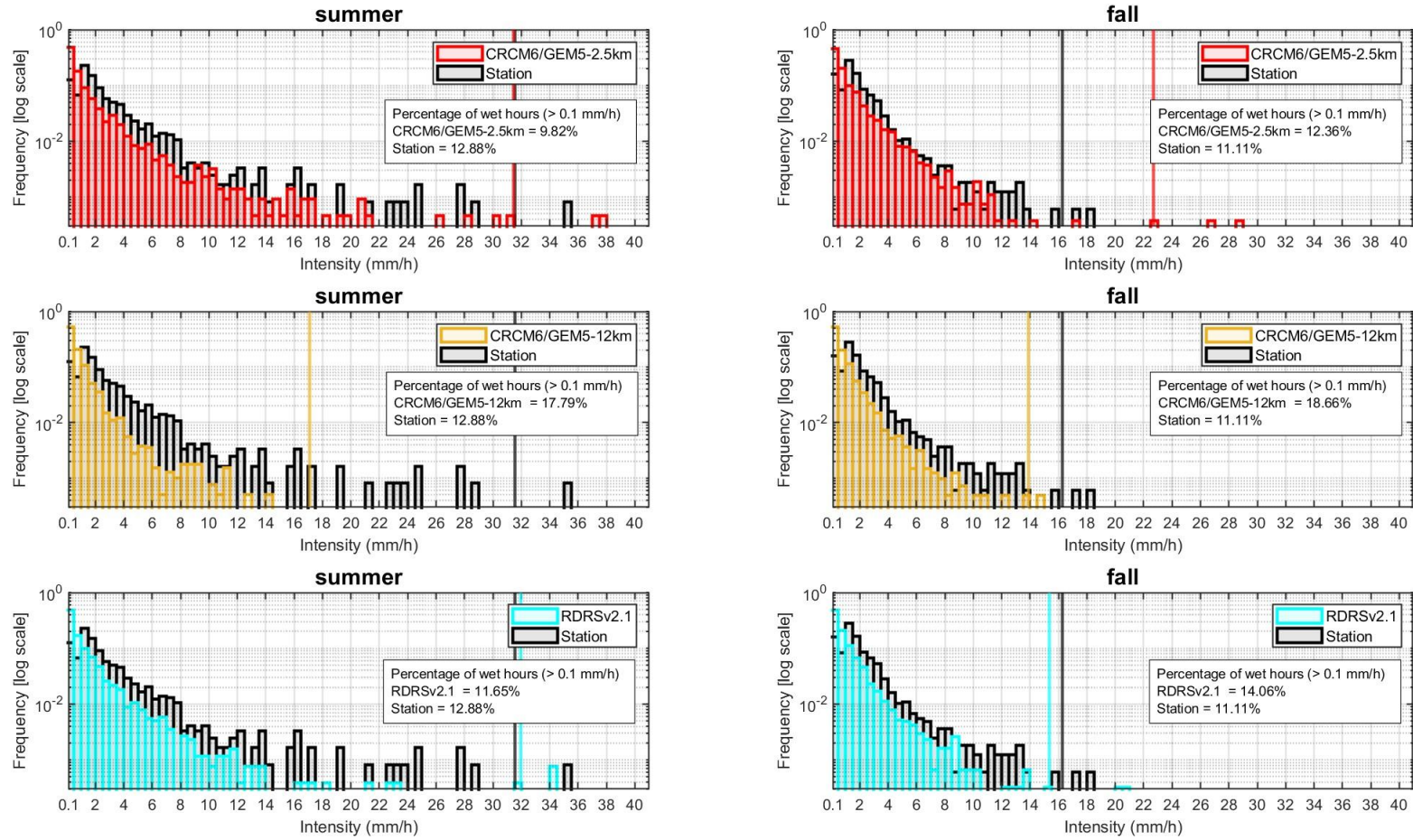
CHARLEVOIX Station

Figure S4. Black bins represent weather station data (2014–2023), yellow bins correspond to CRCM6-12 km (2011–2020), red bins correspond to CRCM6-2.5 km (2011–2020), and cyan bins correspond to RDRS (2009–2018). The vertical line represents the 99.99th percentile for each dataset. Left-side panels correspond to summer seasons (a, c, e), and right-side panels correspond to fall seasons (b, d, f). The bin size is 0.5 mm.
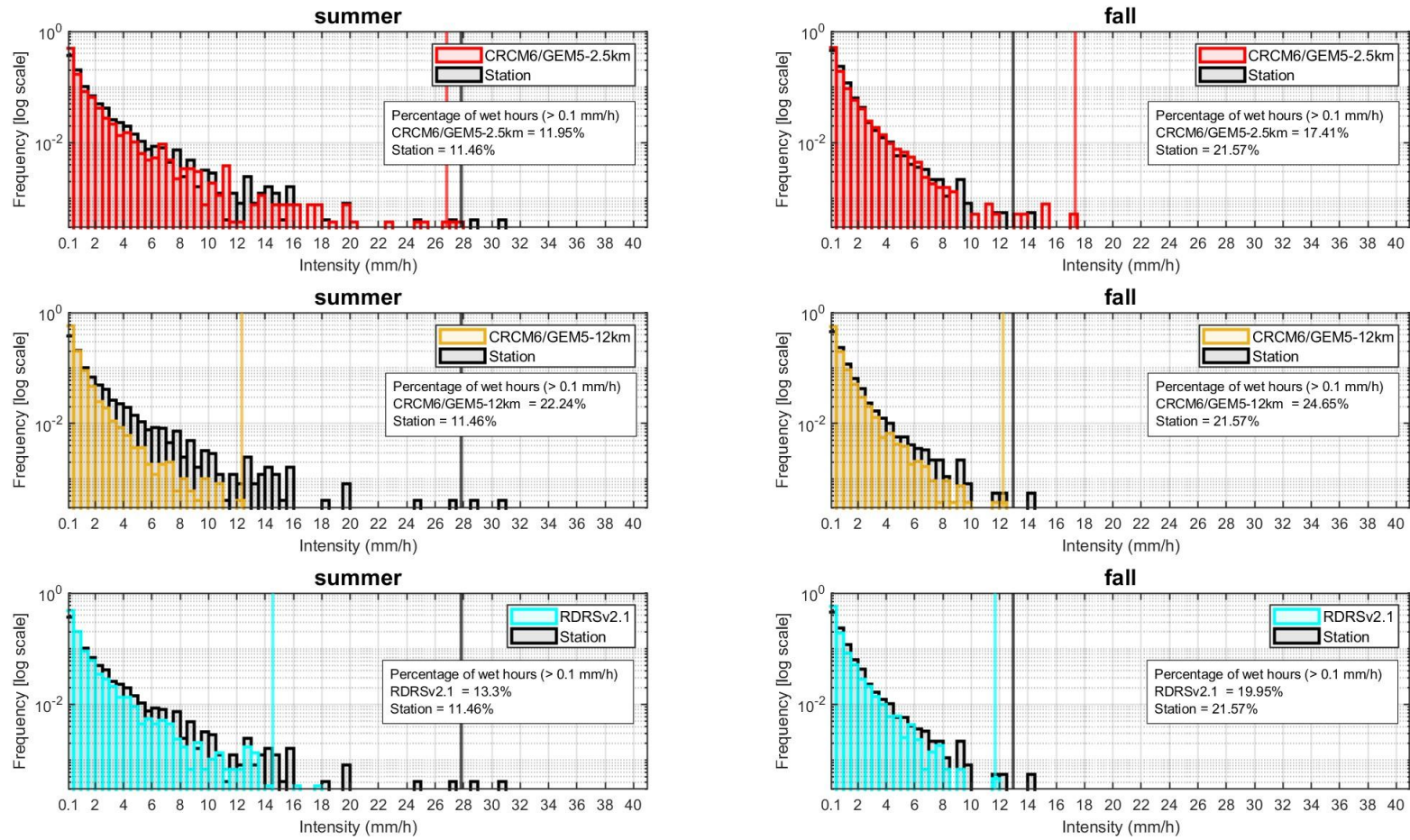
Figure S5. Black bins represent weather station data (2014–2023), yellow bins correspond to CRCM6-12 km (2011–2020), red bins correspond to CRCM6-2.5 km (2011–2020), and cyan bins correspond to RDRS (2009–2018). The vertical line represents the 99.99th percentile for each dataset. Left-side panels correspond to summer seasons (a, c, e), and right-side panels correspond to fall seasons (b, d, f). The bin size is 0.5 mm.
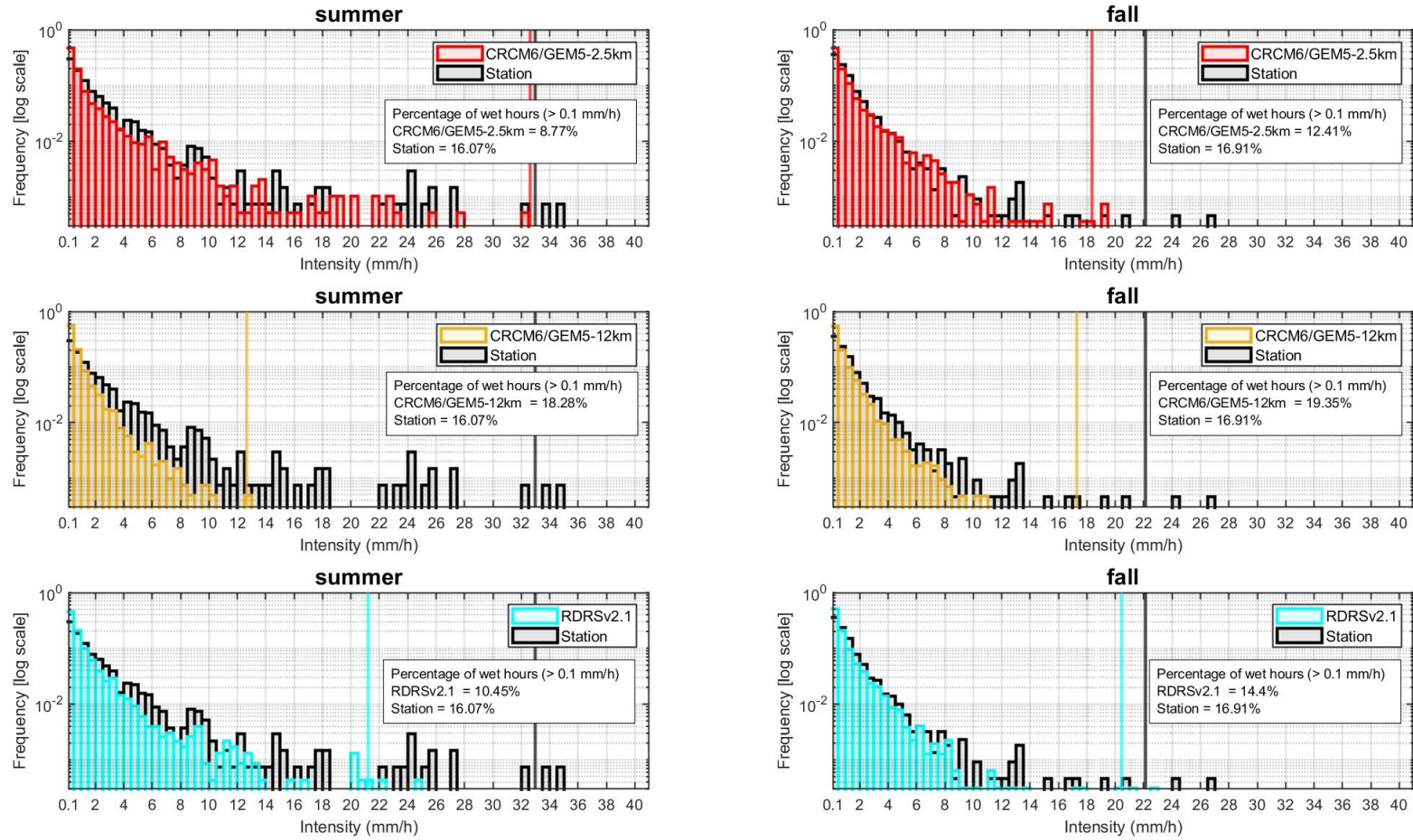
Figure S6. Black bins represent weather station data (2014–2023), yellow bins correspond to CRCM6-12 km (2011–2020), red bins correspond to CRCM6-2.5 km (2011–2020), and cyan bins correspond to RDRS (2009–2018). The vertical line represents the 99.99th percentile for each dataset. Left-side panels correspond to summer seasons (a, c, e), and right-side panels correspond to fall seasons (b, d, f). The bin size is 0.5 mm.
