Projected Impacts of Climate Change for the Province of Newfoundland & Labrador:

2018 Update

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Summary

In 2013, the Provincial Government of Newfoundland & Labrador commissioned a detailed, accessible summary of expected climate change impacts within the province (Finnis, 2013; hereafter CPR13). Since this time, a variety of new data sets and tools have been developed for the purposes of regional/local scale climate prediction, making it possible to explore regional climate impacts in more detail, over a longer period, and with a greater awareness of associated uncertainty. This new information has been used for a substantial update and expansion to CPR13, providing additional guidance for climate adaptation planning within the province.

The full update synthesizes much more data than CPR13, covering two thirty year projection periods (2041-2070 & 2071-2100) from two possible futures (climate change 'scenarios'). Although all data has been submitted to the Province in digital form (GIS files), the current report focuses on key findings from only the most likely future scenario. Results are presented in formats similar to both CPR13 and the province's preferred intensity-duration-frequency (IDF) precipitation analyses (Conestoga-Rovers & Associates, 2015), in order to ease interpretation and comparison. The intention is to provide the most useful climate projections in a reasonably compact form, accessible to all potential users.

The projections summarized here are representative of a 'business as usual' climate change scenario, which assumes continuing growth of carbon dioxide emissions with few government restrictions. At present, this scenario most closely reflects i) recent observations and ii) near-future carbon emissions anticipated under current international controls. Maps show changes for the mid-century prediction period (2041-2070), allowing easy comparison to CPR13's 2038-2070 projections. All tables give results for both mid- and late-century, along with current climate conditions.

Expected patterns of climate change for mid-century are very similar to those outlined in CPR13; brief summaries of these changes are repeated in this report. However, the current report adds detail, with higher resolution in presented maps (25km rather than 50km) and the addition of new locations in all tables (28 locations in the province rather than 17, plus Schefferville in neighbouring Quebec).

For those unsure of how to use these projections, an accompanying User's Guide has been produced. In addition to providing a handful of brief case studies, the guide connects climate variables to potential stakeholder concerns (e.g. flood risk, energy consumption, agricultural potential etc).

Climate Indices

Climate change impacts are summarized using a selection of climate indices; these are seasonally averaged variables with some bearing on how people experience or are affected by climate. Many reflect specific economic, health, or engineering design concerns (e.g. degree days, heat wave durations, and maximum 10-day precipitation respectively); others capture the basic 'flavour' of a climate in simple terms (e.g. mean daily temperatures and precipitation).

Brief definitions are provided for each climate index, along with short summaries of their expected response to climate change. These responses are further illustrated by plots showing the mean projected response for winter (December-January-February; DJF), spring (MAM), summer (JJA), and fall (SON). Accompanying tables give projected changes for communities with a suitable, active climate station. While these maps and table provide comparable information, data in the tables have undergone additional bias correction, grounding projections with available direct climate observations. Tables also provide uncertainty estimates, as the standard deviation of predicted change across all projections examined (12 in total; six produced through dynamic downscaling and six produced with statistical downscaling; see Appendix A).

In most cases the maps and tables are in close agreement. However, for climate indices with large uncertainties (e.g. several precipitation variables), the two sources of information may appear to disagree; e.g. a map may show an increase across the Avalon Peninsula while the corresponding table entry for St. John's shows no projected change. These discrepancies are within the range of uncertainty reported in the table, and should be read as less confident or certain climate change responses.

Daily Mean Temperature (^{o}C)

Summary: Daily mean temperatures are projected to increase throughout the province, with the largest changes in winter.

Daily mean temperature is the variable most commonly associated with climate change; essentially, average temperature. The immediate, direct impact of human-induced climate change is often summarized as ‘global warming’; however, not every location experiences the same degree of warming, and a small number of locations may even respond to climate change with a weak cooling. Alone, this variable is of little use in community adaptation planning. It is, however, a useful starting point for interpreting climate impacts, providing context for other changes that are likely to have greater impact.

Results suggest the entire province can expect to experience warming. Projected changes show the largest increases at high latitudes (e.g. northern Labrador) and away from coastlines (e.g. the Labrador interior). Regions located near large water bodies experience less of a change, as open water changes temperature slowly, keeping climate moderate and reducing the immediate impact of a warming planet. This moderating influence is reduced when sea (or lake) ice forms, as the ice effectively insulates the atmosphere from the underlying ocean. Some of the higher changes on the Great Northern Peninsula, coastal Labrador, and near Ungava Bay during the cold season are related to changing ice conditions (later freeze-up, earlier melt, and thinner ice on average). The lessened impact on the Avalon and Burin peninsulas is due to the fact that open water is located nearby throughout the year.

In locations/seasons with mean temperatures close to zero (e.g. St. John’s), upward trends suggest less precipitation in the form of snow, and more in the form of rain. However, the temperature changes are small enough that snow events will still occur. Precipitation analyses (see mean precipitation event intensity, mean daily precipitation etc. below) suggest more precipitation will fall in individual events, but no significant decrease in the number of precipitation events. Together, temperature and precipitation trends suggest regions like the Avalon will experience a) fewer, yet heavier, snow storms, and b) more frequent and heavier rain events during the cold season. Colder locations (e.g. Great Northern Peninsula; Labrador) can expect similar changes in the shoulder seasons, transitioning to heavier snow events in winter.

Figure 1: Changes in daily mean temperature (^oC) projected for 2041-2070.

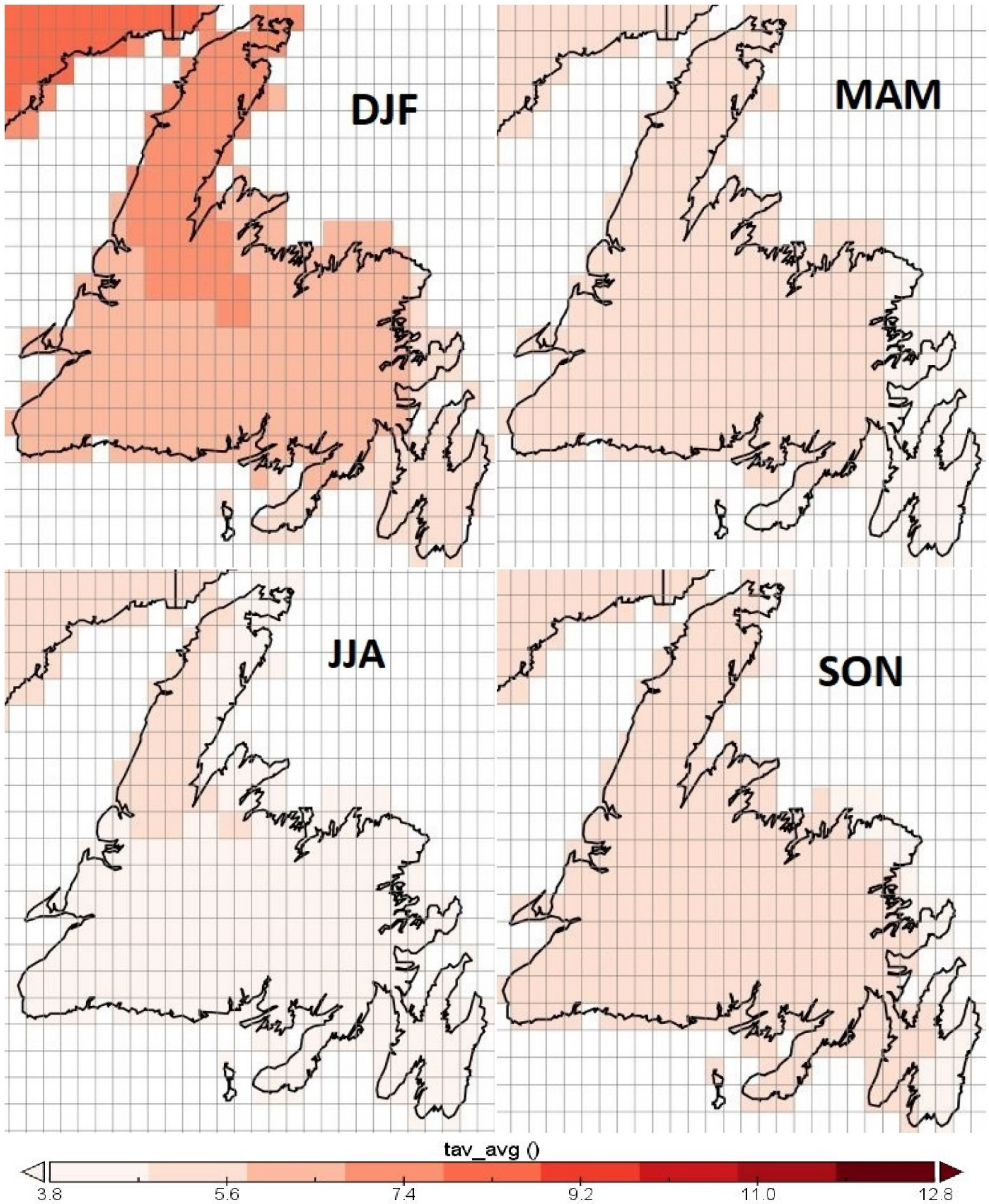

Figure 2: Changes in daily mean temperature (^{o}C) projected for 2041-2070.

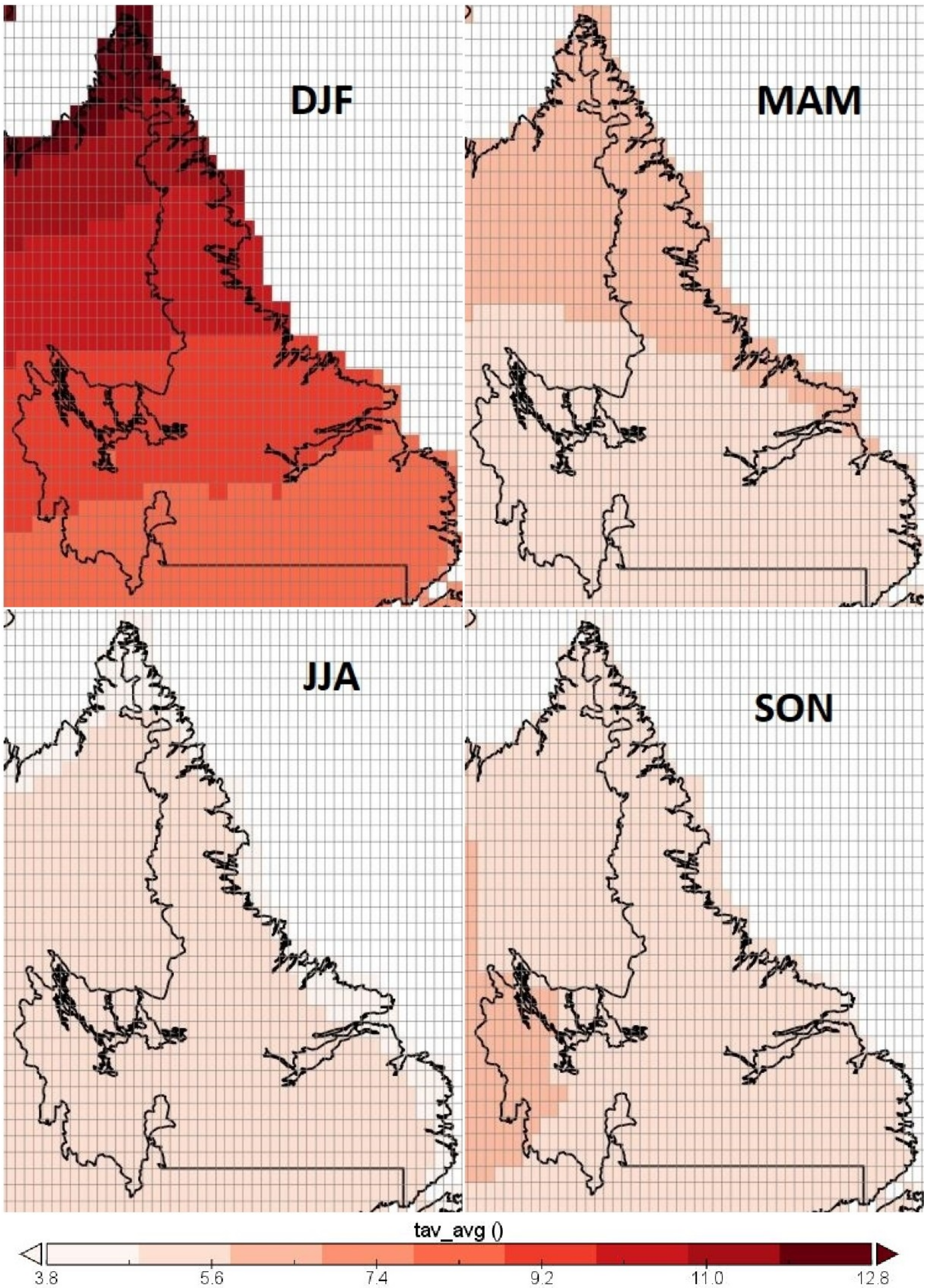

Table 1: Daily mean temperature (^oC) climatology and projected change; Newfoundland. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
Argentia	DJF	-1.0	2.3	1.3	4.3	1.7
	MAM	2.8	5.7	0.8	7.6	1.1
	JJA	13.6	16.6	1.3	18.4	1.8
	SON	9.3	11.5	1.2	13.5	1.6
Bay D'Espoir	DJF	-5.3	-1.0	1.4	1.3	1.9
	MAM	2.6	5.0	1.3	6.9	1.5
	JJA	14.9	17.9	1.3	19.8	1.8
	SON	7.3	10.6	1.4	12.7	1.8
Burgeo	DJF	-4.4	-0.5	1.3	1.7	1.8
	MAM	1.3	4.2	1.1	6.1	1.3
	JJA	12.6	15.5	1.3	17.3	1.8
	SON	7.0	9.9	1.3	12.0	1.7
Comfort Cove	DJF	-6.8	-2.4	1.7	-0.2	2.2
	MAM	1.0	3.1	1.2	5.1	1.5
	JJA	14.2	16.8	1.3	18.8	1.9
	SON	6.0	9.2	1.3	11.3	1.8
Corner Brook	DJF	-4.9	-0.5	1.5	1.9	2.0
	MAM	2.3	5.4	1.3	7.4	1.5
	JJA	15.7	18.7	1.3	20.7	1.9
	SON	7.5	10.5	1.3	12.6	1.8
Daniel's Harbour	DJF	-6.3	-2.0	1.5	0.5	2.1
	MAM	0.4	3.3	1.4	5.3	1.6
	JJA	13.1	16.1	1.4	18.1	2.1
	SON	6.3	9.3	1.4	11.4	1.8
Deer Lake	DJF	-6.7	-2.2	1.6	0.3	2.1
	MAM	1.6	4.4	1.4	6.3	1.7
	JJA	15.2	18.2	1.4	20.1	2.0
	SON	6.3	9.5	1.3	11.7	1.8
Exploits Dam	DJF	-7.1	-2.6	1.5	-0.2	2.1
	MAM	0.5	3.8	1.4	5.7	1.7
	JJA	14.1	17.1	1.3	19.0	1.9
	SON	5.9	8.8	1.3	11.0	1.7
Gander	DJF	-5.5	-1.2	1.6	1.1	2.0
	MAM	1.5	4.5	1.3	6.4	1.5
	JJA	14.9	17.7	1.4	19.6	2.0
	SON	6.7	9.5	1.3	11.6	1.8
Grand Falls	DJF	-6.4	-1.7	1.6	0.7	2.1
	MAM	1.9	4.9	1.4	6.9	1.7
	JJA	15.5	18.4	1.3	20.4	1.9
	SON	6.8	9.9	1.3	12.0	1.8
Isle Aux Morts	DJF	-4.0	0.0	1.3	2.2	1.7
	MAM	1.5	4.5	1.1	6.4	1.3
	JJA	13.3	16.3	1.3	18.2	1.9
	SON	7.6	10.3	1.2	12.4	1.7
La Scie	DJF	-7.4	-2.8	1.6	-0.5	2.2
	MAM	-0.1	2.2	1.2	4.3	1.6
	JJA	13.6	16.4	1.4	18.4	2.1
	SON	5.7	9.0	1.4	11.1	1.9

Table 1, con't

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
North Harbour	DJF	-2.5	0.9	1.3	3.0	1.7
	MAM	2.4	5.0	1.0	6.8	1.2
	JJA	13.8	16.7	1.4	18.4	1.9
	SON	8.6	11.0	1.3	13.0	1.7
Plum Point	DJF	-8.1	-3.2	1.7	-0.6	2.4
	MAM	-0.3	2.5	1.3	4.7	1.6
	JJA	13.0	16.0	1.4	18.0	2.2
	SON	5.7	9.2	1.4	11.2	1.8
Port Aux Basque	DJF	-3.7	0.1	1.3	2.2	1.7
	MAM	1.2	4.2	1.1	6.1	1.3
	JJA	12.9	15.9	1.4	17.8	1.9
	SON	7.5	10.4	1.2	12.4	1.6
Springdale	DJF	-7.0	-2.6	1.7	-0.2	2.2
	MAM	1.1	3.6	1.3	5.6	1.7
	JJA	14.7	17.5	1.4	19.5	2.0
	SON	6.2	9.3	1.4	11.5	1.8
St. Alban's	DJF	-5.0	-1.0	1.4	1.2	1.8
	MAM	2.4	4.6	1.2	6.5	1.4
	JJA	14.3	17.0	1.3	18.8	1.8
	SON	7.1	10.0	1.3	12.1	1.8
St. Anthony	DJF	-8.8	-3.8	1.7	-1.3	2.4
	MAM	-0.9	1.7	1.3	3.8	1.7
	JJA	13.0	15.7	1.5	17.7	2.3
	SON	5.3	8.3	1.4	10.4	1.9
St. John's	DJF	-3.2	0.2	1.5	2.1	1.8
	MAM	1.8	3.4	0.9	5.3	1.1
	JJA	14.1	16.5	1.2	18.3	1.8
	SON	7.6	10.9	1.3	13.0	1.7
St. Lawrence	DJF	-2.1	1.5	1.3	3.5	1.7
	MAM	2.4	4.9	1.0	6.6	1.2
	JJA	14.0	16.8	1.4	18.5	1.8
	SON	8.7	11.9	1.4	14.0	1.9
Stephenville	DJF	-4.6	-0.4	1.5	1.8	1.9
	MAM	2.2	4.9	1.3	6.8	1.5
	JJA	15.1	18.0	1.3	19.9	1.9
	SON	7.7	11.1	1.3	13.2	1.8
Twillingate	DJF	-4.3	-0.1	1.5	2.0	2.1
	MAM	1.0	3.3	1.1	5.3	1.4
	JJA	14.0	16.4	1.2	18.4	1.9
	SON	7.2	10.0	1.4	12.1	1.8

Table 2: Daily mean temperature (°C) climatology and projected change; Labrador.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Std Dev	Ensemble Avg	Std Dev
Cartwright	**DJF**	-12.0	-6.2	2.0	-3.3	2.7
	MAM	-2.6	0.2	1.6	2.6	2.2
	JJA	11.0	13.5	1.4	15.7	2.1
	SON	3.3	6.6	1.5	8.6	1.9
Churchill Falls	**DJF**	-20.3	-15.1	1.5	-11.8	2.2
	MAM	-5.2	-3.8	2.1	-1.6	2.7
	JJA	11.7	13.8	1.6	15.9	2.4
	SON	-0.8	2.7	1.8	5.0	2.3
Goose Bay	**DJF**	-14.7	-8.7	1.6	-5.5	2.4
	MAM	-1.6	1.1	1.8	3.3	2.5
	JJA	14.2	17.1	1.6	19.2	2.4
	SON	3.2	6.8	1.6	9.0	2.1
Mary's Harbour	**DJF**	-12.7	-6.9	1.8	-4.3	2.5
	MAM	-2.7	-0.5	1.6	1.6	2.0
	JJA	11.2	13.6	1.5	15.6	2.3
	SON	3.2	6.6	1.5	8.7	2.0
Nain	**DJF**	-15.5	-8.2	2.1	-4.6	2.9
	MAM	-5.1	-2.5	1.8	0.2	2.4
	JJA	9.3	11.9	1.4	14.1	2.0
	SON	1.6	5.2	1.7	7.2	2.2
Wabush Lake	**DJF**	-20.0	-14.3	1.4	-10.9	2.0
	MAM	-4.9	-2.4	2.2	-0.3	2.8
	JJA	12.1	14.9	1.5	17.0	2.3
	SON	-0.2	3.6	1.7	5.9	2.2
Schefferville	**DJF**	-21.5	-15.3	1.5	-11.7	2.2
	MAM	-7.1	-4.5	2.1	-2.1	2.8
	JJA	10.7	13.3	1.5	15.4	2.2
	SON	-1.7	2.4	1.7	4.6	2.2

Daily Minimum Temperature (°C)

Summary: Daily minimum temperatures are projected to increase throughout the province, with the greatest changes expected in winter. Changes are greater than those of the daily mean or maximum temperatures (3-6 °C in NL; 5-10 °C in Labrador).

Mean daily minimum temperature is calculated by averaging the minimum temperature recorded for each day in a given season. Under typical conditions, and in the absence of passing weather systems, the timing of the daily minimum is determined by the timing of sunshine, occurring at dawn when the rising sun interrupts nighttime cooling.

The mean daily minima has value as an indicator of frost events during the growing season and thaws during the cold season: regions with daily minima close to 0°C in a relevant season can expect more of these events. Because rising greenhouse gases limit nighttime cooling, daily minima often change more than either mean temperatures or daily maximum temperature in response to human-induced climate change. Spatial patterns of minima change projected for Newfoundland & Labrador closely follow daily averages, although the magnitude is typically a little larger.

Figure 3: Changes in mean daily minimum temperature (^{o}C) projected for 2041-2070.

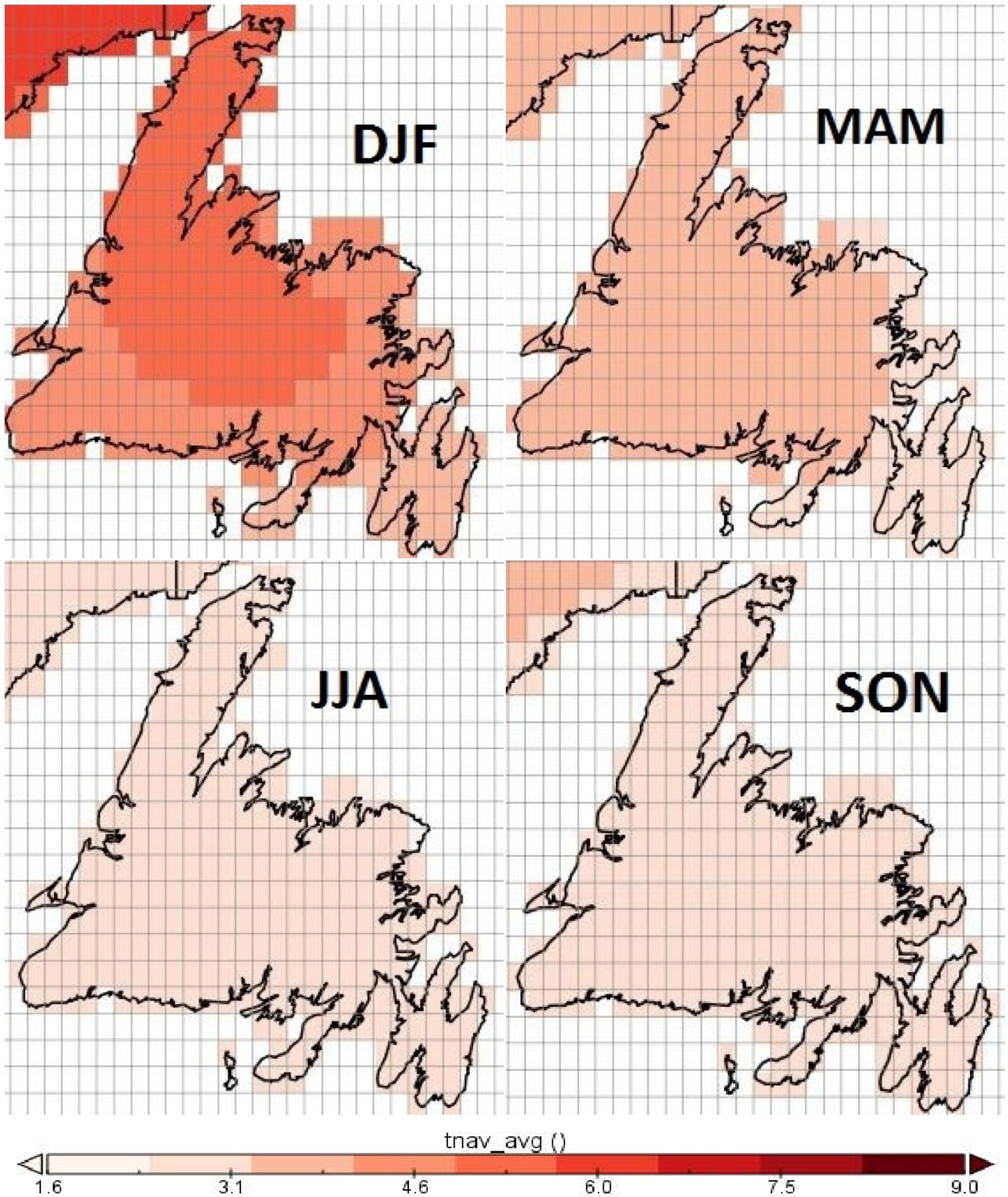

Figure 4: Changes in mean daily minimum temperature (^oC) projected for 2041-2070.

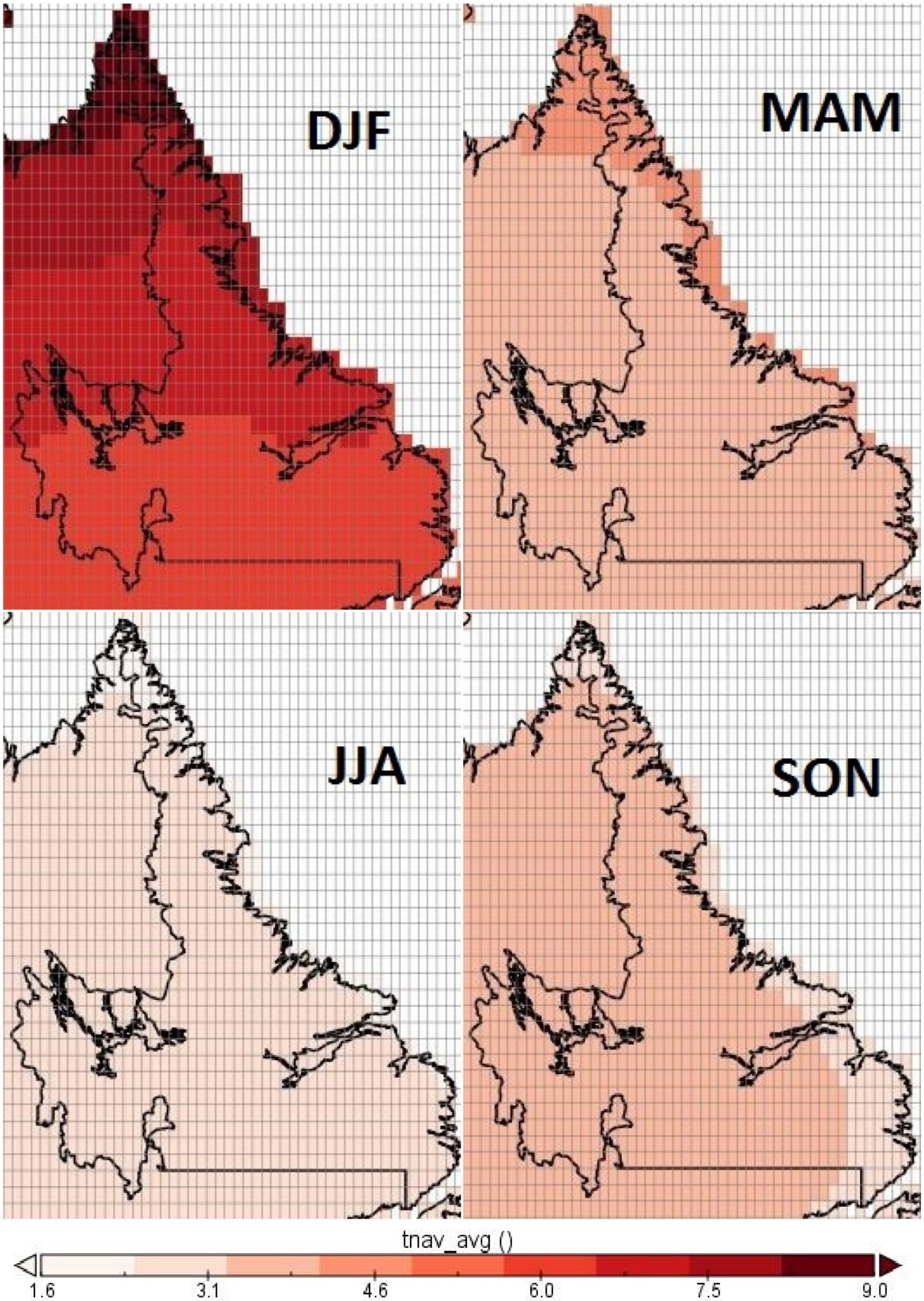

Table 3: Mean daily minimum temperature (^oC) climatology and projected change; Newfoundland. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
Argentia	DJF	-3.82	0.00	1.48	2.24	1.86
	MAM	-0.15	3.10	0.67	5.06	1.01
	JJA	10.94	13.84	1.33	15.68	1.89
	SON	6.68	8.84	1.18	10.91	1.62
Bay D'Espoir	DJF	-10.17	-5.26	1.71	-2.69	2.16
	MAM	-2.40	0.30	1.14	2.33	1.34
	JJA	9.34	12.50	1.31	14.40	1.87
	SON	2.69	6.00	1.24	8.09	1.68
Burgeo	DJF	-8.02	-3.54	1.55	-1.13	1.99
	MAM	-1.96	0.97	1.01	2.98	1.28
	JJA	9.38	12.17	1.30	14.07	1.85
	SON	3.60	6.77	1.19	8.87	1.64
Comfort Cove	DJF	-10.95	-5.95	1.88	-3.48	2.41
	MAM	-3.39	-0.99	1.20	1.12	1.43
	JJA	8.95	11.46	1.23	13.46	1.84
	SON	2.07	5.31	1.26	7.39	1.69
Corner Brook	DJF	-8.23	-3.20	1.69	-0.52	2.20
	MAM	-1.83	1.65	1.14	3.80	1.38
	JJA	10.98	13.94	1.26	15.96	1.84
	SON	3.90	7.01	1.16	9.13	1.64
Daniel's Harbour	DJF	-10.07	-5.04	1.71	-2.27	2.30
	MAM	-3.29	-0.08	1.41	2.13	1.63
	JJA	9.75	12.71	1.40	14.70	2.01
	SON	3.15	6.16	1.29	8.27	1.74
Deer Lake	DJF	-11.03	-5.89	1.83	-3.08	2.37
	MAM	-3.48	-0.26	1.36	1.91	1.62
	JJA	9.36	12.34	1.27	14.36	1.86
	SON	1.99	5.35	1.17	7.47	1.63
Exploits Dam	DJF	-11.80	-6.67	1.81	-3.90	2.37
	MAM	-4.71	-1.07	1.34	1.04	1.62
	JJA	7.92	11.04	1.20	13.04	1.77
	SON	1.25	4.30	1.14	6.39	1.58
Gander	DJF	-9.08	-3.98	1.77	-1.39	2.29
	MAM	-2.57	0.74	1.12	2.84	1.37
	JJA	9.88	12.61	1.30	14.58	1.91
	SON	3.07	5.85	1.20	7.94	1.66
Grand Falls	DJF	-11.02	-5.45	1.82	-2.71	2.36
	MAM	-2.89	0.40	1.29	2.50	1.58
	JJA	9.82	12.72	1.23	14.72	1.82
	SON	2.39	5.60	1.19	7.70	1.63
Isle Aux Morts	DJF	-7.20	-2.65	1.52	-0.27	1.93
	MAM	-1.52	1.67	0.99	3.70	1.29
	JJA	10.19	13.04	1.32	14.98	1.88
	SON	4.69	7.55	1.11	9.67	1.59
La Scie	DJF	-10.99	-5.83	1.79	-3.32	2.35
	MAM	-4.23	-1.34	1.26	0.82	1.56
	JJA	8.86	11.49	1.31	13.51	1.96
	SON	2.25	5.36	1.40	7.44	1.84

Table 3, con't.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
North Harbour	DJF	-6.27	-2.42	1.60	-0.19	1.93
	MAM	-1.51	1.46	0.78	3.43	1.03
	JJA	9.78	12.74	1.37	14.55	1.98
	SON	4.91	7.38	1.24	9.45	1.68
Plum Point	DJF	-11.88	-6.19	1.90	-3.28	2.60
	MAM	-4.09	-0.69	1.36	1.63	1.66
	JJA	9.56	12.48	1.41	14.49	2.06
	SON	2.91	6.17	1.33	8.25	1.80
Port Aux Basque	DJF	-6.72	-2.49	1.44	-0.16	1.83
	MAM	-1.76	1.50	0.99	3.51	1.29
	JJA	9.87	12.79	1.35	14.71	1.89
	SON	4.47	7.54	1.13	9.68	1.60
Springdale	DJF	-12.06	-7.09	1.94	-4.38	2.52
	MAM	-3.67	-1.00	1.36	1.18	1.66
	JJA	8.94	11.80	1.30	13.84	1.91
	SON	1.70	4.95	1.28	7.06	1.73
St. Alban's	DJF	-9.69	-4.94	1.66	-2.40	2.10
	MAM	-2.08	0.28	1.08	2.30	1.27
	JJA	9.33	12.14	1.30	14.03	1.87
	SON	2.78	5.86	1.24	7.95	1.68
St. Anthony	DJF	-12.88	-7.21	1.97	-4.28	2.72
	MAM	-4.55	-1.72	1.37	0.59	1.83
	JJA	8.38	11.05	1.40	13.08	2.07
	SON	1.83	4.87	1.36	6.93	1.80
St. John's	DJF	-6.46	-2.82	1.64	-0.72	1.99
	MAM	-1.90	0.15	0.71	2.14	1.10
	JJA	9.64	11.97	1.18	13.85	1.84
	SON	4.19	7.35	1.27	9.46	1.66
St. Lawrence	DJF	-5.26	-1.69	1.36	0.48	1.74
	MAM	-1.42	1.52	0.85	3.39	1.10
	JJA	10.15	13.02	1.41	14.79	1.93
	SON	4.96	8.22	1.40	10.36	1.88
Stephenville	DJF	-7.79	-3.21	1.63	-0.74	2.09
	MAM	-1.60	1.47	1.20	3.57	1.39
	JJA	11.27	14.24	1.30	16.22	1.87
	SON	4.53	7.84	1.22	10.00	1.68
Twillingate	DJF	-6.86	-2.18	1.68	0.15	2.24
	MAM	-2.21	0.64	1.10	2.75	1.45
	JJA	10.12	12.41	1.21	14.40	1.82
	SON	4.57	7.22	1.34	9.29	1.79

Table 4: Mean daily minimum temperature (°C) climatology and projected change; Labrador. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Std Dev	Ensemble Avg	Std Dev
Cartwright	DJF	-16.26	-9.81	2.28	-6.51	3.08
	MAM	-6.91	-3.46	1.83	-0.92	2.45
	JJA	5.76	8.25	1.21	10.42	1.84
	SON	-0.09	3.22	1.39	5.23	1.82
Churchill Falls	DJF	-26.00	-20.33	1.67	-16.55	2.44
	MAM	-11.05	-9.30	2.17	-6.86	2.83
	JJA	6.49	8.57	1.42	10.65	2.06
	SON	-4.63	-1.06	1.79	1.28	2.24
Goose Bay	DJF	-19.14	-12.45	1.73	-8.75	2.55
	MAM	-6.51	-3.39	1.82	-0.85	2.47
	JJA	9.05	11.87	1.43	13.93	2.04
	SON	-0.54	3.36	1.51	5.55	2.00
Mary's Harbour	DJF	-17.83	-11.15	2.09	-8.18	2.81
	MAM	-7.17	-4.52	1.74	-2.17	2.17
	JJA	6.07	8.42	1.33	10.44	1.99
	SON	-0.85	2.78	1.53	4.78	1.92
Nain	DJF	-19.70	-11.78	2.46	-7.87	3.22
	MAM	-9.53	-6.30	1.87	-3.34	2.56
	JJA	4.50	7.01	1.17	9.18	1.73
	SON	-1.88	1.78	1.65	3.83	2.10
Wabush Lake	DJF	-25.60	-19.11	1.71	-15.25	2.38
	MAM	-10.78	-7.76	2.25	-5.29	2.92
	JJA	6.81	9.53	1.37	11.67	1.99
	SON	-3.94	-0.03	1.64	2.35	2.08
Schefferville	DJF	-26.52	-19.53	1.72	-15.49	2.47
	MAM	-12.60	-9.44	2.21	-6.71	2.92
	JJA	5.83	8.46	1.37	10.54	1.94
	SON	-5.11	-0.82	1.68	1.53	2.14

Daily Maximum Temperature (^{o}C)

Summary: Increases in daily maximum temperature are projected throughout the province, with the greatest change expected in winter. Changes are smaller than those of the minimum (1-4^{o}C in NL; 2-8 ^{o}C in Labrador).

Mean daily maximum temperature is calculated by averaging the maximum temperature recorded for each day in a given season. As with daily minima, the timing of the maxima is strongly related to the diurnal cycle in solar heating; daily maximums are expected mid-to-late afternoon, several hours after solar intensity begins to decrease.

Seasons/locations with daily maxima close to zero and minima considerably below freezing will see a larger number of daily freeze/thaw cycles associated with the daily temperature cycle. These become less common as both maxima and minima increase. Spatial patterns of projected change closely follow those of the daily average and minima.

Figure 5: Changes in mean daily maximum temperature (°C) projected for 2041-2070.

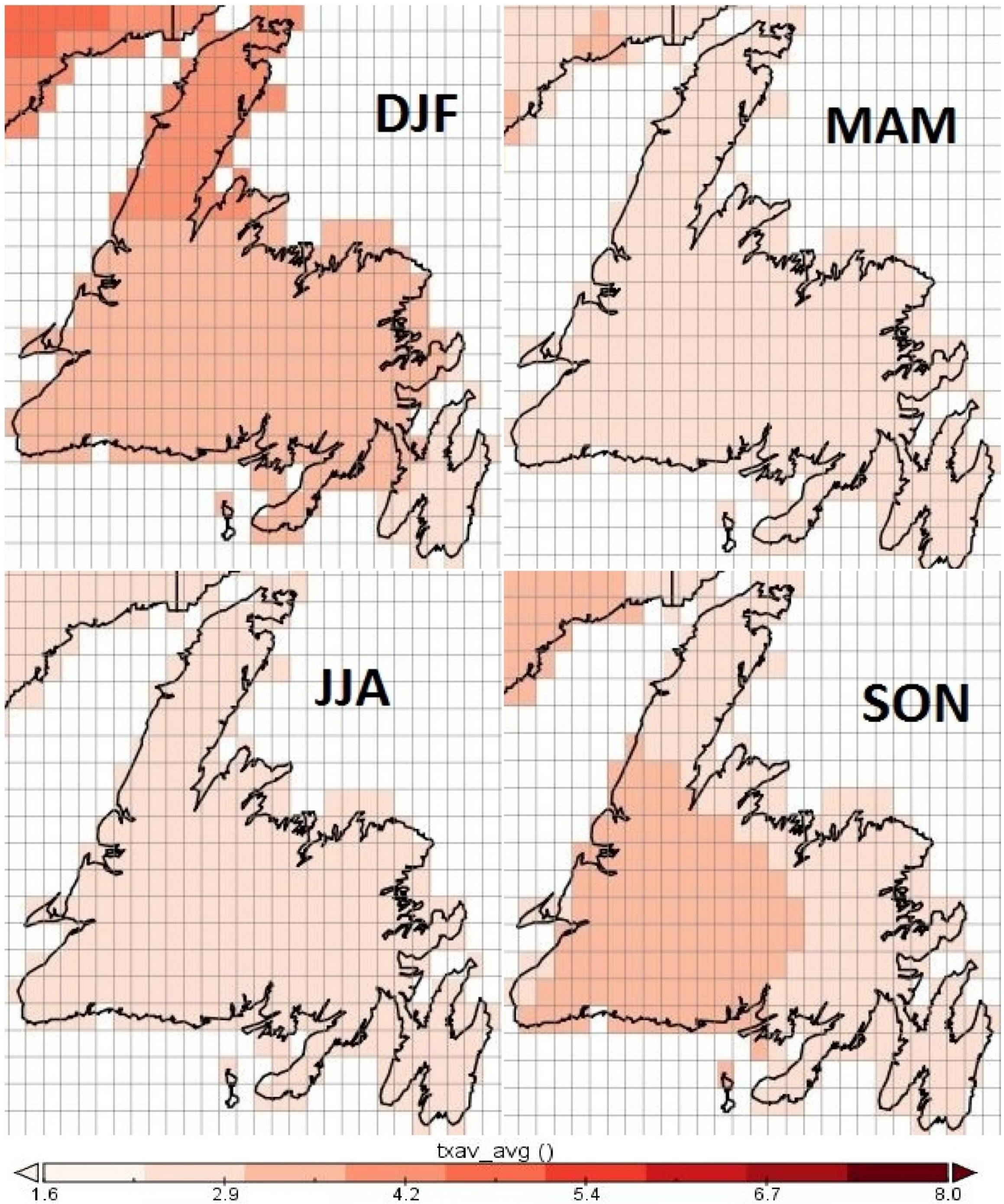

Figure 6: Changes in mean daily maximum temperature (°C) projected for 2041-2070.