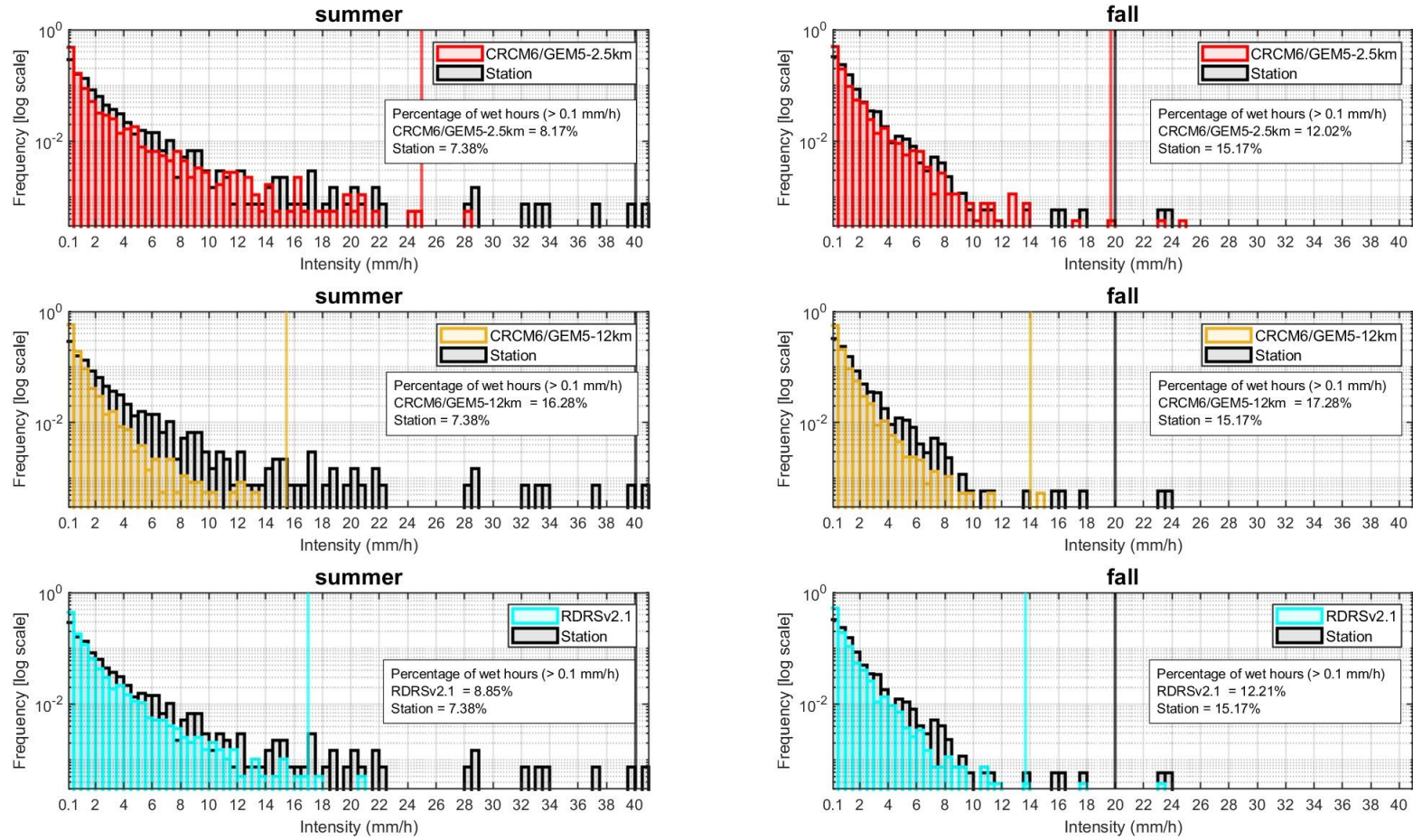
Figure S7. Black bins represent weather station data (2014–2023), yellow bins correspond to CRCM6-12 km (2011–2020), red bins correspond to CRCM6-2.5 km (2011–2020), and cyan bins correspond to RDRS (2009–2018). The vertical line represents the 99.99th percentile for each dataset. Left-side panels correspond to summer seasons (a, c, e), and right-side panels correspond to fall seasons (b, d, f). The bin size is 0.5 mm.

Figure S8. Black bins represent weather station data (2014–2023), yellow bins correspond to CRCM6-12 km (2011–2020), red bins correspond to CRCM6-2.5 km (2011–2020), and cyan bins correspond to RDRS (2009–2018). The vertical line represents the 99.99th percentile for each dataset. Left-side panels correspond to summer seasons (a, c, e), and right-side panels correspond to fall seasons (b, d, f). The bin size is 0.5 mm.
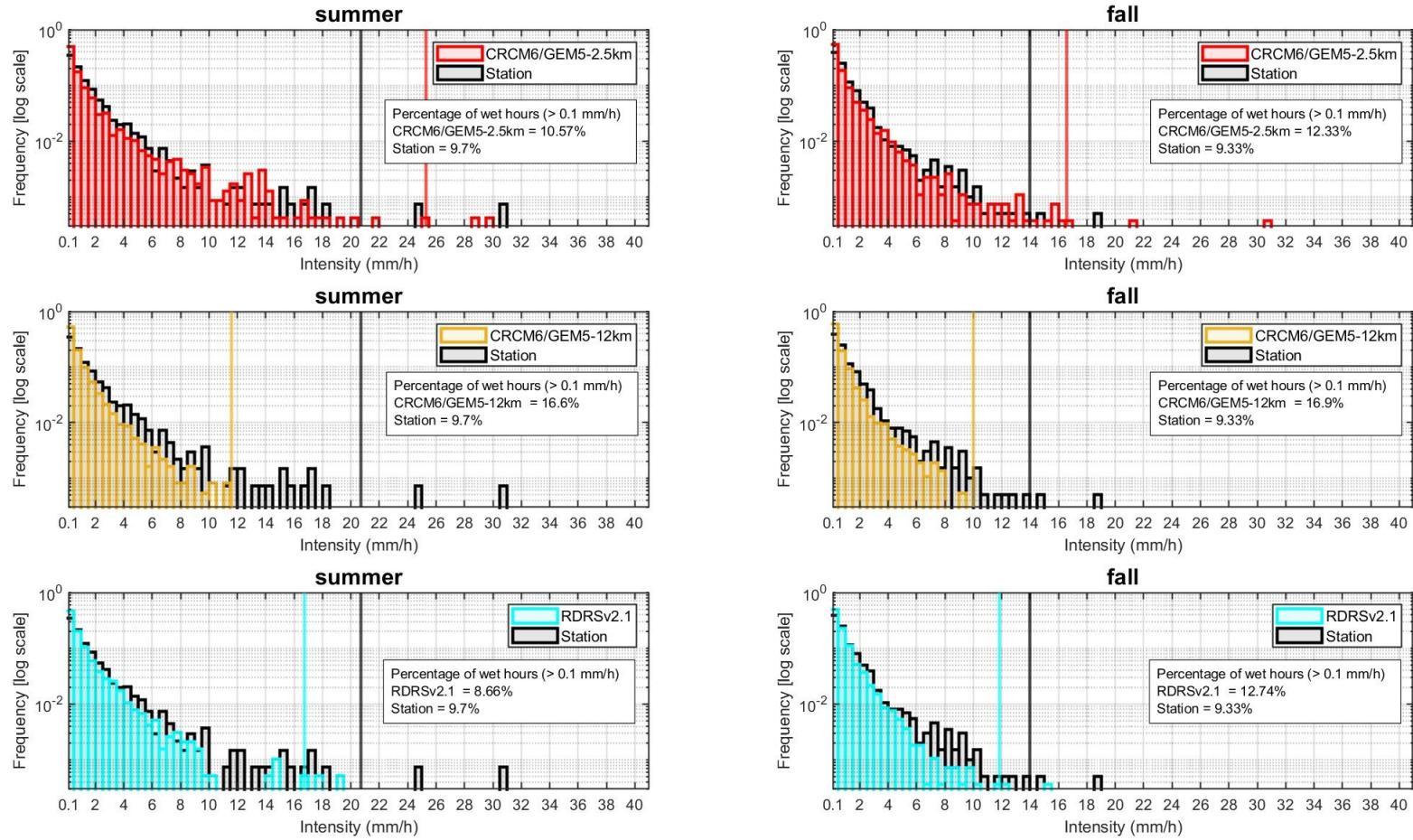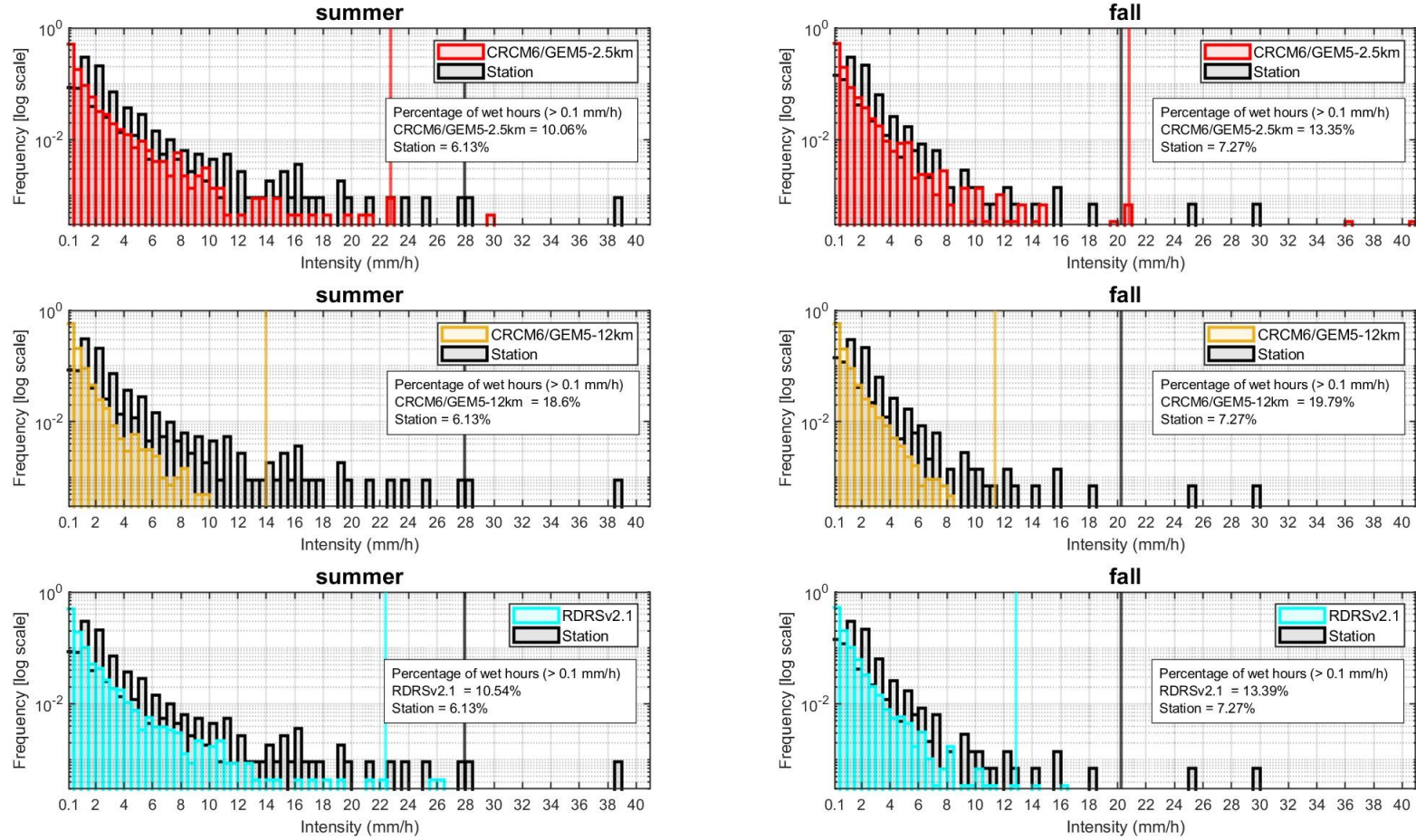
LAPOCATIERE Station

Figure S9. Black bins represent weather station data (2014–2023), yellow bins correspond to CRCM6-12 km (2011–2020), red bins correspond to CRCM6-2.5 km (2011–2020), and cyan bins correspond to RDRS (2009–2018). The vertical line represents the 99.99th percentile for each dataset. Left-side panels correspond to summer seasons (a, c, e), and right-side panels correspond to fall seasons (b, d, f). The bin size is 0.5 mm.

Figure S10. Black bins represent weather station data (2014–2023), yellow bins correspond to CRCM6-12 km (2011–2020), red bins correspond to CRCM6-2.5 km (2011–2020), and cyan bins correspond to RDRS (2009–2018). The vertical line represents the 99.99th percentile for each dataset. Left-side panels correspond to summer seasons (a, c, e), and right-side panels correspond to fall seasons (b, d, f). The bin size is 0.5 mm.
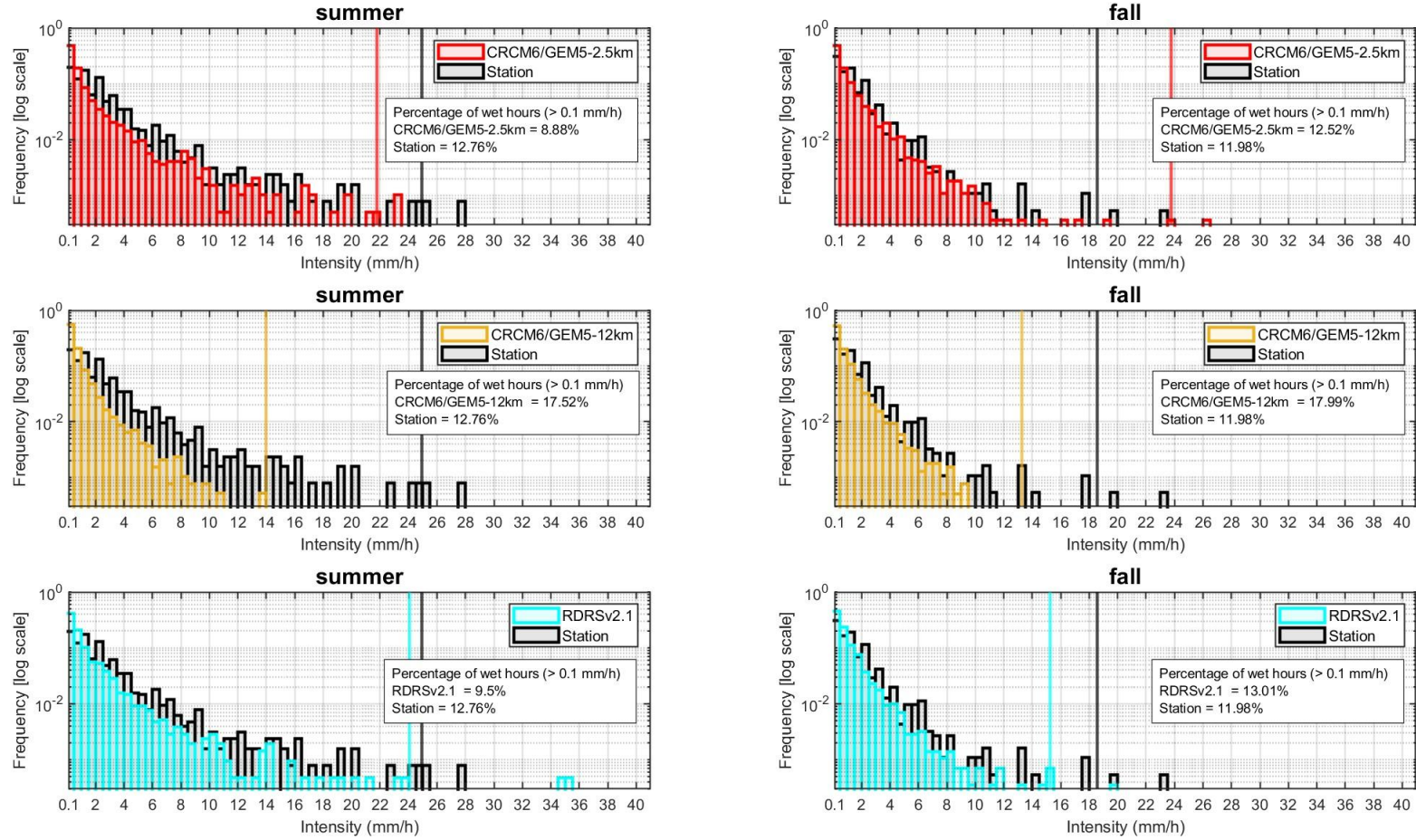
LEMIEUX Station

Figure S11. Black bins represent weather station data (2014–2023), yellow bins correspond to CRCM6-12 km (2011–2020), red bins correspond to CRCM6-2.5 km (2011–2020), and cyan bins correspond to RDRS (2009–2018). The vertical line represents the 99.99th percentile for each dataset. Left-side panels correspond to summer seasons (a, c, e), and right-side panels correspond to fall seasons (b, d, f). The bin size is 0.5 mm.
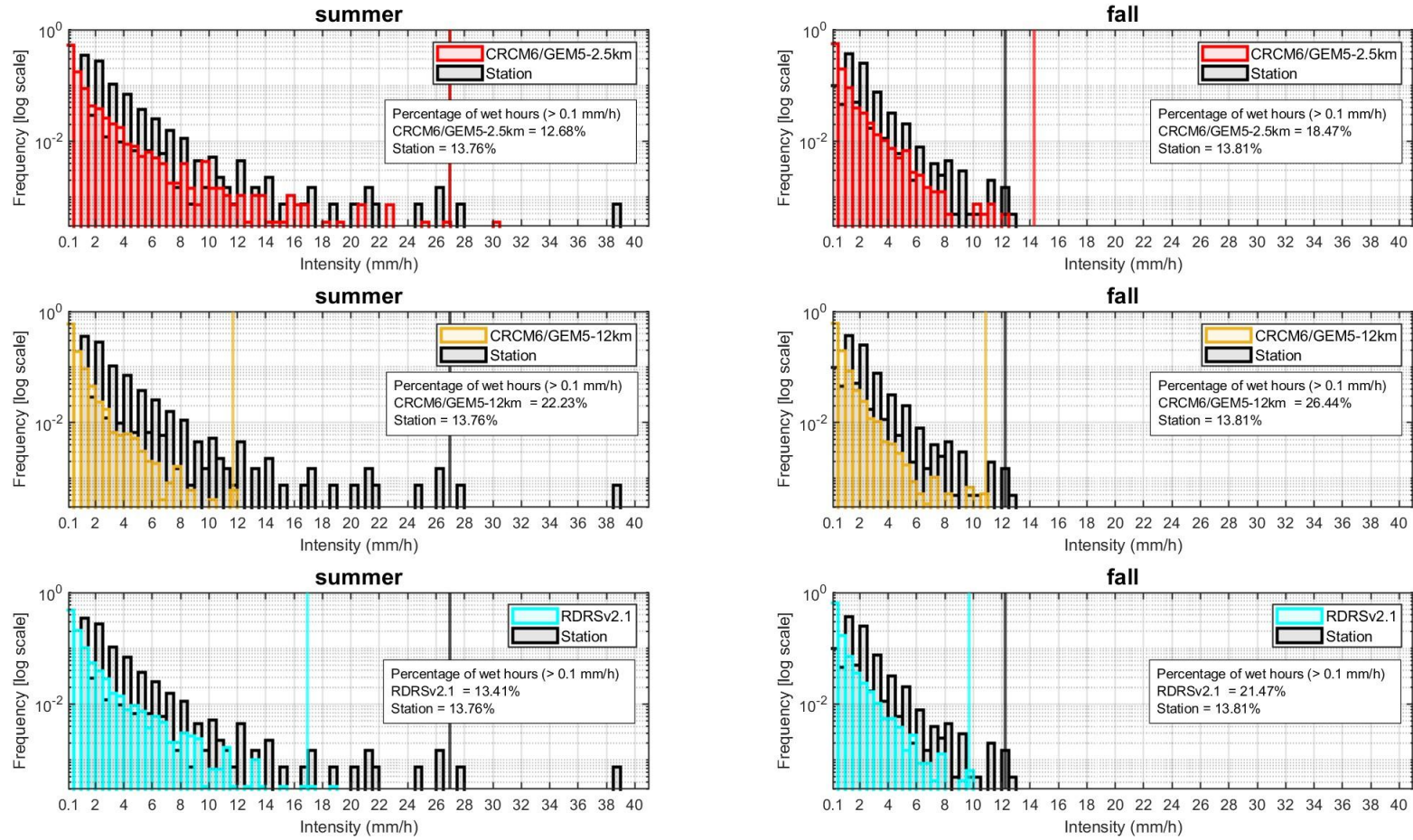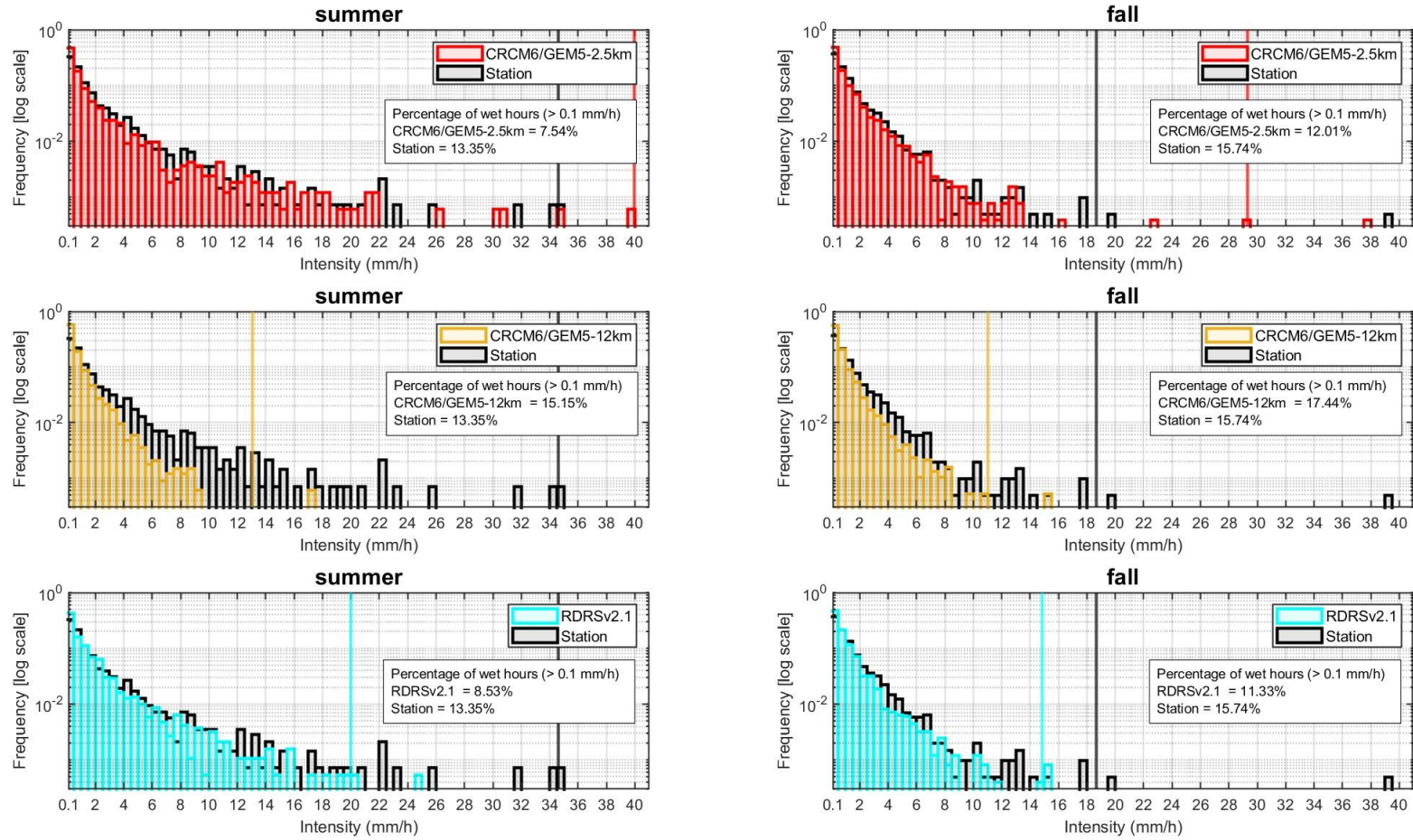
LETAPE Station

Figure S12. Black bins represent weather station data (2014–2023), yellow bins correspond to CRCM6-12 km (2011–2020), red bins correspond to CRCM6-2.5 km (2011–2020), and cyan bins correspond to RDRS (2009–2018). The