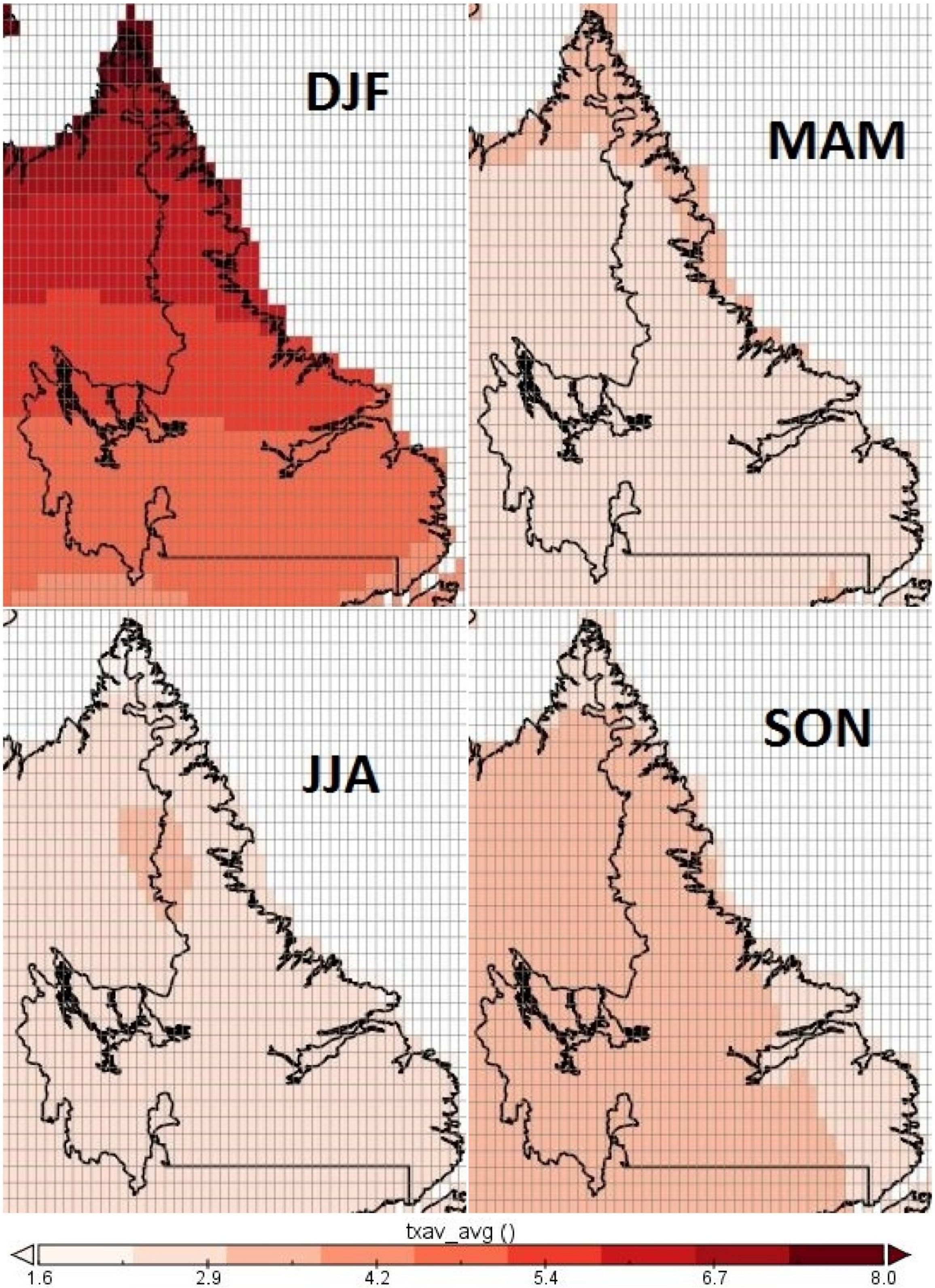

Table 5: Mean daily maximum temperature (ºC) climatology and projected change, Newfoundland. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
Argentia	**DJF**	1.73	4.55	1.12	6.41	1.53
	MAM	5.73	8.39	1.08	10.10	1.34
	JJA	16.35	19.44	1.29	21.13	1.80
	SON	11.92	14.17	1.23	16.15	1.62
Bay D'Espoir	**DJF**	-0.38	3.30	1.21	5.25	1.66
	MAM	7.67	9.72	1.44	11.44	1.67
	JJA	20.45	23.36	1.29	25.11	1.83
	SON	11.95	15.16	1.50	17.24	1.93
Burgeo	**DJF**	-0.83	2.58	1.17	4.52	1.61
	MAM	4.64	7.41	1.29	9.16	1.51
	JJA	15.83	18.83	1.31	20.60	1.83
	SON	10.47	13.03	1.35	15.06	1.75
Comfort Cove	**DJF**	-2.56	1.06	1.49	3.03	1.98
	MAM	5.35	7.14	1.34	9.00	1.70
	JJA	19.47	22.21	1.35	24.16	2.04
	SON	9.92	13.16	1.44	15.29	1.85
Corner Brook	**DJF**	-1.51	2.21	1.33	4.28	1.82
	MAM	6.37	9.25	1.49	11.01	1.74
	JJA	20.40	23.47	1.43	25.39	2.03
	SON	11.11	13.99	1.44	16.12	1.91
Daniel's Harbour	**DJF**	-2.62	1.06	1.42	3.22	1.95
	MAM	4.01	6.60	1.46	8.49	1.70
	JJA	16.44	19.57	1.46	21.55	2.13
	SON	9.42	12.35	1.43	14.43	1.87
Deer Lake	**DJF**	-2.36	1.52	1.35	3.60	1.85
	MAM	6.58	9.00	1.54	10.78	1.86
	JJA	21.09	23.98	1.45	25.92	2.10
	SON	10.61	13.74	1.52	15.89	1.99
Exploits Dam	**DJF**	-2.39	1.44	1.31	3.47	1.79
	MAM	5.81	8.70	1.55	10.44	1.84
	JJA	20.23	23.12	1.37	25.01	2.02
	SON	10.50	13.40	1.51	15.54	1.94
Gander	**DJF**	-1.91	1.61	1.37	3.59	1.84
	MAM	5.64	8.27	1.47	10.05	1.78
	JJA	19.91	22.73	1.43	24.62	2.11
	SON	10.41	13.09	1.49	15.21	1.93
Grand Falls	**DJF**	-1.72	2.14	1.34	4.15	1.82
	MAM	6.63	9.48	1.52	11.23	1.85
	JJA	21.26	24.16	1.40	26.05	2.08
	SON	11.20	14.13	1.52	16.28	1.96
Isle Aux Morts	**DJF**	-0.90	2.64	1.15	4.60	1.59
	MAM	4.46	7.29	1.29	9.07	1.51
	JJA	16.50	19.51	1.38	21.32	1.92
	SON	10.49	13.09	1.31	15.14	1.72
La Scie	**DJF**	-3.72	0.28	1.47	2.30	2.00
	MAM	3.93	5.74	1.26	7.69	1.64
	JJA	18.43	21.37	1.41	23.39	2.17
	SON	9.20	12.62	1.53	14.76	1.97

Table 5, con't.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
North Harbour	DJF	1.24	4.26	1.14	6.12	1.54
	MAM	6.26	8.59	1.22	10.27	1.46
	JJA	17.73	20.64	1.36	22.30	1.90
	SON	12.21	14.53	1.39	16.52	1.78
Plum Point	DJF	-4.37	-0.12	1.52	2.10	2.13
	MAM	3.41	5.73	1.36	7.71	1.69
	JJA	16.53	19.55	1.49	21.54	2.29
	SON	8.55	12.15	1.41	14.23	1.89
Port Aux Basque	DJF	-0.77	2.69	1.16	4.64	1.59
	MAM	4.10	6.98	1.28	8.77	1.48
	JJA	16.00	19.03	1.36	20.83	1.88
	SON	10.43	13.17	1.28	15.21	1.71
Springdale	DJF	-1.93	1.86	1.40	3.93	1.92
	MAM	5.88	8.20	1.36	10.07	1.71
	JJA	20.48	23.20	1.44	25.20	2.15
	SON	10.77	13.70	1.48	15.86	1.93
St. Alban's	DJF	-0.36	2.87	1.19	4.80	1.64
	MAM	6.78	8.96	1.38	10.68	1.61
	JJA	19.19	21.78	1.27	23.52	1.79
	SON	11.41	14.17	1.44	16.23	1.86
St. Anthony	DJF	-4.73	-0.45	1.48	1.77	2.12
	MAM	2.82	5.06	1.30	7.04	1.69
	JJA	17.57	20.28	1.59	22.31	2.48
	SON	8.82	11.72	1.53	13.83	1.99
St. John's	DJF	-0.02	3.13	1.37	4.92	1.74
	MAM	5.42	6.61	1.14	8.39	1.42
	JJA	18.65	21.02	1.17	22.81	1.82
	SON	11.06	14.46	1.40	16.54	1.74
St. Lawrence	DJF	1.07	4.66	1.30	6.51	1.73
	MAM	6.12	8.21	1.25	9.88	1.40
	JJA	17.75	20.52	1.32	22.20	1.74
	SON	12.49	15.54	1.46	17.58	1.91
Stephenville	DJF	-1.33	2.41	1.32	4.44	1.78
	MAM	5.98	8.32	1.52	10.11	1.70
	JJA	18.84	21.78	1.29	23.64	1.86
	SON	10.92	14.28	1.40	16.36	1.83
Twillingate	DJF	-1.65	1.93	1.41	3.88	1.91
	MAM	4.07	5.89	1.11	7.82	1.45
	JJA	17.91	20.41	1.25	22.40	1.97
	SON	9.95	12.82	1.46	14.93	1.87

Table 6: Mean daily maximum temperature (°C) climatology and projected change, Labrador. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Std Dev	Ensemble Avg	Std Dev
Cartwright	DJF	-7.68	-2.67	1.69	-0.16	2.42
	MAM	1.73	3.94	1.50	6.05	2.04
	JJA	16.20	18.76	1.53	20.97	2.43
	SON	6.69	9.92	1.58	12.05	2.06
Churchill Falls	DJF	-14.61	-9.95	1.32	-7.09	1.92
	MAM	0.55	1.72	2.10	3.61	2.68
	JJA	16.96	18.96	1.74	21.09	2.69
	SON	3.08	6.46	1.92	8.67	2.41
Goose Bay	DJF	-10.24	-5.03	1.46	-2.34	2.16
	MAM	3.38	5.60	1.86	7.54	2.48
	JJA	19.37	22.36	1.80	24.46	2.75
	SON	7.03	10.28	1.79	12.46	2.37
Mary's Harbour	DJF	-7.54	-2.68	1.55	-0.44	2.22
	MAM	1.86	3.43	1.42	5.43	1.82
	JJA	16.34	18.71	1.66	20.78	2.53
	SON	7.25	10.44	1.60	12.55	2.06
Nain	DJF	-11.26	-4.56	1.82	-1.42	2.59
	MAM	-0.59	1.35	1.73	3.73	2.28
	JJA	14.10	16.69	1.56	19.10	2.26
	SON	5.12	8.61	1.81	10.65	2.30
Wabush Lake	DJF	-14.38	-9.43	1.17	-6.57	1.66
	MAM	1.05	2.96	2.20	4.78	2.76
	JJA	17.41	20.20	1.64	22.36	2.62
	SON	3.64	7.14	1.85	9.39	2.33
Schefferville	DJF	-16.50	-11.01	1.32	-7.89	1.92
	MAM	-1.69	0.51	2.13	2.53	2.78
	JJA	15.48	18.16	1.66	20.28	2.56
	SON	1.76	5.53	1.78	7.72	2.27

Cooling Degree Days

Summary: Cooling degree days are projected to increase during the summer, but the changes are small enough to be ignored.

Cooling degree days (CDD) are used to estimate the energy required for cooling of buildings in warm seasons. It is essentially a measure of the accumulated heat deficit below a predetermined threshold (in this case, T_{th}=16^{o}C); seasonal values are calculated as the sum of CDD for each day in that season. The formula varies with daily minimimum (T_{min}) and maximum (T_{max}) temperatures, as follows:

CDD = 0;	If $T_{max} < T_{thr}$
CDD = $(T_{max}-T_{thr})/4$;	If $(T_{max}+T_{min})/2 < T_{thr}$
CDD = $(T_{max}-T_{thr})/2-(T_{thr}-T_{min})/4$;	If $T_{min} <= T_{thr}$
CDD = $(T_{max}+T_{min})/2-T_{thr;}$	If $T_{min} > T_{thr}$

The projected change in total CDD is significant in most of the province from a statistical standpoint; that is, models agree that an increase is very likely. However, in economic terms, the change may not be significant. Currently, CCD values are small enough that cooling costs are negligible throughout the province, and the projected change (~50-250 CDD/year) is likely too small to have an economic impact.

Figure 7: Changes in cooling degree days projected for 2041-2070.

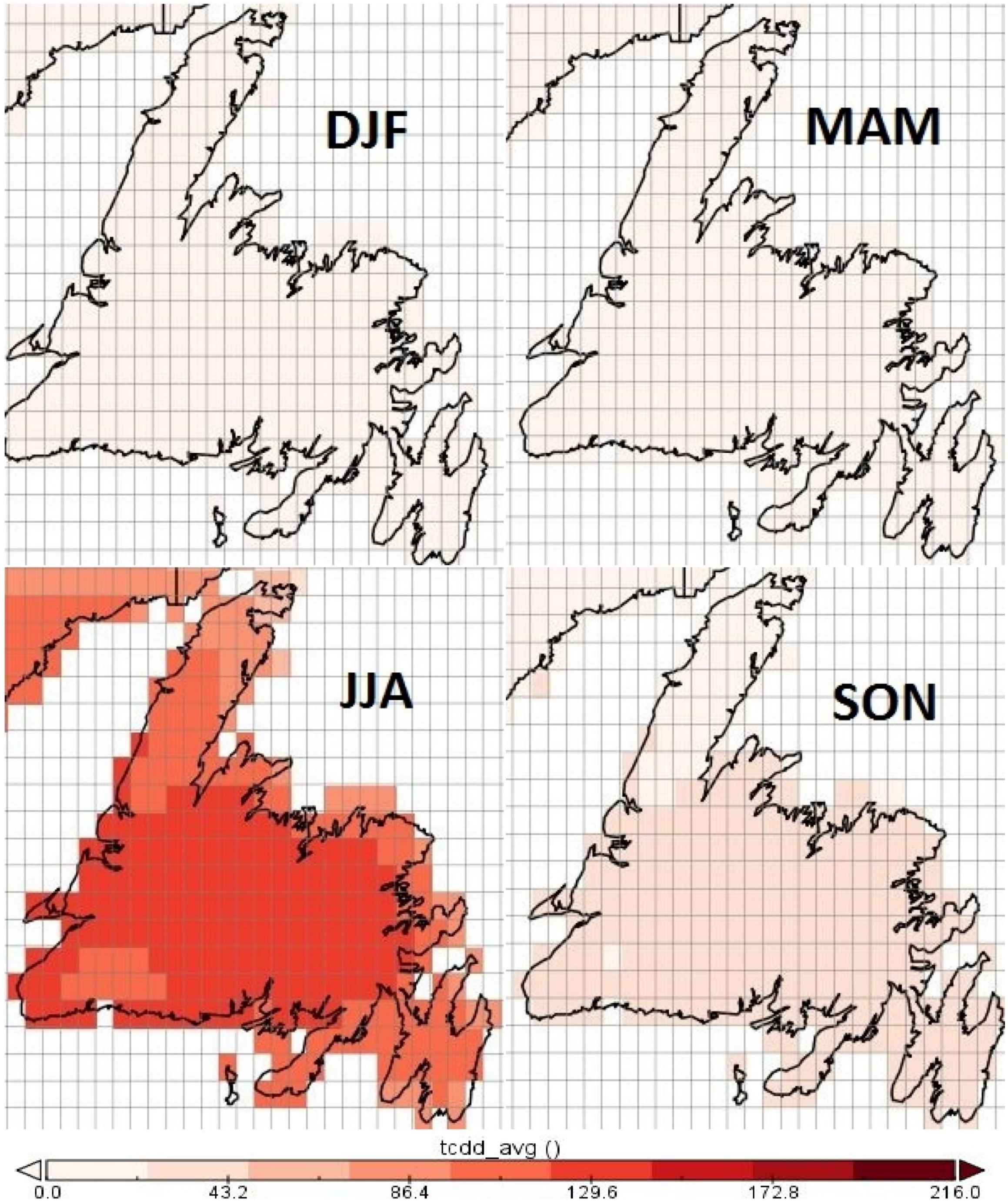

Figure 8: Changes in cooling degree days projected for 2041-2070.

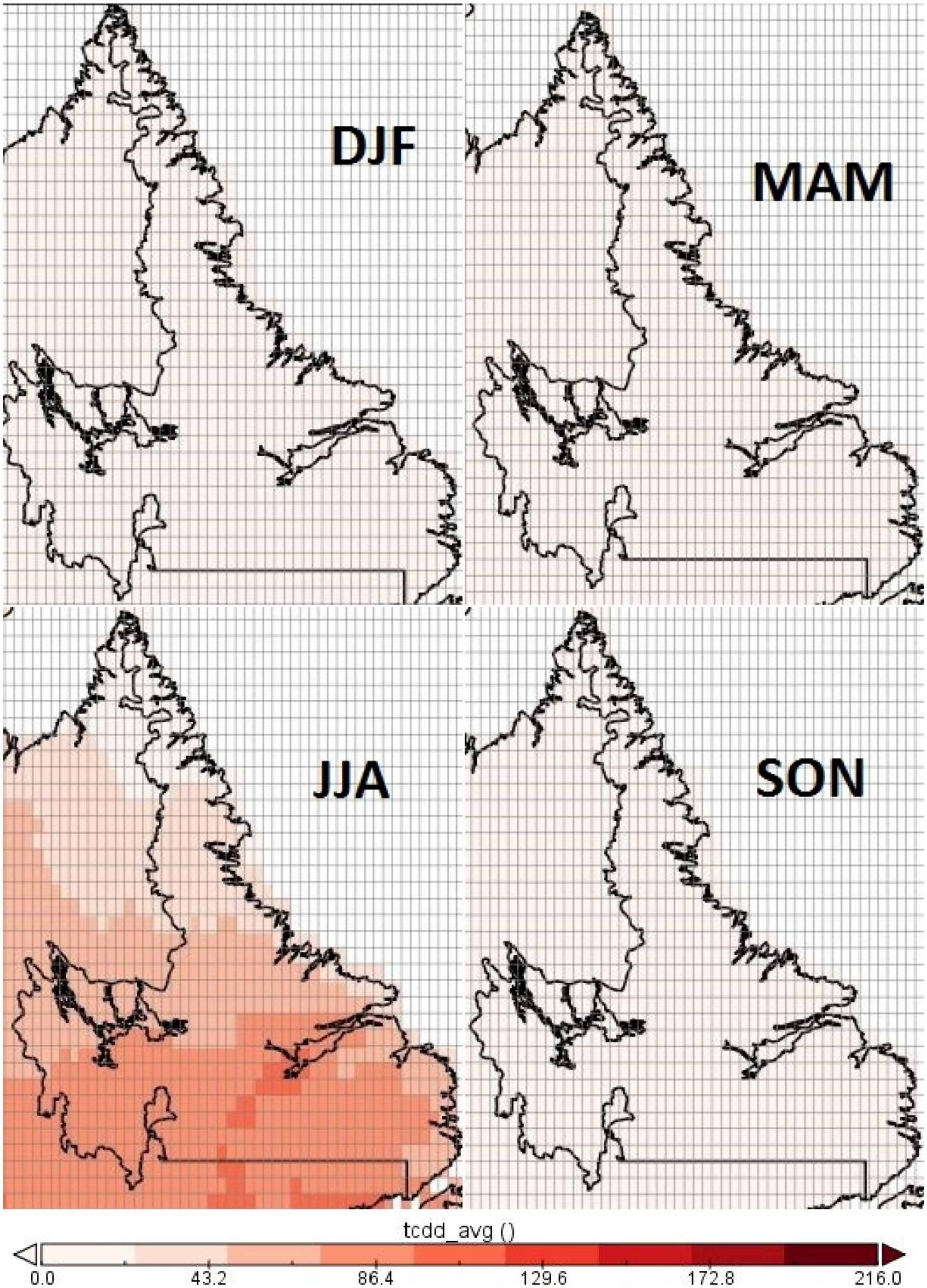

Table 7: Cooling degree day climatology and projected change; Newfoundland. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
Argentia	DJF	0.0	0.1	0.1	0.4	0.5
	MAM	0.7	2.0	2.0	5.2	4.5
	JJA	56.6	188.1	58.7	303.0	104.6
	SON	15.1	48.4	22.3	105.4	46.2
Bay D'Espoir	DJF	0.0	0.1	0.2	0.6	0.7
	MAM	6.5	14.0	7.0	22.5	10.8
	JJA	151.0	312.1	66.1	434.3	110.3
	SON	22.1	72.2	29.1	128.8	53.7
Burgeo	DJF	0.0	0.0	0.0	0.0	0.0
	MAM	0.2	1.7	1.4	3.9	2.7
	JJA	36.7	133.8	48.1	236.2	92.0
	SON	5.3	28.2	14.7	67.0	33.4
Comfort Cove	DJF	0.0	0.1	0.3	0.5	0.7
	MAM	8.3	11.2	5.6	18.3	8.8
	JJA	161.3	279.0	57.2	396.7	103.3
	SON	15.9	50.8	22.2	94.5	41.4
Corner Brook	DJF	0.0	0.2	0.3	0.7	0.8
	MAM	6.4	17.5	7.1	28.1	11.9
	JJA	185.1	354.6	74.9	496.3	125.6
	SON	26.2	66.1	27.3	121.1	53.5
Daniel's Harbour	DJF	0.0	0.1	0.1	0.3	0.4
	MAM	1.2	2.9	2.0	6.6	4.6
	JJA	56.1	180.6	59.2	304.0	110.4
	SON	8.2	29.9	14.5	68.7	33.9
Deer Lake	DJF	0.0	0.2	0.2	0.5	0.6
	MAM	9.0	18.8	7.5	29.2	12.0
	JJA	189.2	344.9	70.0	477.7	119.6
	SON	22.6	61.7	25.6	110.4	48.8
Exploits Dam	DJF	0.0	0.1	0.1	0.3	0.4
	MAM	5.7	15.7	6.5	24.3	10.3
	JJA	144.7	282.8	59.7	401.9	105.7
	SON	17.7	50.2	21.7	91.9	41.4
Gander	DJF	0.0	0.1	0.1	0.3	0.5
	MAM	7.2	16.0	6.1	24.9	10.1
	JJA	173.2	311.3	68.3	437.6	118.6
	SON	21.8	54.8	25.2	101.8	46.0
Grand Falls	DJF	0.0	0.1	0.2	0.5	0.7
	MAM	10.0	22.3	8.5	33.8	13.7
	JJA	201.8	362.0	70.2	493.9	121.1
	SON	26.4	67.8	28.3	119.6	51.3
Isle Aux Morts	DJF	0.0	0.0	0.0	0.0	0.0
	MAM	0.7	1.9	1.2	4.4	2.9
	JJA	58.8	175.7	56.5	290.7	102.8
	SON	7.8	34.5	17.2	78.8	38.6
La Scie	DJF	0.0	0.1	0.3	0.4	0.7
	MAM	4.8	6.8	3.9	12.6	8.4
	JJA	137.7	255.9	55.7	373.8	103.9
	SON	16.4	46.8	21.2	89.3	40.5

Table 7, con't.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
North Harbour	DJF	0.0	0.1	0.1	0.4	0.6
	MAM	1.0	3.5	2.9	7.1	5.7
	JJA	86.7	217.9	59.9	326.7	104.7
	SON	20.5	56.6	25.2	110.9	48.0
Plum Point	DJF	0.0	0.0	0.1	0.2	0.3
	MAM	0.9	1.9	1.3	5.0	3.2
	JJA	57.7	180.7	59.3	303.7	114.5
	SON	7.1	31.0	15.1	71.0	34.6
Port Aux Basque	DJF	0.0	0.0	0.0	0.0	0.0
	MAM	0.3	1.2	0.9	2.9	2.4
	JJA	44.4	156.9	53.6	266.7	97.8
	SON	6.4	32.0	15.4	75.0	36.5
Springdale	DJF	0.0	0.2	0.3	0.5	0.7
	MAM	6.8	13.4	6.1	22.1	9.9
	JJA	180.7	318.0	64.7	444.9	113.9
	SON	21.3	57.7	24.5	104.2	45.5
St. Alban's	DJF	0.0	0.0	0.1	0.2	0.3
	MAM	3.1	8.6	4.6	14.8	7.4
	JJA	110.5	241.3	59.1	356.3	102.3
	SON	15.1	51.5	22.9	100.2	45.1
St. Anthony	DJF	0.0	0.1	0.1	0.1	0.2
	MAM	1.2	3.1	1.8	7.1	3.8
	JJA	92.0	204.7	57.5	318.5	110.5
	SON	12.7	35.1	16.9	71.9	34.0
St. John's	DJF	0.0	0.2	0.4	0.8	1.1
	MAM	4.3	5.2	4.9	8.6	7.7
	JJA	133.2	243.1	51.0	351.3	96.7
	SON	19.5	61.5	25.0	117.1	45.5
St. Lawrence	DJF	0.0	0.2	0.5	0.9	1.4
	MAM	0.7	2.7	3.0	5.2	4.8
	JJA	83.5	218.2	62.4	326.1	101.0
	SON	18.3	70.4	28.2	135.6	56.8
Stephenville	DJF	0.0	0.1	0.2	0.6	0.6
	MAM	3.4	8.6	6.3	15.6	11.2
	JJA	124.6	286.6	70.6	424.6	119.0
	SON	16.9	60.2	24.2	118.4	50.4
Twillingate	DJF	0.0	0.2	0.4	0.5	0.9
	MAM	4.2	5.7	4.0	10.5	8.1
	JJA	130.0	239.9	51.2	358.2	99.2
	SON	17.6	47.3	21.5	94.4	42.5

Table 8: Cooling degree day climatology and projected change; Labrador. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Std Dev	Ensemble Avg	Std Dev
Cartwright	DJF	0.0	0.0	0.0	0.1	0.1
	MAM	2.0	4.0	2.3	8.6	4.8
	JJA	75.4	141.2	38.0	230.4	82.3
	SON	6.5	19.7	10.3	41.7	21.6
Churchill Falls	DJF	0.0	0.0	0.0	0.0	0.0
	MAM	2.4	5.3	3.9	11.6	8.2
	JJA	79.1	139.2	45.5	230.2	92.4
	SON	3.5	12.5	7.3	26.9	17.2
Goose Bay	DJF	0.0	0.0	0.0	0.1	0.1
	MAM	6.2	12.6	6.7	24.3	12.8
	JJA	154.1	287.6	75.3	417.1	132.4
	SON	14.3	37.8	18.6	70.9	38.4
Mary's Harbour	DJF	0.0	0.0	0.0	0.0	0.0
	MAM	1.6	3.2	2.5	6.3	4.3
	JJA	84.1	147.6	42.9	232.1	82.9
	SON	7.2	24.2	12.5	49.4	24.1
Nain	DJF	0.0	0.0	0.0	0.0	0.0
	MAM	0.7	1.1	1.3	3.9	4.8
	JJA	41.8	83.3	26.9	155.4	60.8
	SON	3.7	11.0	6.3	25.0	15.3
Wabush Lake	DJF	0.0	0.0	0.0	0.0	0.0
	MAM	4.0	8.7	5.8	17.2	10.5
	JJA	80.9	174.2	51.2	281.4	103.4
	SON	5.2	17.3	8.5	36.5	20.9
Schefferville	DJF	0.0	0.0	0.0	0.0	0.0
	MAM	1.0	3.6	2.9	9.5	7.7
	JJA	54.6	118.6	38.5	202.0	79.0
	SON	2.5	9.2	4.9	21.0	13.3

Heating Degree Days

Summary: Heating degree days are projected to decrease considerably on an annual basis, with the greatest change expected in winter. Annual decreases are economically significant, implying a substantial decrease in heating costs.

Heating degree days (HDD) are similar to cooling degree days, but measure energy requirements for heating homes to comfortable temperatures. It is defined relative to a selected threshold temperature (T_{th}=16°C was used here). As with cooling degree days, seasonal values of HDD are calculated as the sum over all daily values for the season. The calculations use daily minimum (T_{min}) and daily maximum (T_{max}) temperatures, following:

$HDD = 0$;	if $T_{min} > T_{thr}$
$HDD = (T_{thr}-T_{min})/4$;	if $(T_{max}+T_{min})/2 > T_{thr}$
$HDD = (T_{thr}-T_{min})/2-(T_{max}-T_{thr})/4$;	if $T_{max} >= T_{thr}$
$HDD = T_{thr}-(T_{max}+T_{min})/2$;	if $T_{max} < T_{thr}$

Under the current climate, total HDD is relatively large, and becomes greater as temperatures drop in given seasons/locations. The models universally predict large, statistically significant decreases in HDD across the province during all seasons. The distribution in space and across seasons closely follows shifts in daily mean, minimum, and maximum temperatures, with the largest decreases in Northern Labrador during winter, and the smallest changes over coastal Newfoundland during summer. Regardless of the location, annual decreases in HDD are economically significant. For Newfoundland, the mid-century annual decrease is roughly equivalent to current HDD for Autumn; in Labrador, the decrease is roughly half the spring values. This points to substantial savings on heating costs arising from climate change.

Figure 9: Changes in heating degree days projected for 2041-2070.

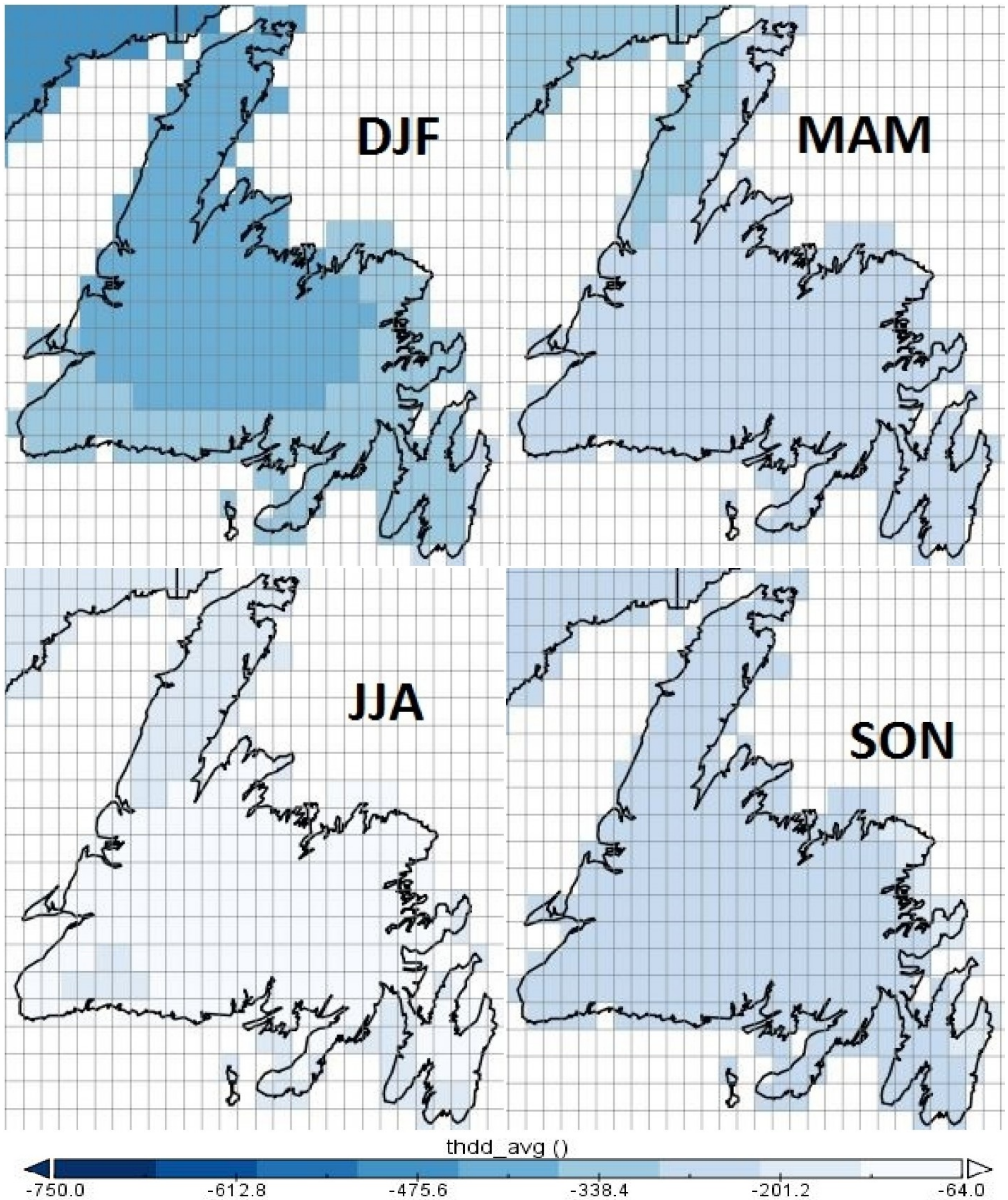

Figure 10: Changes in heating degree days projected for 2041-2070.

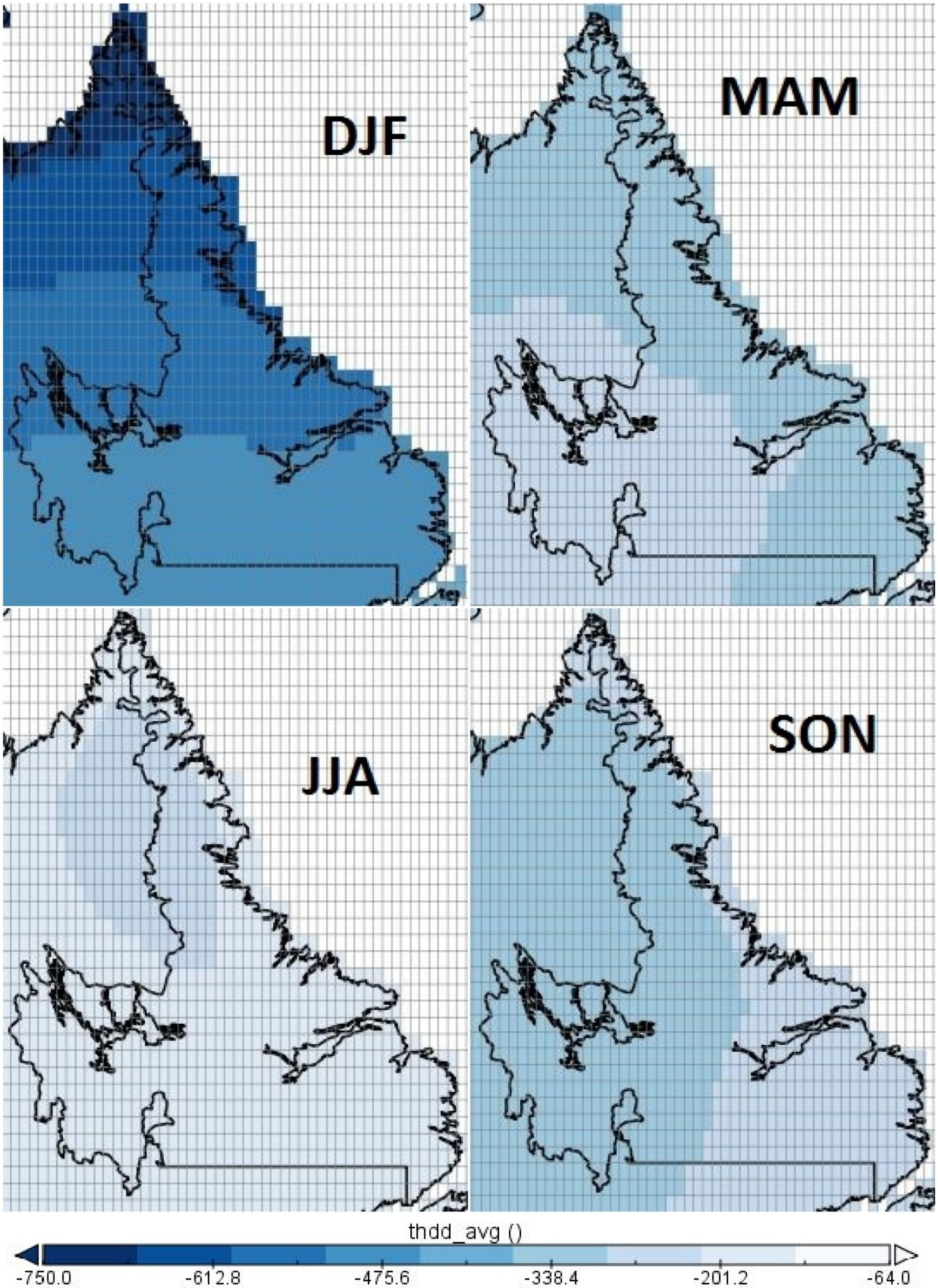

Table 9: Heating degree day climatology and projected change; Newfoundland. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
Argentia	DJF	1518.8	1235.9	116.2	1051.9	151.4
	MAM	1188.6	942.5	79.6	777.5	99.2
	JJA	270.3	129.9	66.4	83.2	70.9
	SON	620.1	456.8	88.3	330.0	102.5
Bay D'Espoir	DJF	1889.3	1529.0	131.0	1326.4	169.9
	MAM	1217.2	1021.9	115.7	858.7	129.0
	JJA	251.8	135.9	56.7	91.0	63.5
	SON	800.2	564.6	96.4	432.1	112.1
Burgeo	DJF	1842.4	1484.0	121.7	1288.2	161.2
	MAM	1348.1	1084.9	108.5	914.8	125.6
	JJA	349.3	179.8	76.6	114.6	82.8
	SON	816.0	582.1	101.5	433.7	122.0
Comfort Cove	DJF	2054.4	1661.7	150.9	1461.9	197.0
	MAM	1390.0	1196.2	112.6	1021.4	135.2
	JJA	326.0	203.3	66.8	139.8	80.3
	SON	922.6	665.5	100.3	518.1	120.3
Corner Brook	DJF	1877.4	1486.0	136.0	1272.5	179.4
	MAM	1266.7	985.1	117.7	816.7	131.0
	JJA	213.8	107.0	53.9	68.3	58.5
	SON	794.8	566.0	91.4	427.9	109.0
Daniel's Harbour	DJF	2002.7	1620.5	140.0	1398.4	190.3
	MAM	1426.3	1170.8	134.2	987.4	150.4
	JJA	320.9	168.2	78.9	110.0	88.1
	SON	881.4	642.4	110.5	491.2	131.8
Deer Lake	DJF	2048.2	1638.0	143.2	1418.1	189.4
	MAM	1338.3	1085.1	130.6	915.0	150.3
	JJA	260.8	147.2	59.9	98.4	67.9
	SON	903.5	648.1	96.3	503.1	116.7
Exploits Dam	DJF	2065.5	1676.5	140.4	1460.7	186.8
	MAM	1418.3	1133.3	130.7	965.5	151.0
	JJA	320.2	184.2	62.3	125.3	72.5
	SON	934.4	700.0	97.8	549.5	118.8
Gander	DJF	1940.1	1547.8	140.7	1342.2	184.3
	MAM	1337.8	1070.1	115.7	901.6	134.1
	JJA	274.6	158.6	62.9	108.0	72.8
	SON	864.5	648.0	96.8	504.2	117.5
Grand Falls	DJF	2001.5	1590.2	141.9	1376.9	187.3
	MAM	1303.3	1036.7	124.6	871.6	145.5
	JJA	247.0	138.9	55.2	92.9	62.8
	SON	861.4	625.1	93.7	484.3	112.2
Isle Aux Morts	DJF	1810.1	1441.6	119.9	1246.2	157.2
	MAM	1337.4	1058.6	106.3	886.8	124.0
	JJA	303.0	150.7	72.1	94.1	78.2
	SON	773.2	550.8	93.9	405.5	113.5
La Scie	DJF	2104.1	1691.2	146.3	1487.3	195.6
	MAM	1488.3	1272.1	112.4	1089.8	139.9
	JJA	353.2	217.2	75.8	149.9	92.1
	SON	915.9	683.6	112.4	534.6	133.5

Table 9, con't.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
North Harbour	DJF	1654.2	1358.3	121.9	1174.4	154.9
	MAM	1251.1	1010.2	90.9	846.7	104.9
	JJA	292.4	155.3	69.6	104.8	78.6
	SON	695.8	515.0	94.9	384.9	111.0
Plum Point	DJF	2177.4	1725.2	154.2	1494.5	213.0
	MAM	1501.4	1237.8	126.7	1044.4	152.3
	JJA	329.4	179.5	81.1	119.5	94.2
	SON	941.4	652.4	111.0	504.0	134.6
Port Aux Basque	DJF	1771.8	1431.8	116.5	1239.2	152.8
	MAM	1363.1	1079.8	105.6	907.8	122.4
	JJA	323.3	165.5	75.8	104.6	82.1
	SON	780.6	544.6	95.0	398.1	115.7
Springdale	DJF	2072.8	1676.9	150.0	1462.1	198.9
	MAM	1374.9	1150.5	121.5	973.9	147.7
	JJA	298.0	180.8	66.1	122.8	78.1
	SON	908.9	663.9	101.1	516.7	121.4
St. Alban's	DJF	1896.6	1534.6	128.1	1333.2	166.9
	MAM	1258.6	1052.4	112.5	887.2	126.0
	JJA	270.2	154.1	62.7	102.4	70.5
	SON	825.5	595.2	99.3	455.7	117.1
St. Anthony	DJF	2239.8	1785.8	154.9	1554.5	217.2
	MAM	1546.3	1316.6	120.9	1124.6	159.2
	JJA	369.0	235.2	86.5	163.6	106.3
	SON	982.8	735.2	115.5	582.7	138.9
St. John's	DJF	1736.0	1427.0	132.9	1252.4	165.9
	MAM	1314.4	1162.1	77.6	992.8	100.1
	JJA	303.9	197.5	63.2	137.7	78.9
	SON	781.6	524.5	96.1	389.6	108.9
St. Lawrence	DJF	1631.9	1307.5	117.3	1127.2	153.2
	MAM	1253.3	1024.0	94.5	864.2	105.8
	JJA	271.3	147.9	67.5	98.1	72.9
	SON	669.9	444.8	102.4	320.1	116.5
Stephenville	DJF	1853.5	1477.1	131.3	1275.3	171.8
	MAM	1273.6	1027.5	122.5	856.2	129.7
	JJA	211.4	102.6	54.8	64.5	58.5
	SON	768.4	509.1	95.9	374.8	110.6
Twillingate	DJF	1775.7	1452.1	138.0	1260.3	185.6
	MAM	1348.2	1173.2	98.0	993.5	124.7
	JJA	308.1	202.4	69.3	138.6	81.5
	SON	796.9	590.7	106.4	448.3	124.5

Table 10: Heating degree day climatology and projected change; Labrador. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Std Dev	Ensemble Avg	Std Dev
Cartwright	DJF	2523.90	2003.10	178.14	1741.60	247.05
	MAM	1712.30	1448.70	150.52	1240.30	203.38
	JJA	536.72	370.23	91.25	258.60	118.83
	SON	1162.20	876.56	124.90	710.54	154.14
Churchill Falls	DJF	3274.70	2804.40	135.86	2505.70	197.19
	MAM	1957.10	1819.90	196.29	1627.50	248.97
	JJA	472.36	344.46	102.93	242.58	133.46
	SON	1529.80	1220.70	161.80	1028.40	195.14
Goose Bay	DJF	2769.00	2228.30	144.75	1940.20	212.79
	MAM	1622.60	1378.50	164.98	1185.00	217.89
	JJA	318.73	186.00	77.58	124.78	95.14
	SON	1174.90	871.86	130.86	706.18	160.14
Mary's Harbour	DJF	2564.10	2063.40	162.91	1829.10	225.70
	MAM	1691.90	1520.10	142.60	1323.90	181.07
	JJA	525.01	370.80	98.57	268.52	129.43
	SON	1170.80	876.85	129.65	715.82	156.85
Nain	DJF	2838.30	2177.10	192.05	1859.20	260.61
	MAM	1937.50	1695.30	169.87	1453.40	223.01
	JJA	658.33	463.63	101.10	326.28	128.27
	SON	1312.20	992.62	152.25	820.81	185.75
Wabush Lake	DJF	3234.50	2726.20	130.57	2423.80	182.53
	MAM	1923.00	1696.20	203.39	1508.00	255.38
	JJA	438.61	278.18	90.24	188.98	116.96
	SON	1474.90	1148.00	150.96	956.67	180.45
Schefferville	DJF	3379.00	2816.00	137.35	2494.00	198.04
	MAM	2130.40	1880.10	201.38	1668.70	260.07
	JJA	545.46	365.72	103.37	256.15	134.59
	SON	1609.90	1248.70	152.58	1054.50	187.57

Growing Degree Days

Summary: An increase in growing degree days is projected across the province. Changes are greatest in summer, and largely concentrated in Newfoundland and southern Labrador. This should increase agricultural and forestry potential in places where such activities are currently viable. Higher growing degree days also suggest an increase in the activity of insect pests (e.g. spruce budworm).

Growing degree days (GDD) are a measure of energy availability for plant growth, measured as *heat accumulation* over a number of days. It is used in agriculture, silviculture, and horticulture as a guide to plant/crop selection. GDD are calculated in the same basic manner as Heating and Cooling degree days. The formula for GDD used here is:

$$GDD = \sum_{days} \left\lfloor \left(\frac{T_{\max} - T_{\min}}{2} \right) - 10^{o} C \right\rfloor ;$$

where T_{max} & T_{min} are the daily maximum and minimum temperatures, respectively. The Σ indicates we sum up the value over a period of days (e.g. June 1st through August 31st for total summer GDD). Only days with T_{max} above 10°C are included in the calculation; days with T_{max} <= 10°C are excluded. This means there is no such thing as a *negative* GDD.

The key point is that a greater GDD implies more plant growth and earlier plant maturation, both because there are more days during which plants can undergo photosynthesis and/or greater potential for growth during those days. In regions where soils are favorable and water is plentiful, GDD increases can bring increased agricultural productivity and greater annual tree growth. Because GDD and growing season length are major factors preventing some species from moving into cool areas like Newfoundland, rising GDD may be accompanied by a shift in vegetation types. At the very least, an increase in mean summer GDD implies more reliable agricultural activity on the island, and fewer of the poor harvests seen in unusually cold years (e.g. 2011 in eastern Newfoundland).

GDDs can also be used to predict pest populations, as the timing of insect maturation and the health of insect populations also depend on heat accumulation. Spruce bud worm and spanworm populations may benefit from increases in GDD; however, so will beneficial species such as bees.

Newfoundland and Southern Labrador are expected to undergo a substantial increase in total GDD during summer, with smaller (but still significant) increases in autumn. The greatest changes are expected on the south coast, west coast, and interior of the island; total annual changes of ~200-400 GDD are expected.

Figure 11: Changes in growing degree days projected for 2041-2070.

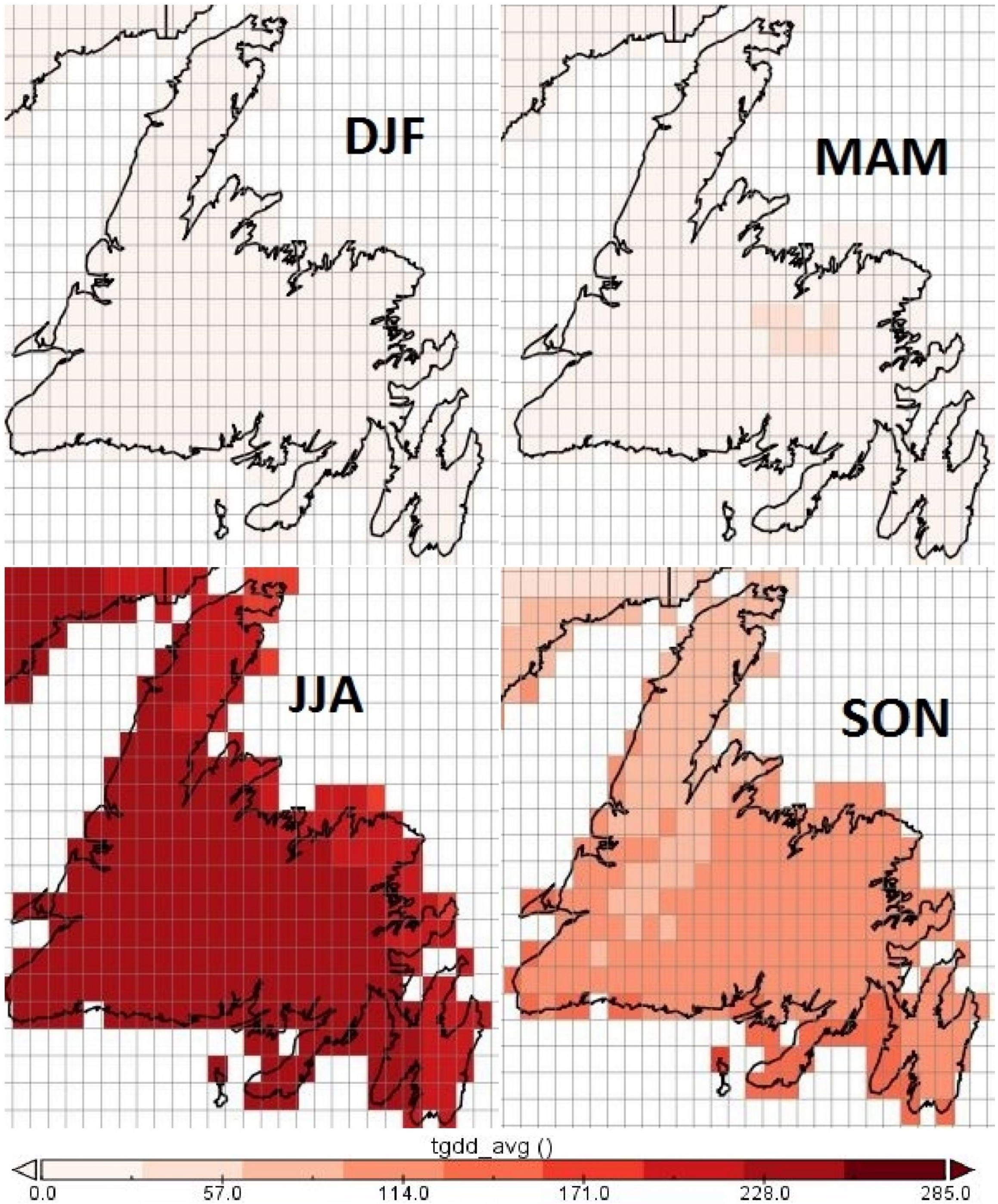

Figure 12: Changes in growing degree days projected for 2041-2070.

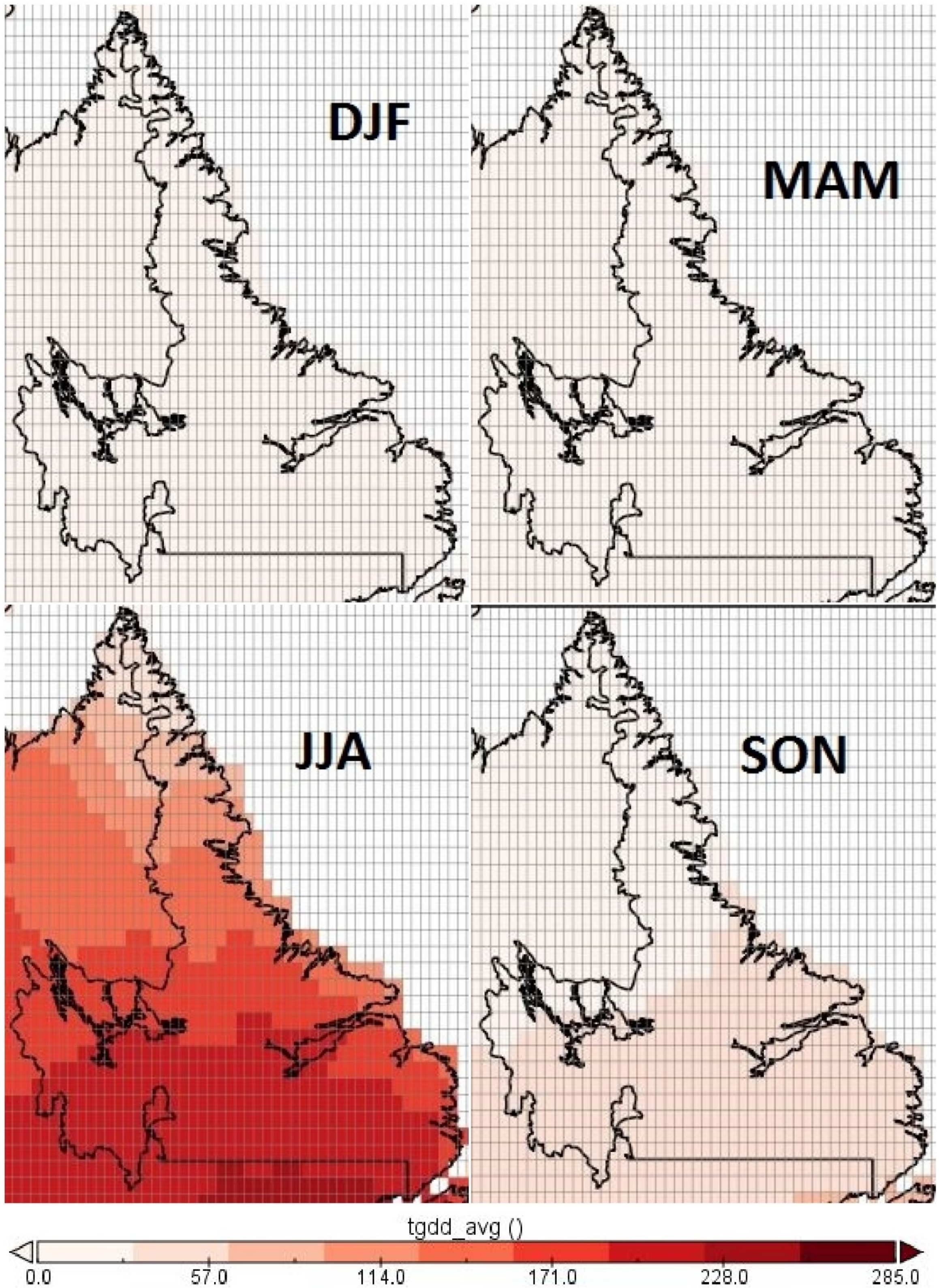

Table 11: Growing degree day climatology and projected change; Newfoundland. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070 Ensemble Avg	Projection: 2041-2070 Uncertainty	Projection: 2071-2100 Ensemble Avg	Projection: 2071-2100 Uncertainty
Argentia	DJF	0.3	2.5	2.2	9.0	8.4
	MAM	4.0	24.8	15.5	55.6	32.5
	JJA	359.2	615.4	107.2	773.7	159.3
	SON	139.2	255.5	69.1	387.9	110.2
Bay D'Espoir	DJF	0.1	1.2	1.2	4.6	4.6
	MAM	15.2	44.0	20.3	78.8	35.8
	JJA	458.4	731.9	108.0	897.0	159.6
	SON	99.0	235.7	69.5	359.0	112.7
Burgeo	DJF	0.0	0.3	0.4	1.9	2.2
	MAM	0.9	14.7	10.9	36.8	25.4
	JJA	274.5	514.2	103.5	677.1	155.5
	SON	66.4	173.3	56.5	288.7	97.7
Comfort Cove	DJF	0.1	0.8	0.9	2.4	2.8
	MAM	20.7	30.6	14.6	54.8	26.0
	JJA	438.4	650.9	97.6	821.5	157.0
	SON	70.8	175.5	56.9	283.6	95.7
Corner Brook	DJF	0.1	1.9	1.6	5.8	5.4
	MAM	20.9	61.1	22.0	102.2	41.7
	JJA	538.1	802.9	112.3	981.3	168.2
	SON	112.9	234.0	66.0	355.8	110.8
Daniel's Harbour	DJF	0.1	0.6	0.7	1.8	2.3
	MAM	5.0	16.6	9.5	39.8	24.1
	JJA	324.7	576.2	109.2	752.7	169.4
	SON	66.2	161.4	55.1	269.4	95.0
Deer Lake	DJF	0.0	1.2	1.1	3.4	3.5
	MAM	17.6	50.2	18.7	85.2	35.7
	JJA	500.4	756.6	110.6	935.0	168.7
	SON	83.8	197.0	61.3	308.7	103.7
Exploits Dam	DJF	0.0	0.5	0.5	2.1	2.3
	MAM	9.2	39.4	16.3	68.7	30.4
	JJA	402.5	660.5	102.5	833.9	159.3
	SON	60.7	160.7	54.5	264.1	93.8
Gander	DJF	0.1	1.2	1.0	3.5	3.7
	MAM	20.4	48.2	18.1	79.0	32.9
	JJA	487.7	718.2	108.7	889.0	168.7
	SON	96.6	193.4	62.0	303.1	101.0
Grand Falls	DJF	0.1	1.4	1.1	4.3	4.4
	MAM	24.5	60.5	21.7	97.8	39.2
	JJA	527.9	782.2	108.1	956.5	167.2
	SON	95.3	212.6	64.0	327.9	105.1
Isle Aux Morts	DJF	0.0	0.5	0.6	2.8	3.0
	MAM	2.3	20.0	13.3	45.9	30.2
	JJA	337.7	583.8	108.0	751.8	161.0
	SON	88.8	196.2	58.3	317.8	101.4
La Scie	DJF	0.0	0.5	0.7	1.4	1.9
	MAM	10.9	19.2	9.6	39.0	22.2
	JJA	400.0	621.1	99.9	792.9	161.7
	SON	71.1	169.7	58.1	276.4	97.6

Table 11, con't.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
North Harbour	DJF	0.0	1.6	1.6	6.2	6.0
	MAM	2.9	22.2	15.0	47.5	30.3
	JJA	373.2	623.3	109.4	778.2	163.7
	SON	127.2	239.2	69.9	363.4	110.6
Plum Point	DJF	0.0	0.4	0.5	1.2	1.5
	MAM	3.0	11.5	5.3	31.2	17.3
	JJA	323.1	568.8	109.4	745.3	176.3
	SON	61.5	165.0	54.1	272.4	95.1
Port Aux Basque	DJF	0.0	0.4	0.5	2.2	2.5
	MAM	1.2	14.2	11.4	35.7	28.0
	JJA	301.4	551.9	106.4	717.8	158.4
	SON	75.4	191.5	56.8	313.9	100.4
Springdale	DJF	0.1	0.8	0.9	2.3	2.8
	MAM	15.8	34.7	15.0	63.3	28.3
	JJA	466.3	704.3	106.4	882.0	167.7
	SON	74.0	181.7	59.9	291.6	100.4
St. Alban's	DJF	0.3	0.7	0.9	3.2	3.4
	MAM	9.3	32.1	15.9	61.3	29.5
	JJA	407.7	645.0	104.5	808.8	156.1
	SON	85.6	200.3	63.1	316.8	104.9
St. Anthony	DJF	0.0	0.3	0.6	0.7	0.9
	MAM	2.6	10.7	5.8	26.9	14.3
	JJA	331.8	553.4	107.9	725.9	176.8
	SON	65.0	145.4	52.5	241.8	89.6
St. John's	DJF	0.3	1.2	1.4	4.5	5.2
	MAM	13.8	19.0	16.2	35.1	26.3
	JJA	427.6	620.6	90.2	777.6	149.5
	SON	103.1	236.9	67.2	365.7	105.7
St. Lawrence	DJF	0.0	1.9	2.0	7.8	8.1
	MAM	2.0	17.9	14.7	40.0	28.7
	JJA	382.6	629.0	110.0	782.7	155.8
	SON	126.1	284.5	78.8	425.5	127.4
Stephenville	DJF	0.1	1.6	1.4	4.9	4.8
	MAM	17.5	43.4	25.7	78.3	44.4
	JJA	480.2	738.8	108.8	913.2	161.5
	SON	109.7	251.4	66.7	380.6	111.5
Twillingate	DJF	0.1	0.8	1.1	2.4	3.2
	MAM	13.1	19.3	11.8	38.6	23.4
	JJA	426.7	619.5	90.3	786.8	150.7
	SON	95.5	198.0	62.4	314.0	103.4

Table 12: Growing degree day climatology and projected change; Labrador. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Std Dev	Ensemble Avg	Std Dev
Cartwright	DJF	0.00	0.07	0.14	0.24	0.30
	MAM	3.14	8.95	4.74	23.29	13.08
	JJA	213.84	383.68	86.70	558.93	155.17
	SON	25.29	79.69	32.93	154.22	67.78
Churchill Falls	DJF	0.00	0.01	0.02	0.00	0.01
	MAM	4.50	11.56	8.71	28.32	19.19
	JJA	251.28	401.76	99.49	573.80	165.22
	SON	13.34	48.63	24.71	97.04	55.21
Goose Bay	DJF	0.00	0.14	0.24	0.42	0.49
	MAM	11.89	30.88	15.69	63.38	32.93
	JJA	428.55	670.05	125.82	855.20	193.49
	SON	52.20	131.14	49.27	215.11	90.05
Mary's Harbour	DJF	0.00	0.02	0.06	0.10	0.22
	MAM	1.45	6.46	4.62	16.09	9.58
	JJA	231.67	397.95	93.74	557.46	157.95
	SON	28.81	91.01	38.72	167.16	70.97
Nain	DJF	0.00	0.00	0.00	0.03	0.08
	MAM	0.96	2.29	2.75	9.68	10.61
	JJA	124.08	262.60	75.29	431.16	132.95
	SON	13.18	47.65	23.89	104.24	56.01
Wabush Lake	DJF	0.00	0.01	0.01	0.03	0.07
	MAM	6.73	20.39	13.91	43.24	26.37
	JJA	264.91	483.37	103.28	667.95	168.34
	SON	19.66	67.64	28.58	127.47	62.00
Schefferville	DJF	0.00	0.00	0.00	0.00	0.01
	MAM	1.83	8.93	7.15	25.12	18.50
	JJA	189.42	368.94	91.05	537.04	149.46
	SON	10.81	42.25	20.16	84.78	47.74

Number of Days With Frost

Summary: The number of days that see temperatures below freezing are expected to decrease, especially in spring and autumn. Regions/seasons with near-freezing temperatures see the greatest decrease (e.g. the Avalon Peninsula in spring; northern Labrador in summer).

The number of days with a minimum temperature below freezing; that is, the number of days during which frost can form. These numbers provide a sense of winter severity and length. They also provide some sense of freeze/thaw event frequency and length. If frost days decrease, freezing events (frosts, re-freezes etc) become less common and/or shorter.

For the island, the shoulder seasons (spring and autumn) are expected to see a substantial decrease in frost days. The largest changes are found in locations with mean temperatures near freezing (e.g. most places aside from the Great Northern Peninsula and interior during spring, and the Avalon in winter). Decreases in spring can be as large as 30 fewer frost days by late century.

In Labrador, spring changes are relatively modest, as cold winter conditions persist well into summer through much of the region. These persistently cold regions (e.g. Northern Labrador) see large decreases in spring (20-30 days), suggesting an earlier melt. Widespread decreases (~15-30 days) are also found in autumn, suggesting later freeze-up and/or more freeze/thaw cycles in the transition to winter.

Figure 13: Changes in the number of frost days projected for 2041-2070.

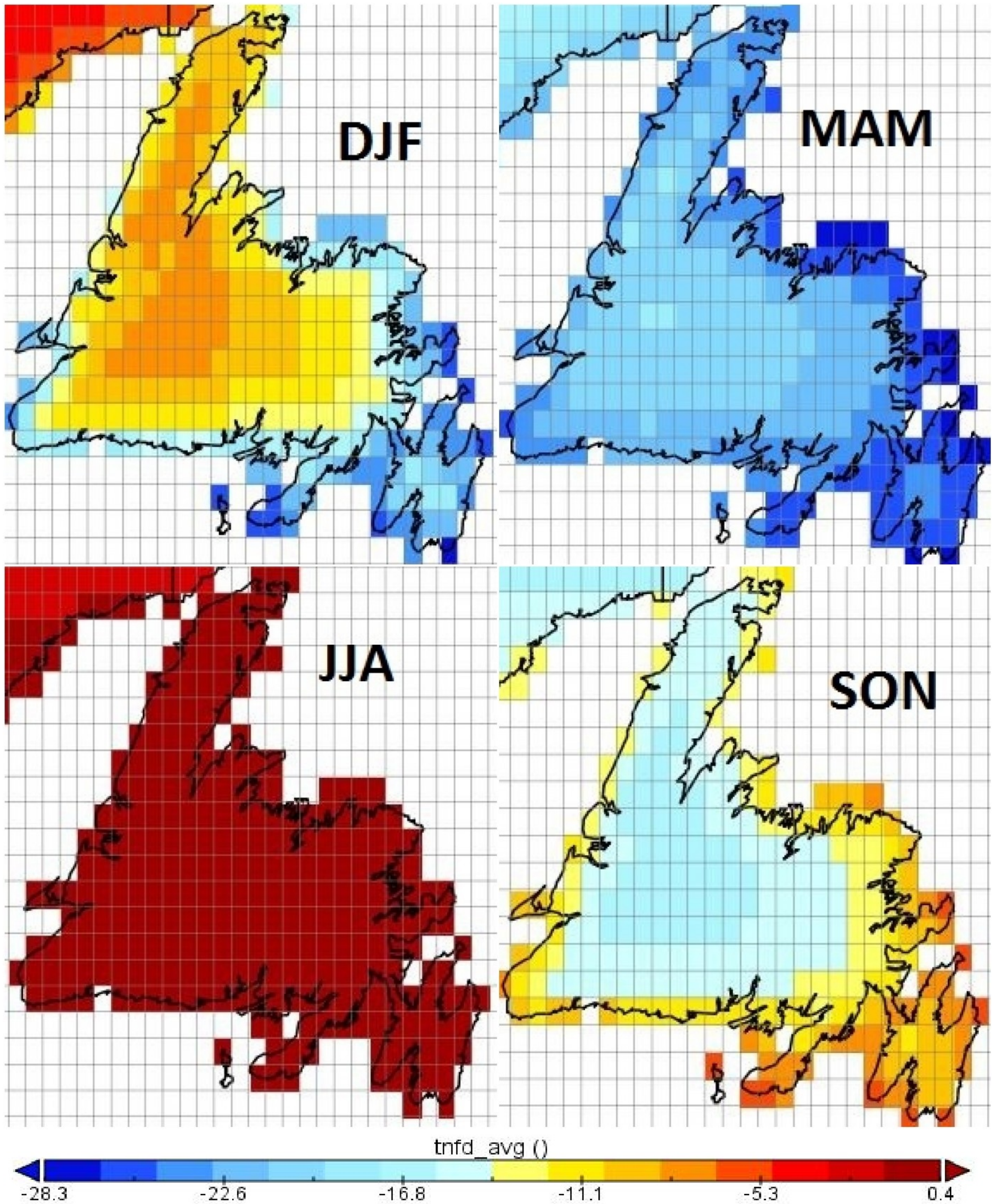

Figure 14: Changes in the number of frost days projected for 2041-2070.

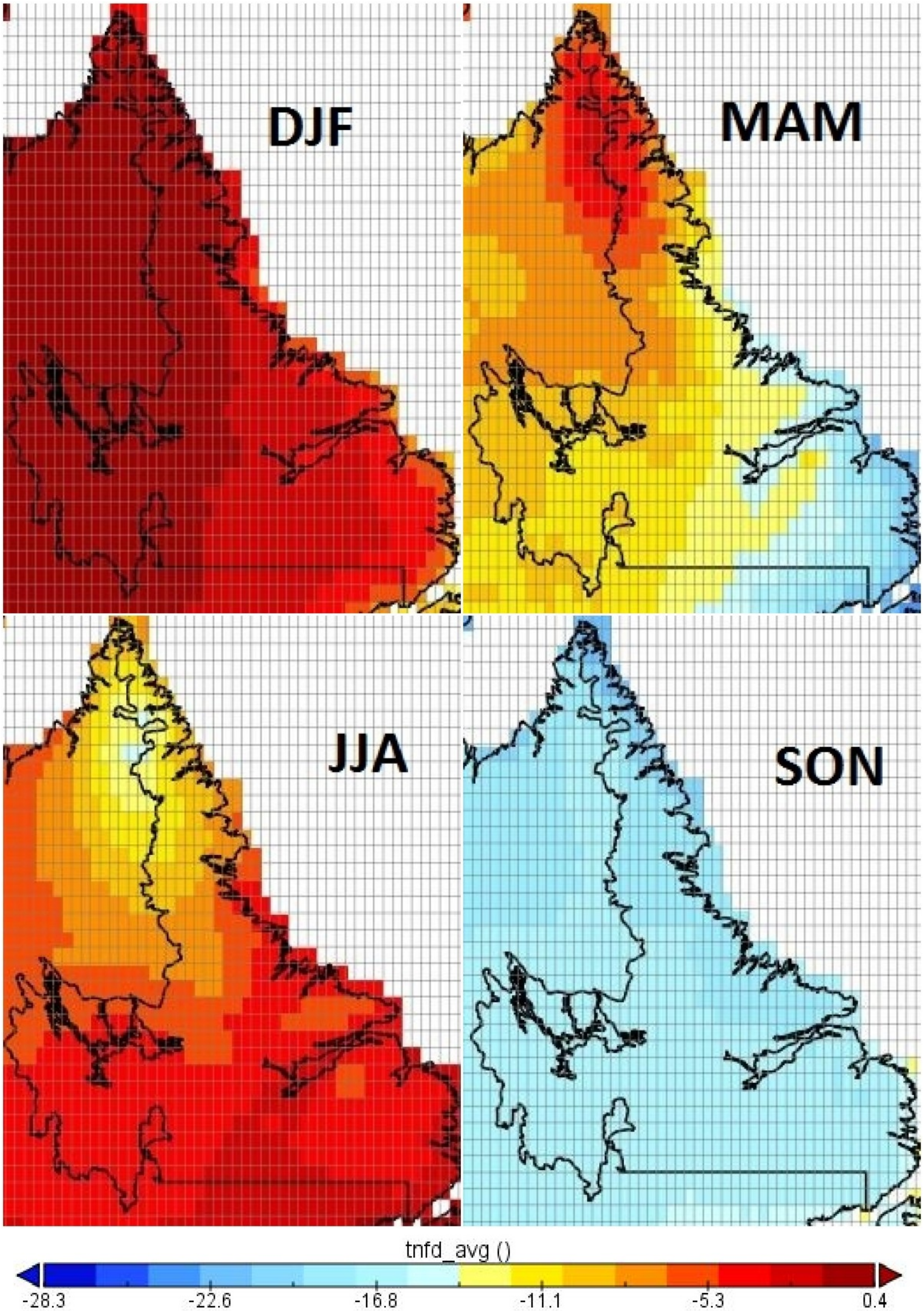

Table 13: Number of frost days climatology and projected change; Newfoundland. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
Argentia	DJF	72.5	44.3	14.9	22.9	18.7
	MAM	40.5	16.5	4.6	6.0	5.4
	JJA	0.0	0.0	0.0	0.0	0.0
	SON	6.9	2.2	1.5	0.6	0.7
Bay D'Espoir	DJF	81.3	69.5	10.3	56.6	14.7
	MAM	51.9	35.6	8.6	24.1	8.1
	JJA	1.6	0.1	0.4	0.1	0.2
	SON	29.4	10.9	5.6	5.6	4.3
Burgeo	DJF	83.2	66.9	10.2	52.7	16.9
	MAM	52.3	32.6	7.4	21.9	7.5
	JJA	0.0	0.0	0.2	0.0	0.1
	SON	20.0	6.7	4.2	3.1	2.7
Comfort Cove	DJF	86.9	76.1	8.9	66.4	14.1
	MAM	64.5	46.6	8.4	33.5	9.2
	JJA	0.9	0.4	0.8	0.2	0.5
	SON	31.0	12.0	6.5	6.6	4.4
Corner Brook	DJF	82.2	63.1	11.3	45.3	18.0
	MAM	48.7	28.4	7.7	17.3	7.1
	JJA	0.2	0.0	0.1	0.0	0.0
	SON	19.1	6.3	3.2	2.4	1.7
Daniel's Harbour	DJF	85.0	72.4	9.1	56.4	16.5
	MAM	59.7	37.3	9.9	24.8	9.6
	JJA	0.5	0.1	0.3	0.0	0.1
	SON	24.9	9.0	5.4	3.8	3.1
Deer Lake	DJF	85.7	72.9	9.7	58.6	15.1
	MAM	59.4	38.5	9.1	26.2	9.0
	JJA	1.9	0.2	0.4	0.1	0.2
	SON	32.7	12.6	5.9	6.0	3.5
Exploits Dam	DJF	85.7	77.1	8.6	64.8	15.6
	MAM	66.0	45.3	9.3	32.8	10.4
	JJA	3.2	0.3	0.6	0.1	0.3
	SON	35.4	16.8	7.7	9.2	6.0
Gander	DJF	85.4	69.7	11.6	54.5	19.9
	MAM	60.8	35.9	9.0	22.4	9.8
	JJA	0.7	0.1	0.3	0.0	0.1
	SON	25.7	11.5	6.1	5.9	4.9
Grand Falls	DJF	84.2	71.3	9.9	59.0	14.8
	MAM	54.9	36.0	8.2	25.2	9.3
	JJA	0.7	0.1	0.3	0.1	0.2
	SON	28.4	12.3	5.7	6.9	4.5
Isle Aux Morts	DJF	82.1	63.3	11.6	46.5	19.0
	MAM	47.5	29.1	6.7	17.7	8.1
	JJA	0.1	0.0	0.1	0.0	0.1
	SON	16.0	4.7	3.2	1.9	2.0
La Scie	DJF	88.1	79.8	7.3	68.7	14.9
	MAM	71.1	51.5	9.8	36.6	11.8
	JJA	1.7	0.5	1.1	0.2	0.4
	SON	30.2	13.3	7.6	7.3	5.7

Table 13, con't.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
North Harbour	DJF	77.9	59.8	11.5	45.0	16.7
	MAM	49.7	29.3	4.3	17.2	6.3
	JJA	0.3	0.1	0.2	0.0	0.1
	SON	15.0	6.5	3.5	3.3	3.1
Plum Point	DJF	86.8	74.1	9.0	61.7	15.3
	MAM	60.1	39.5	9.1	27.7	9.8
	JJA	0.4	0.1	0.2	0.0	0.1
	SON	25.7	9.7	5.7	5.1	3.8
Port Aux Basque	DJF	82.0	63.2	12.5	45.0	19.2
	MAM	53.5	29.3	7.7	17.0	8.5
	JJA	0.0	0.0	0.1	0.0	0.0
	SON	14.9	3.8	3.3	1.3	1.8
Springdale	DJF	84.9	76.5	8.3	65.4	14.6
	MAM	59.7	43.3	8.2	30.6	9.7
	JJA	2.3	0.3	0.6	0.1	0.3
	SON	32.6	13.7	6.6	7.6	4.9
St. Alban's	DJF	81.7	70.3	9.4	58.6	14.1
	MAM	52.6	36.2	8.1	25.8	7.9
	JJA	0.9	0.1	0.4	0.1	0.4
	SON	27.3	11.0	5.5	6.1	4.2
St. Anthony	DJF	88.4	78.6	7.7	68.3	14.2
	MAM	69.7	49.0	9.5	34.6	12.2
	JJA	1.1	0.3	0.9	0.1	0.5
	SON	31.5	15.6	7.4	9.4	5.8
St. John's	DJF	82.1	64.0	13.5	48.8	17.6
	MAM	60.1	40.8	4.3	24.4	8.3
	JJA	0.5	0.2	0.3	0.0	0.1
	SON	17.7	4.9	3.9	1.9	1.8
St. Lawrence	DJF	78.0	57.9	13.3	40.3	18.6
	MAM	52.4	28.7	7.0	16.4	8.1
	JJA	0.5	0.0	0.1	0.0	0.0
	SON	15.5	4.2	3.8	1.8	2.3
Stephenville	DJF	82.4	64.0	11.4	47.6	18.7
	MAM	50.0	30.1	7.9	19.0	7.6
	JJA	0.1	0.0	0.1	0.0	0.1
	SON	17.3	4.4	3.4	1.7	1.9
Twillingate	DJF	83.8	62.9	15.9	42.6	25.0
	MAM	62.3	35.7	11.8	20.3	11.7
	JJA	0.3	0.0	0.0	0.0	0.0
	SON	15.4	4.4	4.0	1.4	1.7

Table 14: Number of frost days climatology and projected change; Labrador.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Std Dev	Ensemble Avg	Std Dev
Cartwright	DJF	89.2	82.9	5.9	74.5	13.0
	MAM	78.6	57.1	9.8	41.3	14.6
	JJA	4.8	0.8	1.9	0.4	1.0
	SON	43.2	20.2	9.3	12.5	8.7
Churchill Falls	DJF	90.0	89.3	0.6	88.3	1.8
	MAM	80.0	73.4	6.0	64.9	9.2
	JJA	4.6	2.4	3.6	1.7	4.1
	SON	62.2	43.4	8.9	33.6	10.9
Goose Bay	DJF	88.9	84.4	3.7	78.8	8.2
	MAM	67.5	51.9	8.7	40.6	10.5
	JJA	1.2	0.4	1.0	0.2	0.8
	SON	43.4	23.9	8.2	15.2	7.4
Mary's Harbour	DJF	88.4	84.6	4.4	80.5	8.0
	MAM	74.6	64.3	8.4	51.4	11.0
	JJA	2.9	1.2	2.5	0.9	2.7
	SON	45.5	23.2	9.2	16.9	8.8
Nain	DJF	89.4	87.2	2.8	81.4	8.6
	MAM	82.5	71.1	8.9	58.5	13.7
	JJA	6.7	1.7	2.8	0.9	2.3
	SON	50.1	28.5	11.6	19.3	11.8
Wabush Lake	DJF	89.7	89.1	0.8	87.7	2.3
	MAM	79.4	67.8	7.7	59.3	10.0
	JJA	3.9	2.0	3.3	1.2	3.4
	SON	58.9	40.7	10.0	30.8	10.6
Schefferville	DJF	90.0	89.5	0.5	88.6	1.4
	MAM	83.4	74.8	6.3	66.6	9.4
	JJA	6.2	3.1	4.3	1.9	4.5
	SON	64.5	45.4	9.7	34.9	11.8

Maximum Heat Wave Duration (days)

Summary: Projected changes in heat waves are small enough to ignore.

Heat waves are a significant health concern in many parts of Canada and the United States, but not a concern in a mild (cool) climate like that of Newfoundland (Labrador). Here, heat waves are defined as a period of consecutive days with maximum temperatures 5^{o}C or more above normal; events less than 6 days in length are not counted.

Results show no significant increase in summer heat wave duration for the province; only winter and spring show any significant change, and heat waves have no clear relevance in these seasons. Consider St. John's: the average summer heat wave duration is less than one day, implying most years don't actually experience a heat wave. Projected changes are zero for all seasons. This is typical of the entire province: climatology is lower than one day, and changes by less than one day.

Figure 15: Changes in the maximum heat wave duration for 2041-2070.

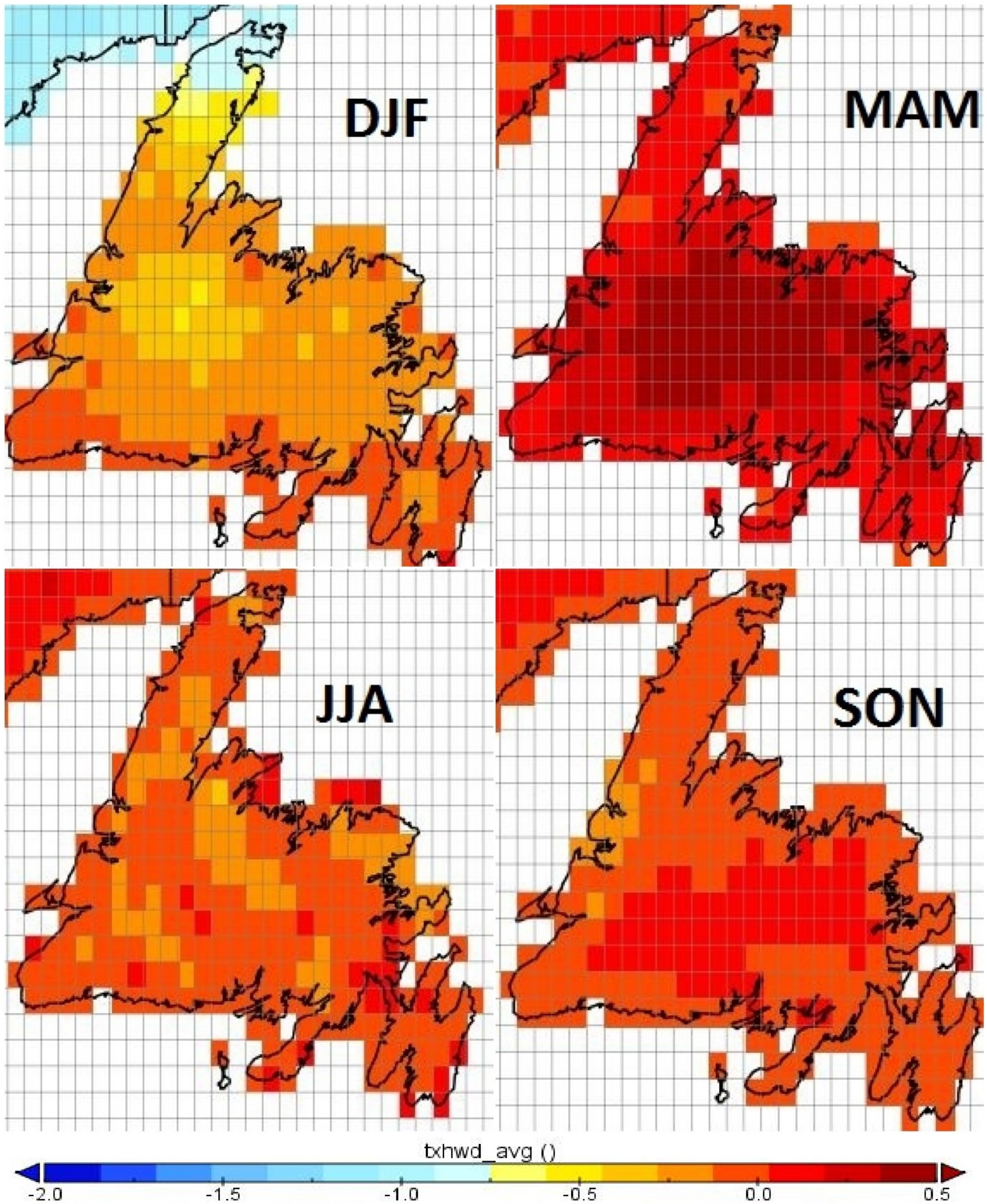

Figure 16: Changes in the maximum heat wave duration for 2041-2070.

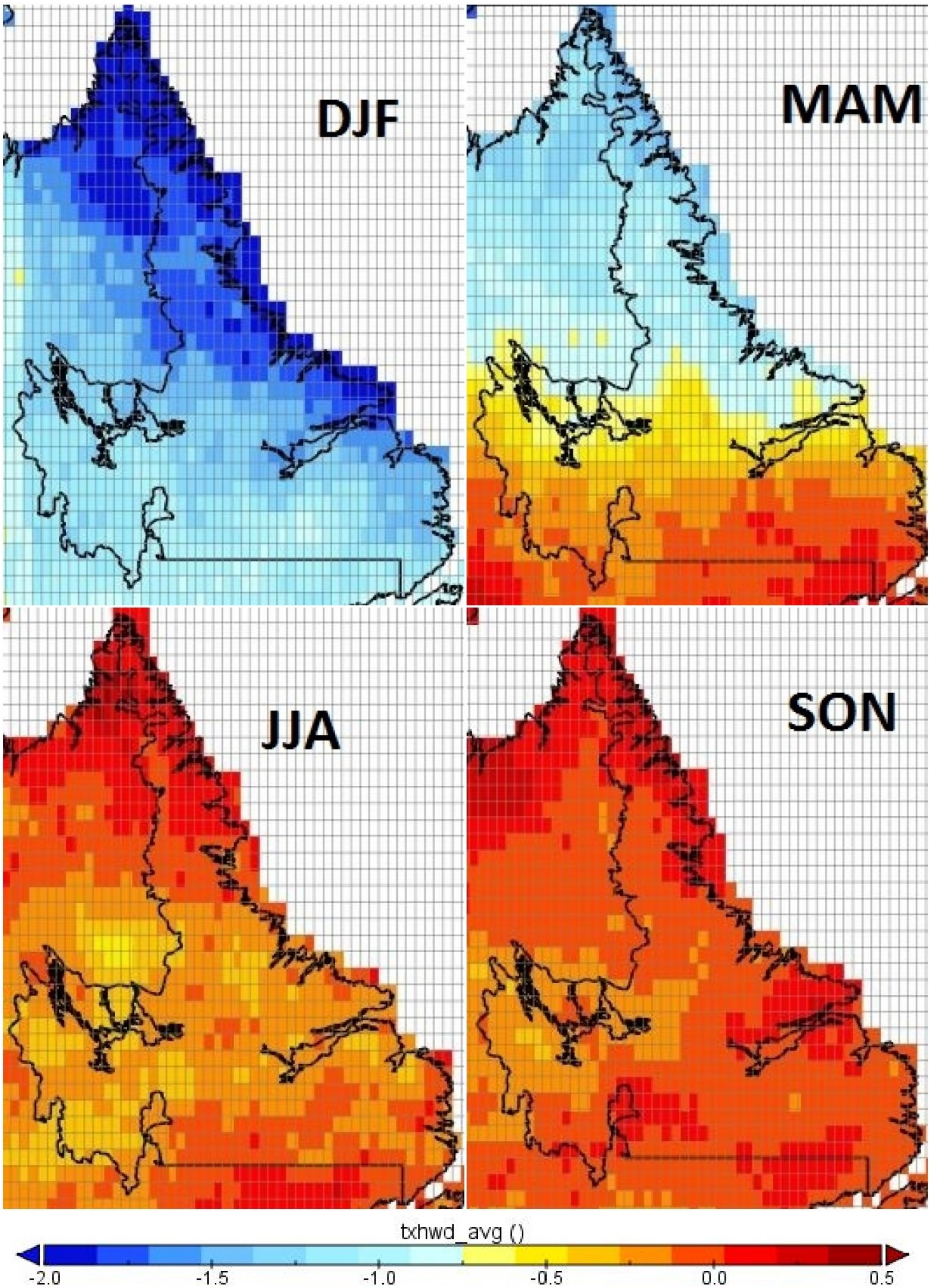

Table 15: Maximum heat wave duration climatology and projected change; Newfoundland. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
Argentia	DJF	0.0	0.2	0.2	0.1	0.2
	MAM	0.0	0.3	0.4	0.1	0.2
	JJA	0.0	0.0	0.1	0.1	0.1
	SON	0.0	0.0	0.0	0.2	0.2
Bay D'Espoir	DJF	0.0	0.3	0.3	0.3	0.3
	MAM	0.0	0.6	0.6	0.5	0.7
	JJA	0.0	0.2	0.3	0.2	0.2
	SON	0.0	0.2	0.2	0.3	0.2
Burgeo	DJF	0.0	0.2	0.2	0.2	0.3
	MAM	0.0	0.2	0.4	0.1	0.3
	JJA	0.0	0.0	0.1	0.1	0.1
	SON	0.0	0.0	0.0	0.1	0.1
Comfort Cove	DJF	1.1	0.4	0.2	0.4	0.4
	MAM	2.0	1.1	0.5	0.9	0.8
	JJA	0.2	1.0	0.6	1.2	0.9
	SON	0.0	0.4	0.4	0.6	0.4
Corner Brook	DJF	0.0	0.3	0.3	0.4	0.4
	MAM	0.0	1.2	0.6	1.0	0.7
	JJA	0.0	0.4	0.3	0.7	0.7
	SON	0.0	0.3	0.2	0.5	0.4
Daniel's Harbour	DJF	0.0	0.4	0.4	0.3	0.4
	MAM	0.0	0.5	0.3	0.4	0.3
	JJA	0.0	0.0	0.1	0.1	0.1
	SON	0.0	0.1	0.2	0.2	0.2
Deer Lake	DJF	1.5	0.3	0.3	0.4	0.4
	MAM	1.4	1.3	0.7	1.1	0.7
	JJA	0.3	0.7	0.6	0.8	0.7
	SON	0.2	0.3	0.2	0.6	0.4
Exploits Dam	DJF	0.1	0.3	0.2	0.4	0.3
	MAM	0.2	1.2	0.6	0.8	0.6
	JJA	0.0	0.5	0.4	0.7	0.6
	SON	0.1	0.3	0.2	0.5	0.4
Gander	DJF	0.9	0.4	0.2	0.3	0.3
	MAM	1.3	1.3	0.5	0.9	0.8
	JJA	0.3	0.9	0.5	0.9	0.8
	SON	0.6	0.4	0.2	0.7	0.5
Grand Falls	DJF	0.0	0.4	0.2	0.3	0.3
	MAM	0.0	1.4	0.5	1.0	0.7
	JJA	0.0	0.8	0.5	0.9	0.8
	SON	0.0	0.4	0.3	0.7	0.5
Isle Aux Morts	DJF	0.0	0.2	0.3	0.2	0.4
	MAM	0.0	0.2	0.4	0.2	0.3
	JJA	0.0	0.1	0.2	0.1	0.2
	SON	0.0	0.0	0.1	0.1	0.2
La Scie	DJF	0.0	0.4	0.3	0.3	0.3
	MAM	0.0	0.9	0.4	0.9	0.6
	JJA	0.0	1.4	1.0	1.1	0.8
	SON	0.0	0.4	0.3	0.5	0.3

Table 15, con't.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
North Harbour	DJF	0.0	0.2	0.2	0.1	0.2
	MAM	0.0	0.3	0.5	0.1	0.2
	JJA	0.0	0.2	0.2	0.2	0.3
	SON	0.0	0.0	0.1	0.2	0.3
Plum Point	DJF	0.0	0.8	0.7	0.4	0.4
	MAM	0.3	0.4	0.3	0.5	0.3
	JJA	0.1	0.1	0.1	0.1	0.3
	SON	0.0	0.0	0.1	0.1	0.1
Port Aux Basque	DJF	0.0	0.2	0.2	0.2	0.4
	MAM	0.0	0.2	0.3	0.2	0.3
	JJA	0.0	0.1	0.1	0.1	0.1
	SON	0.0	0.0	0.1	0.1	0.1
Springdale	DJF	0.0	0.3	0.2	0.3	0.4
	MAM	0.0	1.0	0.6	0.8	0.5
	JJA	0.0	0.9	0.4	1.1	0.7
	SON	0.0	0.4	0.3	0.5	0.3
St. Alban's	DJF	0.0	0.3	0.2	0.3	0.3
	MAM	0.0	0.5	0.5	0.4	0.6
	JJA	0.0	0.1	0.2	0.1	0.2
	SON	0.0	0.1	0.2	0.2	0.3
St. Anthony	DJF	0.0	0.6	0.6	0.3	0.4
	MAM	0.0	0.6	0.3	0.6	0.4
	JJA	0.0	0.6	0.6	0.8	0.8
	SON	0.0	0.2	0.3	0.3	0.3
St. John's	DJF	0.3	0.3	0.2	0.2	0.2
	MAM	0.8	0.8	0.7	0.4	0.4
	JJA	0.5	0.8	0.7	0.7	0.7
	SON	0.4	0.1	0.2	0.4	0.5
St. Lawrence	DJF	0.0	0.2	0.1	0.2	0.2
	MAM	0.0	0.2	0.3	0.1	0.1
	JJA	0.0	0.1	0.2	0.1	0.2
	SON	0.0	0.1	0.1	0.1	0.2
Stephenville	DJF	0.7	0.4	0.4	0.4	0.5
	MAM	0.5	0.7	0.7	0.6	0.8
	JJA	0.0	0.1	0.1	0.2	0.2
	SON	0.0	0.1	0.2	0.2	0.3
Twillingate	DJF	0.0	0.2	0.2	0.2	0.2
	MAM	0.0	0.5	0.5	0.7	0.7
	JJA	0.0	1.1	1.0	1.1	0.6
	SON	0.0	0.2	0.2	0.5	0.5

Table 16: Maximum heat wave duration climatology and projected change; Labrador. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Std Dev	Ensemble Avg	Std Dev
Cartwright	DJF	0.00	1.85	1.11	0.75	0.89
	MAM	0.00	1.05	0.47	1.20	0.62
	JJA	0.00	1.47	0.86	1.52	0.89
	SON	0.07	0.47	0.26	0.46	0.44
Churchill Falls	DJF	4.73	2.81	0.68	1.79	0.62
	MAM	2.65	2.26	0.62	2.10	0.52
	JJA	1.23	1.24	0.61	1.43	0.76
	SON	0.00	1.20	0.63	1.03	0.57
Goose Bay	DJF	4.88	2.65	0.84	1.33	0.94
	MAM	2.05	1.69	0.73	1.73	0.60
	JJA	0.77	1.37	0.86	1.71	0.92
	SON	0.36	0.80	0.48	0.74	0.36
Mary's Harbour	DJF	0.00	1.65	1.02	0.63	0.69
	MAM	0.00	0.73	0.45	0.77	0.52
	JJA	0.00	1.23	0.87	1.52	0.92
	SON	0.00	0.36	0.29	0.40	0.32
Nain	DJF	0.00	2.12	1.12	1.33	1.10
	MAM	0.00	0.91	0.80	0.95	0.77
	JJA	0.00	1.09	0.48	1.23	0.64
	SON	0.00	0.38	0.27	0.31	0.28
Wabush Lake	DJF	3.33	2.87	0.48	2.07	0.77
	MAM	2.41	2.58	0.82	2.38	0.53
	JJA	0.39	1.32	0.54	1.55	0.63
	SON	0.37	1.49	0.74	1.47	0.62
Schefferville	DJF	3.33	3.17	0.61	2.51	0.71
	MAM	3.83	2.51	0.62	2.37	0.74
	JJA	1.80	1.59	0.46	1.75	0.81
	SON	0.13	1.41	0.59	1.32	0.51

Mean Daily Precipitation (mm)

Summary: Mean daily precipitation is expected to increase throughout the province.

This is the mean precipitation falling in a 24 hr period (12AM – 12 AM, UTC). Because most days experience no precipitation, values of mean daily precipitation are typically small. Consequently, changes in this field are also small. However, these changes are often significant when taken over a full season; for example, a 0.5mm/day change for a 90 day season amounts to 45mm, or a roughly 10% change in total seasonal precipitation for a location like St. John's.

In Newfoundland, widespread increases are expected by late century, often on the order of 1mm in strongly affected seasons. Changes in Labrador are typically smaller, but also tend towards an increase. However, with mean daily precipitation and many of the precipitation indices that follow, uncertainty is often large relative to the expected change. This reflects a large spread in responses between different projections (12 in total). Bias correction using station data (e.g. Tables 17-18) often shifts the magnitude and timing of expected precipitation changes; for example, the maps (unadjusted data) show large winter increases in precipitation on the Avalon, while bias corrected entries for St. John's (Table 17) show small winter change but large summer and fall increases. It should be noted, however, that precipitation is expected to increase in most locations and seasons by mid-century, and larger (nearly universal) changes are expected by the end of the century.

Figure 17: Changes in mean daily precipitation (mm) for 2041-2070.