vertical line represents the 99.99th percentile for each dataset. Left-side panels correspond to summer seasons (a, c, e), and right-side panels correspond to fall seasons (b, d, f). The bin size is 0.5 mm.
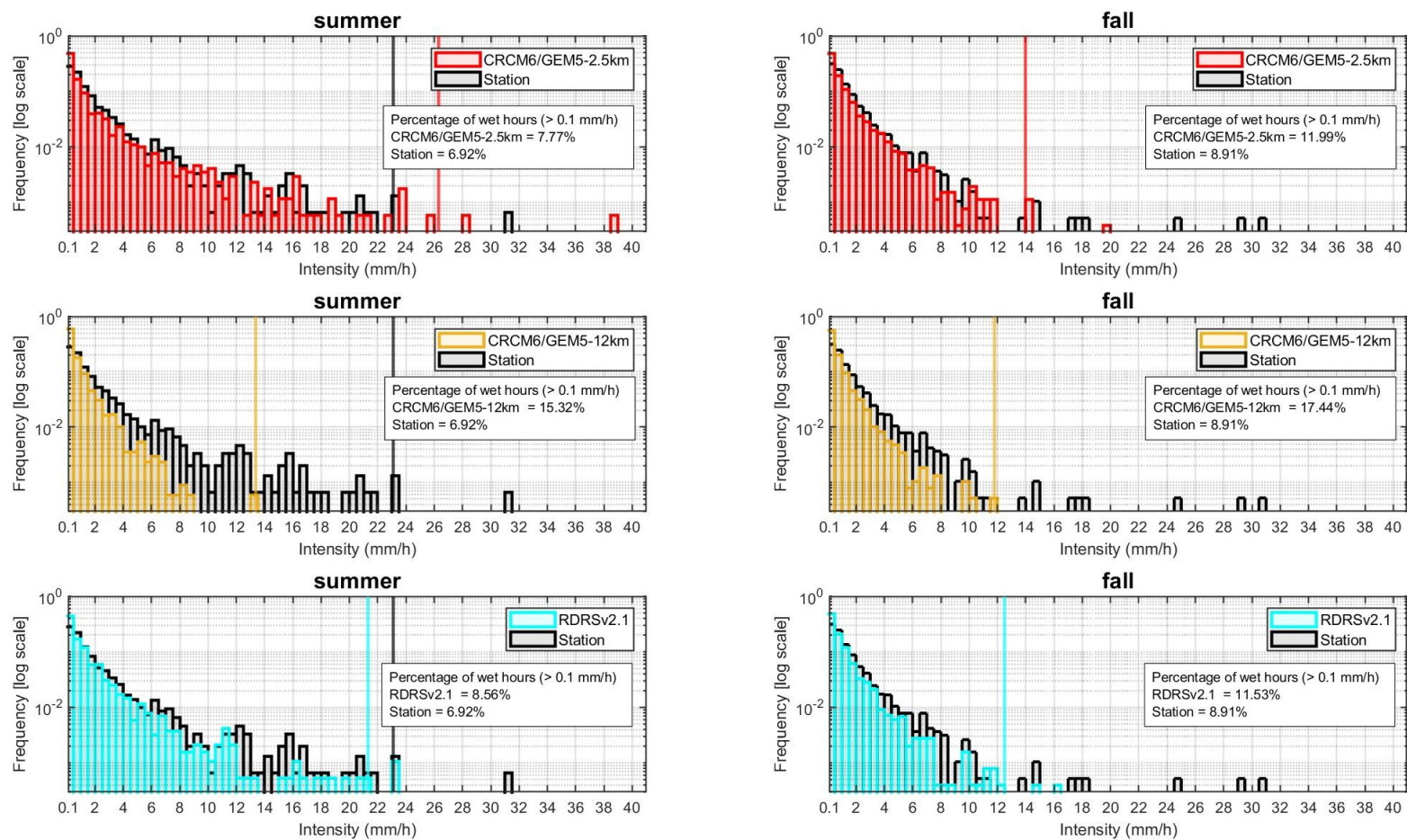
Figure S13. Black bins represent weather station data (2014–2023), yellow bins correspond to CRCM6-12 km (2011–2020), red bins correspond to CRCM6-2.5 km (2011–2020), and cyan bins correspond to RDRS (2009–2018). The vertical line represents the 99.99th percentile for each dataset. Left-side panels correspond to summer seasons (a, c, e), and right-side panels correspond to fall seasons (b, d, f). The bin size is 0.5 mm.

Figure S14. Black bins represent weather station data (2014–2023), yellow bins correspond to CRCM6-12 km (2011–2020), red bins correspond to CRCM6-2.5 km (2011–2020), and cyan bins correspond to RDRS (2009–2018). The vertical line represents the 99.99th percentile for each dataset. Left-side panels correspond to summer seasons (a, c, e), and right-side panels correspond to fall seasons (b, d, f). The bin size is 0.5 mm. The value corresponding to the 99.99th percentile of station data in fall is 80.97 mm/h, which exceeds the limits of the graphs.