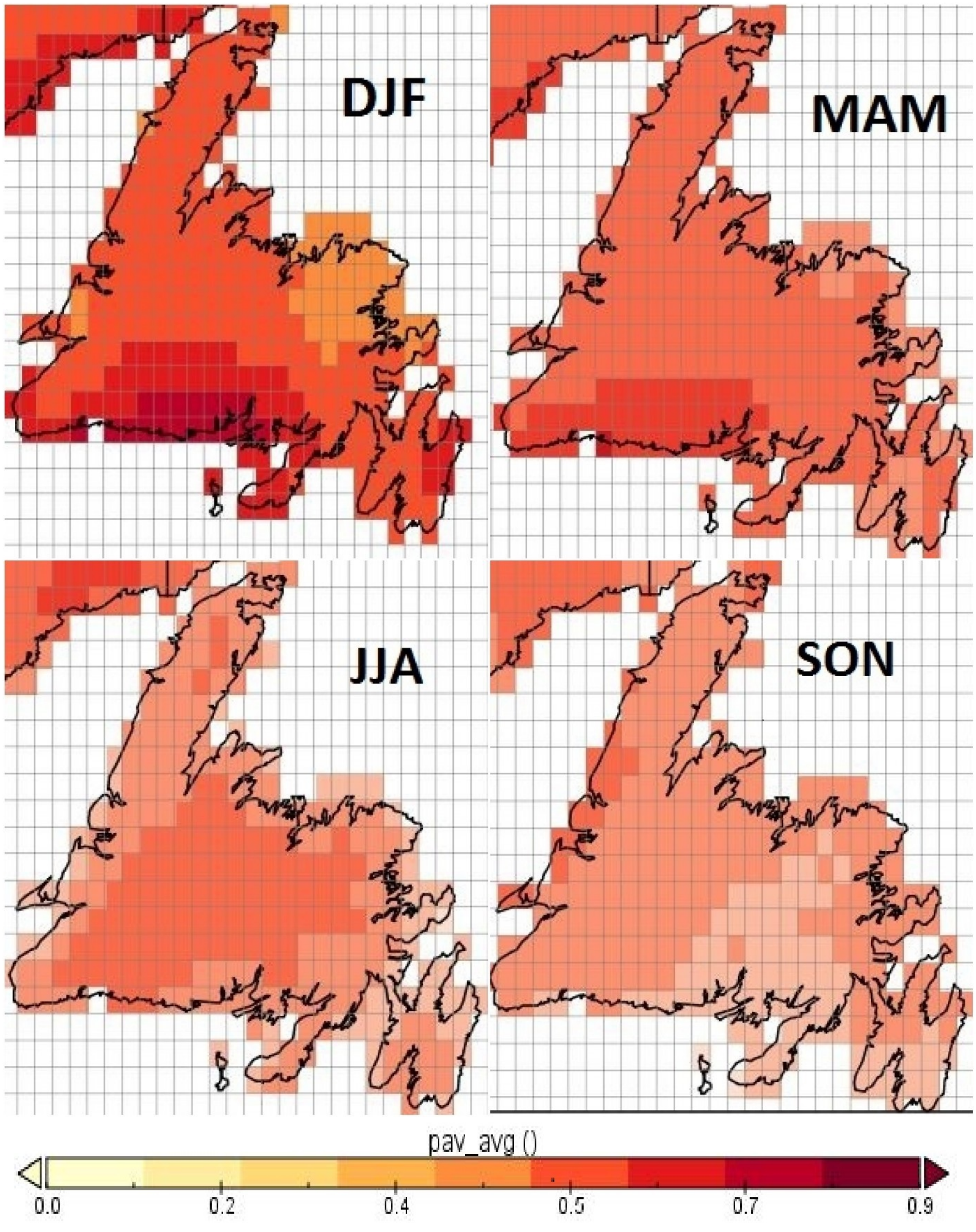

Figure 18: Changes in mean daily precipitation (mm) for 2041-2070.

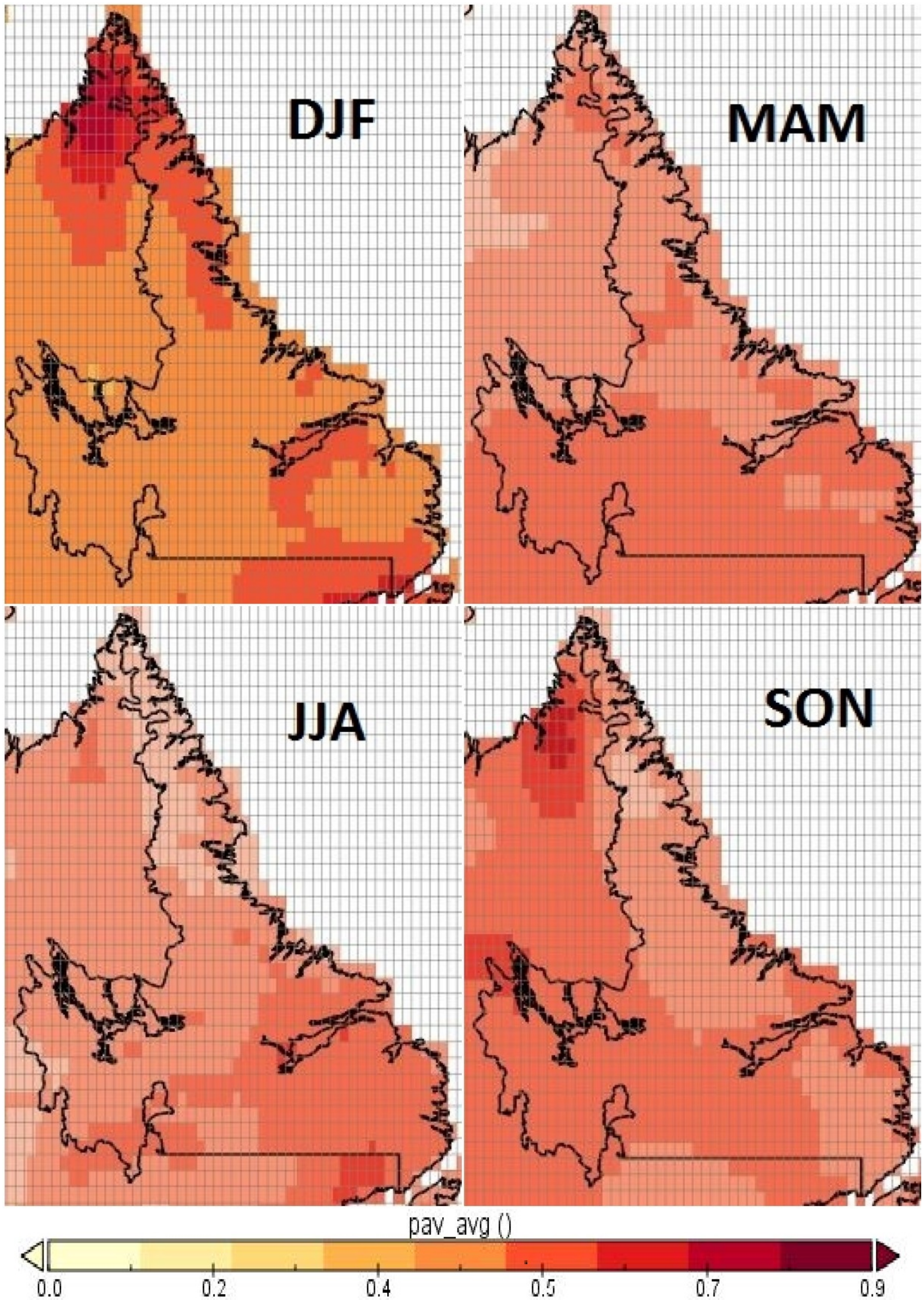

Table 17: Mean daily precipitation (mm) climatology and projected change; Newfoundland. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
Argentia	DJF	3.0	3.9	0.3	4.2	0.4
	MAM	2.1	2.9	0.2	3.1	0.2
	JJA	3.0	2.9	0.4	2.9	0.4
	SON	3.4	3.7	0.2	3.6	0.3
Bay D'Espoir	DJF	6.2	6.3	0.4	6.7	0.5
	MAM	4.3	4.7	0.3	5.0	0.3
	JJA	3.8	4.7	0.6	4.8	0.6
	SON	5.1	5.5	0.4	5.5	0.7
Burgeo	DJF	5.0	6.1	0.5	6.6	0.5
	MAM	4.2	4.8	0.3	5.1	0.3
	JJA	4.6	4.9	0.5	4.9	0.4
	SON	5.2	5.4	0.2	5.3	0.6
Comfort Cove	DJF	3.3	3.8	0.4	4.2	0.4
	MAM	3.0	3.2	0.2	3.5	0.2
	JJA	3.1	3.4	0.5	3.5	0.6
	SON	3.5	3.9	0.2	4.0	0.4
Corner Brook	DJF	4.9	4.6	0.4	4.9	0.4
	MAM	2.8	3.3	0.2	3.6	0.3
	JJA	3.0	4.0	0.4	4.2	0.6
	SON	4.0	4.5	0.2	4.5	0.4
Daniel's Harbour	DJF	2.8	3.4	0.2	3.7	0.3
	MAM	2.2	2.6	0.2	2.9	0.3
	JJA	3.2	3.4	0.4	3.6	0.4
	SON	3.3	3.7	0.3	3.8	0.3
Deer Lake	DJF	4.6	4.3	0.3	4.6	0.4
	MAM	2.8	3.3	0.2	3.6	0.2
	JJA	3.2	3.9	0.5	4.2	0.7
	SON	3.6	4.2	0.2	4.2	0.4
Exploits Dam	DJF	3.1	3.7	0.3	4.1	0.4
	MAM	2.6	3.0	0.2	3.3	0.2
	JJA	3.0	3.6	0.6	3.8	0.7
	SON	3.3	3.7	0.2	3.7	0.5
Gander	DJF	3.5	3.8	0.3	4.2	0.4
	MAM	3.0	3.3	0.2	3.6	0.3
	JJA	2.9	3.5	0.6	3.8	0.8
	SON	3.5	3.8	0.1	3.9	0.3
Grand Falls	DJF	3.5	3.8	0.4	4.1	0.4
	MAM	2.8	3.1	0.2	3.4	0.2
	JJA	3.1	3.7	0.6	4.0	0.7
	SON	3.4	3.8	0.1	3.9	0.4
Isle Aux Morts	DJF	5.2	5.8	0.4	6.2	0.4
	MAM	4.1	4.5	0.3	4.8	0.3
	JJA	3.9	4.5	0.4	4.6	0.5
	SON	5.0	5.2	0.2	5.2	0.5
La Scie	DJF	4.5	4.6	0.4	5.0	0.5
	MAM	3.6	3.9	0.2	4.1	0.2
	JJA	3.4	4.1	0.7	4.2	0.8
	SON	4.1	4.7	0.2	4.7	0.5

Table 17, con't.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
North Harbour	DJF	5.9	6.1	0.4	6.5	0.5
	MAM	4.5	4.7	0.2	5.0	0.3
	JJA	3.6	4.6	0.5	4.7	0.7
	SON	5.2	5.5	0.3	5.3	0.5
Plum Point	DJF	4.4	4.4	0.3	4.7	0.4
	MAM	3.3	3.6	0.3	3.9	0.3
	JJA	3.6	4.4	0.6	4.5	0.6
	SON	3.9	4.4	0.2	4.5	0.3
Port Aux Basque	DJF	4.2	5.0	0.4	5.5	0.4
	MAM	3.4	3.9	0.3	4.2	0.3
	JJA	3.6	3.9	0.4	4.0	0.5
	SON	4.3	4.7	0.2	4.7	0.5
Springdale	DJF	3.2	3.6	0.4	3.9	0.4
	MAM	2.6	2.9	0.2	3.2	0.2
	JJA	3.1	3.6	0.6	3.8	0.8
	SON	3.3	3.7	0.1	3.8	0.4
St. Alban's	DJF	6.4	7.0	0.5	7.5	0.6
	MAM	4.9	5.3	0.3	5.7	0.3
	JJA	4.5	5.3	0.7	5.4	0.7
	SON	6.0	6.2	0.4	6.1	0.7
St. Anthony	DJF	3.8	3.5	0.3	3.8	0.4
	MAM	2.3	2.9	0.3	3.2	0.3
	JJA	2.5	3.5	0.5	3.6	0.6
	SON	2.8	3.5	0.2	3.6	0.3
St. John's	DJF	7.2	6.6	0.5	7.1	0.6
	MAM	4.8	5.0	0.3	5.4	0.4
	JJA	3.4	4.3	0.6	4.2	0.6
	SON	5.1	6.0	0.4	5.8	0.5
St. Lawrence	DJF	4.8	5.5	0.5	5.9	0.6
	MAM	3.7	4.3	0.3	4.6	0.3
	JJA	3.9	4.0	0.4	4.1	0.6
	SON	4.7	4.9	0.4	4.8	0.5
Stephenville	DJF	5.3	4.8	0.4	5.2	0.4
	MAM	3.2	3.5	0.3	3.8	0.3
	JJA	3.6	4.0	0.4	4.2	0.5
	SON	4.4	4.8	0.2	4.8	0.4
Twillingate	DJF	3.6	3.6	0.3	3.9	0.4
	MAM	2.4	2.8	0.2	3.1	0.2
	JJA	2.3	2.9	0.5	3.0	0.5
	SON	3.0	3.7	0.2	3.7	0.4

Table 18: Mean daily precipitation (mm) climatology and projected change; Labrador. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Std Dev	Ensemble Avg	Std Dev
Cartwright	DJF	3.79	3.57	0.32	3.83	0.50
	MAM	3.27	3.41	0.34	3.71	0.34
	JJA	3.12	4.19	0.63	4.37	0.73
	SON	3.23	3.99	0.25	4.11	0.43
Churchill Falls	DJF	2.66	1.93	0.24	2.33	0.50
	MAM	2.48	1.97	0.17	2.21	0.27
	JJA	3.48	3.38	0.30	3.60	0.54
	SON	3.44	2.81	0.15	2.93	0.21
Goose Bay	DJF	2.15	2.55	0.19	2.83	0.36
	MAM	2.09	2.48	0.17	2.79	0.23
	JJA	3.19	3.84	0.40	4.13	0.53
	SON	2.60	3.09	0.16	3.20	0.29
Mary's Harbour	DJF	3.65	3.31	0.28	3.59	0.40
	MAM	2.49	2.91	0.23	3.20	0.22
	JJA	3.11	3.55	0.53	3.67	0.60
	SON	2.93	3.47	0.25	3.58	0.38
Nain	DJF	3.28	3.20	0.37	3.40	0.58
	MAM	2.94	2.83	0.28	3.14	0.34
	JJA	2.85	3.89	0.32	3.91	0.50
	SON	2.85	3.59	0.22	3.68	0.24
Wabush Lake	DJF	2.56	2.57	0.29	2.88	0.38
	MAM	2.29	2.75	0.18	2.95	0.24
	JJA	3.49	4.37	0.40	4.55	0.57
	SON	3.23	3.64	0.18	3.83	0.28
Schefferville	DJF	2.07	2.15	0.29	2.47	0.35
	MAM	2.02	2.36	0.17	2.63	0.24
	JJA	3.18	4.07	0.42	4.17	0.53
	SON	3.13	3.54	0.18	3.84	0.22

Mean Intensity of Precipitation Events (mm/day)

Summary: The typical precipitation event is expected to become more intense under a warming climate.

This variable captures 24hr mean precipitation intensity, calculated over all days with measurable precipitation (more than 1mm). While mean daily precipitation gives a sense of how total precipitation changes, mean intensity describes changes in the typical event; an increase in mean daily precipitation can be produced by *fewer* rain events, if mean intensity increases to a sufficient degree. Basically, fewer stronger events can have the same impact on total precipitation as a higher number of normal events.

Models predict mean intensity increases for all of Newfoundland in all seasons, with the south coast seeing the greatest increases (winter; ~ 0.7-1.2 mm/day). Changes in Labrador are smaller and less spatially organized. Bias corrections at stations show some notable differences relative to the maps, and estimated uncertainty (spread across the 12 projections examined) are about as large as predicted changes. This reflects disagreement among the models regarding precipitation intensity changes. Still, as a whole the models predict rising intensity by end of century in all seasons.

Figure 19: Changes in mean intensity of precipitation events (mm/day) for 2041-2070.

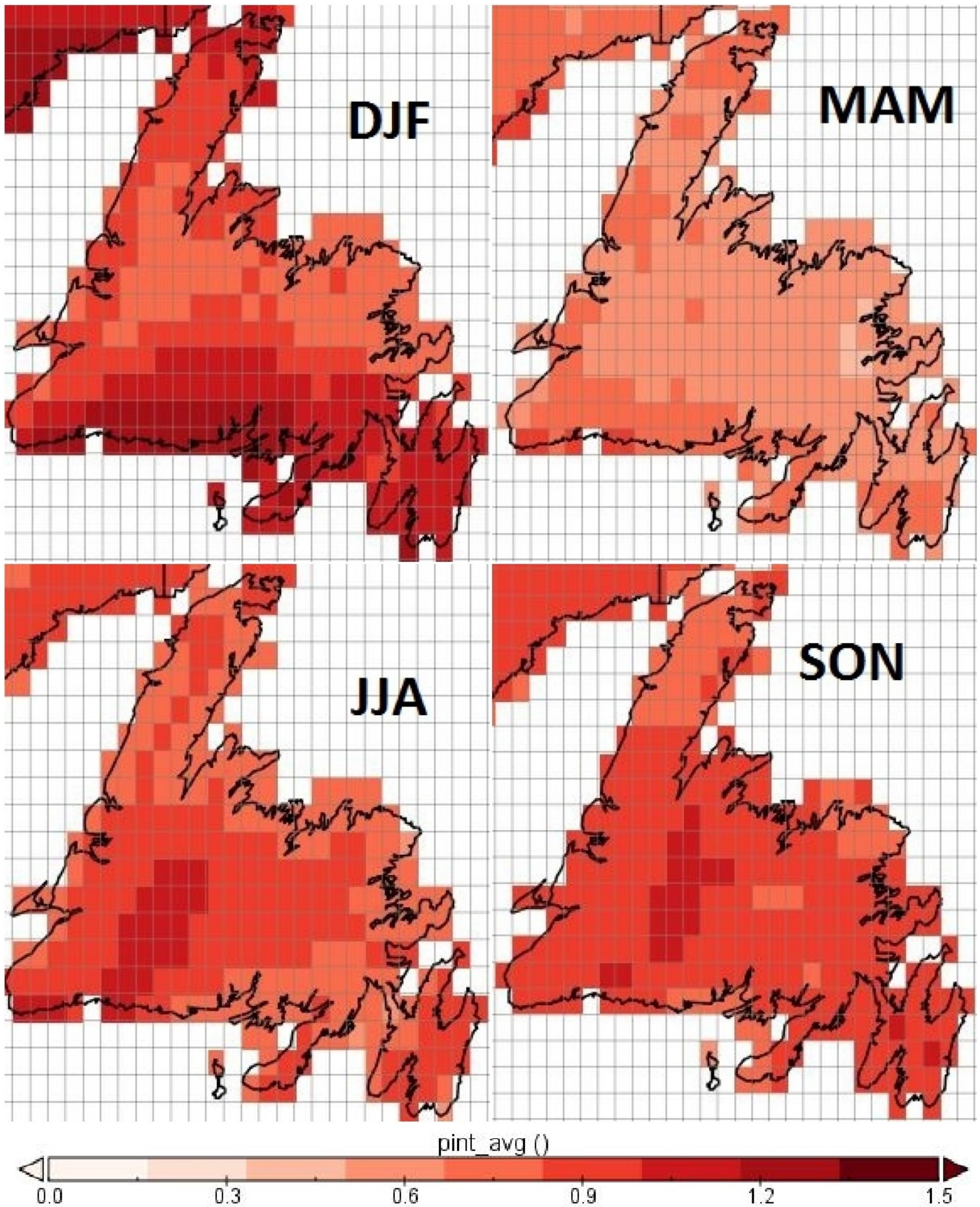

Figure 20: Changes in mean intensity of precipitation events (mm/day) for 2041-2070.

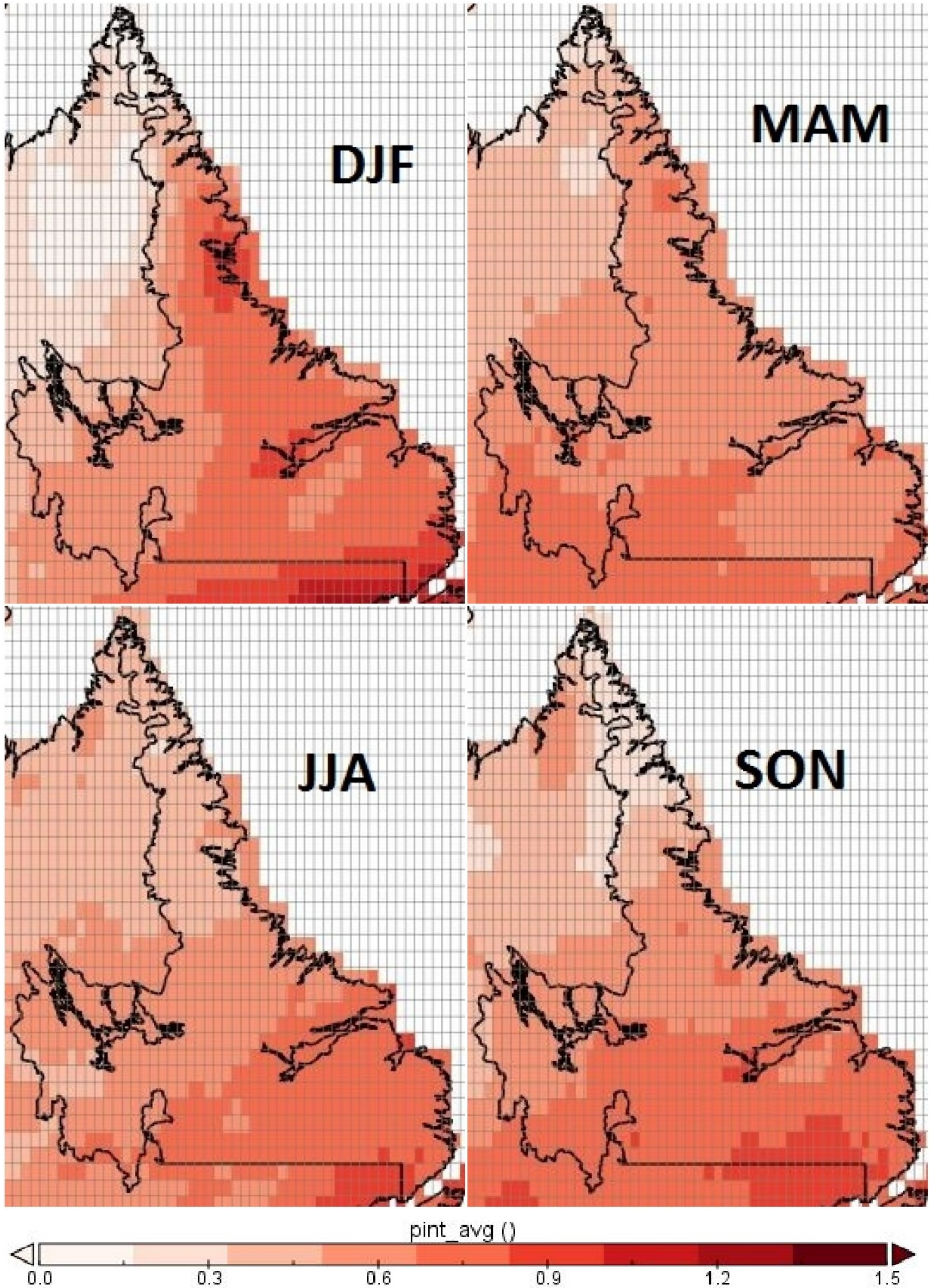

Table 19: Mean precipitation event intensity (mm/day) climatology and projected change; Newfoundland. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
Argentia	DJF	8.5	10.0	0.9	10.7	0.9
	MAM	8.0	8.8	0.3	9.3	0.3
	JJA	10.8	9.9	0.7	10.1	0.7
	SON	10.8	11.7	0.5	11.9	0.7
Bay D'Espoir	DJF	13.5	13.5	0.9	14.4	1.0
	MAM	10.8	11.3	0.2	12.0	0.5
	JJA	10.0	11.6	0.7	11.7	0.6
	SON	11.6	13.9	0.6	14.5	1.2
Burgeo	DJF	10.6	12.3	1.3	13.3	1.3
	MAM	10.6	11.3	0.6	12.0	0.9
	JJA	11.8	12.2	1.2	12.2	1.1
	SON	12.6	13.3	0.5	13.8	1.1
Comfort Cove	DJF	7.6	8.3	0.3	8.9	0.6
	MAM	7.4	7.5	0.2	8.0	0.3
	JJA	8.2	8.4	0.8	8.7	0.9
	SON	8.2	9.2	0.4	9.7	0.8
Corner Brook	DJF	7.9	7.7	0.5	8.4	0.6
	MAM	6.9	7.5	0.3	8.0	0.5
	JJA	7.9	9.4	0.6	9.9	0.9
	SON	8.0	9.5	0.3	10.1	0.6
Daniel's Harbour	DJF	6.2	7.1	0.6	7.7	0.8
	MAM	6.8	7.2	0.4	7.5	0.5
	JJA	9.2	9.4	1.0	9.6	1.2
	SON	8.4	8.9	0.4	9.4	0.6
Deer Lake	DJF	8.0	8.0	0.7	8.7	0.8
	MAM	7.2	7.8	0.3	8.3	0.4
	JJA	8.6	9.6	0.8	10.0	0.8
	SON	8.0	9.7	0.3	10.2	0.9
Exploits Dam	DJF	8.5	8.7	0.6	9.5	0.9
	MAM	7.6	7.8	0.3	8.3	0.3
	JJA	8.5	9.3	0.7	9.8	0.7
	SON	9.2	10.2	0.4	10.6	1.0
Gander	DJF	7.7	8.5	0.4	9.2	0.7
	MAM	7.4	7.5	0.2	8.0	0.3
	JJA	8.2	8.6	0.8	9.0	0.9
	SON	8.4	9.4	0.4	10.0	0.8
Grand Falls	DJF	9.1	9.4	0.6	10.1	0.8
	MAM	7.7	8.2	0.2	8.7	0.2
	JJA	8.4	9.7	0.8	10.1	0.9
	SON	8.5	10.6	0.4	11.1	0.9
Isle Aux Morts	DJF	8.8	10.1	0.9	11.1	1.1
	MAM	10.3	9.9	0.5	10.5	0.8
	JJA	10.6	10.9	0.9	11.2	0.7
	SON	10.7	11.5	0.7	12.2	0.9
La Scie	DJF	8.8	9.4	0.6	9.9	0.7
	MAM	8.4	8.4	0.4	8.9	0.4
	JJA	8.4	9.3	0.7	9.6	0.8
	SON	9.5	10.0	0.3	10.4	0.7

Table 19, con't.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
North Harbour	**DJF**	10.1	11.4	0.9	12.3	1.0
	MAM	9.8	9.9	0.5	10.4	0.6
	JJA	8.5	10.5	0.7	10.7	1.1
	SON	10.2	12.2	0.7	12.5	0.8
Plum Point	**DJF**	7.7	8.5	0.9	9.0	1.0
	MAM	7.2	7.7	0.5	8.1	0.5
	JJA	8.7	9.2	1.0	9.5	1.1
	SON	8.1	9.1	0.3	9.5	0.5
Port Aux Basque	**DJF**	8.8	9.8	0.8	10.7	0.9
	MAM	9.3	9.9	0.5	10.4	0.8
	JJA	11.0	11.1	1.2	11.5	1.3
	SON	10.6	11.5	0.6	12.2	0.9
Springdale	**DJF**	10.3	10.5	0.7	11.3	1.0
	MAM	9.0	9.3	0.4	10.1	0.5
	JJA	9.1	10.9	0.9	11.3	1.0
	SON	9.6	12.0	0.6	12.6	1.0
St. Alban's	**DJF**	13.4	14.4	1.0	15.4	1.2
	MAM	11.4	12.1	0.2	12.8	0.5
	JJA	11.1	12.3	0.7	12.5	0.7
	SON	13.5	14.9	0.7	15.5	1.3
St. Anthony	**DJF**	7.4	8.0	0.8	8.6	0.9
	MAM	6.6	7.1	0.5	7.4	0.4
	JJA	7.9	8.2	0.7	8.6	1.0
	SON	7.2	8.4	0.4	8.8	0.7
St. John's	**DJF**	11.9	12.0	0.5	12.8	0.8
	MAM	10.1	10.5	0.3	11.0	0.4
	JJA	9.6	11.1	1.0	11.2	1.0
	SON	10.8	12.4	0.5	12.7	0.5
St. Lawrence	**DJF**	9.0	10.9	0.9	11.9	1.1
	MAM	9.3	10.3	0.3	11.0	0.5
	JJA	11.1	10.9	0.7	11.3	0.8
	SON	11.9	12.4	0.7	13.0	1.0
Stephenville	**DJF**	7.7	8.1	0.6	8.9	0.8
	MAM	7.7	8.5	0.4	8.9	0.6
	JJA	9.4	10.5	1.0	11.2	1.2
	SON	9.0	10.3	0.5	11.0	0.7
Twillingate	**DJF**	8.6	9.2	0.5	9.8	0.6
	MAM	7.8	8.3	0.3	8.9	0.4
	JJA	8.4	9.6	1.4	10.1	1.6
	SON	8.4	10.5	0.4	10.8	0.7

Table 20: Mean precipitation event intensity (mm/day) climatology and projected change; Labrador. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Std Dev	Ensemble Avg	Std Dev
	DJF	8.9	8.8	0.6	9.3	0.8
Cartwright	**MAM**	7.9	8.4	0.6	8.8	0.6
	JJA	7.3	9.1	0.9	9.5	1.2
	SON	7.7	9.2	0.4	9.6	0.7
	DJF	6.7	7.0	0.5	8.0	1.1
Churchill Falls	**MAM**	6.6	6.9	0.4	7.3	0.4
	JJA	7.5	8.5	0.5	8.9	0.7
	SON	6.9	8.1	0.5	8.3	0.4
	DJF	6.7	7.4	0.6	7.9	0.7
Goose Bay	**MAM**	6.7	7.1	0.2	7.6	0.4
	JJA	8.1	8.7	0.5	9.3	0.7
	SON	7.6	8.5	0.5	8.8	0.6
	DJF	8.9	8.7	0.5	9.3	0.9
Mary's Harbour	**MAM**	7.4	8.0	0.4	8.4	0.3
	JJA	7.6	8.9	0.9	9.3	1.0
	SON	8.0	9.3	0.5	9.7	0.8
	DJF	10.1	9.9	0.5	10.1	0.8
Nain	**MAM**	9.1	8.8	0.5	9.3	0.5
	JJA	8.1	9.9	0.6	10.2	0.9
	SON	8.1	9.7	0.5	9.7	0.5
	DJF	6.2	6.3	0.3	6.7	0.4
Wabush Lake	**MAM**	6.4	6.8	0.3	7.2	0.4
	JJA	7.4	8.3	0.3	8.7	0.6
	SON	6.5	7.4	0.3	7.7	0.3
	DJF	5.6	6.0	0.4	6.2	0.3
Schefferville	**MAM**	5.7	6.6	0.4	6.9	0.4
	JJA	6.8	8.1	0.4	8.3	0.5
	SON	6.4	7.1	0.4	7.4	0.4

Maximum 3-day Precipitation (mm)

Summary: Maximum precipitation falling over three consecutive days increases by 1-12mm. The greatest increases occur on the island in winter. Increases are generally smaller in Labrador.

Hazardous precipitation events often occur over several days, during which reservoirs, soil moisture capacity, and water bodies may gradually become overwhelmed, leading to flooding even if precipitation intensity remains low. This index is much more variable than the other precipitation indices discussed, due to variations in the length, intensity, and procession of individual precipitation systems occurring over consecutive 3-day periods. However, in many cases it can provide a better estimate of increased flooding potential, as it covers heavy precipitation events occurring over multiple days and slow-building flood events. In addition to the three day maximum, maximum 5 and 10 day precipitation are also presented.

Projected changes in maximum 3, 5, and 10-day precipitation all follow spatial patterns similar to those described for mean precipitation intensity, particularly in Newfoundland; the greatest changes on the island occur in winter, and are concentrated along the south coast. As with mean precipitation intensity, there is some notable uncertainty in mid-century projections; station corrected data (Tables 21-22) increase the expected changes in some seasons (usually summer and fall), and reduce them in others (winter). However, by late century strong increases emerge in bias corrected projections for all station locations (Tables 21-22).

Figure 21: Changes in maximum 3-day precipitation (mm) for 2041-2070.

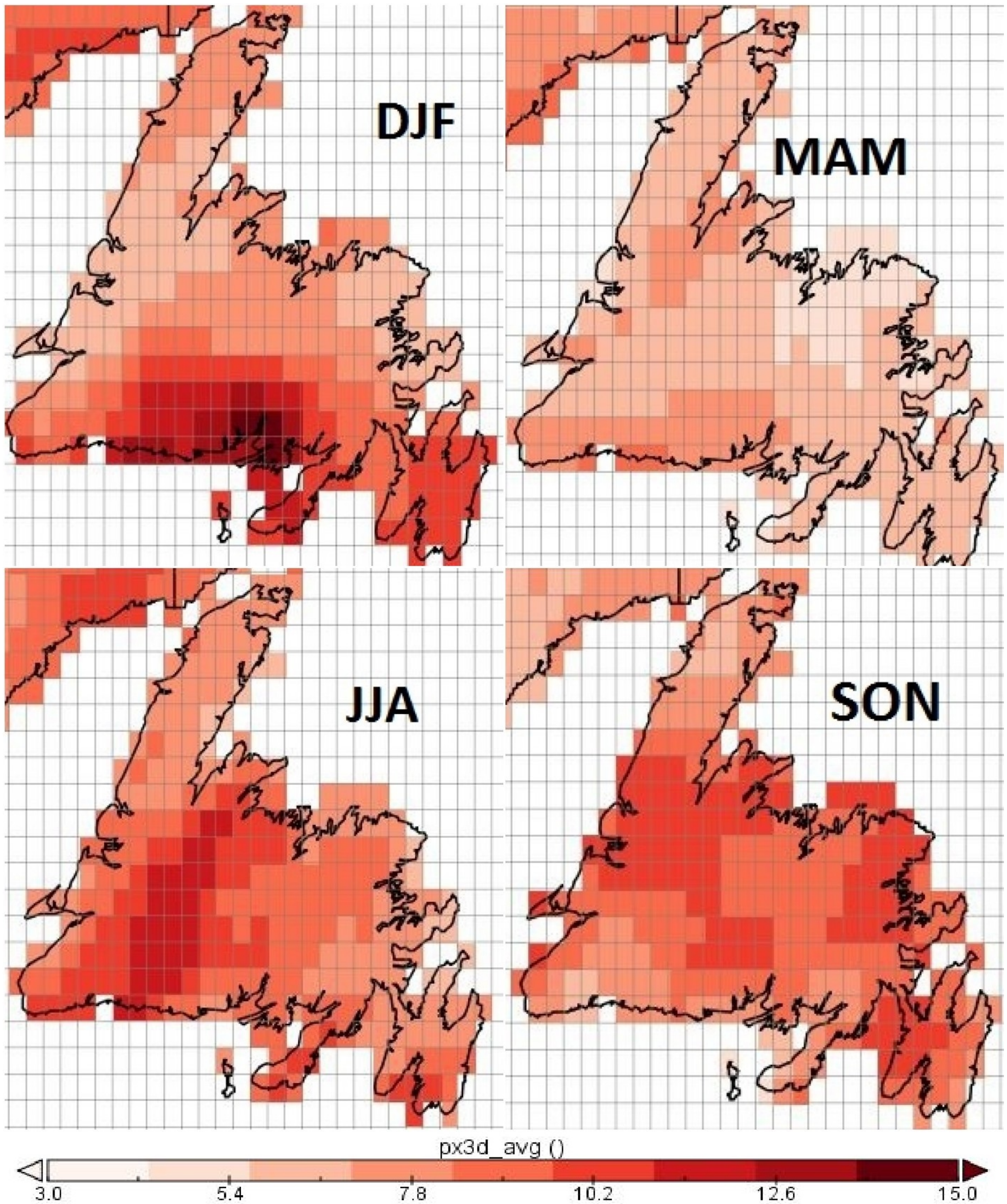

Figure 22: Changes in maximum 3-day precipitation (mm) for 2041-2070.

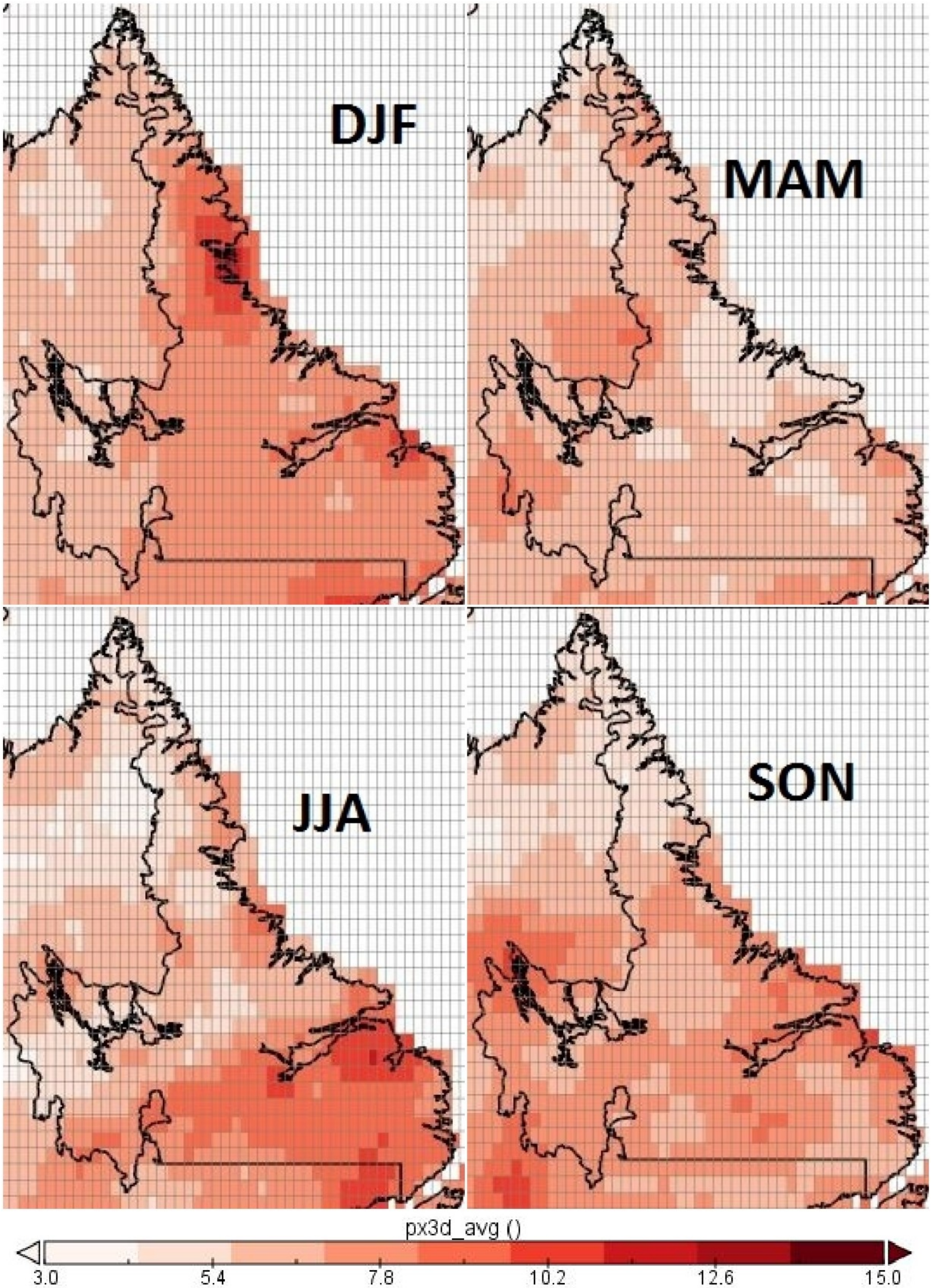

Table 21: Maximum 3-day precipitation (mm) climatology and projected change; Newfoundland. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
Argentia	DJF	44.0	58.6	7.7	63.6	9.2
	MAM	42.1	51.0	4.1	56.4	4.7
	JJA	63.5	58.6	7.1	63.2	9.3
	SON	54.2	72.8	7.3	74.2	6.4
Bay D'Espoir	DJF	92.7	92.1	7.6	96.9	11.6
	MAM	71.6	75.6	5.4	83.1	6.8
	JJA	65.6	80.5	12.4	84.6	10.6
	SON	75.7	93.5	9.3	102.6	17.1
Burgeo	DJF	73.8	84.5	6.2	92.0	8.4
	MAM	68.9	74.9	6.5	83.0	6.8
	JJA	74.2	85.6	11.5	86.8	10.5
	SON	72.8	86.0	5.8	91.5	9.5
Comfort Cove	DJF	46.1	52.1	4.4	55.2	5.9
	MAM	45.0	47.1	2.2	52.6	4.5
	JJA	51.8	56.7	9.4	60.6	9.2
	SON	49.4	64.5	4.2	68.6	8.5
Corner Brook	DJF	56.9	55.1	4.4	61.7	4.4
	MAM	43.2	49.5	3.1	55.1	4.1
	JJA	50.3	65.4	8.8	71.1	12.7
	SON	56.1	68.7	6.4	74.4	10.5
Daniel's Harbour	DJF	41.5	49.3	4.6	55.3	5.9
	MAM	41.5	44.4	2.9	48.5	6.0
	JJA	59.4	62.8	8.8	66.5	13.0
	SON	54.6	62.8	4.7	67.3	9.0
Deer Lake	DJF	51.7	53.3	4.4	59.0	5.0
	MAM	45.6	49.6	3.3	54.3	5.0
	JJA	51.5	64.4	9.9	69.9	13.3
	SON	50.0	67.1	6.2	72.2	12.4
Exploits Dam	DJF	44.3	53.3	4.8	58.3	6.0
	MAM	45.3	47.2	4.0	52.8	4.1
	JJA	50.3	62.9	9.3	69.6	11.8
	SON	54.8	65.9	6.8	71.1	13.7
Gander	DJF	47.8	52.5	4.4	55.9	6.5
	MAM	49.8	49.8	3.5	55.5	6.1
	JJA	48.6	60.1	10.3	65.1	10.5
	SON	55.7	66.5	5.2	70.7	7.2
Grand Falls	DJF	55.7	57.0	5.2	61.3	6.4
	MAM	47.4	50.0	1.9	55.0	3.5
	JJA	55.5	66.0	10.5	73.4	13.4
	SON	54.1	68.9	5.7	74.5	12.3
Isle Aux Morts	DJF	62.2	74.3	4.3	79.5	5.6
	MAM	66.2	67.0	5.3	71.6	5.7
	JJA	68.6	75.4	10.1	79.1	11.0
	SON	66.0	78.1	6.5	84.4	7.8
La Scie	DJF	53.6	58.1	4.7	61.4	6.9
	MAM	60.0	53.6	3.2	58.3	3.7
	JJA	54.6	66.2	10.6	70.8	12.2
	SON	60.2	72.5	5.8	76.7	10.9

Table 21, con't.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
North Harbour	DJF	70.8	77.0	8.0	83.2	8.6
	MAM	66.6	68.6	3.8	74.5	5.5
	JJA	59.0	78.4	8.5	82.1	14.0
	SON	77.2	91.1	8.3	92.6	6.5
Plum Point	DJF	50.7	54.6	4.9	58.0	6.8
	MAM	48.4	50.9	2.7	53.9	3.2
	JJA	60.4	67.2	10.5	72.3	13.7
	SON	53.8	64.3	4.2	69.2	6.1
Port Aux Basque	DJF	61.0	71.8	5.5	76.6	5.7
	MAM	57.7	65.0	6.5	68.8	7.3
	JJA	63.5	73.7	10.4	77.8	12.4
	SON	64.5	76.7	6.1	83.0	8.0
Springdale	DJF	49.5	53.8	4.8	58.1	5.9
	MAM	46.6	49.3	3.2	54.7	4.4
	JJA	50.7	65.7	10.1	69.4	12.4
	SON	55.5	67.5	5.4	70.9	11.3
St. Alban's	DJF	103.3	102.9	8.6	107.4	13.2
	MAM	82.3	84.0	6.6	92.2	8.1
	JJA	71.9	89.1	14.0	93.1	12.7
	SON	93.5	104.1	9.7	113.3	17.4
St. Anthony	DJF	42.6	47.5	4.1	51.7	4.7
	MAM	38.0	43.8	4.5	47.2	3.6
	JJA	47.2	55.2	7.5	60.7	12.6
	SON	40.7	54.3	3.9	59.8	5.2
St. John's	DJF	84.4	85.0	7.8	90.8	8.8
	MAM	81.8	76.3	5.5	82.4	5.8
	JJA	62.6	77.9	10.3	80.2	11.2
	SON	79.2	94.5	4.4	97.5	4.9
St. Lawrence	DJF	56.4	73.5	7.6	80.1	9.9
	MAM	52.4	68.8	6.7	75.7	6.9
	JJA	69.3	77.0	8.7	81.2	10.8
	SON	80.6	85.5	11.9	88.7	10.2
Stephenville	DJF	60.1	59.5	4.3	66.4	5.4
	MAM	51.3	54.9	3.4	58.4	5.3
	JJA	59.3	70.8	10.2	79.4	14.6
	SON	60.7	74.9	5.0	79.5	9.6
Twillingate	DJF	50.4	54.7	4.7	56.8	6.1
	MAM	44.7	47.0	2.8	52.4	5.2
	JJA	41.7	56.7	11.8	60.9	11.2
	SON	47.1	65.9	4.7	69.5	8.4

Table 22: Maximum 3-day precipitation (mm) climatology and projected change; Labrador. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Std Dev	Ensemble Avg	Std Dev
Cartwright	DJF	66.9	59.8	6.0	62.5	8.2
	MAM	61.9	60.0	9.0	63.2	10.9
	JJA	49.3	69.3	12.9	74.5	14.5
	SON	55.6	70.5	8.3	74.9	12.0
Churchill Falls	DJF	43.4	40.3	8.5	56.4	28.4
	MAM	41.9	38.9	3.8	42.2	4.3
	JJA	46.8	57.5	5.4	62.2	9.9
	SON	46.2	51.3	4.1	54.9	4.8
Goose Bay	DJF	37.7	42.6	2.7	46.7	4.3
	MAM	37.3	42.6	2.8	46.4	2.1
	JJA	51.3	61.8	6.9	70.1	8.5
	SON	44.7	54.4	3.8	57.2	5.2
Mary's Harbour	DJF	52.5	50.7	3.2	55.1	5.1
	MAM	45.7	49.1	3.3	52.4	3.6
	JJA	50.2	61.0	8.3	66.7	12.2
	SON	51.3	61.0	4.4	65.4	7.5
Nain	DJF	74.7	68.3	10.3	69.3	14.4
	MAM	63.8	55.7	7.8	61.9	8.9
	JJA	53.8	71.8	5.2	77.6	8.5
	SON	52.7	69.3	5.6	70.7	5.8
Wabush Lake	DJF	40.9	40.9	5.3	45.4	6.0
	MAM	39.8	44.8	4.3	48.9	4.9
	JJA	47.8	58.3	5.6	65.2	9.2
	SON	40.6	52.8	4.3	56.6	4.8
Schefferville	DJF	37.4	36.7	3.5	40.4	4.9
	MAM	38.1	40.6	4.7	45.3	6.3
	JJA	46.6	59.9	6.7	61.5	8.2
	SON	45.8	54.4	4.4	56.8	5.0

Maximum 5-day Precipitation (mm)

Summary: Maximum precipitation falling over five consecutive days increases by 1.5-15mm. The greatest increases occur on the island in winter. Increases are generally smaller in Labrador.