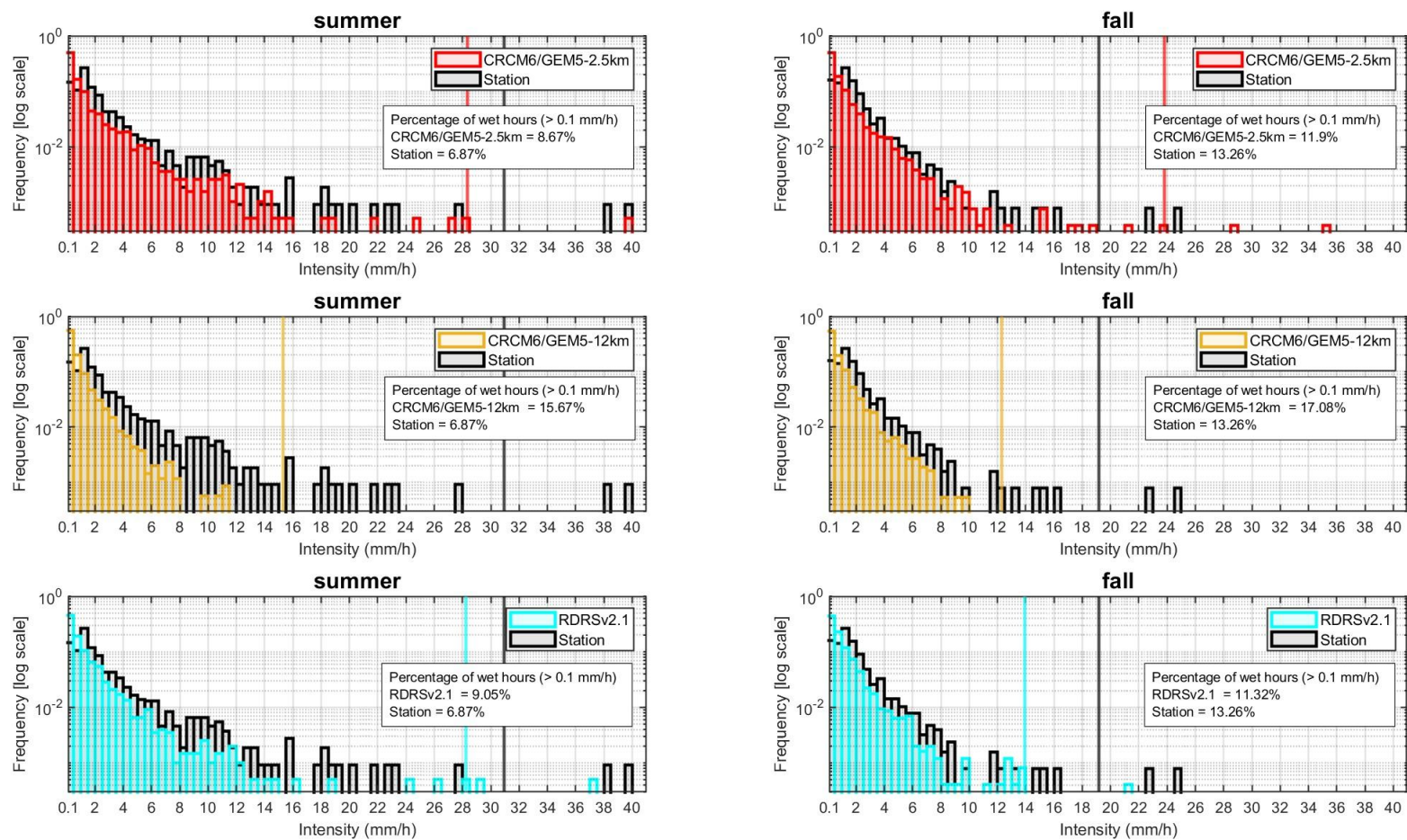
NICOLET Station

Figure S15. Black bins represent weather station data (2014–2023), yellow bins correspond to CRCM6-12 km (2011–2020), red bins correspond to CRCM6-2.5 km (2011–2020), and cyan bins correspond to RDRS (2009–2018). The vertical line represents the 99.99th percentile for each dataset. Left-side panels correspond to summer seasons (a, c, e), and right-side panels correspond to fall seasons (b, d, f). The bin size is 0.5 mm.
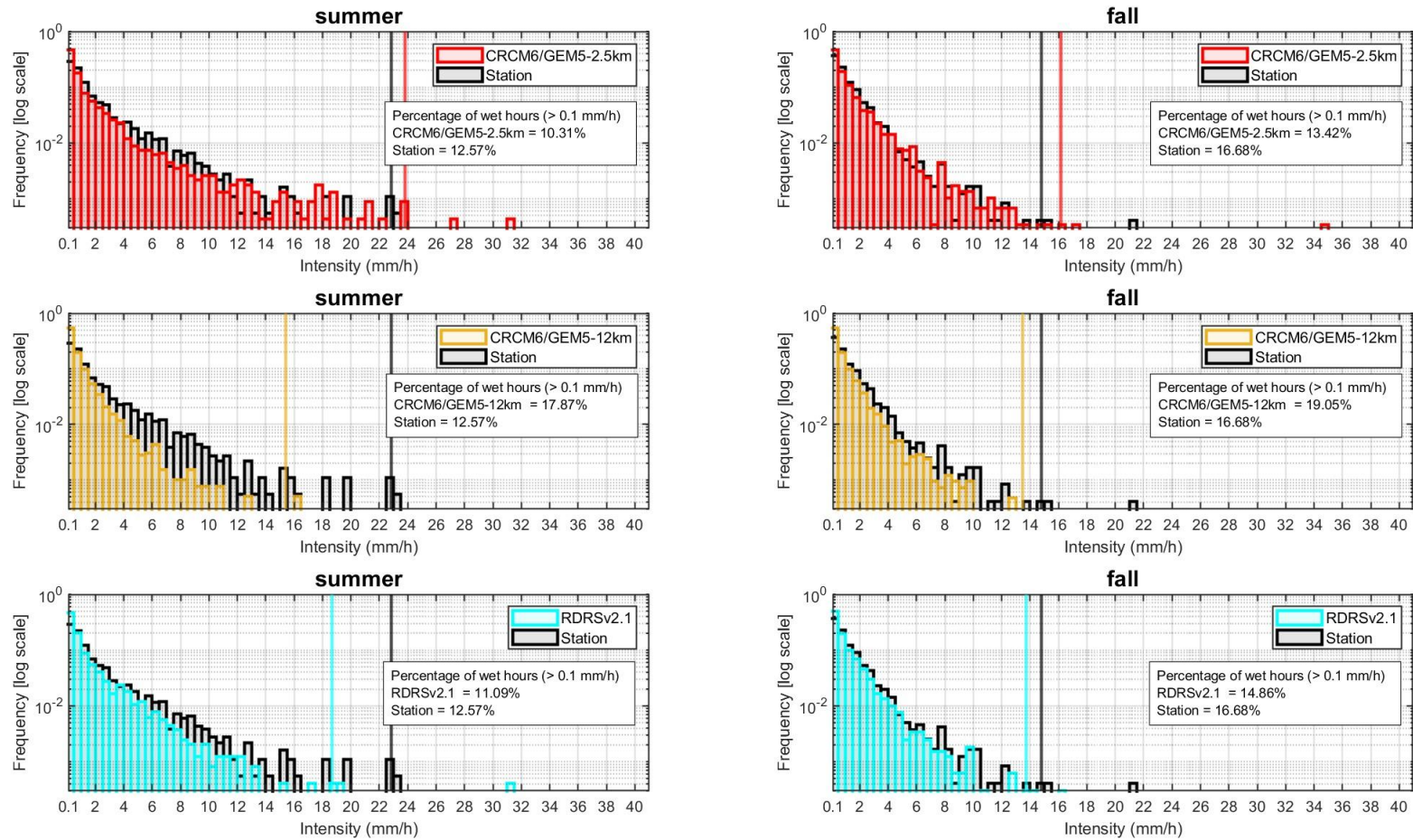
QUEBEC/JEAN LESAGE INTL Station

Figure S16. Black bins represent weather station data (2014–2023), yellow bins correspond to CRCM6-12 km (2011–2020), red bins correspond to CRCM6-2.5 km (2011–2020), and cyan bins correspond to RDRS (2009–2018). The vertical line represents the 99.99th percentile for each dataset. Left-side panels correspond to summer seasons (a, c, e), and right-side panels correspond to fall seasons (b, d, f). The bin size is 0.5 mm.
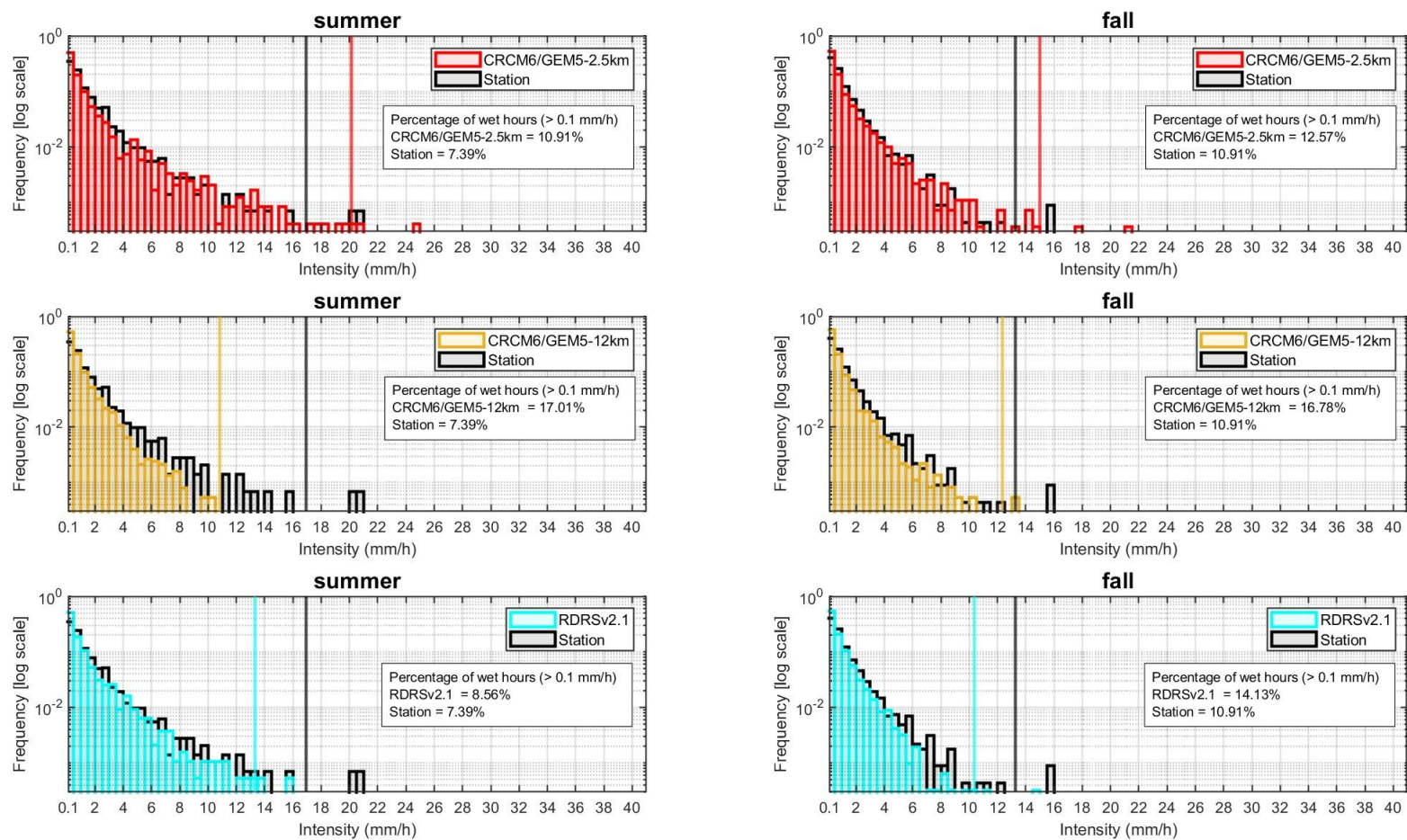
Figure S17. Black bins represent weather station data (2014–2023), yellow bins correspond to CRCM6-12 km (2011–2020), red bins correspond to CRCM6-2.5 km (2011–2020), and cyan bins correspond to RDRS (2009–2018). The vertical line represents the 99.99th percentile for each dataset. Left-side panels correspond to summer seasons (a, c, e), and right-side panels correspond to fall seasons (b, d, f). The bin size is 0.5 mm.