Same as maximum 3-day precipitation but calculated over five consecutive days. Projected changes in maximum 3, 5, and 10-day precipitation all follow spatial patterns similar to those described for mean precipitation intensity, particularly in Newfoundland; the greatest changes on the island occur in winter, and are concentrated along the south coast. As with mean precipitation intensity, there is some notable uncertainty in mid-century projections; station corrected data increase the expected changes in some seasons/locations (usually summer and fall), and reduce them in others (winter). However, by late century strong increases emerge in bias corrected projections for all station locations.

Figure 23: Changes in maximum 5-day precipitation (mm) for 2041-2070.

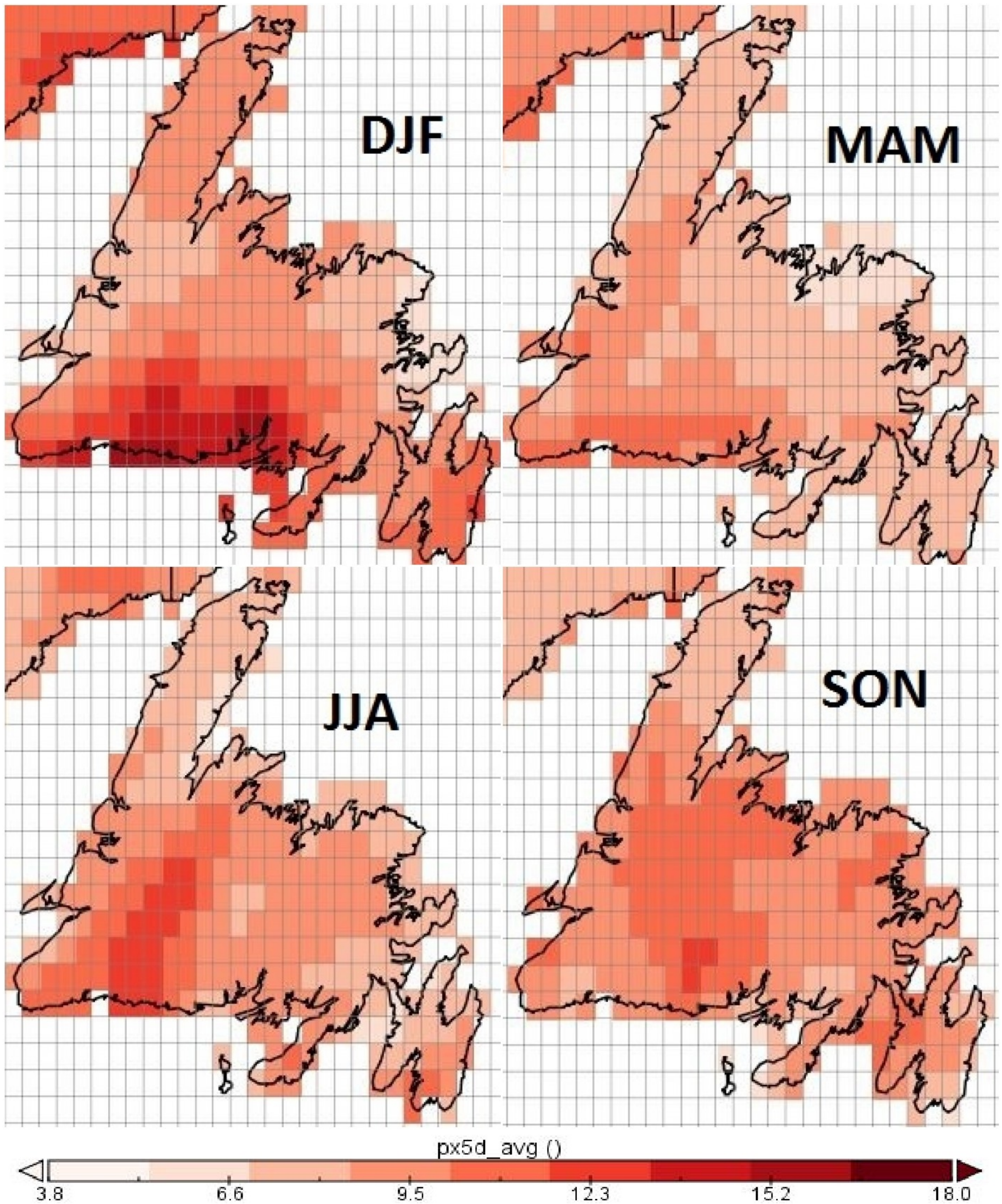

Figure 24: Changes in maximum 5-day precipitation (mm) for 2041-2070.

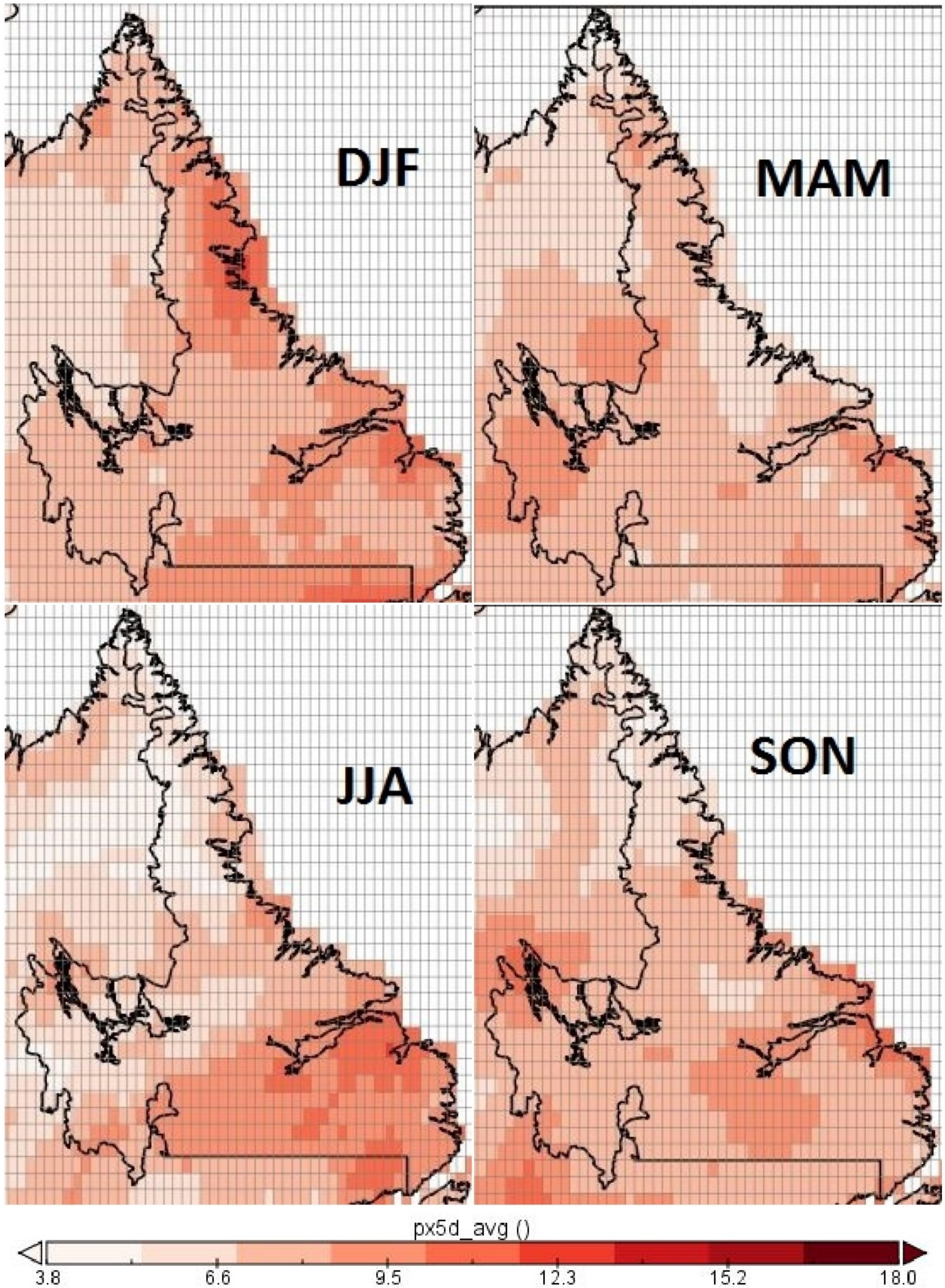

Table 23: Maximum 5-day precipitation (mm) climatology and projected change; Newfoundland. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
Argentia	DJF	56.5	69.8	7.8	76.4	9.4
	MAM	48.9	60.1	4.1	67.1	4.9
	JJA	71.8	67.1	7.8	73.0	10.8
	SON	66.3	83.0	7.7	85.3	8.0
Bay D'Espoir	DJF	111.3	111.1	8.2	118.1	11.7
	MAM	87.9	91.4	5.4	99.1	8.2
	JJA	78.9	95.1	13.8	100.9	13.8
	SON	96.1	111.2	9.7	117.6	17.5
Burgeo	DJF	88.7	103.7	6.4	112.7	9.0
	MAM	83.5	91.1	6.5	99.7	8.4
	JJA	90.4	101.1	13.4	101.7	10.4
	SON	89.2	103.5	5.9	107.9	11.3
Comfort Cove	DJF	56.3	64.1	5.6	68.7	6.8
	MAM	57.2	57.6	2.5	64.1	5.2
	JJA	60.8	67.2	10.4	72.6	11.7
	SON	60.8	76.5	3.7	80.6	8.8
Corner Brook	DJF	73.8	69.1	5.6	76.5	5.3
	MAM	54.0	61.0	3.5	66.6	5.5
	JJA	60.5	77.8	9.4	84.0	14.8
	SON	69.3	81.7	7.4	86.9	11.5
Daniel's Harbour	DJF	50.8	59.9	4.5	66.3	6.4
	MAM	49.7	53.0	3.3	57.8	7.4
	JJA	67.9	73.0	9.2	77.3	14.2
	SON	62.6	73.9	5.4	78.9	9.5
Deer Lake	DJF	65.3	66.2	5.2	73.3	5.9
	MAM	54.6	60.9	3.9	66.0	5.4
	JJA	60.9	76.7	10.4	83.0	15.2
	SON	60.6	79.7	6.8	85.0	12.8
Exploits Dam	DJF	53.3	64.4	5.2	71.4	6.9
	MAM	54.7	57.4	4.3	63.4	4.1
	JJA	61.5	74.3	10.3	81.3	13.4
	SON	64.0	77.3	6.9	82.3	13.9
Gander	DJF	58.6	64.2	4.8	69.3	6.7
	MAM	60.1	59.9	4.0	66.6	7.0
	JJA	57.0	71.0	11.7	77.6	12.8
	SON	66.1	77.9	4.7	82.2	8.5
Grand Falls	DJF	67.2	68.8	6.2	75.4	7.3
	MAM	57.9	60.8	2.7	66.3	4.3
	JJA	66.2	77.0	11.5	86.5	15.6
	SON	65.0	81.1	5.6	85.9	12.8
Isle Aux Morts	DJF	76.2	92.6	5.0	98.8	6.0
	MAM	77.0	82.3	5.8	86.1	6.0
	JJA	79.1	89.0	11.9	92.9	11.8
	SON	80.8	95.1	8.0	100.2	9.0
La Scie	DJF	66.9	72.5	5.8	76.3	7.3
	MAM	71.7	65.9	3.0	71.4	3.8
	JJA	68.0	78.1	10.7	83.8	14.4
	SON	69.7	86.4	6.6	90.6	11.3

Table 23, con't.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
North Harbour	DJF	88.5	94.3	8.1	102.6	8.9
	MAM	80.1	83.4	4.6	90.7	5.8
	JJA	73.9	91.7	9.8	98.3	17.3
	SON	91.3	106.5	9.0	109.0	9.4
Plum Point	DJF	64.3	68.4	5.3	71.8	7.8
	MAM	60.0	62.1	3.3	65.8	4.0
	JJA	70.3	79.3	10.7	85.8	14.6
	SON	65.0	77.5	4.6	83.1	6.3
Port Aux Basque	DJF	73.5	87.4	5.7	93.6	5.8
	MAM	68.4	78.5	7.2	81.8	7.6
	JJA	73.1	85.5	11.6	90.0	13.1
	SON	77.4	92.3	7.7	97.3	8.9
Springdale	DJF	60.4	65.4	5.2	70.7	6.5
	MAM	57.3	59.1	2.9	65.3	4.8
	JJA	59.9	76.3	10.9	81.8	14.6
	SON	66.0	79.1	6.0	82.7	11.4
St. Alban's	DJF	117.7	123.8	9.5	130.6	13.3
	MAM	106.4	101.5	6.3	110.0	9.4
	JJA	86.9	105.5	15.4	111.1	16.0
	SON	115.0	123.9	10.3	130.2	18.1
St. Anthony	DJF	53.6	59.2	4.4	63.7	6.2
	MAM	46.6	53.1	4.4	57.3	4.3
	JJA	54.7	65.5	8.4	71.4	13.4
	SON	48.6	65.2	4.5	71.6	6.4
St. John's	DJF	105.7	104.3	8.4	112.8	9.3
	MAM	93.8	91.5	6.0	99.8	6.0
	JJA	73.3	92.1	12.8	94.5	13.8
	SON	94.7	112.3	5.1	116.3	6.7
St. Lawrence	DJF	73.0	89.6	9.1	98.5	10.8
	MAM	61.8	82.0	7.1	90.4	6.5
	JJA	78.5	90.0	10.1	94.8	13.0
	SON	99.2	101.3	13.7	103.7	11.2
Stephenville	DJF	77.8	73.6	4.9	81.9	6.3
	MAM	62.0	67.2	3.9	70.2	6.5
	JJA	70.3	83.8	10.5	92.2	16.2
	SON	74.4	88.6	5.7	93.3	11.4
Twillingate	DJF	60.1	65.9	6.1	69.4	6.9
	MAM	55.0	56.6	3.0	62.9	6.2
	JJA	49.5	66.4	11.9	71.0	12.5
	SON	56.1	77.5	5.2	80.8	8.9

Table 24: Maximum 5-day precipitation (mm) climatology and projected change; Labrador. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Std Dev	Ensemble Avg	Std Dev
Cartwright	DJF	82.1	71.9	7.3	73.9	9.0
	MAM	76.1	71.9	10.5	75.7	11.8
	JJA	59.8	81.1	13.5	87.4	15.8
	SON	67.4	82.4	8.1	86.7	13.1
Churchill Falls	DJF	50.7	46.2	8.8	63.1	28.5
	MAM	50.5	45.8	4.3	49.3	4.5
	JJA	58.6	66.7	4.9	73.5	11.6
	SON	54.8	59.3	4.3	64.6	5.3
Goose Bay	DJF	44.6	50.8	3.5	55.6	5.2
	MAM	44.8	51.6	3.0	55.7	3.2
	JJA	60.0	72.7	7.4	82.5	10.1
	SON	53.0	64.1	4.3	67.2	7.0
Mary's Harbour	DJF	63.2	61.0	3.6	66.5	6.7
	MAM	56.0	58.1	4.0	62.2	4.1
	JJA	61.6	71.9	8.9	77.1	14.4
	SON	59.2	71.4	4.9	77.4	8.3
Nain	DJF	84.6	79.4	10.7	80.9	15.9
	MAM	76.6	65.6	8.3	72.5	10.7
	JJA	63.4	83.8	5.3	89.7	9.5
	SON	63.9	80.4	6.0	82.6	6.2
Wabush Lake	DJF	47.8	49.2	6.0	53.9	6.8
	MAM	47.8	53.7	4.6	57.9	5.4
	JJA	59.2	71.1	6.6	77.8	9.6
	SON	50.5	63.2	4.8	68.4	6.6
Schefferville	DJF	43.6	43.3	4.9	48.2	5.7
	MAM	45.0	48.6	5.5	53.7	7.3
	JJA	55.0	72.4	7.8	74.2	9.1
	SON	53.8	64.5	5.1	69.2	5.2

Maximum 10-day Precipitation (mm)

Summary: Maximum precipitation falling over ten consecutive days increases by 5-20mm.

Maximum precipitation falling in a 10-day consecutive period. Projected changes in maximum 3, 5, and 10-day precipitation all follow spatial patterns similar to those described for mean precipitation intensity. Projected changes in maximum 3, 5, and 10-day precipitation all follow spatial patterns similar to those described for mean precipitation intensity, particularly in Newfoundland; the greatest changes on the island occur in winter, and are concentrated along the south coast. As with mean precipitation intensity, there is some notable uncertainty in mid-century projections; station corrected data increase the expected changes in some seasons (usually summer and fall), and reduce them in others (winter). However, by late century strong increases emerge in bias corrected projections for all station locations

Figure 25: Changes in maximum 10-day precipitation (mm) for 2041-2070.

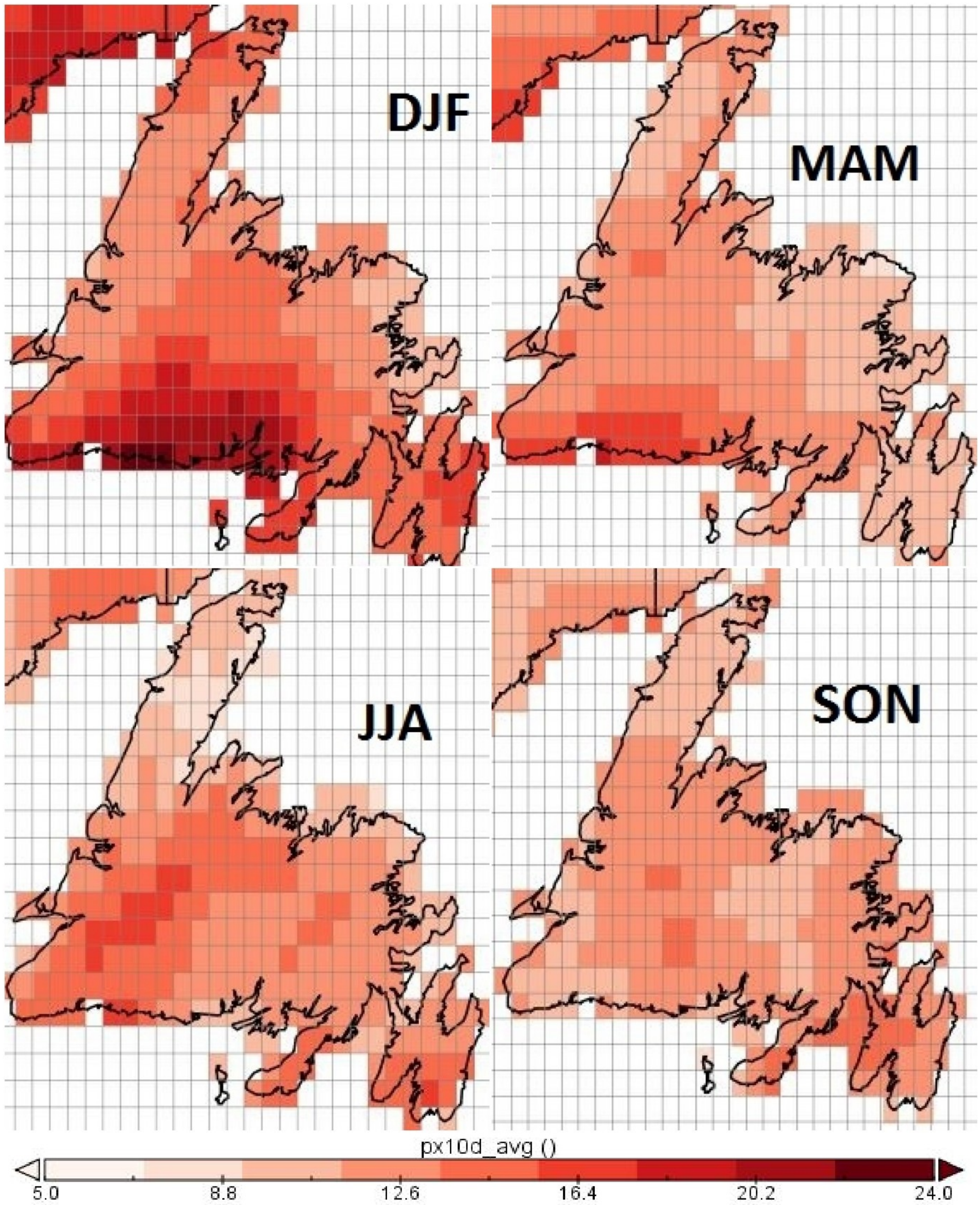

Figure 26: Changes in maximum 10-day precipitation (mm) for 2041-2070.

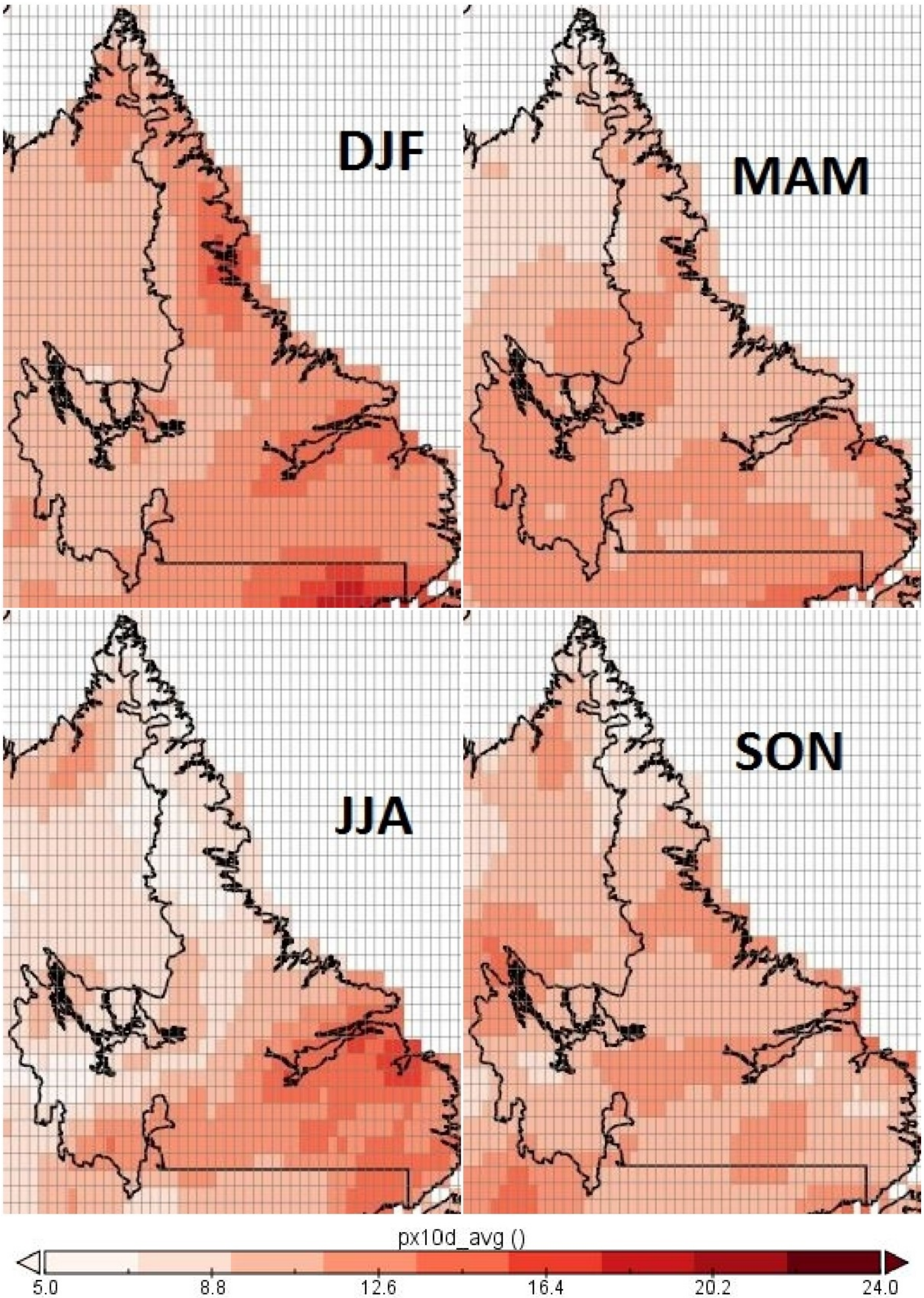

Table 25: Maximum 10-day precipitation (mm) climatology and projected change; Newfoundland. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
Argentia	DJF	84.8	101.9	10.1	111.6	12.5
	MAM	66.1	84.9	6.2	93.9	5.9
	JJA	91.2	93.9	12.0	98.0	14.0
	SON	99.0	113.3	7.8	113.2	9.6
Bay D'Espoir	DJF	165.0	163.0	10.1	170.8	13.4
	MAM	127.8	132.0	8.0	142.6	11.1
	JJA	110.3	134.8	20.1	141.4	17.4
	SON	136.3	156.8	10.1	161.4	20.5
Burgeo	DJF	132.4	154.2	10.6	166.7	12.4
	MAM	121.6	133.1	10.0	144.6	11.7
	JJA	128.8	142.6	17.6	143.2	12.8
	SON	126.3	148.4	6.5	151.8	11.7
Comfort Cove	DJF	84.3	95.0	8.0	102.6	8.8
	MAM	84.4	84.9	4.3	93.1	7.6
	JJA	87.6	94.9	14.3	100.7	16.0
	SON	89.3	107.2	3.4	110.8	12.0
Corner Brook	DJF	115.6	106.3	8.0	116.0	7.5
	MAM	80.1	89.1	5.0	97.1	8.4
	JJA	85.0	111.1	12.0	117.9	20.0
	SON	103.2	117.4	7.6	122.8	12.9
Daniel's Harbour	DJF	76.2	87.7	6.1	97.2	9.7
	MAM	67.8	75.5	4.6	82.6	8.9
	JJA	91.6	100.3	12.7	107.9	17.1
	SON	88.6	103.3	6.4	109.3	9.7
Deer Lake	DJF	103.9	101.3	7.9	110.4	8.6
	MAM	78.8	88.9	5.3	95.8	7.5
	JJA	85.7	109.0	14.3	117.1	21.0
	SON	91.1	112.8	7.3	118.0	15.5
Exploits Dam	DJF	80.2	96.1	7.6	104.9	9.4
	MAM	76.6	83.0	6.1	90.8	6.3
	JJA	86.7	104.1	14.5	113.0	20.0
	SON	91.1	106.5	5.4	110.2	16.5
Gander	DJF	89.9	95.7	7.1	102.4	8.0
	MAM	85.1	87.1	6.2	96.0	9.4
	JJA	81.3	100.6	16.8	109.5	20.3
	SON	92.6	107.7	4.5	112.2	11.2
Grand Falls	DJF	97.3	100.3	8.8	108.5	9.0
	MAM	82.5	87.6	4.7	94.9	6.5
	JJA	89.6	109.2	17.0	119.7	22.0
	SON	92.6	111.7	4.4	115.6	15.0
Isle Aux Morts	DJF	116.6	139.2	8.4	149.3	10.2
	MAM	113.8	120.6	8.8	127.1	7.8
	JJA	121.5	125.9	14.0	131.0	16.4
	SON	118.3	137.0	8.4	142.9	11.3
La Scie	DJF	100.4	109.4	8.6	117.4	11.4
	MAM	103.0	98.4	4.6	104.5	6.6
	JJA	93.9	110.9	13.8	117.2	20.3
	SON	102.9	123.5	6.1	126.8	13.1

Table 25, con't.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
North Harbour	**DJF**	132.0	143.7	11.6	154.1	12.8
	MAM	110.1	123.0	7.3	132.2	6.7
	JJA	98.7	133.1	14.7	137.5	22.0
	SON	130.9	152.7	10.0	151.1	12.6
Plum Point	**DJF**	101.7	104.9	7.4	110.3	11.4
	MAM	89.0	92.2	5.5	98.6	7.1
	JJA	96.9	113.0	13.8	121.1	19.3
	SON	94.4	113.4	5.4	119.4	7.7
Port Aux Basque	**DJF**	106.7	128.2	8.6	139.1	10.1
	MAM	101.2	111.6	9.9	117.8	9.2
	JJA	105.1	117.9	13.9	123.7	17.3
	SON	108.7	129.9	7.8	135.7	11.3
Springdale	**DJF**	87.7	95.3	8.2	104.2	9.3
	MAM	82.1	84.9	4.3	91.9	6.9
	JJA	84.4	106.3	14.3	111.5	21.1
	SON	95.7	109.8	6.0	112.0	12.9
St. Alban's	**DJF**	166.6	181.9	11.7	189.3	15.3
	MAM	148.5	147.1	9.0	158.8	12.4
	JJA	130.4	149.5	22.5	156.2	20.2
	SON	161.3	174.4	10.8	178.5	21.0
St. Anthony	**DJF**	83.8	88.5	6.8	95.2	10.4
	MAM	64.8	77.6	6.1	84.5	7.4
	JJA	72.3	92.9	12.1	100.7	17.5
	SON	72.8	94.2	5.4	101.9	8.7
St. John's	**DJF**	160.9	157.2	11.7	169.5	13.8
	MAM	136.8	133.6	8.2	144.0	7.3
	JJA	101.4	131.3	21.0	130.8	18.7
	SON	139.8	161.3	6.9	161.7	7.8
St. Lawrence	**DJF**	113.0	134.3	11.8	145.7	14.1
	MAM	95.9	118.1	8.9	129.1	7.2
	JJA	111.1	125.5	14.4	129.1	16.1
	SON	137.4	143.2	14.7	143.8	14.1
Stephenville	**DJF**	119.3	112.9	8.0	123.6	9.1
	MAM	91.0	97.2	6.0	101.8	9.5
	JJA	101.3	118.3	13.2	127.5	21.1
	SON	107.4	125.6	5.8	132.2	12.3
Twillingate	**DJF**	89.1	94.5	7.7	101.8	9.8
	MAM	73.0	80.9	4.8	89.0	8.4
	JJA	67.6	90.7	14.3	95.5	16.6
	SON	82.4	106.8	5.5	109.3	10.9

Table 26: Maximum 10-day precipitation (mm) climatology and projected change; Labrador. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Std Dev	Ensemble Avg	Std Dev
	DJF	114.70	101.51	9.46	108.43	15.08
Cartwright	**MAM**	106.54	100.17	13.35	107.02	15.22
	JJA	81.55	115.96	18.11	123.16	21.90
	SON	91.61	112.66	10.08	119.84	15.56
	DJF	76.34	62.88	10.15	81.83	29.76
Churchill Falls	**MAM**	70.08	63.02	5.66	68.84	6.03
	JJA	85.41	93.44	7.15	102.02	15.73
	SON	83.91	82.47	5.05	90.60	8.09
	DJF	65.01	73.70	4.44	80.33	8.65
Goose Bay	**MAM**	62.34	72.84	4.38	78.98	4.93
	JJA	83.51	104.58	10.51	116.04	14.71
	SON	72.53	89.08	5.60	93.52	9.71
	DJF	96.25	88.75	5.76	96.40	10.43
Mary's Harbour	**MAM**	75.37	81.74	6.37	89.41	6.53
	JJA	87.14	100.85	13.10	106.94	18.68
	SON	83.66	99.52	6.53	107.40	11.29
	DJF	118.88	106.87	13.48	110.59	20.25
Nain	**MAM**	100.64	91.40	9.82	99.37	15.73
	JJA	85.35	114.03	6.32	120.21	11.10
	SON	87.46	112.74	8.33	114.00	6.71
	DJF	70.63	71.10	7.43	77.44	9.02
Wabush Lake	**MAM**	66.98	76.71	5.39	83.03	5.78
	JJA	86.94	104.76	6.79	113.95	12.27
	SON	77.84	90.64	4.81	98.78	8.06
	DJF	62.13	61.91	6.96	68.18	8.96
Schefferville	**MAM**	62.43	68.61	6.46	76.74	8.65
	JJA	81.47	103.50	10.17	106.70	10.84
	SON	76.76	93.06	5.36	99.21	6.61

Number of Days with 10mm or more Precipitation

Summary: The number of days with 10mm or more of precipitation increases across the province, with an expected increase 1-4 days, depending on the season and location.

This indicates the number of days with significant precipitation. Depending on the intensity of rainfall (amount/time), 10mm rain events can lead to flooding and associated erosion. During winter, 10mm of water can translate to 10-100cm of snow, depending on the temperature during the event.

Maps suggest the largest increases are expected during winter and spring (an additional 2-4 days); as with other precipitation variables, station-based analyses shift the timing and magnitude at many locations towards heavier increases in summer and fall in mid-century.

Figure 27: Changes in the number of days with precipitation > 10mm projected for 2041-2070.

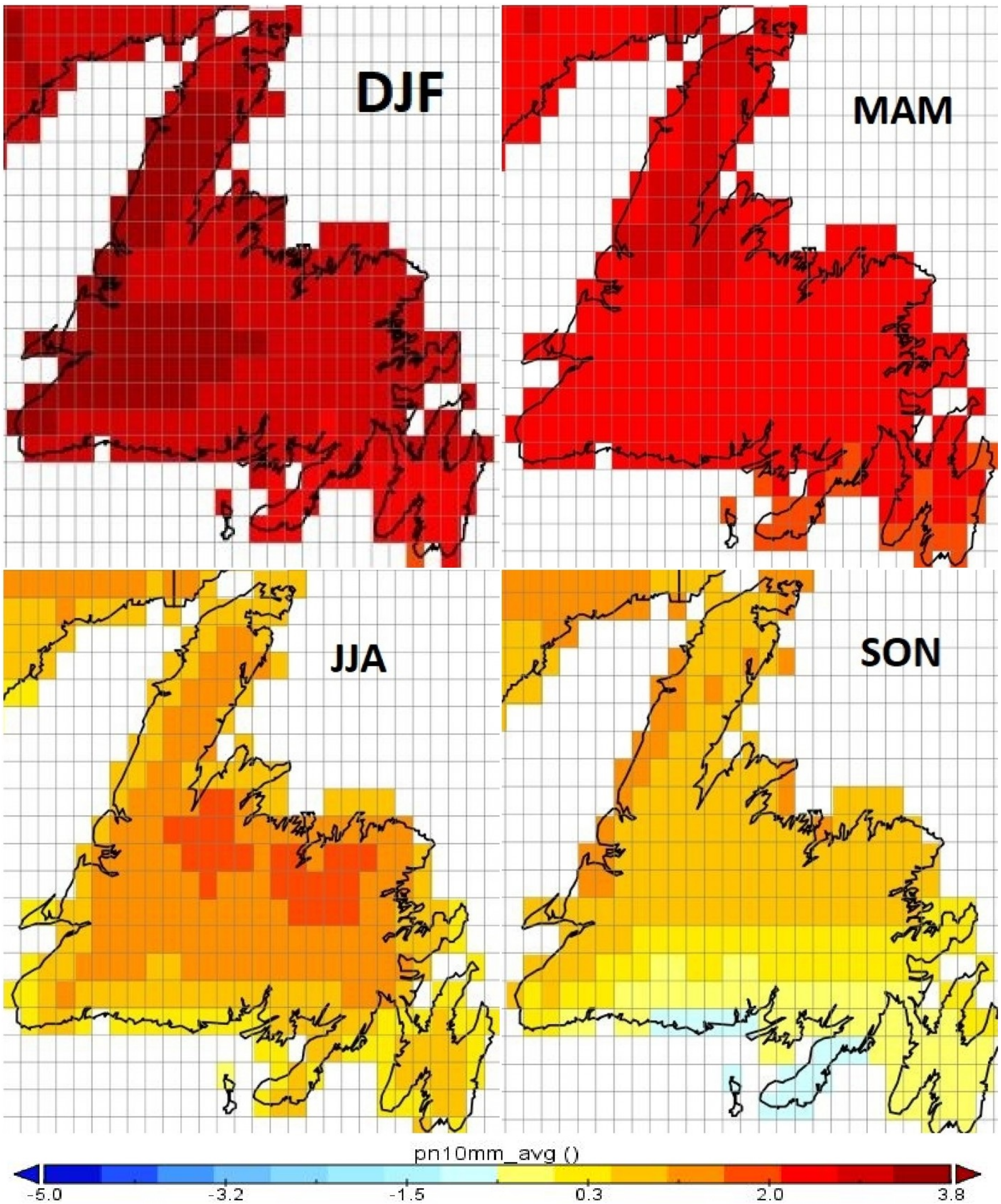

Figure 28: Changes in the number of days with precipitation > 10mm projected for 2041-2070.

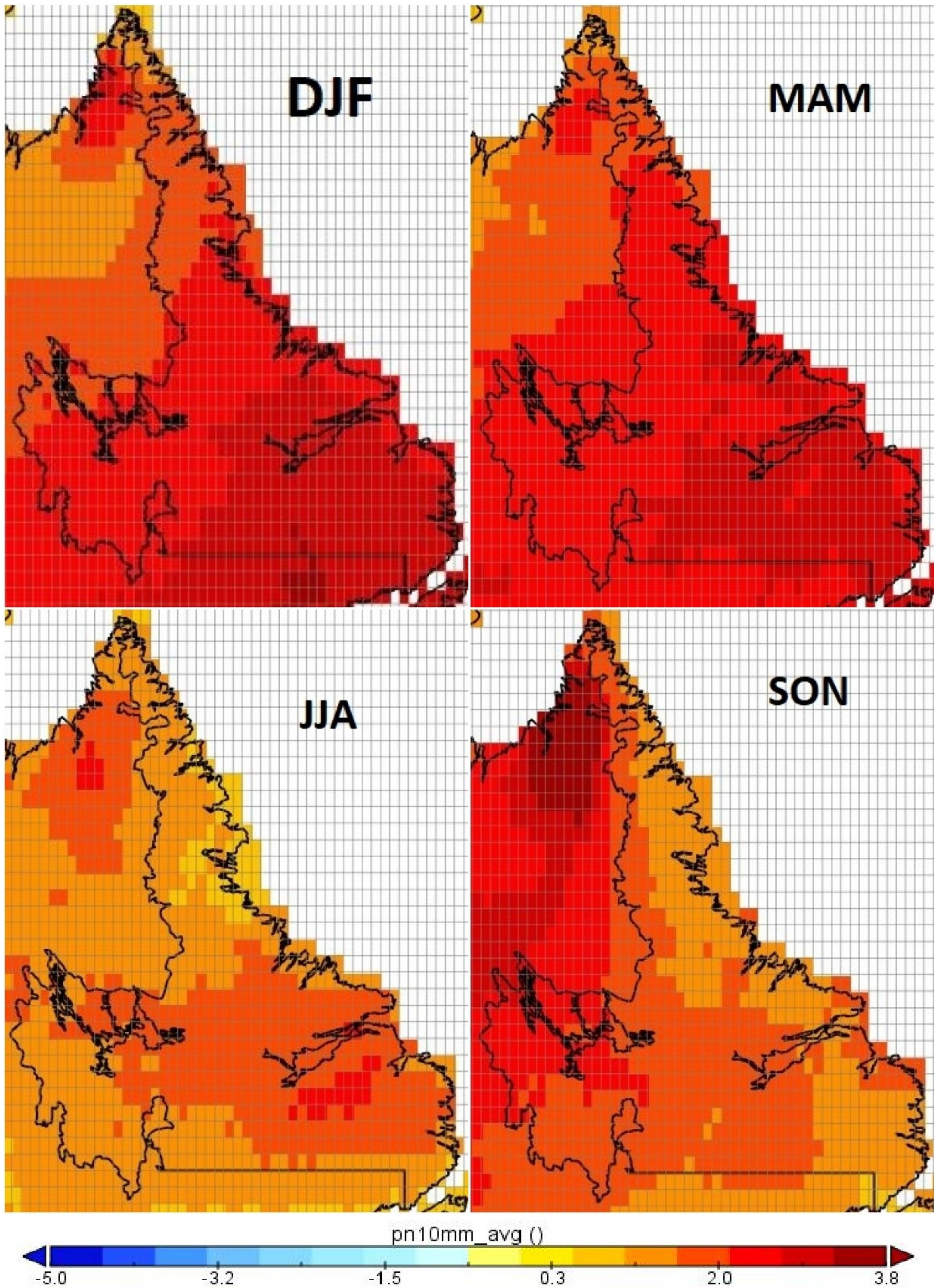

Table 27: Number of events with 10mm or more of precipitation climatology and projected change; Newfoundland. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
Argentia	DJF	8.5	11.9	1.0	13.0	1.2
	MAM	5.8	8.6	0.7	9.4	0.6
	JJA	8.9	8.3	0.9	8.3	0.7
	SON	11.1	10.7	0.6	10.3	1.0
Bay D'Espoir	DJF	18.4	17.7	1.3	18.9	1.4
	MAM	13.4	14.0	0.9	14.5	0.7
	JJA	11.4	12.8	0.8	12.8	1.2
	SON	14.3	15.1	0.9	14.3	1.7
Burgeo	DJF	14.4	17.4	1.6	18.7	1.5
	MAM	13.1	13.9	0.8	14.7	0.8
	JJA	13.3	13.7	0.6	13.5	0.9
	SON	15.5	15.5	0.8	14.5	1.8
Comfort Cove	DJF	9.2	11.6	1.3	12.9	1.4
	MAM	8.1	9.3	0.6	10.3	0.8
	JJA	9.1	9.7	1.6	9.8	2.0
	SON	10.1	11.4	0.6	11.3	1.2
Corner Brook	DJF	13.9	12.7	1.4	14.3	1.4
	MAM	7.4	9.8	0.8	10.5	1.0
	JJA	8.2	11.7	0.9	11.8	1.5
	SON	11.4	13.5	0.4	13.0	1.5
Daniel's Harbour	DJF	6.6	8.9	1.0	10.0	1.1
	MAM	5.9	7.1	0.6	7.9	0.7
	JJA	9.5	9.6	1.0	9.9	1.0
	SON	9.0	10.5	0.8	10.5	0.9
Deer Lake	DJF	14.0	12.4	1.5	13.6	1.3
	MAM	7.8	9.9	0.8	10.7	0.8
	JJA	9.7	11.7	1.2	12.0	1.4
	SON	10.1	12.7	0.7	12.1	1.5
Exploits Dam	DJF	10.2	11.5	1.2	13.0	1.2
	MAM	7.4	9.0	0.7	10.0	0.7
	JJA	9.0	10.4	1.6	10.8	2.2
	SON	9.9	10.9	0.6	10.6	1.3
Gander	DJF	9.8	11.5	1.2	12.8	1.3
	MAM	7.9	9.1	0.6	10.1	0.6
	JJA	8.4	9.8	1.9	10.4	2.4
	SON	9.8	10.9	0.6	10.8	1.2
Grand Falls	DJF	11.3	11.5	1.2	12.8	1.2
	MAM	8.3	9.3	0.5	10.2	0.6
	JJA	9.0	10.6	1.6	10.9	2.1
	SON	10.3	11.0	0.4	10.7	1.2
Isle Aux Morts	DJF	14.2	16.6	1.2	17.9	1.4
	MAM	12.6	13.7	0.7	14.4	0.9
	JJA	11.5	13.1	0.9	12.8	1.3
	SON	14.5	15.2	0.8	14.5	1.8
La Scie	DJF	15.1	14.6	1.4	15.7	1.3
	MAM	10.4	11.6	0.8	12.8	1.0
	JJA	9.3	12.0	1.6	11.8	1.8
	SON	11.9	13.9	0.7	13.6	1.7

Table 27, con't.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
North Harbour	DJF	18.8	18.6	1.5	19.3	1.1
	MAM	13.6	14.3	0.8	15.1	1.0
	JJA	11.7	12.9	0.9	12.8	1.6
	SON	15.0	15.7	0.8	14.8	1.5
Plum Point	DJF	13.5	13.8	1.2	14.5	1.2
	MAM	9.5	10.6	1.2	11.7	1.5
	JJA	10.4	12.7	1.3	12.5	1.3
	SON	11.4	13.4	0.7	13.1	1.2
Port Aux Basque	DJF	11.7	14.0	1.2	15.3	1.3
	MAM	9.7	11.5	0.9	12.0	0.7
	JJA	10.7	10.8	0.9	10.7	1.3
	SON	12.3	13.1	0.7	12.6	1.6
Springdale	DJF	10.3	11.7	1.2	12.7	1.3
	MAM	7.7	9.4	0.6	10.3	0.8
	JJA	9.5	10.7	1.5	10.6	1.7
	SON	9.9	11.6	0.5	11.2	1.2
St. Alban's	DJF	20.4	19.9	1.5	20.9	1.5
	MAM	14.7	16.0	1.1	16.5	0.9
	JJA	12.5	14.6	0.9	14.8	1.4
	SON	17.0	16.9	1.0	16.0	1.9
St. Anthony	DJF	10.9	10.9	1.5	12.0	1.2
	MAM	6.3	8.3	1.2	9.5	1.3
	JJA	6.7	9.8	1.4	10.0	1.4
	SON	7.3	10.5	0.7	10.5	1.2
St. John's	DJF	21.9	19.6	1.5	20.3	1.5
	MAM	14.0	14.9	1.1	15.6	1.2
	JJA	9.6	11.8	1.4	11.1	1.4
	SON	14.4	16.2	1.1	15.2	1.5
St. Lawrence	DJF	14.5	16.2	1.3	17.2	1.5
	MAM	11.7	12.5	0.8	13.2	0.7
	JJA	10.7	10.9	0.6	10.9	1.4
	SON	13.0	14.0	1.2	13.1	1.7
Stephenville	DJF	14.6	13.2	1.1	14.8	1.1
	MAM	9.1	10.5	0.9	11.4	1.0
	JJA	11.0	11.8	1.1	11.7	1.2
	SON	13.5	14.2	0.4	13.8	1.3
Twillingate	DJF	9.7	10.9	1.1	12.3	1.4
	MAM	6.8	8.6	0.7	9.5	0.8
	JJA	6.7	8.6	1.4	8.6	1.4
	SON	8.4	10.8	0.7	10.7	1.2

Table 28: Number of events with 10mm or more of precipitation; climatology and projected change. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Std Dev	Ensemble Avg	Std Dev
Cartwright	DJF	11.3	10.4	1.0	11.3	1.4
	MAM	9.1	9.6	0.9	10.7	1.0
	JJA	8.6	11.7	1.5	11.8	1.7
	SON	8.9	10.8	0.6	11.0	1.0
Churchill Falls	DJF	7.0	5.1	0.9	6.0	1.0
	MAM	6.3	5.4	0.8	6.2	0.9
	JJA	10.0	9.5	0.9	10.0	1.2
	SON	9.1	8.0	0.6	8.4	0.8
Goose Bay	DJF	5.6	7.2	0.7	8.2	1.3
	MAM	5.7	7.1	0.6	8.0	0.9
	JJA	9.5	10.8	1.0	11.5	1.2
	SON	7.2	8.9	0.5	9.0	1.1
Mary's Harbour	DJF	10.8	9.9	1.2	10.8	1.3
	MAM	7.2	8.5	0.8	9.4	0.7
	JJA	8.6	9.7	1.4	9.9	1.3
	SON	8.1	9.8	0.8	9.7	1.1
Nain	DJF	9.7	9.2	0.8	9.6	1.3
	MAM	8.4	8.4	0.8	9.4	0.9
	JJA	8.3	10.8	0.8	10.7	1.1
	SON	8.0	10.3	0.8	10.3	0.9
Wabush Lake	DJF	5.7	6.0	0.8	7.0	0.9
	MAM	5.9	7.4	0.6	8.2	1.0
	JJA	10.1	12.7	1.2	12.7	1.2
	SON	8.2	10.0	0.8	10.3	0.9
Schefferville	DJF	4.5	4.6	0.8	5.7	1.0
	MAM	4.5	5.6	0.5	6.7	0.7
	JJA	8.5	11.3	1.0	11.5	1.2
	SON	7.7	9.2	0.9	10.2	0.9

90th Percentile of Precipitation Events (mm)

Summary: The 90th percentile of precipitation events are expected to increase across the island, adding 0.5-2mm to heavy precipitation in most locations.

While values such as 3/5/10-day maximum precipitation give a sense of hazards associated with long duration precipitation events, the 90th percentile illustrates changes in intensity of individual single-day events. The maximum 10% of precipitation events will meet or exceed the 90th percentile; this then measures the change in these often serious events.

Recurring patterns are found in all examined variables related to precipitation intensity, and the 90th percentile precipitation again resembles mean intensity, 3-day maximum precipitation etc.

Figure 29: Changes in the 90th percentile of precipitation (mm) projected for 2041-2070.

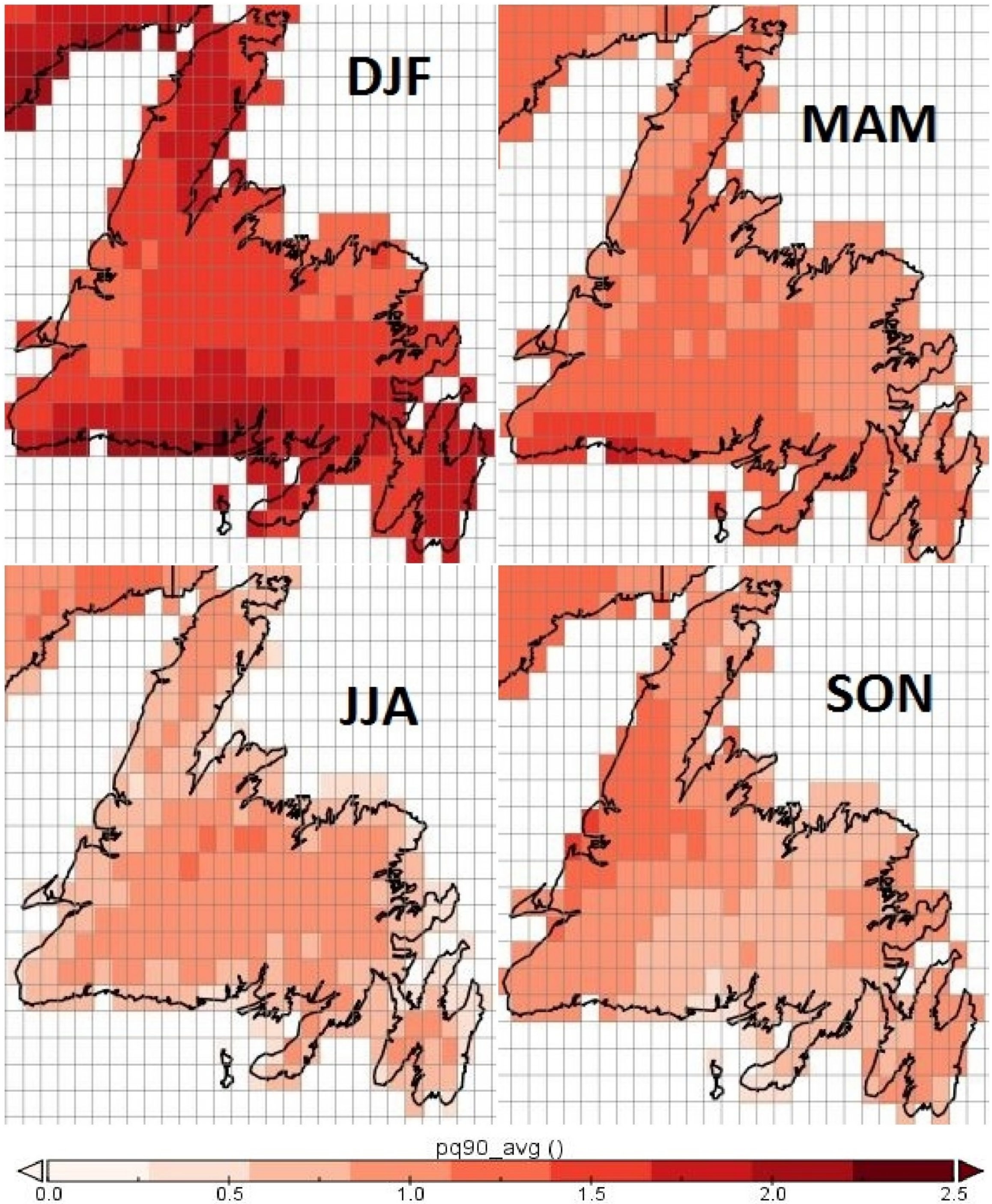

Figure 30: Changes in the 90th percentile of precipitation (mm) projected for 2041-2070.

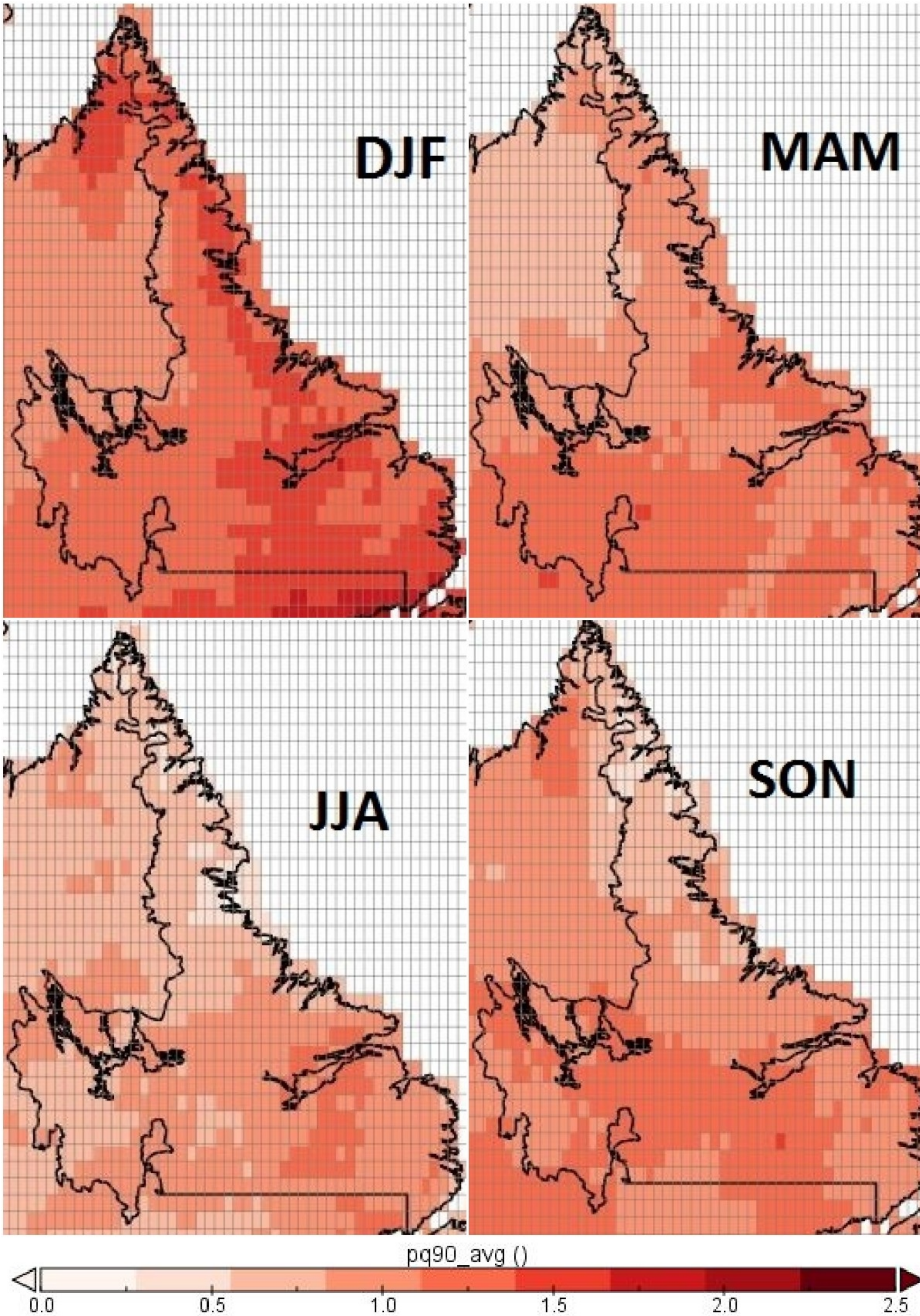

Table 29: 90th percentile of precipitation events (mm); climatology and projected change; Newfoundland. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
Argentia	DJF	9.0	12.1	1.0	13.6	1.4
	MAM	6.4	8.5	0.5	9.2	0.6
	JJA	8.0	8.0	0.8	7.9	1.1
	SON	11.5	10.6	0.7	10.3	1.4
Bay D'Espoir	DJF	19.0	19.5	1.5	21.1	1.7
	MAM	13.6	14.0	1.0	14.9	0.7
	JJA	11.0	13.3	1.1	13.4	1.5
	SON	14.9	16.3	1.3	15.8	2.4
Burgeo	DJF	15.1	18.4	2.2	20.0	2.2
	MAM	12.5	14.1	1.1	15.0	1.2
	JJA	13.6	13.9	1.0	13.9	1.4
	SON	15.5	16.2	1.2	15.5	2.7
Comfort Cove	DJF	9.8	11.7	1.1	13.0	1.2
	MAM	8.6	9.3	0.5	10.2	0.4
	JJA	9.2	9.5	1.3	9.8	1.7
	SON	10.0	11.1	0.6	11.1	1.1
Corner Brook	DJF	13.1	12.1	1.0	13.4	1.0
	MAM	8.1	9.5	0.7	10.2	1.0
	JJA	8.5	11.2	0.9	11.6	1.6
	SON	11.1	12.5	0.5	12.4	1.5
Daniel's Harbour	DJF	7.8	9.7	0.8	10.5	1.1
	MAM	6.4	7.4	0.7	8.1	0.8
	JJA	9.1	9.6	0.9	9.9	0.9
	SON	9.3	10.3	0.6	10.4	0.9
Deer Lake	DJF	12.5	12.2	1.1	13.3	1.1
	MAM	7.8	9.6	0.7	10.4	0.7
	JJA	9.5	11.3	1.1	11.8	1.6
	SON	10.0	12.3	0.7	11.9	1.5
Exploits Dam	DJF	10.4	11.7	1.0	12.8	1.0
	MAM	7.8	9.1	0.6	9.8	0.6
	JJA	8.9	10.4	1.5	10.6	2.0
	SON	9.9	10.7	0.8	10.5	1.6
Gander	DJF	10.6	11.8	1.0	12.8	1.0
	MAM	8.3	9.2	0.5	9.9	0.4
	JJA	8.5	9.8	1.6	10.4	2.3
	SON	9.5	10.7	0.6	10.8	1.2
Grand Falls	DJF	11.4	12.1	1.2	13.4	1.1
	MAM	8.1	9.3	0.5	10.0	0.4
	JJA	9.0	10.6	1.6	11.0	2.2
	SON	10.0	11.0	0.7	10.9	1.6
Isle Aux Morts	DJF	13.4	16.3	1.5	17.8	1.6
	MAM	12.1	13.0	0.8	13.6	1.2
	JJA	11.1	12.6	1.0	12.6	1.6
	SON	14.7	14.9	0.9	14.7	2.2
La Scie	DJF	12.6	13.9	1.0	15.1	1.1
	MAM	10.1	11.1	0.6	11.9	0.6
	JJA	8.9	11.5	1.5	11.6	1.5
	SON	11.8	13.1	0.6	13.1	1.5

Table 29, con't.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
North Harbour	**DJF**	16.1	18.1	1.3	19.6	1.6
	MAM	13.4	13.7	0.8	14.5	0.7
	JJA	10.3	13.1	1.0	13.2	2.2
	SON	14.3	16.0	0.9	15.6	1.9
Plum Point	**DJF**	12.2	13.1	1.3	13.8	1.4
	MAM	9.4	10.2	1.0	11.0	1.1
	JJA	10.2	12.2	1.2	12.2	1.3
	SON	10.8	12.5	0.7	12.4	1.1
Port Aux Basque	**DJF**	12.0	14.4	1.4	16.0	1.5
	MAM	9.8	11.4	1.0	12.0	1.3
	JJA	10.7	10.8	1.1	10.7	1.5
	SON	12.3	13.3	0.8	13.0	2.1
Springdale	**DJF**	10.8	11.9	1.3	13.0	1.3
	MAM	8.0	9.2	0.6	10.0	0.6
	JJA	9.2	10.4	1.4	10.7	1.7
	SON	10.3	11.3	0.6	11.2	1.6
St. Alban's	**DJF**	19.3	21.4	1.5	23.1	1.8
	MAM	13.2	15.7	1.0	16.6	0.8
	JJA	12.9	15.1	1.2	15.0	1.6
	SON	17.5	18.2	1.3	17.6	2.5
St. Anthony	**DJF**	10.9	10.9	1.1	11.8	1.2
	MAM	7.5	8.6	0.9	9.4	1.0
	JJA	7.6	9.8	1.0	10.0	1.1
	SON	8.2	10.2	0.7	10.2	1.2
St. John's	**DJF**	20.1	19.9	1.4	21.2	1.8
	MAM	13.3	14.3	0.8	15.1	0.9
	JJA	9.0	11.8	1.5	11.2	1.4
	SON	14.2	17.0	1.3	16.3	1.6
St. Lawrence	**DJF**	14.6	16.3	1.4	18.1	1.8
	MAM	11.2	12.3	0.9	13.1	0.8
	JJA	11.1	11.1	1.0	11.1	1.9
	SON	13.3	14.1	1.3	13.5	2.4
Stephenville	**DJF**	13.1	12.7	1.0	14.1	1.1
	MAM	8.8	10.3	0.7	10.9	1.1
	JJA	10.7	11.6	1.0	11.8	1.6
	SON	12.2	13.6	0.6	13.5	1.6
Twillingate	**DJF**	11.0	11.3	0.9	12.6	1.2
	MAM	7.3	8.5	0.5	9.3	0.6
	JJA	7.2	8.6	1.4	8.4	1.4
	SON	8.9	10.7	0.6	10.6	1.4

Table 30: 90th percentile of precipitation events (mm); climatology and projected change; Labrador. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Std Dev	Ensemble Avg	Std Dev
Cartwright	DJF	11.3	10.8	1.1	11.6	1.4
	MAM	9.3	9.5	1.0	10.4	1.0
	JJA	8.5	11.4	1.5	11.6	1.6
	SON	8.6	10.7	0.8	10.7	1.1
Churchill Falls	DJF	7.8	5.7	0.6	6.5	1.1
	MAM	7.2	5.6	0.7	6.4	1.0
	JJA	9.8	9.3	0.9	9.7	1.3
	SON	9.2	7.8	0.6	8.1	0.8
Goose Bay	DJF	6.5	7.9	0.7	8.8	1.3
	MAM	6.2	7.3	0.6	8.2	1.0
	JJA	9.1	10.6	1.0	11.4	1.3
	SON	7.3	8.9	0.6	9.0	1.2
Mary's Harbour	DJF	10.9	10.4	1.1	11.3	1.4
	MAM	7.2	8.6	0.9	9.3	0.9
	JJA	8.6	9.7	1.3	9.8	1.3
	SON	8.0	9.6	0.9	9.6	1.3
Nain	DJF	9.8	9.6	0.9	10.0	1.4
	MAM	8.3	8.3	0.9	9.3	1.0
	JJA	8.2	10.4	0.5	10.4	1.1
	SON	8.3	10.0	0.7	10.2	0.8
Wabush Lake	DJF	7.0	7.1	0.7	8.0	1.0
	MAM	6.5	7.8	0.7	8.3	0.9
	JJA	9.7	11.8	1.0	11.9	0.9
	SON	8.7	9.7	0.6	10.1	0.8
Schefferville	DJF	5.8	5.7	0.8	6.7	0.9
	MAM	5.5	6.4	0.4	7.0	0.7
	JJA	8.6	11.0	1.0	11.0	1.1
	SON	8.2	9.2	0.7	10.0	0.8

Maximum Number of Consecutive Dry Days (days)

Summary: Results show few notable changes in maximum number of consecutive dry days. In general, the typical length of dry periods is not expected to change by more than a day or two. The only exception is northern Labrador in winter, which can expect somewhat shorter dry periods.

Calculated as the longest stretch of days without precipitation in a given year, this is the first of several indices intended to examine potential issues around drought. For each year, the maximum dry spell is identified; the average is then calculated over all years. This is useful as an indicator of changing drought severity (droughts defined as an extended period without precipitation).

Results suggest droughts are not a growing concern for the province; significant changes are rare, and typically show a decrease in the maximum stretch of dry days (i.e. shorter 'drought'). The only exception is northern Labrador in winter, which sees a decrease of about 2-4 days.

Figure 31: Changes in the maximum number of consecutive dry days projected for 2041-2070.

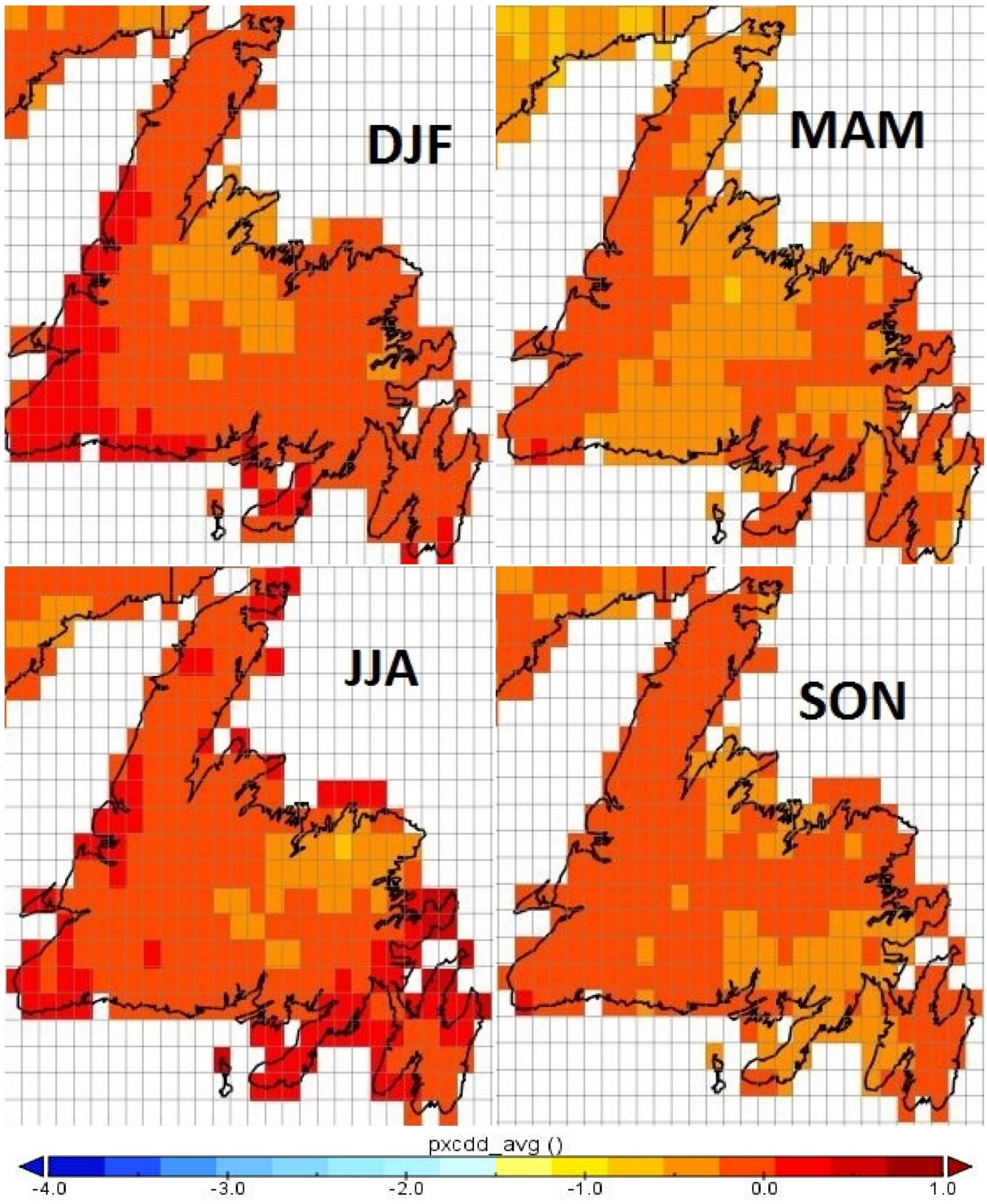

Figure 32: Changes in the maximum number of consecutive dry days projected for 2041-2070.

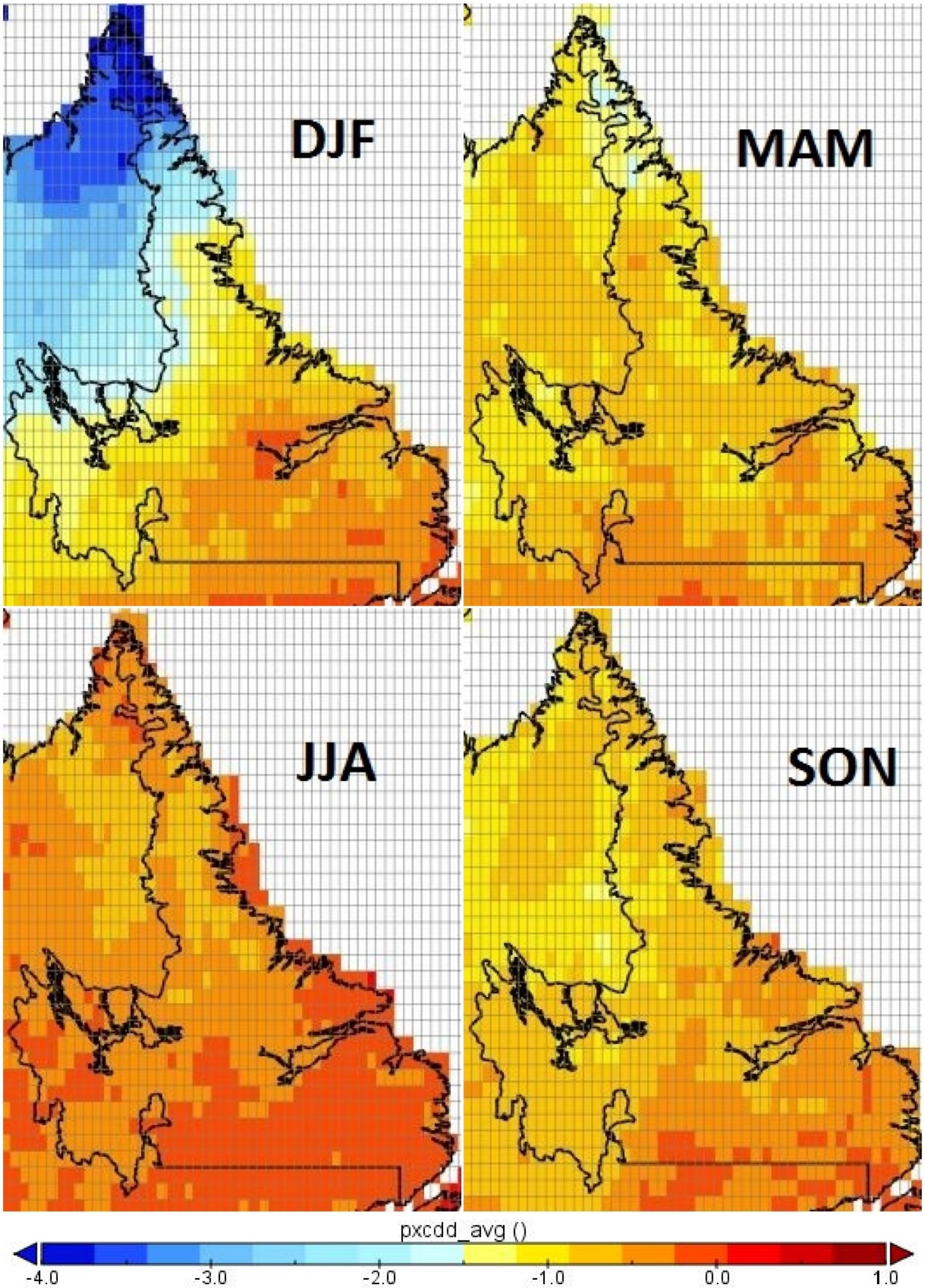

Table 31: Maximum number of consecutive dry days climatology and projected change; Newfoundland. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
Argentia	**DJF**	10.8	8.3	0.6	8.1	0.7
	MAM	23.6	11.0	0.6	10.6	0.7
	JJA	11.7	12.0	1.4	12.3	1.3
	SON	11.6	10.9	1.0	11.0	1.2
Bay D'Espoir	**DJF**	7.4	7.1	0.5	7.2	0.6
	MAM	9.3	8.9	0.6	8.8	0.7
	JJA	8.6	8.5	0.8	8.6	1.2
	SON	7.4	8.5	0.6	9.1	0.9
Burgeo	**DJF**	7.1	6.9	0.3	6.8	0.7
	MAM	9.1	9.0	0.6	9.0	0.8
	JJA	8.2	8.7	0.9	8.7	1.1
	SON	7.8	8.7	0.7	9.2	1.1
Comfort Cove	**DJF**	8.4	7.2	0.6	7.1	0.6
	MAM	9.6	8.5	0.9	8.2	0.9
	JJA	10.8	8.6	1.3	8.6	1.3
	SON	8.0	8.1	0.7	8.5	0.8
Corner Brook	**DJF**	5.8	5.7	0.7	5.8	0.7
	MAM	9.8	9.0	1.0	8.6	0.7
	JJA	8.9	8.4	0.9	8.6	1.1
	SON	7.6	7.6	0.7	7.8	0.7
Daniel's Harbour	**DJF**	8.4	7.5	0.7	7.2	0.8
	MAM	13.2	10.6	1.2	10.0	0.7
	JJA	10.6	9.5	1.0	9.6	1.1
	SON	9.1	8.6	0.9	8.7	0.9
Deer Lake	**DJF**	6.7	6.4	0.6	6.4	0.6
	MAM	11.0	9.3	0.8	8.7	0.6
	JJA	9.5	8.5	1.0	8.6	1.2
	SON	7.6	8.0	0.5	8.1	0.7
Exploits Dam	**DJF**	9.6	8.2	0.5	8.1	0.8
	MAM	10.7	9.7	0.9	9.4	0.6
	JJA	9.7	9.1	1.4	9.4	1.3
	SON	8.5	9.5	0.4	9.9	0.8
Gander	**DJF**	7.3	7.1	0.4	7.0	0.6
	MAM	9.7	8.3	0.9	7.9	0.8
	JJA	10.3	8.3	1.0	8.5	1.3
	SON	8.1	8.2	0.4	8.5	0.9
Grand Falls	**DJF**	9.4	8.3	0.4	8.1	0.5
	MAM	10.3	9.5	1.0	9.3	0.8
	JJA	9.7	9.0	1.2	9.1	1.2
	SON	8.2	9.5	0.5	9.6	0.7
Isle Aux Morts	**DJF**	5.5	5.8	0.6	6.1	0.8
	MAM	11.2	8.8	0.9	8.3	0.8
	JJA	10.1	8.3	1.1	8.5	0.9
	SON	7.2	8.2	0.6	8.8	0.9
La Scie	**DJF**	6.3	6.7	0.5	6.6	0.6
	MAM	9.3	8.1	0.9	7.8	0.9
	JJA	10.8	7.8	1.5	8.0	1.4
	SON	8.8	7.4	0.5	7.6	0.7

Table 31, con't.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
North Harbour	DJF	4.8	5.9	0.6	6.0	0.5
	MAM	7.9	7.4	0.7	7.4	0.8
	JJA	7.7	7.9	1.3	8.1	1.5
	SON	6.3	7.1	0.7	7.6	0.6
Plum Point	DJF	6.1	6.8	0.9	6.8	0.9
	MAM	9.7	8.3	0.7	7.8	0.7
	JJA	8.4	7.1	0.9	7.2	0.7
	SON	7.2	7.2	0.5	7.2	0.7
Port Aux Basque	DJF	7.8	6.6	0.5	6.9	0.8
	MAM	10.7	9.9	1.0	9.3	0.7
	JJA	10.5	9.9	0.9	10.1	0.8
	SON	9.0	9.2	0.6	9.6	1.2
Springdale	DJF	12.4	9.8	0.6	9.8	0.8
	MAM	14.4	11.6	0.7	11.2	1.1
	JJA	11.2	10.5	1.2	10.8	1.5
	SON	9.3	10.9	0.6	11.4	1.0
St. Alban's	DJF	7.5	6.7	0.5	6.8	0.6
	MAM	7.7	8.5	0.6	8.4	0.8
	JJA	8.6	8.1	0.8	8.2	1.3
	SON	6.9	8.2	0.6	8.7	0.9
St. Anthony	DJF	6.5	8.0	0.7	7.9	0.7
	MAM	15.1	9.2	0.6	8.8	0.9
	JJA	11.4	8.2	1.2	8.3	1.0
	SON	8.3	8.5	0.6	8.3	1.0
St. John's	DJF	4.9	5.6	0.4	5.6	0.3
	MAM	7.5	7.2	0.8	7.1	0.9
	JJA	10.0	9.1	1.0	9.7	1.1
	SON	7.4	7.1	0.9	7.4	0.7
St. Lawrence	DJF	5.1	6.6	0.4	6.5	0.6
	MAM	9.6	8.8	0.5	8.7	0.8
	JJA	10.1	9.4	1.2	9.7	1.2
	SON	8.7	8.7	0.8	9.5	0.9
Stephenville	DJF	5.6	5.8	0.7	6.0	1.0
	MAM	10.6	9.4	0.7	9.3	0.8
	JJA	9.2	9.1	1.0	9.4	0.9
	SON	7.0	7.9	1.0	8.1	1.1
Twillingate	DJF	8.7	8.7	0.6	8.4	0.5
	MAM	20.5	10.7	0.9	10.3	0.8
	JJA	16.7	11.3	2.1	11.5	2.0
	SON	9.6	9.9	0.9	10.1	1.1

Table 32: Maximum number of consecutive dry days climatology and projected change; Labrador. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Std Dev	Ensemble Avg	Std Dev
Cartwright	DJF	9.2	9.1	1.0	8.8	1.3
	MAM	10.6	9.4	0.9	9.1	0.9
	JJA	8.6	7.6	1.0	7.5	1.0
	SON	8.9	8.3	0.5	8.2	0.8
Churchill Falls	DJF	9.6	14.3	1.2	13.6	1.6
	MAM	11.2	13.7	1.2	13.1	1.1
	JJA	8.0	8.8	1.1	8.9	1.3
	SON	7.4	10.5	0.6	10.1	1.0
Goose Bay	DJF	12.3	11.5	1.1	10.7	1.3
	MAM	14.1	11.2	1.1	10.6	0.8
	JJA	9.3	8.0	0.9	7.8	1.1
	SON	10.7	9.9	0.9	10.0	0.6
Mary's Harbour	DJF	10.4	9.4	0.9	9.1	1.0
	MAM	12.5	10.7	0.9	10.0	0.7
	JJA	9.1	8.7	1.0	8.8	0.9
	SON	9.4	9.4	0.7	9.5	0.9
Nain	DJF	12.9	12.9	1.6	12.3	2.1
	MAM	14.0	12.4	1.1	11.9	1.0
	JJA	10.9	9.8	1.1	9.9	1.5
	SON	10.8	9.9	0.6	9.9	1.0
Wabush Lake	DJF	8.8	9.9	1.3	9.1	1.5
	MAM	12.2	10.3	1.0	9.7	0.7
	JJA	8.2	6.6	1.2	6.6	1.2
	SON	7.5	7.4	0.5	7.1	0.8
Schefferville	DJF	10.3	11.4	1.7	10.1	1.5
	MAM	12.9	11.3	1.1	10.5	0.9
	JJA	8.4	7.0	1.2	7.1	1.4
	SON	7.4	7.3	0.6	7.0	0.2

Mean Dry Spell Length (days)

Summary: Results show few noticeable changes in the length of dry spells. The only exception is northern Labrador in winter, which sees more frequent precipitation (typical dry spell length decreases by about 1-2 days).

The average number of days between precipitation events. Dry spell length gives an indication of:

1) Water stress on vegetation, as longer spells mean a greater chance of dehydration/heat stress
2) Potential flood frequency, as smaller spells mean less time for water courses to route precipitation from one event out of a region before the next event occurs.

The current report also standard deviation (i.e. typical range) of dry spells. None of these values show a large response to climate change in the models examined; generally projected changes are considerably less than a day. There is a weak indication that dry spells will become slightly shorter in the future, but the changes are both statistically insignificant in most locations and small enough that no serious impact is likely. In short, the *frequency* of precipitation is unlikely to change in a dramatic fashion, unlike the *intensity* of the events that do occur.

Figure 33: Changes in the mean dry spell length projected for 2041-2070.

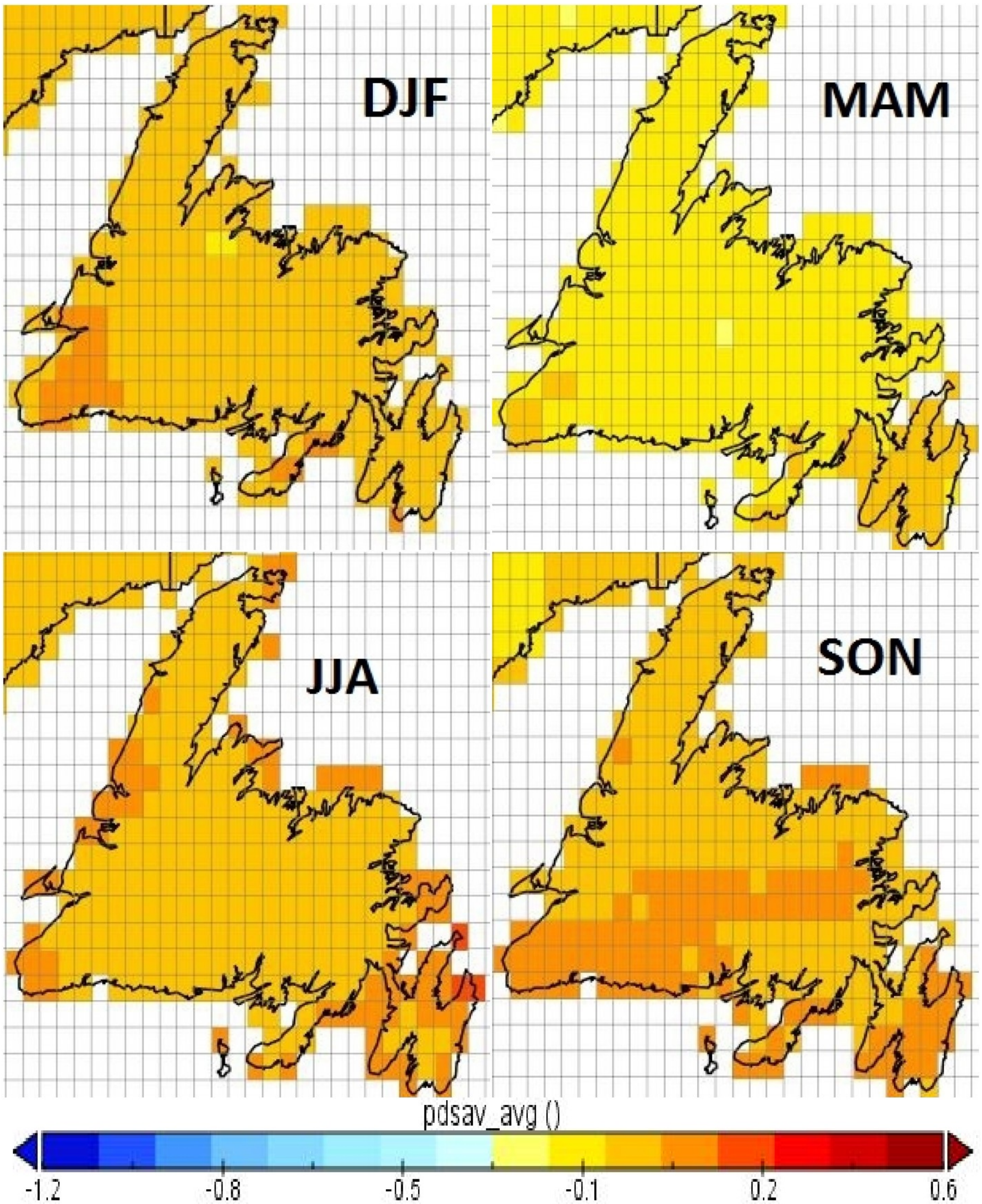

Figure 34: Changes in the mean dry spell length projected for 2041-2070.

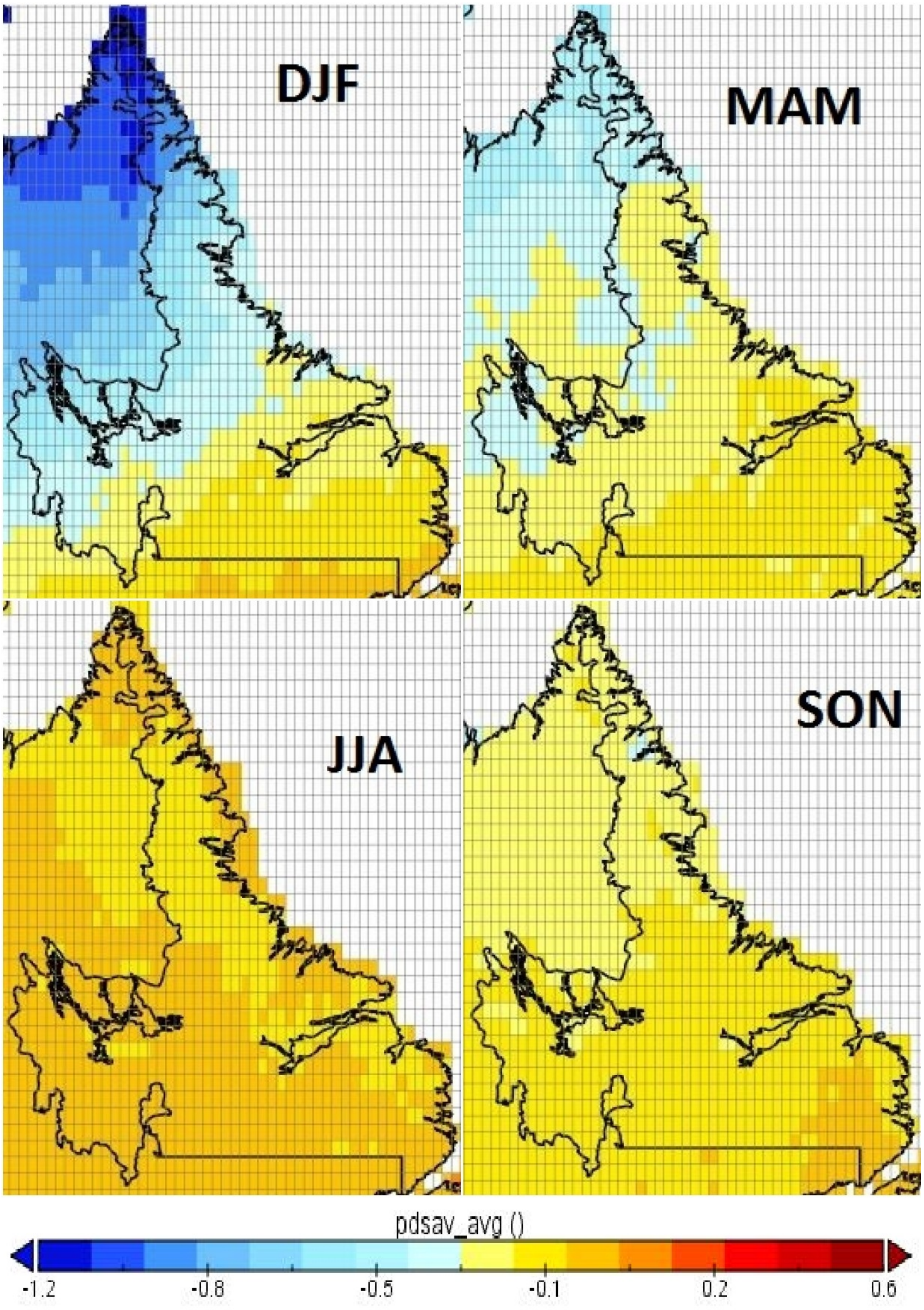

Table 33: Mean dry spell length climatology and projected change; Newfoundland. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
Argentia	DJF	3.0	3.9	0.3	4.2	0.4
	MAM	2.1	2.9	0.2	3.1	0.2
	JJA	3.0	2.9	0.4	2.9	0.4
	SON	3.4	3.7	0.2	3.6	0.3
Bay D'Espoir	DJF	6.2	6.3	0.4	6.7	0.5
	MAM	4.3	4.7	0.3	5.0	0.3
	JJA	3.8	4.7	0.6	4.8	0.6
	SON	5.1	5.5	0.4	5.5	0.7
Burgeo	DJF	5.0	6.1	0.5	6.6	0.5
	MAM	4.2	4.8	0.3	5.1	0.3
	JJA	4.6	4.9	0.5	4.9	0.4
	SON	5.2	5.4	0.2	5.3	0.6
Comfort Cove	DJF	3.3	3.8	0.4	4.2	0.4
	MAM	3.0	3.2	0.2	3.5	0.2
	JJA	3.1	3.4	0.5	3.5	0.6
	SON	3.5	3.9	0.2	4.0	0.4
Corner Brook	DJF	4.9	4.6	0.4	4.9	0.4
	MAM	2.8	3.3	0.2	3.6	0.3
	JJA	3.0	4.0	0.4	4.2	0.6
	SON	4.0	4.5	0.2	4.5	0.4
Daniel's Harbour	DJF	2.8	3.4	0.2	3.7	0.3
	MAM	2.2	2.6	0.2	2.9	0.3
	JJA	3.2	3.4	0.4	3.6	0.4
	SON	3.3	3.7	0.3	3.8	0.3
Deer Lake	DJF	4.6	4.3	0.3	4.6	0.4
	MAM	2.8	3.3	0.2	3.6	0.2
	JJA	3.2	3.9	0.5	4.2	0.7
	SON	3.6	4.2	0.2	4.2	0.4
Exploits Dam	DJF	3.1	3.7	0.3	4.1	0.4
	MAM	2.6	3.0	0.2	3.3	0.2
	JJA	3.0	3.6	0.6	3.8	0.7
	SON	3.3	3.7	0.2	3.7	0.5
Gander	DJF	3.5	3.8	0.3	4.2	0.4
	MAM	3.0	3.3	0.2	3.6	0.3
	JJA	2.9	3.5	0.6	3.8	0.8
	SON	3.5	3.8	0.1	3.9	0.3
Grand Falls	DJF	3.5	3.8	0.4	4.1	0.4
	MAM	2.8	3.1	0.2	3.4	0.2
	JJA	3.1	3.7	0.6	4.0	0.7
	SON	3.4	3.8	0.1	3.9	0.4
Isle Aux Morts	DJF	5.2	5.8	0.4	6.2	0.4
	MAM	4.1	4.5	0.3	4.8	0.3
	JJA	3.9	4.5	0.4	4.6	0.5
	SON	5.0	5.2	0.2	5.2	0.5
La Scie	DJF	4.5	4.6	0.4	5.0	0.5
	MAM	3.6	3.9	0.2	4.1	0.2
	JJA	3.4	4.1	0.7	4.2	0.8
	SON	4.1	4.7	0.2	4.7	0.5

Table 33, con't.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Std Dev	Ensemble Avg	Std Dev
North Harbour	DJF	5.9	6.1	0.4	6.5	0.5
	MAM	4.5	4.7	0.2	5.0	0.3
	JJA	3.6	4.6	0.5	4.7	0.7
	SON	5.2	5.5	0.3	5.3	0.5
Plum Point	DJF	4.4	4.4	0.3	4.7	0.4
	MAM	3.3	3.6	0.3	3.9	0.3
	JJA	3.6	4.4	0.6	4.5	0.6
	SON	3.9	4.4	0.2	4.5	0.3
Port Aux Basque	DJF	4.2	5.0	0.4	5.5	0.4
	MAM	3.4	3.9	0.3	4.2	0.3
	JJA	3.6	3.9	0.4	4.0	0.5
	SON	4.3	4.7	0.2	4.7	0.5
Springdale	DJF	3.2	3.6	0.4	3.9	0.4
	MAM	2.6	2.9	0.2	3.2	0.2
	JJA	3.1	3.6	0.6	3.8	0.8
	SON	3.3	3.7	0.1	3.8	0.4
St. Alban's	DJF	6.4	7.0	0.5	7.5	0.6
	MAM	4.9	5.3	0.3	5.7	0.3
	JJA	4.5	5.3	0.7	5.4	0.7
	SON	6.0	6.2	0.4	6.1	0.7
St. Anthony	DJF	3.8	3.5	0.3	3.8	0.4
	MAM	2.3	2.9	0.3	3.2	0.3
	JJA	2.5	3.5	0.5	3.6	0.6
	SON	2.8	3.5	0.2	3.6	0.3
St. John's	DJF	7.2	6.6	0.5	7.1	0.6
	MAM	4.8	5.0	0.3	5.4	0.4
	JJA	3.4	4.3	0.6	4.2	0.6
	SON	5.1	6.0	0.4	5.8	0.5
St. Lawrence	DJF	4.8	5.5	0.5	5.9	0.6
	MAM	3.7	4.3	0.3	4.6	0.3
	JJA	3.9	4.0	0.4	4.1	0.6
	SON	4.7	4.9	0.4	4.8	0.5
Stephenville	DJF	5.3	4.8	0.4	5.2	0.4
	MAM	3.2	3.5	0.3	3.8	0.3
	JJA	3.6	4.0	0.4	4.2	0.5
	SON	4.4	4.8	0.2	4.8	0.4
Twillingate	DJF	3.6	3.6	0.3	3.9	0.4
	MAM	2.4	2.8	0.2	3.1	0.2
	JJA	2.3	2.9	0.5	3.0	0.5
	SON	3.0	3.7	0.2	3.7	0.4

Table 34: Mean dry spell length climatology and projected change; Labrador. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Std Dev	Ensemble Avg	Std Dev
Cartwright	DJF	3.1	3.0	0.3	3.0	0.4
	MAM	3.3	3.0	0.2	2.9	0.2
	JJA	2.8	2.5	0.3	2.5	0.3
	SON	3.0	2.7	0.1	2.7	0.2
Churchill Falls	DJF	3.2	4.7	0.5	4.5	0.5
	MAM	3.5	4.4	0.4	4.1	0.4
	JJA	2.5	2.9	0.3	2.9	0.4
	SON	2.4	3.4	0.2	3.3	0.3
Goose Bay	DJF	3.9	3.7	0.3	3.6	0.4
	MAM	4.4	3.6	0.3	3.4	0.3
	JJA	3.0	2.6	0.3	2.6	0.3
	SON	3.6	3.2	0.2	3.2	0.2
Mary's Harbour	DJF	2.9	3.0	0.3	3.0	0.3
	MAM	3.8	3.2	0.2	3.1	0.2
	JJA	3.0	2.8	0.3	2.8	0.3
	SON	3.1	3.0	0.2	3.1	0.3
Nain	DJF	4.7	4.3	0.6	4.1	0.6
	MAM	4.7	4.0	0.3	3.9	0.4
	JJA	3.5	3.0	0.3	3.1	0.4
	SON	3.6	3.2	0.1	3.1	0.2
Wabush Lake	DJF	3.0	3.2	0.4	3.0	0.4
	MAM	3.9	3.2	0.2	3.1	0.2
	JJA	2.5	2.2	0.3	2.2	0.3
	SON	2.4	2.4	0.1	2.3	0.2
Schefferville	DJF	3.6	3.6	0.5	3.2	0.4
	MAM	3.9	3.5	0.3	3.3	0.3
	JJA	2.6	2.4	0.3	2.4	0.3
	SON	2.5	2.4	0.1	2.3	0.1

Standard Deviation of Dry Spell Length (days)

Summary: Results show no noticeable change in range of expected dry spell lengths (variability in length) under a warming climate. Expected change is approximately 0 to 0.1 days.