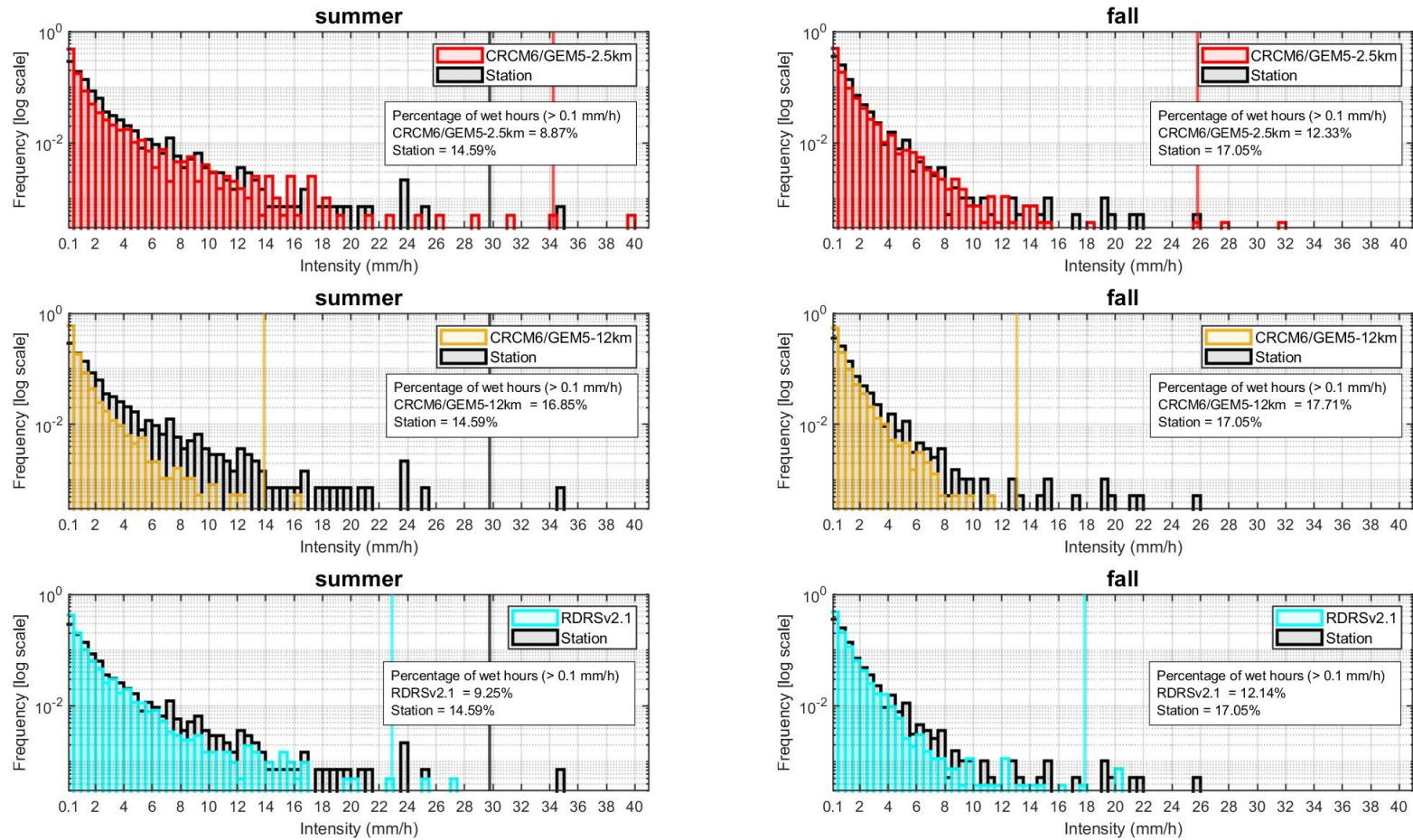
SAINT-GERMAIN-DE-GRANTHAM Station

Figure S18. Black bins represent weather station data (2014–2023), yellow bins correspond to CRCM6-12 km (2011–2020), red bins correspond to CRCM6-2.5 km (2011–2020), and cyan bins correspond to RDRS (2009–2018). The vertical line represents the 99.99th percentile for each dataset. Left-side panels correspond to summer seasons (a, c, e), and right-side panels correspond to fall seasons (b, d, f). The bin size is 0.5 mm. The value corresponding to the 99.99th percentile of station data in fall is 45.28 mm/h, which exceeds the limits of the graphs.
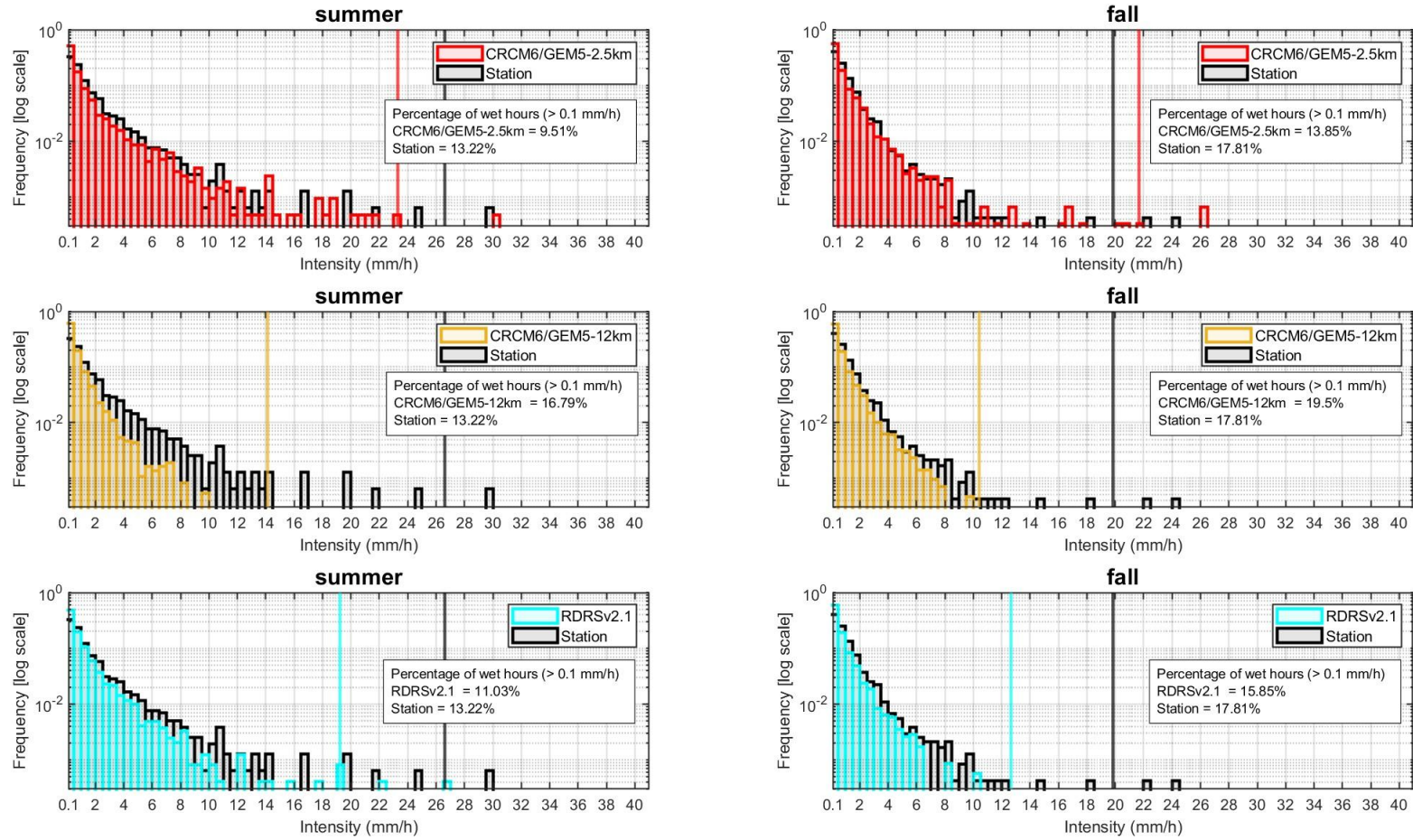
Figure S19. Black bins represent weather station data (2014–2023), yellow bins correspond to CRCM6-12 km (2011–2020), red bins correspond to CRCM6-2.5 km (2011–2020), and cyan bins correspond to RDRS (2009–2018). The vertical line represents the 99.99th percentile for each dataset. Left-side panels correspond to summer seasons (a, c, e), and right-side panels correspond to fall seasons (b, d, f). The bin size is 0.5 mm.
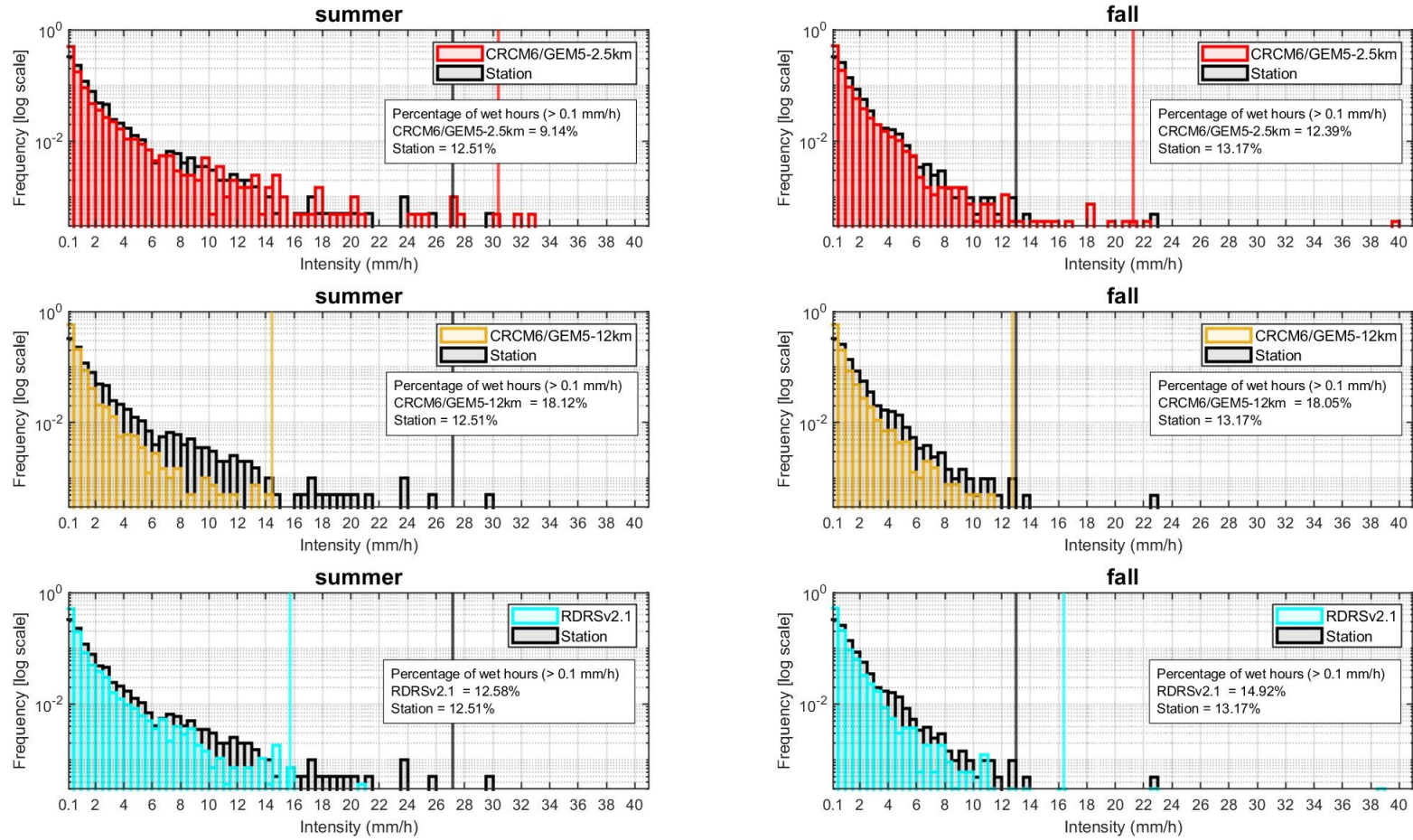
SHERBROOKE Station

Figure S20. Black bins represent weather station data (2014–2023), yellow bins correspond to CRCM6-12 km (2011–2020), red bins correspond to CRCM6-2.5 km (2011–2020), and cyan bins correspond to RDRS (2009–2018). The vertical line represents the 99.99th percentile for each dataset. Left-side panels correspond to summer seasons (a, c, e), and right-side panels correspond to fall seasons (b, d, f). The bin size is 0.5 mm.
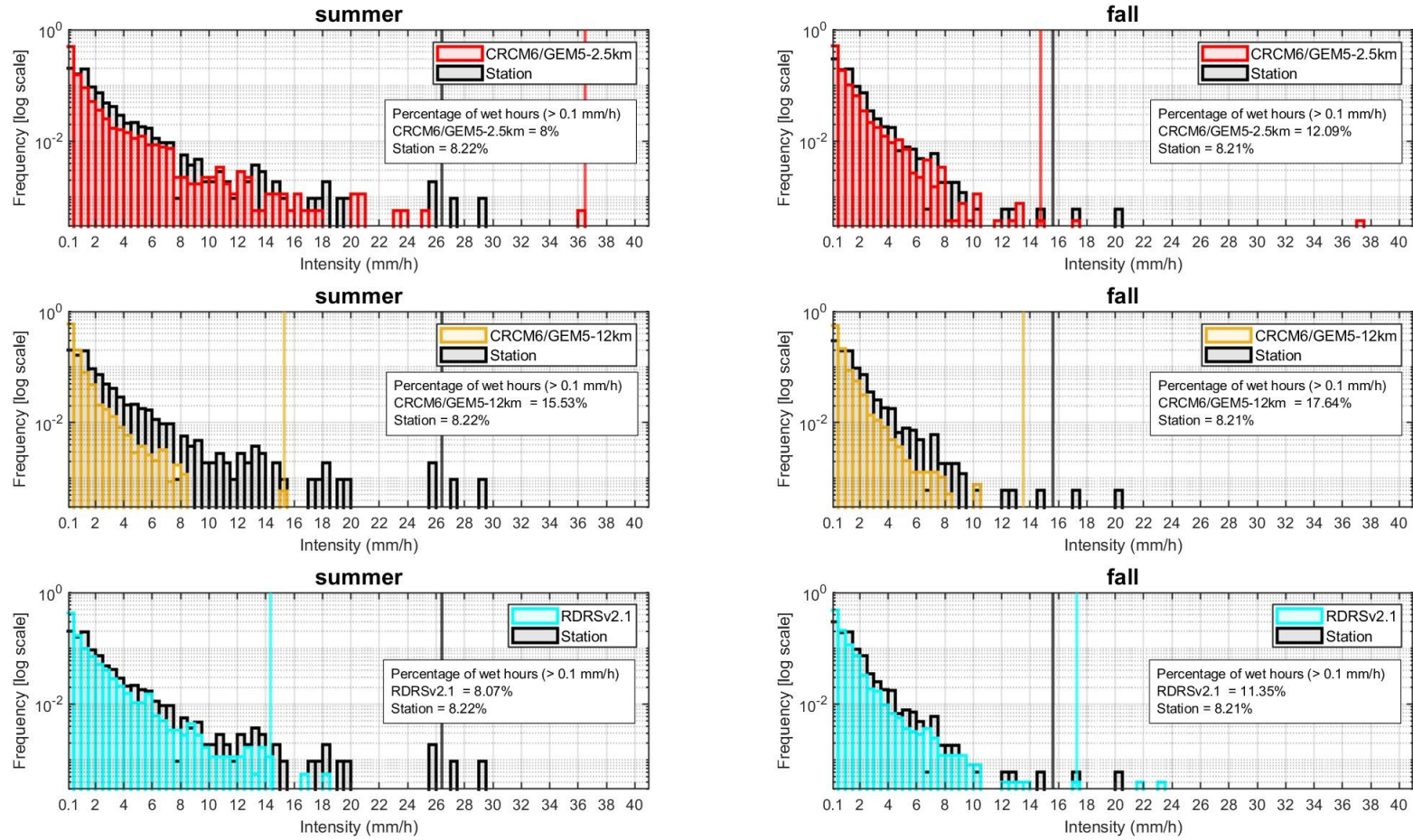
Figure S21. Black bins represent weather station data (2014–2023), yellow bins correspond to CRCM6-12 km (2011–2020), red bins correspond to CRCM6-2.5 km (2011–2020), and cyan bins correspond to RDRS (2009–2018). The vertical line represents the 99.99th percentile for each dataset. Left-side panels correspond to summer seasons (a, c, e), and right-side panels correspond to fall seasons (b, d, f). The bin size is 0.5 mm.
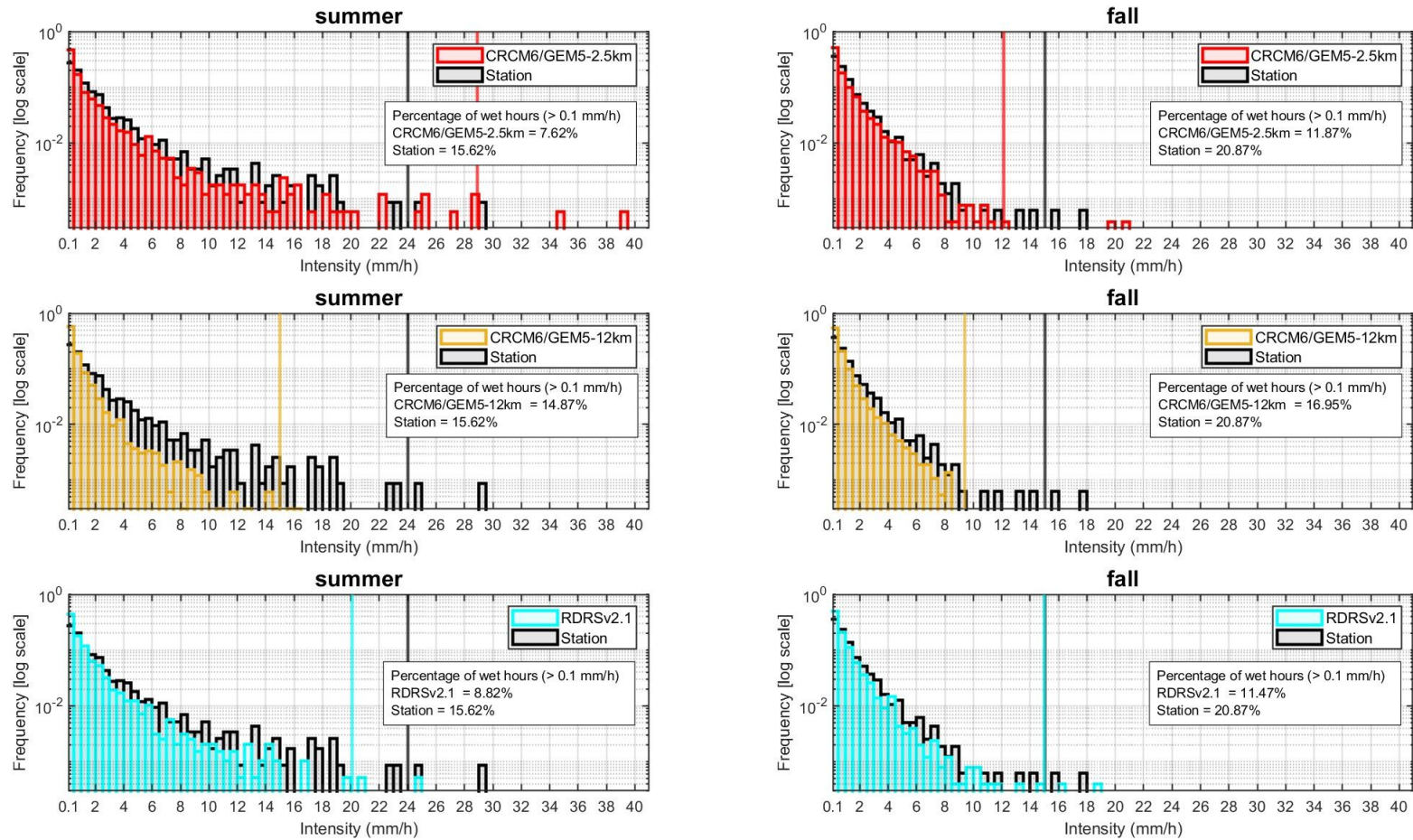
STE-ANNE-DE-BELLEVUE 1 Station

Figure S22. Black bins represent weather station data (2014–2023), yellow bins correspond to CRCM6-12 km (2011–2020), red bins correspond to CRCM6-2.5 km (2011–2020), and cyan bins correspond to RDRS (2009–2018). The vertical line represents the 99.99th percentile for each dataset. Left-side panels correspond to summer seasons (a, c, e), and right-side panels correspond to fall seasons (b, d, f). The bin size is 0.5 mm.