Included to give context to the mean and median dry spell length; the standard deviation is a measure of variability (spread) around the mean. Higher values imply a wider range of dry spell length. Changes are inconsequential, with only northern Labrador experiencing any statistically significant change (a decrease of 1-2 days in winter; i.e. dry spells stay closer to the mean length in a warmer climate).

Figure 35: Changes in the standard deviation of dry spell length projected for 2041-2070.

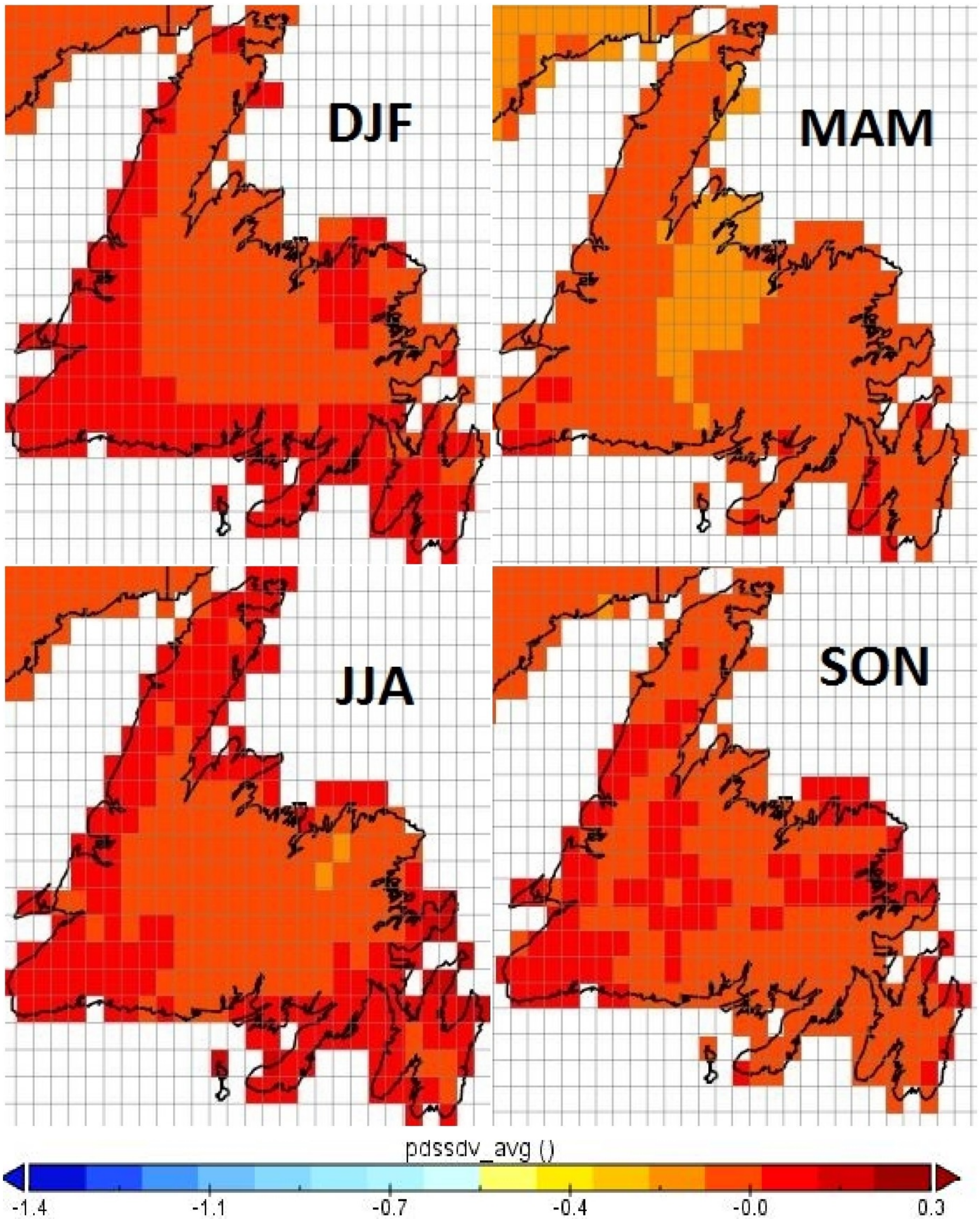

Figure 36: Changes in the standard deviation of dry spell length projected for 2041-2070.

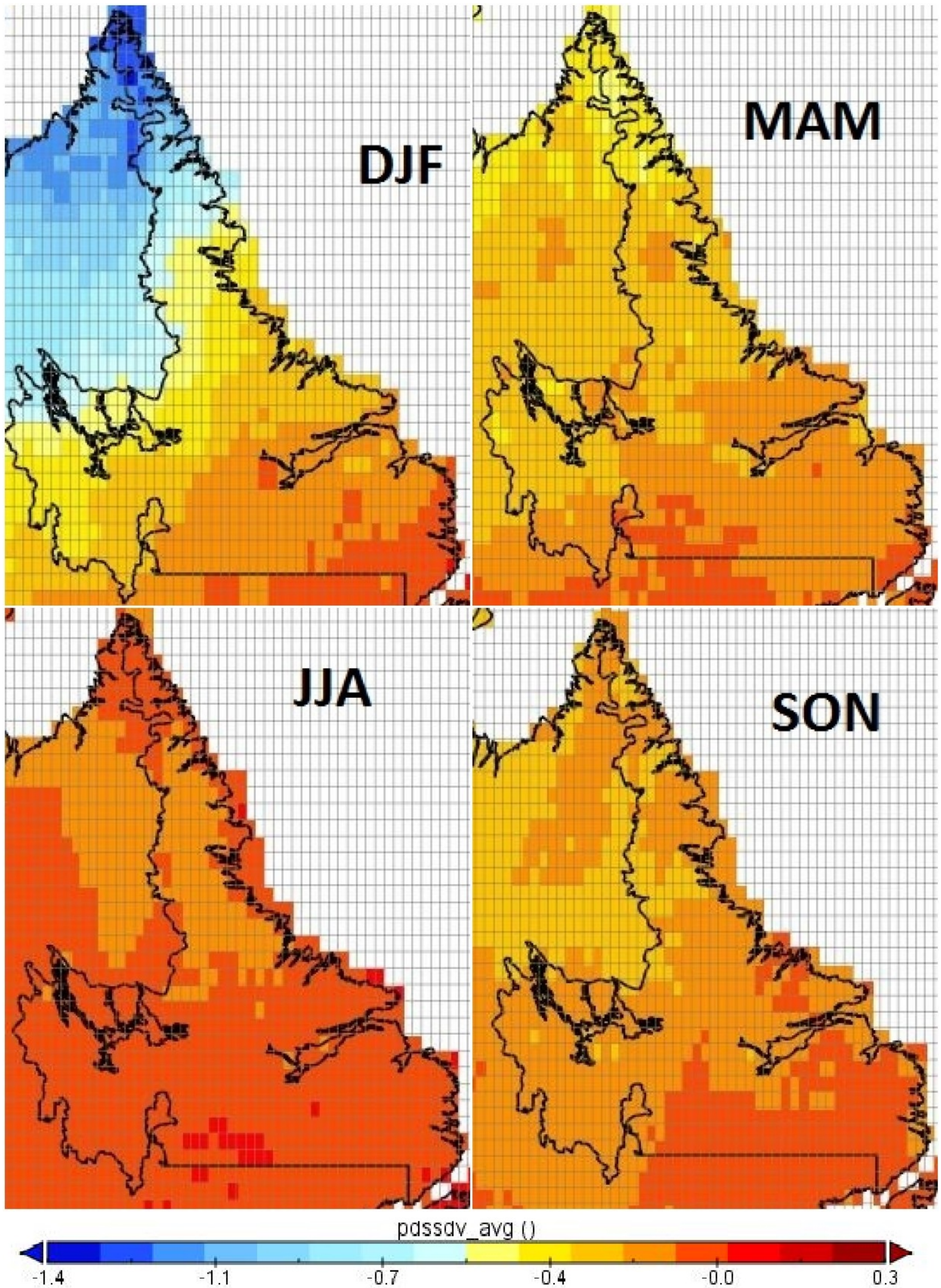

Table 35: Standard deviation of dry spell length climatology and projected change; Newfoundland. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
Argentia	DJF	2.8	2.0	0.1	2.0	0.2
	MAM	4.7	2.8	0.2	2.7	0.2
	JJA	3.1	3.1	0.4	3.3	0.5
	SON	3.1	2.8	0.3	2.8	0.3
Bay D'Espoir	DJF	1.9	1.7	0.1	1.7	0.1
	MAM	2.4	2.2	0.2	2.2	0.2
	JJA	2.2	2.1	0.3	2.2	0.3
	SON	1.8	2.1	0.1	2.3	0.2
Burgeo	DJF	1.8	1.7	0.1	1.6	0.2
	MAM	2.4	2.3	0.2	2.3	0.2
	JJA	2.1	2.2	0.3	2.2	0.3
	SON	2.0	2.2	0.2	2.3	0.3
Comfort Cove	DJF	2.1	1.8	0.2	1.7	0.2
	MAM	2.4	2.1	0.3	2.0	0.2
	JJA	2.7	2.1	0.4	2.1	0.4
	SON	2.0	2.0	0.2	2.1	0.2
Corner Brook	DJF	1.5	1.4	0.2	1.4	0.2
	MAM	2.5	2.2	0.3	2.2	0.2
	JJA	2.3	2.1	0.3	2.1	0.3
	SON	1.9	1.8	0.2	1.9	0.2
Daniel's Harbour	DJF	2.1	1.8	0.2	1.8	0.2
	MAM	3.4	2.7	0.4	2.6	0.2
	JJA	2.7	2.4	0.3	2.4	0.3
	SON	2.3	2.1	0.2	2.2	0.3
Deer Lake	DJF	1.6	1.5	0.2	1.5	0.2
	MAM	2.9	2.3	0.2	2.2	0.2
	JJA	2.4	2.1	0.3	2.1	0.4
	SON	1.9	2.0	0.1	2.0	0.2
Exploits Dam	DJF	2.4	2.0	0.2	2.0	0.2
	MAM	2.7	2.5	0.3	2.4	0.2
	JJA	2.5	2.3	0.4	2.4	0.4
	SON	2.2	2.4	0.1	2.5	0.2
Gander	DJF	1.8	1.7	0.1	1.7	0.1
	MAM	2.4	2.0	0.3	1.9	0.2
	JJA	2.6	2.1	0.3	2.1	0.4
	SON	2.1	2.1	0.1	2.1	0.2
Grand Falls	DJF	2.3	2.0	0.1	2.0	0.1
	MAM	2.6	2.4	0.3	2.3	0.2
	JJA	2.5	2.2	0.4	2.3	0.4
	SON	2.0	2.4	0.2	2.5	0.2
Isle Aux Morts	DJF	1.3	1.4	0.2	1.5	0.2
	MAM	2.9	2.2	0.2	2.1	0.2
	JJA	2.6	2.1	0.3	2.1	0.2
	SON	1.7	2.0	0.2	2.2	0.2
La Scie	DJF	1.5	1.6	0.1	1.6	0.1
	MAM	2.5	2.0	0.2	1.9	0.2
	JJA	3.2	1.9	0.4	2.0	0.4
	SON	2.2	1.8	0.1	1.9	0.2

Table 35, con't.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Uncertainty	Ensemble Avg	Uncertainty
North Harbour	**DJF**	1.2	1.4	0.1	1.4	0.1
	MAM	2.0	1.8	0.2	1.8	0.2
	JJA	1.9	2.0	0.3	2.0	0.4
	SON	1.5	1.7	0.2	1.9	0.2
Plum Point	**DJF**	1.5	1.7	0.2	1.7	0.2
	MAM	2.5	2.0	0.2	1.9	0.2
	JJA	2.1	1.7	0.2	1.8	0.2
	SON	1.8	1.8	0.1	1.8	0.2
Port Aux Basque	**DJF**	1.9	1.6	0.1	1.7	0.2
	MAM	2.8	2.5	0.3	2.4	0.2
	JJA	2.8	2.5	0.3	2.6	0.2
	SON	2.2	2.3	0.2	2.4	0.3
Springdale	**DJF**	3.3	2.5	0.2	2.5	0.2
	MAM	4.0	3.0	0.2	2.9	0.3
	JJA	2.9	2.7	0.4	2.8	0.5
	SON	2.4	2.8	0.2	3.0	0.3
St. Alban's	**DJF**	1.9	1.6	0.1	1.6	0.2
	MAM	2.0	2.1	0.2	2.1	0.2
	JJA	2.2	2.0	0.3	2.1	0.3
	SON	1.7	2.0	0.1	2.2	0.2
St. Anthony	**DJF**	1.6	2.0	0.2	2.0	0.2
	MAM	4.0	2.3	0.1	2.2	0.3
	JJA	2.9	2.0	0.3	2.0	0.3
	SON	2.2	2.1	0.2	2.1	0.3
St. John's	**DJF**	1.1	1.3	0.1	1.3	0.1
	MAM	1.8	1.8	0.2	1.7	0.2
	JJA	2.5	2.3	0.3	2.4	0.3
	SON	1.8	1.7	0.2	1.8	0.2
St. Lawrence	**DJF**	1.3	1.6	0.1	1.6	0.1
	MAM	2.5	2.2	0.1	2.2	0.2
	JJA	2.4	2.4	0.3	2.5	0.4
	SON	2.3	2.2	0.2	2.4	0.3
Stephenville	**DJF**	1.4	1.4	0.2	1.4	0.2
	MAM	2.7	2.4	0.2	2.3	0.2
	JJA	2.3	2.3	0.3	2.4	0.3
	SON	1.8	2.0	0.3	2.0	0.3
Twillingate	**DJF**	2.3	2.2	0.2	2.1	0.1
	MAM	4.0	2.7	0.2	2.6	0.2
	JJA	2.6	2.9	0.6	3.1	0.7
	SON	2.5	2.5	0.3	2.6	0.3

Table 36: Standard deviation of dry spell length climatology and projected change; Labrador. Projections include the average value calculated over a 12 member ensemble of climate realizations, and standard deviation over the ensemble as a measure of uncertainty.

		20th Century Climate	Projection: 2041-2070		Projection: 2071-2100	
			Ensemble Avg	Std Dev	Ensemble Avg	Std Dev
Cartwright	DJF	2.4	2.4	0.3	2.3	0.4
	MAM	2.8	2.4	0.3	2.3	0.3
	JJA	2.2	1.8	0.3	1.8	0.3
	SON	2.3	2.1	0.1	2.1	0.2
Churchill Falls	DJF	2.5	4.0	0.4	3.7	0.5
	MAM	3.0	3.7	0.4	3.6	0.4
	JJA	2.0	2.2	0.3	2.2	0.4
	SON	1.8	2.7	0.2	2.6	0.3
Goose Bay	DJF	3.3	3.0	0.3	2.8	0.4
	MAM	3.9	3.0	0.3	2.8	0.3
	JJA	2.3	2.0	0.3	1.9	0.3
	SON	2.8	2.5	0.2	2.6	0.2
Mary's Harbour	DJF	2.6	2.4	0.2	2.3	0.3
	MAM	3.3	2.7	0.2	2.5	0.2
	JJA	2.4	2.2	0.3	2.2	0.2
	SON	2.3	2.4	0.2	2.4	0.2
Nain	DJF	3.8	3.6	0.5	3.4	0.7
	MAM	4.1	3.4	0.3	3.2	0.4
	JJA	2.9	2.5	0.3	2.5	0.4
	SON	2.8	2.6	0.2	2.5	0.3
Wabush Lake	DJF	2.2	2.6	0.4	2.4	0.4
	MAM	3.4	2.6	0.3	2.5	0.2
	JJA	2.0	1.6	0.3	1.6	0.3
	SON	1.8	1.8	0.1	1.7	0.2
Schefferville	DJF	2.8	3.0	0.5	2.6	0.4
	MAM	3.5	3.0	0.3	2.8	0.3
	JJA	2.0	1.7	0.3	1.7	0.4
	SON	1.9	1.8	0.1	1.7	0.1

Intensity Duration Frequency Analysis

The following section outlines expected changes to intensity-duration-frequency precipitation (IDF) analyses; changes have been calculated for all provincial locations with an existing, up-to-date IDF curve. As with the previous section, Schefferville (QC) has also been included to provide an additional reference point near Labrador. Projections for the most likely climate change scenario (RCP 8.5) are presented, based on an ensemble of twelve climate realizations (six dynamically downscaled, six statistically downscaled; see Appendix A). The ensemble median, 10th percentile, and 90th percentile are given in separate tables; the median can be considered the most likely outcome, and a comparison of the 10th and 90th percentiles gives a sense of projection uncertainty.

The frequency and intensity of natural hazards are often reported as return periods, or recurrence intervals, which provide an estimate of the time between events of a given magnitude. For example, events meeting or exceeding a 100 year return period event can be expected roughly once a century. It is important to note, however, that the specified interval is rarely met in the real world. For example, it is possible, though unlikely, to see the 100 year event exceeded twice in two consecutive years. A better interpretation of the return period is as a *probability*; a 10 year return period has a 1 in 10 chance of occurring in a given year, a 20 year has a 1 in 20 chance, and so on. This emphasizes the fact that, in the absence of some change in the probability distribution, every year has the same chance of seeing a 100 year event.

Return periods are used to describe extreme precipitation by engineers and planners, who often design structures, drainage systems, and transportation networks to withstand events with a specific return period. Design criteria derived from return period events are typically based on historical observations. This approach assumes that the precipitation probabilities will not change significantly during the lifetime of the structure or infrastructure being designed. Climate change violates this assumption, leading to potential under-design problems. However, although engineering guidelines may need to be re-evaluated in the context of climate change, estimating future return periods is a much more difficult problem than estimating changes in mean temperature or precipitation. Regional models can provide guidance in this regard, but it is necessary to interpret results with caution. This is particularly true for longer return period estimates, as uncertainty increases as the probability of an event decreases. Similarly, uncertainty increases as the period of record decreases; e.g. estimating the 100 year event from ~30 years is problematic, yet often done. Many IDF curves for Canadian locations are based on observational records as short as 10-15 years (e.g. La Scie, St. Albans, and Argentia, among other Newfoundland & Labrador examples); these locations should be interpreted with caution, but may still provide useful guidance.

It is important to note that the climate projections available for the current study provide daily precipitation data; this can be used in a relatively straight-forward manner to estimate precipitation return period events of *daily (twenty-four hour)* duration. Many engineering and planning applications require additional information on shorter durations (2 minutes to 12 hours). These shorter durations have been interpolated from the daily data, but doing so introduces new sources of potential error (see Appendix A). The shorter the duration, the larger the additional uncertainty. With this in mind, we encourage users to approach short duration, low frequency events with caution.

It may be tempting to interpret the above discussion as an indication that uncertainty in projected IDFs is too large for them to be useful. However, the spread in the projection ensemble (90th percentile – 10th percentile) is comparable to the reported uncertainty in in the observationally derived IDFs currently used in engineering design. Accommodating climate projections in design certainly introduces new uncertainties, but these are comparable to uncertainties we already accept.

Summary

The median projected IDF response indicate considerable increases in extreme precipitation can be expected over the following century. The magnitude of expected change differs by community; for mid-century, the 100 year, 24 hour duration event typically increases by 10 to 50mm. Another way to interpret these changes is to consider shifts in the likelihood of given events. For example, the current 100 year, 24 event for St. John's is 133mm; by mid-century, this is closer to the 25 year event (131mm). The interpretation is that the 100 year event becomes the 25 year event, and is four times more likely to occur in a given year. This is fairly common across the province.

Because extreme precipitation analysis can be very sensitive to one or two large events, the models show considerable disagreement. In general, the mid-century 'worst-case' projection (similar to 90th percentile)expects increases of 20-80mm in the 100 year, 24 hour event. The 'best-case' projections (10th percentile) may show increases of only 5-15mm, and some even suggest a weak decrease in intensity. It is important to note that no single projection in the 12-member ensemble consistently predicts a decrease in extreme precipitation, and rarely do multiple projections show decreases for the same location. Rather than truly indicating a potential decrease, decreases in the 10th percentile tables reflect the fact that a) the periods of simulation (2041-2070, 2071-2100) and observation (variable; >100 years to < 30 years depending on the station) are relatively short, and b) we are considering rare events. This is a problem familiar to engineers and hydrologists; it is difficult to estimate the 100 year event from only 30 years of information. If longer simulation periods were available, results suggest projected decreases would disappear and the ensemble mean would shift towards the projected maximum change.

Argentia

Table 37: Median of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	4.6	6.1	7.0	8.2	9.1	9.9
10 min	8.1	10.7	12.5	14.8	16.4	18.1
15 min	10.5	13.9	16.2	19.0	21.1	23.2
30 min	14.4	18.3	21.0	24.3	26.8	29.3
1 hour	19.0	24.6	28.3	33.0	36.5	40.0
2 hour	25.9	35.2	41.4	49.2	55.0	60.7
6 hour	43.0	69.8	87.5	110.0	126.6	143.1
12 hour	55.7	91.5	115.1	145.1	167.3	189.3
24 hour	67.2	103.2	127.0	157.2	179.5	201.7
Projected IDF Data, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	5.1	6.4	7.4	8.5	9.4	10.2
10 min	8.9	11.5	13.2	15.4	17.0	18.6
15 min	11.5	14.8	17.0	19.8	21.8	23.9
30 min	15.5	19.4	22.0	25.2	27.7	30.1
1 hour	20.7	26.1	29.8	34.3	37.7	41.1
2 hour	28.6	37.7	43.7	51.3	57.0	62.6
6 hour	50.7	76.9	94.2	116.1	132.3	148.5
12 hour	66.1	101.0	124.1	153.3	174.9	196.4
24 hour	77.6	112.8	136.0	165.4	187.2	208.9
Projected IDF Data, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	5.2	6.6	7.6	8.8	9.7	10.6
10 min	9.1	11.8	13.6	15.9	17.6	19.3
15 min	11.8	15.3	17.6	20.4	22.6	24.7
30 min	15.9	19.9	22.6	26.0	28.5	31.1
1 hour	21.1	26.8	30.6	35.4	39.0	42.5
2 hour	29.4	38.9	45.2	53.1	59.1	64.9
6 hour	53.0	80.3	98.4	121.3	138.3	155.2
12 hour	69.0	105.5	129.7	160.2	182.9	205.4
24 hour	80.6	117.4	141.7	172.4	195.2	217.9

Table 38: 10^{th} percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	4.6	6.1	7.0	8.2	9.1	9.9
10 min	8.1	10.7	12.5	14.8	16.4	18.1
15 min	10.5	13.9	16.2	19.0	21.1	23.2
30 min	14.4	18.3	21.0	24.3	26.8	29.3
1 hour	19.0	24.6	28.3	33.0	36.5	40.0
2 hour	25.9	35.2	41.4	49.2	55.0	60.7
6 hour	43.0	69.8	87.5	110.0	126.6	143.1
12 hour	55.7	91.5	115.1	145.1	167.3	189.3
24 hour	67.2	103.2	127.0	157.2	179.5	201.7
Projected IDF Data, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	4.9	6.1	6.9	8.0	8.7	9.5
10 min	8.5	10.9	12.4	14.4	15.9	17.3
15 min	11.1	14.1	16.1	18.5	20.4	22.2
30 min	15.0	18.5	20.9	23.8	25.9	28.1
1 hour	20.0	24.9	28.2	32.3	35.3	38.3
2 hour	27.5	35.7	41.1	47.9	53.0	58.0
6 hour	47.4	71.1	86.6	106.2	120.8	135.2
12 hour	61.7	93.2	113.9	140.1	159.5	178.8
24 hour	73.2	104.9	125.8	152.2	171.7	191.1
Projected IDF Data, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	5.0	6.2	7.0	8.0	8.8	9.5
10 min	8.8	11.1	12.6	14.5	15.9	17.2
15 min	11.4	14.3	16.2	18.6	20.4	22.2
30 min	15.4	18.8	21.1	23.9	26.0	28.0
1 hour	20.4	25.3	28.5	32.4	35.4	38.3
2 hour	28.2	36.3	41.6	48.1	53.0	57.9
6 hour	49.7	73.0	88.0	107.0	121.1	135.0
12 hour	64.7	95.8	115.8	141.1	159.9	178.5
24 hour	76.3	107.5	127.7	153.2	172.0	190.8

Table 39: 90th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	4.6	6.1	7.0	8.2	9.1	9.9
10 min	8.1	10.7	12.5	14.8	16.4	18.1
15 min	10.5	13.9	16.2	19.0	21.1	23.2
30 min	14.4	18.3	21.0	24.3	26.8	29.3
1 hour	19.0	24.6	28.3	33.0	36.5	40.0
2 hour	25.9	35.2	41.4	49.2	55.0	60.7
6 hour	43.0	69.8	87.5	110.0	126.6	143.1
12 hour	55.7	91.5	115.1	145.1	167.3	189.3
24 hour	67.2	103.2	127.0	157.2	179.5	201.7
90th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	5.3	6.6	7.5	8.7	9.6	10.6
10 min	9.4	11.9	13.5	15.7	17.5	19.2
15 min	12.2	15.3	17.4	20.3	22.5	24.7
30 min	16.3	20.0	22.4	25.8	28.4	31.0
1 hour	21.8	27.0	30.4	35.1	38.8	42.5
2 hour	30.5	39.1	44.8	52.7	58.8	64.8
6 hour	56.3	80.8	97.1	120.0	137.5	154.9
12 hour	73.5	106.2	128.0	158.4	181.8	205.1
24 hour	85.1	118.1	139.9	170.6	194.1	217.6
90th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	5.4	6.9	8.1	9.6	10.7	11.8
10 min	9.5	12.4	14.7	17.5	19.6	21.7
15 min	12.3	16.1	18.9	22.5	25.1	27.8
30 min	16.4	20.9	24.2	28.4	31.5	34.6
1 hour	21.9	28.2	32.9	38.8	43.2	47.5
2 hour	30.7	41.1	48.9	58.7	66.0	73.3
6 hour	56.9	86.6	109.0	137.4	158.4	179.2
12 hour	74.3	114.0	143.9	181.6	209.7	237.5
24 hour	85.9	125.8	155.9	194.0	222.2	250.2

Burgeo

Table 40: Median of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	5.8	7.5	8.7	10.1	11.2	12.2
10 min	8.3	10.8	12.4	14.5	16.0	17.5
15 min	10.4	13.5	15.5	18.1	20.0	21.9
30 min	14.4	17.9	20.3	23.2	25.4	27.5
1 hour	19.7	24.2	27.2	31.0	33.8	36.6
2 hour	28.0	34.1	38.1	43.2	46.9	50.6
6 hour	46.3	56.4	63.2	71.7	78.0	84.2
12 hour	59.6	71.0	78.5	88.1	95.1	102.2
24 hour	71.9	86.2	95.7	107.7	116.6	125.4
Projected IDF Data, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	7.2	9.1	10.4	12.0	13.2	14.4
10 min	10.2	13.0	14.9	17.2	18.9	20.6
15 min	12.8	16.3	18.6	21.6	23.7	25.9
30 min	17.2	21.1	23.8	27.1	29.6	32.1
1 hour	23.2	28.3	31.7	36.1	39.2	42.4
2 hour	32.8	39.6	44.2	49.9	54.2	58.4
6 hour	54.2	65.8	73.4	83.0	90.2	97.3
12 hour	68.5	81.4	90.0	100.8	108.8	116.8
24 hour	83.1	99.4	110.1	123.7	133.8	143.8
Projected IDF Data, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	8.0	10.3	11.8	13.8	15.2	16.6
10 min	11.4	14.7	16.9	19.7	21.7	23.8
15 min	14.3	18.5	21.2	24.7	27.3	29.8
30 min	18.8	23.6	26.7	30.7	33.6	36.6
1 hour	25.4	31.5	35.5	40.6	44.4	48.2
2 hour	35.7	43.8	49.2	56.0	61.1	66.1
6 hour	59.1	72.8	81.8	93.3	101.8	110.3
12 hour	73.9	89.3	99.5	112.3	121.9	131.3
24 hour	89.9	109.2	122.0	138.2	150.2	162.1

Table 41: 10th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	5.8	7.5	8.7	10.1	11.2	12.2
10 min	8.3	10.8	12.4	14.5	16.0	17.5
15 min	10.4	13.5	15.5	18.1	20.0	21.9
30 min	14.4	17.9	20.3	23.2	25.4	27.5
1 hour	19.7	24.2	27.2	31.0	33.8	36.6
2 hour	28.0	34.1	38.1	43.2	46.9	50.6
6 hour	46.3	56.4	63.2	71.7	78.0	84.2
12 hour	59.6	71.0	78.5	88.1	95.1	102.2
24 hour	71.9	86.2	95.7	107.7	116.6	125.4
Projected IDF Data, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	6.2	7.7	8.6	9.8	10.7	11.5
10 min	8.9	11.0	12.3	14.0	15.3	16.5
15 min	11.1	13.7	15.4	17.5	19.1	20.7
30 min	15.2	18.2	20.1	22.5	24.3	26.1
1 hour	20.7	24.5	27.0	30.1	32.5	34.8
2 hour	29.5	34.5	37.9	42.0	45.1	48.2
6 hour	48.6	57.2	62.8	69.8	75.0	80.2
12 hour	62.2	71.8	78.1	85.9	91.8	97.6
24 hour	75.2	87.3	95.1	105.0	112.4	119.7
Projected IDF Data, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	7.6	9.6	11.0	12.6	13.9	15.1
10 min	10.9	13.8	15.7	18.1	19.8	21.6
15 min	13.7	17.3	19.6	22.6	24.9	27.1
30 min	18.2	22.2	24.9	28.4	30.9	33.4
1 hour	24.5	29.7	33.2	37.6	40.9	44.1
2 hour	34.5	41.5	46.2	52.0	56.4	60.7
6 hour	57.1	68.9	76.7	86.6	93.9	101.2
12 hour	71.7	85.0	93.7	104.8	113.0	121.1
24 hour	87.2	103.8	114.8	128.7	139.0	149.3

Table 42: 90th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	5.8	7.5	8.7	10.1	11.2	12.2
10 min	8.3	10.8	12.4	14.5	16.0	17.5
15 min	10.4	13.5	15.5	18.1	20.0	21.9
30 min	14.4	17.9	20.3	23.2	25.4	27.5
1 hour	19.7	24.2	27.2	31.0	33.8	36.6
2 hour	28.0	34.1	38.1	43.2	46.9	50.6
6 hour	46.3	56.4	63.2	71.7	78.0	84.2
12 hour	59.6	71.0	78.5	88.1	95.1	102.2
24 hour	71.9	86.2	95.7	107.7	116.6	125.4
90th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	7.8	10.2	11.8	13.8	15.3	16.8
10 min	11.1	14.5	16.8	19.7	21.8	23.9
15 min	13.9	18.2	21.1	24.7	27.4	30.0
30 min	18.4	23.3	26.6	30.7	33.8	36.8
1 hour	24.8	31.1	35.3	40.7	44.6	48.5
2 hour	34.9	43.4	49.0	56.1	61.3	66.5
6 hour	57.8	72.0	81.5	93.4	102.2	111.0
12 hour	72.5	88.5	99.0	112.4	122.3	132.1
24 hour	88.1	108.2	121.5	138.3	150.7	163.1
90th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	8.5	11.0	12.6	14.7	16.3	17.8
10 min	12.2	15.7	18.0	21.0	23.2	25.4
15 min	15.2	19.7	22.6	26.4	29.2	31.9
30 min	19.9	24.9	28.3	32.6	35.8	38.9
1 hour	26.8	33.2	37.6	43.1	47.2	51.2
2 hour	37.5	46.2	52.0	59.3	64.8	70.2
6 hour	62.2	76.7	86.5	98.9	108.0	117.1
12 hour	77.4	93.7	104.7	118.5	128.8	139.0
24 hour	94.3	114.8	128.6	146.0	158.9	171.8

Churchill Falls

Table 43: Median of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	4.5	6.2	7.3	8.8	9.8	10.9
10 min	6.0	8.3	9.8	11.7	13.2	14.6
15 min	7.1	9.8	11.7	13.9	15.6	17.3
30 min	9.0	12.4	14.6	17.4	19.5	21.6
1 hour	10.8	14.1	16.4	19.2	21.3	23.3
2 hour	13.7	17.0	19.2	22.0	24.1	26.2
6 hour	20.9	27.2	31.3	36.6	40.4	44.3
12 hour	28.8	35.7	40.2	45.9	50.2	54.4
24 hour	35.9	43.4	48.4	54.6	59.3	63.9
Projected IDF Data, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	6.6	8.3	9.4	10.8	11.9	13.0
10 min	8.8	11.1	12.6	14.5	15.9	17.4
15 min	10.4	13.2	15.0	17.2	18.9	20.6
30 min	13.1	16.5	18.7	21.5	23.5	25.6
1 hour	14.9	18.2	20.4	23.3	25.3	27.4
2 hour	17.8	21.1	23.3	26.1	28.2	30.2
6 hour	28.6	34.8	38.9	44.1	48.0	51.9
12 hour	37.2	44.0	48.6	54.3	58.5	62.8
24 hour	45.1	52.5	57.5	63.7	68.4	73.0
Projected IDF Data, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	7.5	9.5	10.8	12.4	13.7	14.9
10 min	10.0	12.7	14.4	16.7	18.3	19.9
15 min	11.9	15.1	17.2	19.8	21.7	23.7
30 min	15.0	18.8	21.4	24.6	27.0	29.4
1 hour	16.7	20.6	23.1	26.4	28.8	31.2
2 hour	19.6	23.4	26.0	29.2	31.6	33.9
6 hour	32.0	39.2	43.9	50.0	54.4	58.9
12 hour	40.9	48.8	54.1	60.7	65.6	70.5
24 hour	49.2	57.8	63.5	70.7	76.1	81.4

Table 44: 10th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	4.5	6.2	7.3	8.8	9.8	10.9
10 min	6.0	8.3	9.8	11.7	13.2	14.6
15 min	7.1	9.8	11.7	13.9	15.6	17.3
30 min	9.0	12.4	14.6	17.4	19.5	21.6
1 hour	10.8	14.1	16.4	19.2	21.3	23.3
2 hour	13.7	17.0	19.2	22.0	24.1	26.2
6 hour	20.9	27.2	31.3	36.6	40.4	44.3
12 hour	28.8	35.7	40.2	45.9	50.2	54.4
24 hour	35.9	43.4	48.4	54.6	59.3	63.9
Projected IDF Data, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	5.5	7.1	8.2	9.5	10.4	11.3
10 min	7.3	9.5	10.9	12.7	14.0	15.1
15 min	8.7	11.3	13.0	15.1	16.6	17.9
30 min	11.0	14.2	16.3	18.9	20.7	22.3
1 hour	12.7	15.9	18.0	20.7	22.4	24.1
2 hour	15.6	18.8	20.9	23.5	25.3	26.9
6 hour	24.6	30.5	34.4	39.3	42.6	45.7
12 hour	32.8	39.3	43.6	49.0	52.6	56.0
24 hour	40.3	47.4	52.1	58.0	61.9	65.6
Projected IDF Data, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	5.7	7.2	8.2	9.5	10.4	11.3
10 min	7.6	9.7	11.0	12.7	14.0	15.2
15 min	9.1	11.5	13.1	15.1	16.6	18.0
30 min	11.4	14.4	16.4	18.8	20.7	22.5
1 hour	13.2	16.2	18.1	20.6	22.4	24.3
2 hour	16.1	19.0	21.0	23.4	25.3	27.1
6 hour	25.4	31.0	34.6	39.2	42.6	46.0
12 hour	33.7	39.8	43.8	48.9	52.6	56.3
24 hour	41.3	47.9	52.3	57.8	61.9	66.0

Table 45: 90th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	4.5	6.2	7.3	8.8	9.8	10.9
10 min	6.0	8.3	9.8	11.7	13.2	14.6
15 min	7.1	9.8	11.7	13.9	15.6	17.3
30 min	9.0	12.4	14.6	17.4	19.5	21.6
1 hour	10.8	14.1	16.4	19.2	21.3	23.3
2 hour	13.7	17.0	19.2	22.0	24.1	26.2
6 hour	20.9	27.2	31.3	36.6	40.4	44.3
12 hour	28.8	35.7	40.2	45.9	50.2	54.4
24 hour	35.9	43.4	48.4	54.6	59.3	63.9
90th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	7.8	10.2	11.7	13.8	15.3	16.7
10 min	10.4	13.6	15.7	18.4	20.5	22.4
15 min	12.3	16.2	18.7	21.9	24.3	26.6
30 min	15.5	20.1	23.3	27.2	30.1	33.0
1 hour	17.2	21.9	25.0	29.0	31.9	34.8
2 hour	20.1	24.7	27.9	31.8	34.7	37.6
6 hour	32.9	41.6	47.5	54.8	60.3	65.7
12 hour	41.9	51.5	57.9	66.0	72.0	77.9
24 hour	50.3	60.7	67.7	76.5	83.0	89.5
90th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	9.8	12.7	14.6	17.0	18.7	20.5
10 min	13.2	17.0	19.5	22.8	25.1	27.5
15 min	15.6	20.2	23.2	27.0	29.8	32.6
30 min	19.5	25.1	28.8	33.4	36.9	40.3
1 hour	21.3	26.9	30.6	35.3	38.8	42.2
2 hour	24.1	29.7	33.4	38.0	41.5	44.9
6 hour	40.5	50.9	57.8	66.5	73.0	79.4
12 hour	50.3	61.7	69.3	78.9	86.0	93.0
24 hour	59.4	71.8	80.1	90.5	98.3	105.9

Comfort Cove

Table 46: Median of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	4.3	5.8	6.8	8.1	9.0	10.0
10 min	6.5	8.9	10.6	12.6	14.1	15.6
15 min	8.1	11.2	13.2	15.8	17.8	19.7
30 min	10.7	15.0	17.8	21.4	24.0	26.7
1 hour	13.5	18.3	21.5	25.5	28.5	31.5
2 hour	17.6	23.1	26.8	31.4	34.8	38.2
6 hour	29.3	38.8	45.1	53.0	58.9	64.8
12 hour	37.3	47.4	54.1	62.5	68.8	75.0
24 hour	44.9	57.0	65.0	75.1	82.6	90.0
Projected IDF Data, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	5.5	7.7	9.1	11.0	12.3	13.7
10 min	8.5	12.0	14.3	17.2	19.4	21.6
15 min	10.6	15.0	18.0	21.7	24.5	27.2
30 min	14.2	20.3	24.3	29.4	33.2	37.0
1 hour	17.4	24.3	28.8	34.6	38.9	43.1
2 hour	22.1	30.0	35.2	41.8	46.7	51.5
6 hour	37.0	50.6	59.6	70.9	79.3	87.7
12 hour	45.4	59.9	69.4	81.5	90.5	99.4
24 hour	54.7	71.9	83.4	97.8	108.5	119.2
Projected IDF Data, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	6.1	8.3	9.7	11.6	13.0	14.3
10 min	9.4	12.9	15.2	18.2	20.4	22.5
15 min	11.8	16.2	19.2	22.9	25.7	28.5
30 min	15.8	21.9	26.0	31.1	34.9	38.7
1 hour	19.2	26.1	30.7	36.5	40.8	45.0
2 hour	24.2	32.1	37.3	43.9	48.8	53.7
6 hour	40.6	54.2	63.3	74.6	83.1	91.5
12 hour	49.3	63.8	73.4	85.5	94.5	103.4
24 hour	59.3	76.6	88.1	102.6	113.3	124.0

Table 47: 10th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	**Return Interval (years)**					
	2	**5**	**10**	**25**	**50**	**100**
5 min	4.3	5.8	6.8	8.1	9.0	10.0
10 min	6.5	8.9	10.6	12.6	14.1	15.6
15 min	8.1	11.2	13.2	15.8	17.8	19.7
30 min	10.7	15.0	17.8	21.4	24.0	26.7
1 hour	13.5	18.3	21.5	25.5	28.5	31.5
2 hour	17.6	23.1	26.8	31.4	34.8	38.2
6 hour	29.3	38.8	45.1	53.0	58.9	64.8
12 hour	37.3	47.4	54.1	62.5	68.8	75.0
24 hour	44.9	57.0	65.0	75.1	82.6	90.0
10th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	**Return Interval (years)**					
	2	**5**	**10**	**25**	**50**	**100**
5 min	4.9	7.0	8.4	10.1	11.4	12.7
10 min	7.5	10.8	13.0	15.8	17.8	19.9
15 min	9.4	13.6	16.4	19.9	22.5	25.1
30 min	12.5	18.3	22.1	26.9	30.5	34.1
1 hour	15.5	22.0	26.3	31.8	35.8	39.9
2 hour	19.9	27.4	32.3	38.6	43.2	47.8
6 hour	33.3	46.1	54.6	65.4	73.3	81.2
12 hour	41.5	55.2	64.2	75.6	84.1	92.5
24 hour	50.0	66.3	77.1	90.8	100.9	111.0
10th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	**Return Interval (years)**					
	2	**5**	**10**	**25**	**50**	**100**
5 min	5.3	7.5	9.0	10.9	12.3	13.6
10 min	8.1	11.7	14.1	17.1	19.3	21.3
15 min	10.1	14.7	17.7	21.6	24.3	26.9
30 min	13.6	19.9	24.0	29.2	33.0	36.6
1 hour	16.7	23.8	28.5	34.4	38.6	42.7
2 hour	21.3	29.4	34.8	41.5	46.4	51.0
6 hour	35.7	49.6	58.9	70.5	78.8	86.8
12 hour	44.0	58.9	68.7	81.1	89.9	98.4
24 hour	53.0	70.7	82.5	97.3	107.9	118.0