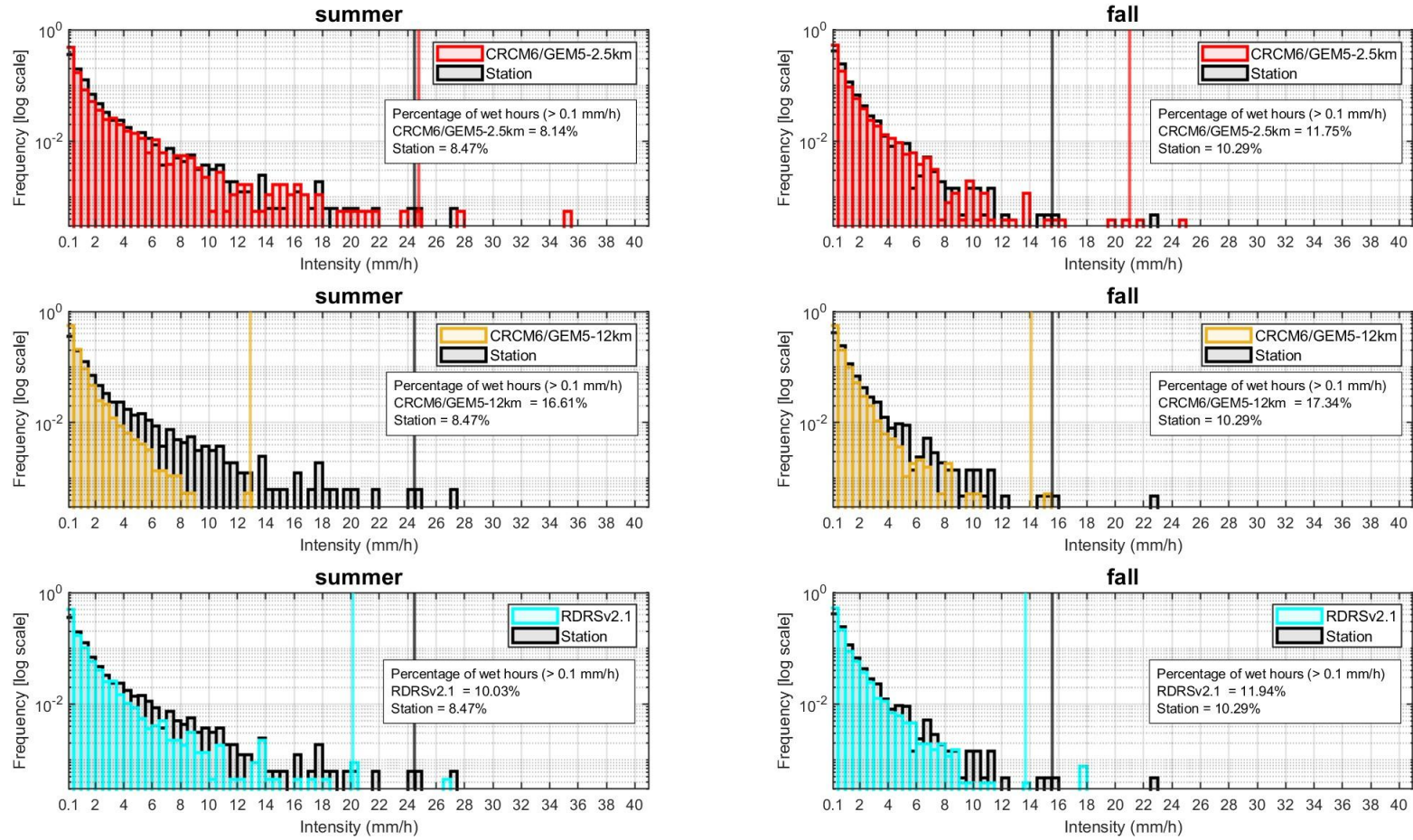
STE-CLOTILDE Station

Figure S23. Black bins represent weather station data (2014–2023), yellow bins correspond to CRCM6-12 km (2011–2020), red bins correspond to CRCM6-2.5 km (2011–2020), and cyan bins correspond to RDRS (2009–2018). The vertical line represents the 99.99th percentile for each dataset. Left-side panels correspond to summer seasons (a, c, e), and right-side panels correspond to fall seasons (b, d, f). The bin size is 0.5 mm.
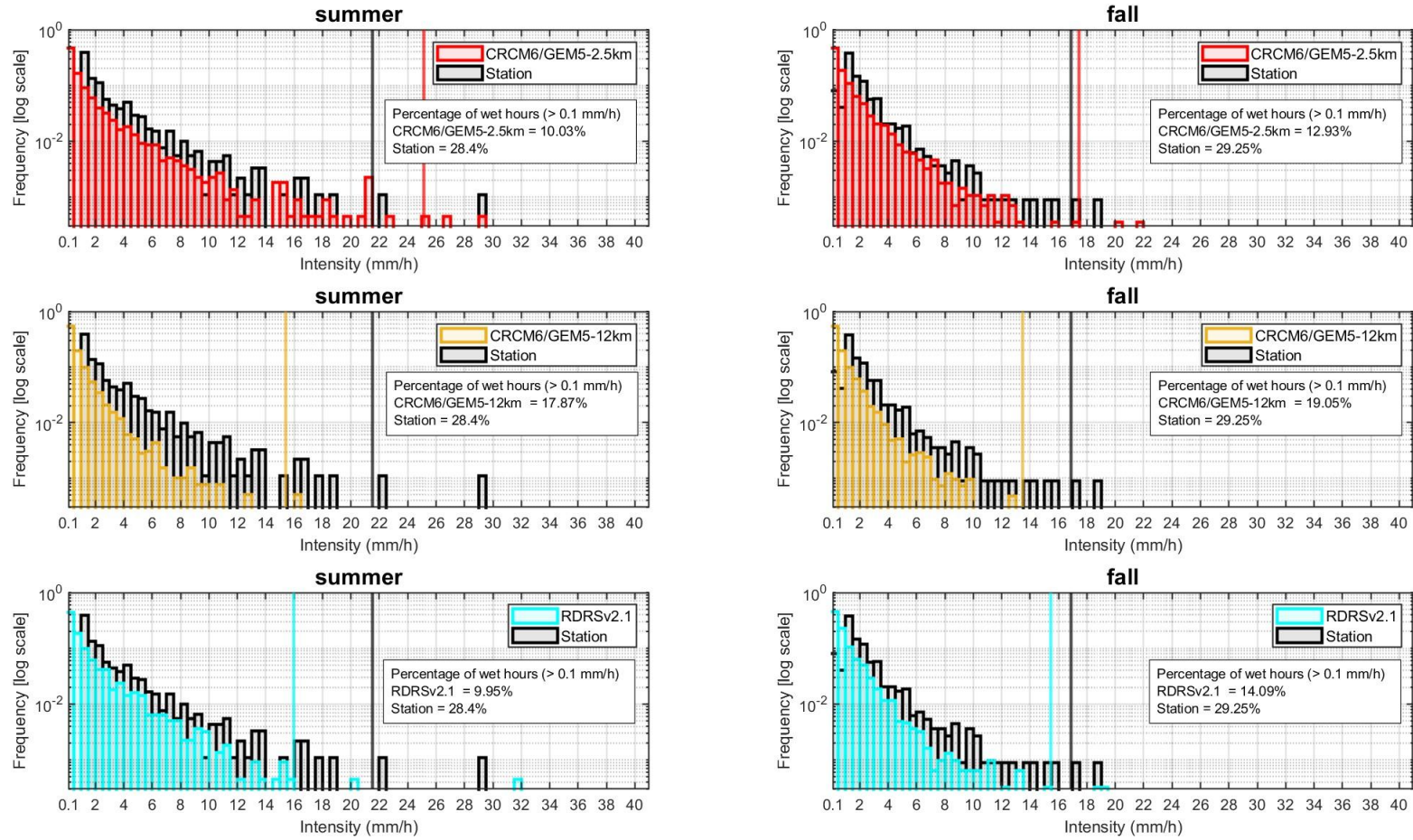
Figure S24. Black bins represent weather station data (2014–2023), yellow bins correspond to CRCM6-12 km (2011–2020), red bins correspond to CRCM6-2.5 km (2011–2020), and cyan bins correspond to RDRS (2009–2018). The vertical line represents the 99.99th percentile for each dataset. Left-side panels correspond to summer seasons (a, c, e), and right-side panels correspond to fall seasons (b, d, f). The bin size is 0.5 mm.
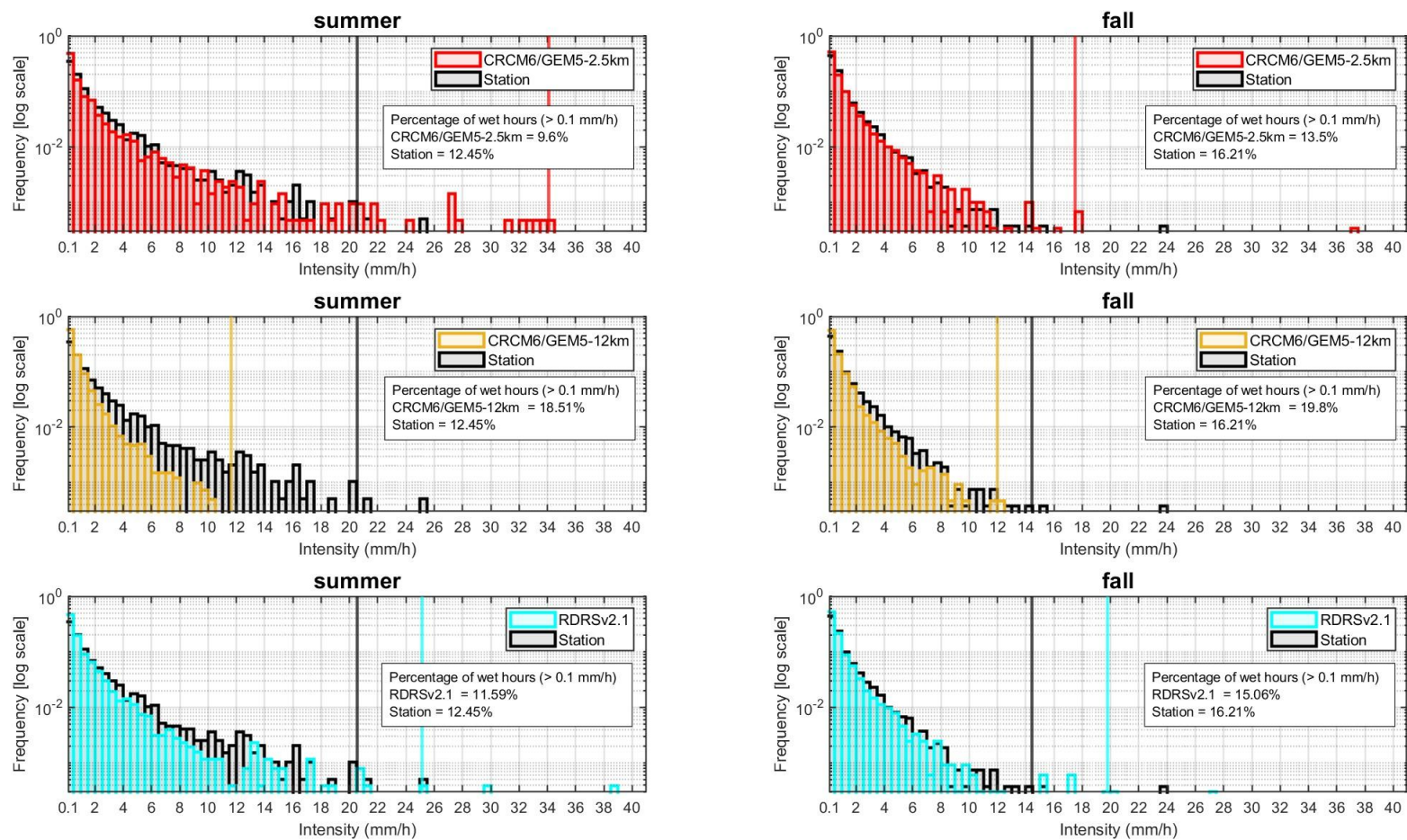
THETFORD MINES RCS Station

Figure S25. Black bins represent weather station data (2014–2023), yellow bins correspond to CRCM6-12 km (2011–2020), red bins correspond to CRCM6-2.5 km (2011–2020), and cyan bins correspond to RDRS (2009–2018). The vertical line represents the 99.99th percentile for each dataset. Left-side panels correspond to summer seasons (a, c, e), and right-side panels correspond to fall seasons (b, d, f). The bin size is 0.5 mm.