Table 48: 90th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	4.3	5.8	6.8	8.1	9.0	10.0
10 min	6.5	8.9	10.6	12.6	14.1	15.6
15 min	8.1	11.2	13.2	15.8	17.8	19.7
30 min	10.7	15.0	17.8	21.4	24.0	26.7
1 hour	13.5	18.3	21.5	25.5	28.5	31.5
2 hour	17.6	23.1	26.8	31.4	34.8	38.2
6 hour	29.3	38.8	45.1	53.0	58.9	64.8
12 hour	37.3	47.4	54.1	62.5	68.8	75.0
24 hour	44.9	57.0	65.0	75.1	82.6	90.0
90th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	6.2	8.4	9.9	11.8	13.2	14.5
10 min	9.6	13.1	15.5	18.5	20.7	22.9
15 min	12.0	16.5	19.5	23.3	26.1	28.9
30 min	16.1	22.3	26.4	31.6	35.5	39.3
1 hour	19.6	26.6	31.2	37.1	41.5	45.8
2 hour	24.6	32.6	37.9	44.6	49.6	54.5
6 hour	41.3	55.1	64.3	75.8	84.4	92.9
12 hour	50.0	64.7	74.5	86.8	95.9	104.9
24 hour	60.2	77.7	89.4	104.1	115.0	125.8
90th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	7.0	9.2	10.7	12.6	14.1	15.6
10 min	10.9	14.5	16.8	19.8	22.1	24.6
15 min	13.6	18.2	21.2	25.0	27.9	31.1
30 min	18.4	24.6	28.7	33.9	38.0	42.2
1 hour	22.1	29.1	33.8	39.7	44.3	49.1
2 hour	27.5	35.5	40.9	47.6	52.8	58.3
6 hour	46.3	60.2	69.4	81.0	89.9	99.4
12 hour	55.3	70.1	79.9	92.2	101.7	111.9
24 hour	66.5	84.2	95.9	110.6	122.0	134.1

Daniel's Harbour

Table 49: Median of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	3.9	6.1	7.6	9.4	10.8	12.1
10 min	5.8	8.4	10.2	12.4	14.0	15.6
15 min	7.0	9.8	11.7	14.1	15.9	17.7
30 min	9.2	13.0	15.4	18.6	20.9	23.2
1 hour	13.5	18.5	21.9	26.1	29.3	32.4
2 hour	19.1	24.5	28.1	32.6	36.0	39.3
6 hour	31.4	40.2	46.1	53.6	59.1	64.5
12 hour	42.0	54.2	62.3	72.5	80.1	87.6
24 hour	55.4	74.5	87.2	103.2	115.1	126.9
Projected IDF Data, 2041-2070 (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	4.9	7.6	9.3	11.5	13.1	14.7
10 min	7.0	10.2	12.3	14.9	16.8	18.8
15 min	8.3	11.7	14.0	16.8	19.0	21.1
30 min	10.9	15.4	18.4	22.1	24.9	27.7
1 hour	15.8	21.8	25.8	30.9	34.7	38.4
2 hour	21.5	28.0	32.3	37.7	41.8	45.7
6 hour	35.4	46.0	53.1	62.0	68.6	75.2
12 hour	47.5	62.2	71.9	84.1	93.2	102.2
24 hour	64.1	87.0	102.2	121.4	135.6	149.8
Projected IDF Data, 2071-2100 (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	5.6	8.7	10.8	13.4	15.4	17.3
10 min	7.8	11.6	14.1	17.2	19.5	21.9
15 min	9.2	13.3	16.0	19.4	21.9	24.4
30 min	12.1	17.4	21.0	25.4	28.8	32.0
1 hour	17.4	24.6	29.4	35.4	39.9	44.3
2 hour	23.3	31.0	36.1	42.5	47.3	52.1
6 hour	38.2	50.9	59.3	69.9	77.7	85.5
12 hour	51.4	68.8	80.4	95.0	105.8	116.5
24 hour	70.1	97.4	115.5	138.4	155.3	172.1

Table 50: 10th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	3.9	6.1	7.6	9.4	10.8	12.1
10 min	5.8	8.4	10.2	12.4	14.0	15.6
15 min	7.0	9.8	11.7	14.1	15.9	17.7
30 min	9.2	13.0	15.4	18.6	20.9	23.2
1 hour	13.5	18.5	21.9	26.1	29.3	32.4
2 hour	19.1	24.5	28.1	32.6	36.0	39.3
6 hour	31.4	40.2	46.1	53.6	59.1	64.5
12 hour	42.0	54.2	62.3	72.5	80.1	87.6
24 hour	55.4	74.5	87.2	103.2	115.1	126.9
10th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	4.1	6.1	7.5	9.2	10.4	11.6
10 min	6.1	8.5	10.1	12.1	13.6	15.1
15 min	7.2	9.9	11.6	13.8	15.5	17.1
30 min	9.6	13.0	15.3	18.2	20.3	22.4
1 hour	13.9	18.6	21.7	25.6	28.5	31.3
2 hour	19.6	24.6	27.8	32.0	35.1	38.2
6 hour	32.2	40.3	45.7	52.6	57.7	62.7
12 hour	43.1	54.4	61.8	71.2	78.2	85.1
24 hour	57.1	74.7	86.4	101.1	112.1	122.9
10th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	4.3	6.5	7.9	9.7	11.0	12.3
10 min	6.3	8.9	10.6	12.7	14.3	15.9
15 min	7.5	10.3	12.2	14.5	16.2	17.9
30 min	9.9	13.6	16.0	19.0	21.3	23.5
1 hour	14.4	19.3	22.6	26.7	29.8	32.8
2 hour	20.1	25.3	28.8	33.2	36.5	39.8
6 hour	33.0	41.6	47.4	54.6	60.0	65.3
12 hour	44.2	56.1	64.0	74.0	81.4	88.7
24 hour	58.9	77.5	89.9	105.5	117.1	128.6

Table 51: 90th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	3.9	6.1	7.6	9.4	10.8	12.1
10 min	5.8	8.4	10.2	12.4	14.0	15.6
15 min	7.0	9.8	11.7	14.1	15.9	17.7
30 min	9.2	13.0	15.4	18.6	20.9	23.2
1 hour	13.5	18.5	21.9	26.1	29.3	32.4
2 hour	19.1	24.5	28.1	32.6	36.0	39.3
6 hour	31.4	40.2	46.1	53.6	59.1	64.5
12 hour	42.0	54.2	62.3	72.5	80.1	87.6
24 hour	55.4	74.5	87.2	103.2	115.1	126.9
90th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	6.1	9.4	11.6	14.4	16.4	18.5
10 min	8.4	12.4	15.0	18.4	20.8	23.3
15 min	9.8	14.1	17.0	20.6	23.3	25.9
30 min	12.9	18.6	22.3	27.1	30.6	34.1
1 hour	18.4	26.1	31.2	37.6	42.3	47.1
2 hour	24.4	32.6	38.0	44.9	49.9	55.0
6 hour	40.0	53.5	62.4	73.7	82.0	90.3
12 hour	53.9	72.5	84.7	100.2	111.7	123.1
24 hour	74.1	103.1	122.3	146.6	164.6	182.5
90th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	6.7	10.7	13.8	17.7	20.5	23.4
10 min	9.2	14.0	17.7	22.3	25.8	29.2
15 min	10.6	15.8	19.8	24.9	28.6	32.3
30 min	14.0	20.8	26.1	32.7	37.6	42.5
1 hour	19.9	29.1	36.2	45.2	51.8	58.4
2 hour	26.0	35.9	43.4	53.0	60.1	67.1
6 hour	42.7	58.9	71.3	87.0	98.7	110.3
12 hour	57.5	79.9	97.0	118.6	134.6	150.5
24 hour	79.7	114.7	141.5	175.4	200.5	225.4

Deer Lake

Table 52: Median of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	**Return Interval (years)**					
	2	**5**	**10**	**25**	**50**	**100**
5 min	3.9	5.5	6.5	7.8	8.7	9.7
10 min	5.7	7.8	9.3	11.1	12.5	13.8
15 min	6.9	9.4	11.0	13.0	14.5	16.0
30 min	9.8	12.7	14.6	17.0	18.8	20.5
1 hour	13.3	16.5	18.6	21.3	23.3	25.3
2 hour	18.8	23.9	27.2	31.5	34.7	37.8
6 hour	29.0	36.1	40.8	46.8	51.2	55.5
12 hour	37.8	46.4	52.1	59.3	64.6	69.9
24 hour	44.9	55.7	62.8	71.8	78.5	85.2
Projected IDF Data, 2041-2070 (mm)						
Duration	**Return Interval (years)**					
	2	**5**	**10**	**25**	**50**	**100**
5 min	5.4	7.6	9.1	10.9	12.2	13.6
10 min	7.8	10.9	12.9	15.5	17.4	19.3
15 min	9.3	12.8	15.1	18.0	20.1	22.3
30 min	12.6	16.7	19.4	22.8	25.4	27.9
1 hour	16.5	21.0	24.0	27.8	30.7	33.5
2 hour	23.8	31.0	35.8	41.9	46.3	50.8
6 hour	36.0	46.1	52.8	61.2	67.5	73.7
12 hour	46.2	58.4	66.5	76.7	84.3	91.8
24 hour	55.6	70.8	81.0	93.7	103.2	112.6
Projected IDF Data, 2071-2100 (mm)						
Duration	**Return Interval (years)**					
	2	**5**	**10**	**25**	**50**	**100**
5 min	6.3	8.9	10.7	12.8	14.5	16.1
10 min	9.1	12.8	15.2	18.3	20.6	22.9
15 min	10.7	14.9	17.6	21.1	23.7	26.3
30 min	14.3	19.2	22.4	26.5	29.6	32.6
1 hour	18.3	23.8	27.4	32.0	35.4	38.7
2 hour	26.7	35.4	41.1	48.4	53.8	59.1
6 hour	40.1	52.2	60.2	70.3	77.8	85.3
12 hour	51.2	65.8	75.5	87.8	96.9	105.9
24 hour	61.8	80.1	92.2	107.6	118.9	130.2

Table 53: 10th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	3.9	5.5	6.5	7.8	8.7	9.7
10 min	5.7	7.8	9.3	11.1	12.5	13.8
15 min	6.9	9.4	11.0	13.0	14.5	16.0
30 min	9.8	12.7	14.6	17.0	18.8	20.5
1 hour	13.3	16.5	18.6	21.3	23.3	25.3
2 hour	18.8	23.9	27.2	31.5	34.7	37.8
6 hour	29.0	36.1	40.8	46.8	51.2	55.5
12 hour	37.8	46.4	52.1	59.3	64.6	69.9
24 hour	44.9	55.7	62.8	71.8	78.5	85.2
10th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	4.8	6.5	7.6	9.0	10.0	11.1
10 min	6.9	9.3	10.9	12.9	14.3	15.8
15 min	8.3	11.0	12.8	15.0	16.6	18.3
30 min	11.5	14.6	16.7	19.3	21.3	23.2
1 hour	15.2	18.7	21.0	23.9	26.1	28.2
2 hour	21.7	27.3	31.0	35.6	39.1	42.5
6 hour	33.1	40.9	46.0	52.5	57.3	62.1
12 hour	42.8	52.1	58.4	66.2	72.0	77.8
24 hour	51.2	63.0	70.7	80.5	87.8	95.1
10th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	5.4	7.6	9.0	10.8	12.1	13.4
10 min	7.7	10.8	12.8	15.4	17.3	19.2
15 min	9.3	12.7	15.0	17.9	20.0	22.1
30 min	12.5	16.6	19.3	22.7	25.2	27.7
1 hour	16.4	20.9	23.9	27.7	30.5	33.2
2 hour	23.6	30.8	35.6	41.6	46.0	50.4
6 hour	35.8	45.8	52.4	60.8	67.0	73.1
12 hour	46.0	58.1	66.1	76.3	83.8	91.2
24 hour	55.2	70.4	80.5	93.2	102.5	111.8

Table 54: 90th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	3.9	5.5	6.5	7.8	8.7	9.7
10 min	5.7	7.8	9.3	11.1	12.5	13.8
15 min	6.9	9.4	11.0	13.0	14.5	16.0
30 min	9.8	12.7	14.6	17.0	18.8	20.5
1 hour	13.3	16.5	18.6	21.3	23.3	25.3
2 hour	18.8	23.9	27.2	31.5	34.7	37.8
6 hour	29.0	36.1	40.8	46.8	51.2	55.5
12 hour	37.8	46.4	52.1	59.3	64.6	69.9
24 hour	44.9	55.7	62.8	71.8	78.5	85.2
90th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	6.6	9.2	10.9	13.1	14.7	16.3
10 min	9.5	13.1	15.6	18.7	20.9	23.2
15 min	11.2	15.3	18.1	21.5	24.1	26.6
30 min	14.8	19.7	22.9	27.0	30.0	33.0
1 hour	18.9	24.3	27.9	32.5	35.9	39.2
2 hour	27.7	36.3	42.0	49.2	54.6	59.9
6 hour	41.4	53.4	61.4	71.5	78.9	86.3
12 hour	52.8	67.3	77.0	89.2	98.2	107.2
24 hour	63.7	82.0	94.0	109.3	120.6	131.8
90th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	7.4	10.1	11.9	14.3	16.3	18.3
10 min	10.6	14.4	16.9	20.4	23.2	26.0
15 min	12.5	16.7	19.5	23.5	26.7	29.8
30 min	16.3	21.3	24.7	29.4	33.1	36.8
1 hour	20.6	26.2	29.9	35.1	39.2	43.4
2 hour	30.3	39.2	45.1	53.4	60.0	66.5
6 hour	45.1	57.5	65.7	77.3	86.4	95.6
12 hour	57.3	72.2	82.2	96.2	107.3	118.3
24 hour	69.4	88.1	100.6	118.1	132.0	145.8

Gander

Table 55: Median of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	4.5	6.2	7.3	8.8	9.8	10.9
10 min	6.4	8.9	10.5	12.5	14.0	15.5
15 min	7.7	10.7	12.7	15.2	17.1	18.9
30 min	10.3	14.2	16.8	20.1	22.5	24.9
1 hour	13.2	17.4	20.1	23.6	26.2	28.7
2 hour	18.0	23.0	26.3	30.4	33.5	36.5
6 hour	29.3	36.7	41.5	47.7	52.2	56.7
12 hour	37.8	47.7	54.2	62.4	68.5	74.5
24 hour	45.8	58.9	67.5	78.4	86.5	94.6
Projected IDF Data, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	6.0	8.4	10.0	12.1	13.6	15.1
10 min	8.6	12.0	14.3	17.2	19.3	21.5
15 min	10.3	14.6	17.4	20.9	23.6	26.2
30 min	13.7	19.2	22.9	27.5	31.0	34.4
1 hour	16.8	22.7	26.6	31.6	35.2	38.8
2 hour	22.3	29.4	34.0	39.9	44.3	48.6
6 hour	35.7	46.1	53.0	61.7	68.2	74.6
12 hour	46.4	60.3	69.5	81.2	89.8	98.4
24 hour	57.2	75.7	87.9	103.4	114.9	126.3
Projected IDF Data, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	6.7	8.9	10.3	12.2	13.5	14.9
10 min	9.6	12.7	14.7	17.3	19.2	21.1
15 min	11.6	15.4	17.9	21.1	23.5	25.8
30 min	15.4	20.3	23.6	27.8	30.8	33.9
1 hour	18.6	23.9	27.4	31.8	35.1	38.3
2 hour	24.5	30.7	34.9	40.2	44.1	47.9
6 hour	38.8	48.1	54.3	62.1	67.9	73.7
12 hour	50.6	63.0	71.3	81.7	89.4	97.1
24 hour	62.7	79.3	90.3	104.1	114.4	124.6

Table 56: 10th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	4.5	6.2	7.3	8.8	9.8	10.9
10 min	6.4	8.9	10.5	12.5	14.0	15.5
15 min	7.7	10.7	12.7	15.2	17.1	18.9
30 min	10.3	14.2	16.8	20.1	22.5	24.9
1 hour	13.2	17.4	20.1	23.6	26.2	28.7
2 hour	18.0	23.0	26.3	30.4	33.5	36.5
6 hour	29.3	36.7	41.5	47.7	52.2	56.7
12 hour	37.8	47.7	54.2	62.4	68.5	74.5
24 hour	45.8	58.9	67.5	78.4	86.5	94.6
10th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	5.4	7.7	9.1	10.9	12.3	13.6
10 min	7.8	11.1	13.1	15.6	17.5	19.4
15 min	9.4	13.4	15.9	19.0	21.3	23.6
30 min	12.5	17.7	20.9	25.0	28.0	31.0
1 hour	15.5	21.1	24.5	28.9	32.1	35.3
2 hour	20.8	27.4	31.5	36.7	40.5	44.3
6 hour	33.4	43.2	49.3	57.0	62.7	68.3
12 hour	43.2	56.4	64.5	74.8	82.4	89.9
24 hour	53.0	70.6	81.3	95.0	105.1	115.1
10th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	6.0	7.7	8.7	10.1	11.1	12.1
10 min	8.7	11.0	12.5	14.4	15.8	17.2
15 min	10.5	13.3	15.2	17.5	19.2	21.0
30 min	13.9	17.6	20.0	23.1	25.3	27.6
1 hour	17.0	20.9	23.5	26.8	29.2	31.6
2 hour	22.5	27.2	30.3	34.2	37.1	39.9
6 hour	36.0	43.0	47.5	53.3	57.5	61.8
12 hour	46.8	56.1	62.2	69.9	75.6	81.3
24 hour	57.7	70.1	78.2	88.4	96.0	103.5

Table 57th: 90th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	4.5	6.2	7.3	8.8	9.8	10.9
10 min	6.4	8.9	10.5	12.5	14.0	15.5
15 min	7.7	10.7	12.7	15.2	17.1	18.9
30 min	10.3	14.2	16.8	20.1	22.5	24.9
1 hour	13.2	17.4	20.1	23.6	26.2	28.7
2 hour	18.0	23.0	26.3	30.4	33.5	36.5
6 hour	29.3	36.7	41.5	47.7	52.2	56.7
12 hour	37.8	47.7	54.2	62.4	68.5	74.5
24 hour	45.8	58.9	67.5	78.4	86.5	94.6
90th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	6.7	9.4	11.1	13.4	15.1	16.7
10 min	9.6	13.4	15.9	19.1	21.4	23.8
15 min	11.6	16.3	19.3	23.3	26.2	29.1
30 min	15.4	21.4	25.5	30.6	34.4	38.1
1 hour	18.6	25.1	29.3	34.8	38.8	42.8
2 hour	24.5	32.1	37.2	43.7	48.5	53.3
6 hour	38.9	50.2	57.8	67.4	74.6	81.6
12 hour	50.6	65.8	75.9	88.8	98.3	107.8
24 hour	62.8	83.0	96.4	113.5	126.2	138.8
90th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	8.1	11.0	13.0	15.4	17.3	19.1
10 min	11.5	15.7	18.5	22.0	24.6	27.1
15 min	14.0	19.1	22.5	26.8	30.0	33.2
30 min	18.5	25.2	29.6	35.2	39.4	43.5
1 hour	21.9	29.0	33.8	39.7	44.1	48.5
2 hour	28.4	36.9	42.5	49.6	54.9	60.1
6 hour	44.7	57.3	65.6	76.1	84.0	91.7
12 hour	58.4	75.2	86.3	100.4	110.9	121.3
24 hour	73.1	95.5	110.3	129.0	142.9	156.7

Happy Valley – Goose Bay

Table 58: Median of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	4.0	5.5	6.6	7.9	8.9	9.8
10 min	5.7	8.1	9.7	11.7	13.2	14.7
15 min	6.8	9.6	11.5	13.8	15.5	17.3
30 min	8.6	12.0	14.3	17.1	19.2	21.3
1 hour	11.0	14.5	16.8	19.8	22.0	24.2
2 hour	14.3	18.3	21.0	24.3	26.8	29.2
6 hour	23.9	29.5	33.3	38.0	41.5	45.0
12 hour	32.1	40.0	45.2	51.8	56.7	61.6
24 hour	40.7	51.9	59.3	68.7	75.7	82.6
Projected IDF Data, 2041-2070 (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	5.3	7.3	8.6	10.3	11.6	12.8
10 min	7.7	10.8	12.8	15.4	17.3	19.2
15 min	9.1	12.7	15.1	18.1	20.4	22.6
30 min	11.5	15.9	18.7	22.4	25.1	27.8
1 hour	13.9	18.4	21.5	25.3	28.1	30.9
2 hour	17.6	22.8	26.2	30.5	33.7	36.8
6 hour	28.6	35.9	40.7	46.7	51.3	55.7
12 hour	38.7	48.9	55.6	64.1	70.4	76.6
24 hour	50.0	64.5	74.1	86.1	95.1	104.0
Projected IDF Data, 2071-2100 (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	6.0	8.2	9.7	11.5	12.9	14.2
10 min	8.8	12.2	14.4	17.2	19.3	21.3
15 min	10.5	14.4	17.0	20.2	22.7	25.1
30 min	13.1	17.8	21.0	24.9	27.9	30.8
1 hour	15.6	20.5	23.8	27.9	30.9	34.0
2 hour	19.5	25.1	28.8	33.5	36.9	40.4
6 hour	31.2	39.1	44.3	50.9	55.8	60.7
12 hour	42.4	53.4	60.7	70.0	76.8	83.6
24 hour	55.3	71.0	81.4	94.5	104.2	113.9

Table 59: 10th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records. (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	4.0	5.5	6.6	7.9	8.9	9.8
10 min	5.7	8.1	9.7	11.7	13.2	14.7
15 min	6.8	9.6	11.5	13.8	15.5	17.3
30 min	8.6	12.0	14.3	17.1	19.2	21.3
1 hour	11.0	14.5	16.8	19.8	22.0	24.2
2 hour	14.3	18.3	21.0	24.3	26.8	29.2
6 hour	23.9	29.5	33.3	38.0	41.5	45.0
12 hour	32.1	40.0	45.2	51.8	56.7	61.6
24 hour	40.7	51.9	59.3	68.7	75.7	82.6
10th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	4.5	5.9	6.9	8.0	8.9	9.8
10 min	6.5	8.7	10.1	11.9	13.3	14.6
15 min	7.8	10.3	12.0	14.1	15.7	17.2
30 min	9.8	12.9	14.9	17.5	19.4	21.3
1 hour	12.2	15.4	17.5	20.1	22.1	24.1
2 hour	15.7	19.3	21.7	24.7	26.9	29.2
6 hour	25.8	30.9	34.3	38.6	41.7	44.9
12 hour	34.8	42.0	46.7	52.6	57.1	61.5
24 hour	44.5	54.7	61.4	69.9	76.2	82.4
10th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	4.8	6.8	8.1	9.8	11.0	12.2
10 min	7.0	10.1	12.1	14.6	16.4	18.3
15 min	8.4	11.9	14.2	17.2	19.4	21.5
30 min	10.5	14.8	17.7	21.2	23.9	26.5
1 hour	12.9	17.4	20.3	24.0	26.8	29.5
2 hour	16.5	21.6	24.9	29.1	32.2	35.3
6 hour	27.0	34.1	38.8	44.8	49.2	53.6
12 hour	36.5	46.5	53.0	61.3	67.5	73.6
24 hour	46.9	61.1	70.4	82.2	91.0	99.7

Table 60: 90th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	4.0	5.5	6.6	7.9	8.9	9.8
10 min	5.7	8.1	9.7	11.7	13.2	14.7
15 min	6.8	9.6	11.5	13.8	15.5	17.3
30 min	8.6	12.0	14.3	17.1	19.2	21.3
1 hour	11.0	14.5	16.8	19.8	22.0	24.2
2 hour	14.3	18.3	21.0	24.3	26.8	29.2
6 hour	23.9	29.5	33.3	38.0	41.5	45.0
12 hour	32.1	40.0	45.2	51.8	56.7	61.6
24 hour	40.7	51.9	59.3	68.7	75.7	82.6
90th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	6.3	8.9	10.7	12.8	14.5	16.1
10 min	9.3	13.3	15.9	19.2	21.7	24.2
15 min	11.0	15.7	18.7	22.6	25.5	28.4
30 min	13.8	19.4	23.1	27.9	31.4	34.8
1 hour	16.3	22.1	26.0	30.9	34.5	38.2
2 hour	20.4	27.0	31.3	36.9	41.0	45.1
6 hour	32.4	41.8	47.9	55.8	61.6	67.4
12 hour	44.0	57.1	65.8	76.7	84.9	93.0
24 hour	57.6	76.2	88.5	104.1	115.7	127.2
90th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	7.5	10.2	12.0	14.3	16.0	17.7
10 min	11.0	15.2	18.0	21.5	24.1	26.7
15 min	13.1	18.0	21.2	25.3	28.3	31.4
30 min	16.2	22.2	26.1	31.1	34.8	38.4
1 hour	18.8	25.0	29.1	34.3	38.1	41.9
2 hour	23.2	30.2	34.8	40.7	45.0	49.3
6 hour	36.5	46.4	52.9	61.2	67.3	73.4
12 hour	49.7	63.6	72.7	84.3	92.8	101.4
24 hour	65.7	85.4	98.4	114.8	127.0	139.2

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Table 61: Median of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	3.0	4.0	4.7	5.5	6.1	6.7
10 min	4.2	5.7	6.7	7.9	8.9	9.8
15 min	5.2	7.2	8.5	10.2	11.4	12.6
30 min	7.4	10.1	12.0	14.3	16.0	17.7
1 hour	10.7	14.1	16.3	19.2	21.2	23.3
2 hour	15.6	19.9	22.7	26.3	28.9	31.5
6 hour	26.9	34.8	39.9	46.5	51.3	56.2
12 hour	39.1	49.8	56.9	65.9	72.5	79.1
24 hour	52.2	65.5	74.3	85.5	93.8	102.0
Projected IDF Data, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	3.8	5.0	5.8	6.8	7.5	8.2
10 min	5.5	7.2	8.4	9.9	11.0	12.1
15 min	6.9	9.2	10.8	12.8	14.2	15.7
30 min	9.7	13.0	15.1	17.9	19.9	21.9
1 hour	13.5	17.5	20.2	23.5	26.0	28.5
2 hour	19.2	24.2	27.6	31.8	34.9	38.1
6 hour	33.5	42.8	48.9	56.7	62.4	68.2
12 hour	48.1	60.8	69.2	79.8	87.7	95.5
24 hour	63.3	79.1	89.6	102.9	112.7	122.4
Projected IDF Data, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	4.2	5.6	6.5	7.6	8.4	9.2
10 min	6.0	8.1	9.4	11.1	12.3	13.6
15 min	7.7	10.3	12.1	14.3	16.0	17.7
30 min	10.8	14.5	17.0	20.1	22.4	24.7
1 hour	14.9	19.4	22.5	26.3	29.1	31.9
2 hour	20.9	26.6	30.4	35.2	38.8	42.4
6 hour	36.6	47.1	54.1	63.0	69.5	76.1
12 hour	52.3	66.7	76.3	88.4	97.4	106.3
24 hour	68.6	86.6	98.5	113.6	124.8	135.9

Table 62: 10th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	3.0	4.0	4.7	5.5	6.1	6.7
10 min	4.2	5.7	6.7	7.9	8.9	9.8
15 min	5.2	7.2	8.5	10.2	11.4	12.6
30 min	7.4	10.1	12.0	14.3	16.0	17.7
1 hour	10.7	14.1	16.3	19.2	21.2	23.3
2 hour	15.6	19.9	22.7	26.3	28.9	31.5
6 hour	26.9	34.8	39.9	46.5	51.3	56.2
12 hour	39.1	49.8	56.9	65.9	72.5	79.1
24 hour	52.2	65.5	74.3	85.5	93.8	102.0
10th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	3.4	4.2	4.7	5.4	5.9	6.4
10 min	4.7	6.0	6.8	7.8	8.6	9.3
15 min	5.9	7.6	8.7	10.0	11.0	12.0
30 min	8.4	10.7	12.2	14.1	15.5	16.9
1 hour	11.9	14.7	16.6	18.9	20.6	22.3
2 hour	17.1	20.7	23.0	26.0	28.1	30.3
6 hour	29.7	36.2	40.5	45.9	49.9	53.9
12 hour	42.9	51.8	57.7	65.1	70.5	76.0
24 hour	56.9	68.0	75.3	84.5	91.3	98.1
10th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	3.5	4.6	5.2	6.1	6.8	7.4
10 min	4.9	6.5	7.6	8.9	9.8	10.8
15 min	6.2	8.3	9.7	11.4	12.7	14.0
30 min	8.7	11.7	13.6	16.0	17.8	19.6
1 hour	12.4	15.9	18.3	21.3	23.5	25.7
2 hour	17.7	22.2	25.2	28.9	31.7	34.5
6 hour	30.8	39.0	44.5	51.4	56.5	61.6
12 hour	44.4	55.7	63.1	72.6	79.5	86.5
24 hour	58.8	72.8	82.1	93.8	102.6	111.2

Table 63: 90th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	3.0	4.0	4.7	5.5	6.1	6.7
10 min	4.2	5.7	6.7	7.9	8.9	9.8
15 min	5.2	7.2	8.5	10.2	11.4	12.6
30 min	7.4	10.1	12.0	14.3	16.0	17.7
1 hour	10.7	14.1	16.3	19.2	21.2	23.3
2 hour	15.6	19.9	22.7	26.3	28.9	31.5
6 hour	26.9	34.8	39.9	46.5	51.3	56.2
12 hour	39.1	49.8	56.9	65.9	72.5	79.1
24 hour	52.2	65.5	74.3	85.5	93.8	102.0
90th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	4.4	5.7	6.6	7.7	8.6	9.4
10 min	6.3	8.3	9.6	11.3	12.5	13.8
15 min	8.0	10.6	12.4	14.6	16.3	17.9
30 min	11.2	14.9	17.4	20.5	22.8	25.1
1 hour	15.4	20.0	23.0	26.8	29.6	32.4
2 hour	21.6	27.3	31.1	35.9	39.4	43.0
6 hour	37.8	48.3	55.3	64.2	70.7	77.2
12 hour	54.0	68.4	78.0	90.0	99.0	107.9
24 hour	70.7	88.7	100.6	115.6	126.8	137.8
90th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	4.9	6.5	7.6	9.0	10.1	11.1
10 min	7.0	9.5	11.1	13.2	14.8	16.4
15 min	9.0	12.2	14.4	17.2	19.3	21.4
30 min	12.6	17.1	20.2	24.1	27.1	30.0
1 hour	17.1	22.6	26.4	31.2	34.8	38.4
2 hour	23.7	30.7	35.4	41.4	46.0	50.5
6 hour	41.7	54.5	63.3	74.4	82.7	91.1
12 hour	59.4	76.8	88.8	104.0	115.4	126.8
24 hour	77.4	99.2	114.1	133.0	147.2	161.4

Mary's Harbour

Table 64: Median of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	2.8	3.9	4.7	5.6	6.3	7.0
10 min	3.9	5.3	6.2	7.4	8.2	9.1
15 min	4.7	6.2	7.2	8.4	9.3	10.3
30 min	6.7	8.4	9.6	11.0	12.1	13.2
1 hour	9.3	11.3	12.7	14.4	15.7	16.9
2 hour	13.6	16.7	18.7	21.4	23.3	25.2
6 hour	24.0	30.0	34.0	39.1	42.8	46.5
12 hour	33.4	43.4	50.0	58.3	64.5	70.7
24 hour	40.8	53.7	62.2	73.0	80.9	88.9
Projected IDF Data, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	3.8	5.2	6.0	7.1	8.0	8.8
10 min	5.2	6.8	7.9	9.3	10.3	11.3
15 min	6.0	7.8	9.0	10.5	11.6	12.7
30 min	8.3	10.4	11.7	13.4	14.7	16.0
1 hour	11.2	13.6	15.2	17.2	18.8	20.3
2 hour	16.4	20.1	22.6	25.6	27.9	30.2
6 hour	29.5	36.7	41.4	47.4	51.8	56.2
12 hour	42.6	54.4	62.2	72.1	79.4	86.7
24 hour	52.6	67.9	78.0	90.7	100.2	109.6
Projected IDF Data, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	4.3	5.8	6.8	8.1	9.1	10.0
10 min	5.7	7.6	8.9	10.5	11.7	12.9
15 min	6.6	8.7	10.1	11.8	13.1	14.4
30 min	9.0	11.4	13.0	15.0	16.5	17.9
1 hour	11.9	14.8	16.7	19.1	20.8	22.6
2 hour	17.6	21.9	24.8	28.4	31.1	33.7
6 hour	31.9	40.2	45.7	52.7	57.9	63.0
12 hour	46.4	60.2	69.4	80.9	89.5	97.9
24 hour	57.6	75.4	87.2	102.1	113.1	124.1

Table 65: 10th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	2.8	3.9	4.7	5.6	6.3	7.0
10 min	3.9	5.3	6.2	7.4	8.2	9.1
15 min	4.7	6.2	7.2	8.4	9.3	10.3
30 min	6.7	8.4	9.6	11.0	12.1	13.2
1 hour	9.3	11.3	12.7	14.4	15.7	16.9
2 hour	13.6	16.7	18.7	21.4	23.3	25.2
6 hour	24.0	30.0	34.0	39.1	42.8	46.5
12 hour	33.4	43.4	50.0	58.3	64.5	70.7
24 hour	40.8	53.7	62.2	73.0	80.9	88.9
10th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	3.3	4.4	5.0	5.9	6.5	7.1
10 min	4.6	5.8	6.7	7.7	8.5	9.3
15 min	5.4	6.8	7.7	8.8	9.6	10.5
30 min	7.5	9.1	10.2	11.5	12.5	13.4
1 hour	10.2	12.1	13.4	14.9	16.1	17.3
2 hour	15.1	17.9	19.8	22.2	23.9	25.7
6 hour	26.9	32.4	36.0	40.6	44.0	47.4
12 hour	38.2	47.3	53.3	60.9	66.6	72.2
24 hour	47.0	58.8	66.5	76.3	83.6	90.8
10th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	3.4	4.6	5.4	6.4	7.2	7.9
10 min	4.7	6.2	7.1	8.4	9.3	10.2
15 min	5.5	7.1	8.2	9.5	10.5	11.5
30 min	7.7	9.5	10.8	12.3	13.5	14.6
1 hour	10.4	12.6	14.1	15.9	17.3	18.7
2 hour	15.3	18.7	20.9	23.7	25.8	27.8
6 hour	27.4	33.8	38.1	43.6	47.6	51.6
12 hour	39.0	49.7	56.8	65.8	72.4	79.0
24 hour	48.0	61.8	71.0	82.6	91.2	99.7

Table 66: 90th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	2.8	3.9	4.7	5.6	6.3	7.0
10 min	3.9	5.3	6.2	7.4	8.2	9.1
15 min	4.7	6.2	7.2	8.4	9.3	10.3
30 min	6.7	8.4	9.6	11.0	12.1	13.2
1 hour	9.3	11.3	12.7	14.4	15.7	16.9
2 hour	13.6	16.7	18.7	21.4	23.3	25.2
6 hour	24.0	30.0	34.0	39.1	42.8	46.5
12 hour	33.4	43.4	50.0	58.3	64.5	70.7
24 hour	40.8	53.7	62.2	73.0	80.9	88.9
90th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	4.4	6.1	7.1	8.5	9.5	10.5
10 min	5.9	7.9	9.2	10.9	12.2	13.4
15 min	6.8	9.0	10.5	12.3	13.6	15.0
30 min	9.2	11.7	13.4	15.5	17.1	18.7
1 hour	12.2	15.2	17.2	19.7	21.6	23.4
2 hour	18.1	22.6	25.6	29.4	32.2	35.0
6 hour	32.7	41.5	47.3	54.7	60.1	65.5
12 hour	47.9	62.4	72.0	84.1	93.1	102.1
24 hour	59.5	78.2	90.6	106.2	117.9	129.4
90th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	5.3	7.3	8.6	10.3	11.6	12.8
10 min	7.0	9.5	11.1	13.2	14.8	16.3
15 min	8.0	10.7	12.5	14.8	16.4	18.1
30 min	10.5	13.7	15.8	18.4	20.3	22.3
1 hour	13.8	17.5	20.0	23.1	25.4	27.7
2 hour	20.5	26.1	29.8	34.5	38.0	41.5
6 hour	37.3	48.2	55.5	64.6	71.4	78.1
12 hour	55.5	73.5	85.4	100.6	111.8	122.9
24 hour	69.3	92.5	107.9	127.5	141.9	156.3

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Table 67: Median of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	2.7	3.7	4.3	5.2	5.8	6.4
10 min	3.9	5.6	6.7	8.0	9.1	10.1
15 min	4.8	6.7	8.0	9.6	10.8	12.0
30 min	6.6	8.8	10.2	12.0	13.4	14.8
1 hour	9.3	11.9	13.6	15.8	17.4	19.0
2 hour	13.5	16.7	18.8	21.5	23.5	25.4
6 hour	23.7	29.9	34.0	39.2	43.0	46.8
12 hour	32.4	40.9	46.5	53.7	59.0	64.2
24 hour	41.1	51.9	59.1	68.1	74.8	81.5
Projected IDF Data, 2041-2070 (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	3.7	4.8	5.5	6.4	7.0	7.7
10 min	5.6	7.4	8.5	10.0	11.1	12.2
15 min	6.8	8.8	10.2	11.9	13.2	14.4
30 min	8.8	11.1	12.7	14.6	16.1	17.5
1 hour	11.9	14.7	16.6	18.9	20.6	22.3
2 hour	16.8	20.2	22.4	25.3	27.4	29.5
6 hour	30.0	36.6	41.0	46.5	50.6	54.7
12 hour	41.1	50.2	56.2	63.8	69.5	75.1
24 hour	52.1	63.7	71.3	80.9	88.1	95.2
Projected IDF Data, 2071-2100 (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	4.3	5.6	6.5	7.6	8.5	9.3
10 min	6.5	8.8	10.2	12.1	13.5	14.9
15 min	7.9	10.5	12.2	14.4	16.0	17.6
30 min	10.0	13.0	15.0	17.4	19.3	21.1
1 hour	13.4	16.9	19.2	22.2	24.4	26.5
2 hour	18.6	22.9	25.7	29.3	32.0	34.7
6 hour	33.5	41.8	47.4	54.4	59.6	64.7
12 hour	45.8	57.4	65.0	74.7	81.8	89.0
24 hour	58.2	72.8	82.5	94.7	103.8	112.8

Table 68: 10th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	2.7	3.7	4.3	5.2	5.8	6.4
10 min	3.9	5.6	6.7	8.0	9.1	10.1
15 min	4.8	6.7	8.0	9.6	10.8	12.0
30 min	6.6	8.8	10.2	12.0	13.4	14.8
1 hour	9.3	11.9	13.6	15.8	17.4	19.0
2 hour	13.5	16.7	18.8	21.5	23.5	25.4
6 hour	23.7	29.9	34.0	39.2	43.0	46.8
12 hour	32.4	40.9	46.5	53.7	59.0	64.2
24 hour	41.1	51.9	59.1	68.1	74.8	81.5
10th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	3.4	4.4	5.1	5.9	6.6	7.2
10 min	5.0	6.7	7.9	9.3	10.3	11.4
15 min	6.1	8.1	9.4	11.1	12.3	13.5
30 min	8.0	10.3	11.8	13.7	15.1	16.5
1 hour	11.0	13.7	15.5	17.7	19.4	21.0
2 hour	15.6	18.9	21.1	23.9	25.9	27.9
6 hour	27.8	34.2	38.4	43.8	47.7	51.7
12 hour	38.0	46.9	52.7	60.0	65.5	70.9
24 hour	48.3	59.5	66.8	76.1	83.1	89.9
10th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	3.6	4.7	5.4	6.2	6.9	7.5
10 min	5.4	7.3	8.4	9.8	10.8	11.8
15 min	6.6	8.7	10.1	11.7	12.8	14.0
30 min	8.6	11.0	12.6	14.4	15.7	17.0
1 hour	11.7	14.5	16.4	18.5	20.1	21.7
2 hour	16.4	20.0	22.2	24.9	26.8	28.8
6 hour	29.3	36.2	40.6	45.7	49.5	53.3
12 hour	40.1	49.6	55.7	62.7	68.0	73.2
24 hour	50.9	62.9	70.6	79.6	86.2	92.8

Table 69: 90th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	**Return Interval (years)**					
	2	**5**	**10**	**25**	**50**	**100**
5 min	2.7	3.7	4.3	5.2	5.8	6.4
10 min	3.9	5.6	6.7	8.0	9.1	10.1
15 min	4.8	6.7	8.0	9.6	10.8	12.0
30 min	6.6	8.8	10.2	12.0	13.4	14.8
1 hour	9.3	11.9	13.6	15.8	17.4	19.0
2 hour	13.5	16.7	18.8	21.5	23.5	25.4
6 hour	23.7	29.9	34.0	39.2	43.0	46.8
12 hour	32.4	40.9	46.5	53.7	59.0	64.2
24 hour	41.1	51.9	59.1	68.1	74.8	81.5
90th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	**Return Interval (years)**					
	2	**5**	**10**	**25**	**50**	**100**
5 min	4.0	5.2	6.1	7.1	7.8	8.6
10 min	6.1	8.1	9.5	11.2	12.5	13.7
15 min	7.4	9.7	11.3	13.3	14.8	16.2
30 min	9.5	12.2	13.9	16.2	17.9	19.5
1 hour	12.8	15.9	18.0	20.7	22.7	24.7
2 hour	17.8	21.7	24.3	27.5	30.0	32.4
6 hour	32.0	39.5	44.5	50.9	55.7	60.4
12 hour	43.8	54.2	61.1	69.9	76.4	82.9
24 hour	55.6	68.7	77.5	88.7	96.9	105.1
90th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	**Return Interval (years)**					
	2	**5**	**10**	**25**	**50**	**100**
5 min	4.8	6.2	7.3	8.7	9.8	10.8
10 min	7.3	9.7	11.6	13.9	15.7	17.4
15 min	8.8	11.6	13.7	16.5	18.5	20.5
30 min	11.1	14.2	16.7	19.8	22.1	24.4
1 hour	14.7	18.4	21.3	25.0	27.8	30.5
2 hour	20.1	24.7	28.3	32.8	36.2	39.5
6 hour	36.5	45.4	52.3	61.1	67.7	74.2
12 hour	50.0	62.2	71.8	84.0	93.0	101.9
24 hour	63.4	79.0	91.1	106.5	117.9	129.2

Port-Aux-Basques

Table 70: Median of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	4.3	5.6	6.4	7.5	8.3	9.0
10 min	6.7	8.8	10.1	11.9	13.1	14.4
15 min	8.7	11.4	13.3	15.6	17.3	19.0
30 min	12.7	17.1	20.1	23.7	26.5	29.2
1 hour	17.5	22.8	26.3	30.7	34.0	37.2
2 hour	25.9	33.9	39.2	45.8	50.8	55.7
6 hour	41.6	53.9	62.1	72.4	80.1	87.7
12 hour	54.4	68.4	77.6	89.3	98.0	106.6
24 hour	67.1	84.9	96.6	111.4	122.4	133.3
Projected IDF Data, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	5.0	6.3	7.1	8.2	9.0	9.8
10 min	7.8	9.9	11.3	13.0	14.3	15.6
15 min	10.1	12.9	14.8	17.1	18.9	20.6
30 min	15.0	19.5	22.5	26.2	29.0	31.8
1 hour	20.2	25.6	29.1	33.7	37.0	40.3
2 hour	30.0	38.1	43.5	50.3	55.3	60.3
6 hour	47.9	60.5	68.8	79.4	87.2	95.0
12 hour	61.5	75.8	85.2	97.2	106.1	114.9
24 hour	76.2	94.3	106.2	121.4	132.6	143.7
Projected IDF Data, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	5.5	7.2	8.3	9.8	10.8	11.8
10 min	8.7	11.4	13.3	15.6	17.3	19.0
15 min	11.3	15.0	17.5	20.6	22.9	25.2
30 min	16.9	22.8	26.7	31.7	35.3	39.0
1 hour	22.5	29.6	34.2	40.2	44.6	48.9
2 hour	33.4	44.1	51.2	60.1	66.8	73.4
6 hour	53.2	69.8	80.8	94.6	104.9	115.2
12 hour	67.5	86.3	98.8	114.5	126.2	137.8
24 hour	83.8	107.6	123.4	143.3	158.1	172.7

Table 71: 10th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	4.3	5.6	6.4	7.5	8.3	9.0
10 min	6.7	8.8	10.1	11.9	13.1	14.4
15 min	8.7	11.4	13.3	15.6	17.3	19.0
30 min	12.7	17.1	20.1	23.7	26.5	29.2
1 hour	17.5	22.8	26.3	30.7	34.0	37.2
2 hour	25.9	33.9	39.2	45.8	50.8	55.7
6 hour	41.6	53.9	62.1	72.4	80.1	87.7
12 hour	54.4	68.4	77.6	89.3	98.0	106.6
24 hour	67.1	84.9	96.6	111.4	122.4	133.3
10th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	4.4	5.5	6.2	7.1	7.8	8.5
10 min	6.9	8.6	9.8	11.3	12.4	13.5
15 min	8.9	11.3	12.8	14.8	16.3	17.7
30 min	13.1	16.8	19.3	22.5	24.8	27.2
1 hour	17.9	22.4	25.4	29.2	32.0	34.8
2 hour	26.5	33.3	37.9	43.6	47.8	52.0
6 hour	42.5	53.1	60.1	69.0	75.5	82.0
12 hour	55.4	67.4	75.4	85.4	92.8	100.2
24 hour	68.4	83.7	93.7	106.4	115.9	125.2
10th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	5.2	6.8	7.9	9.2	10.2	11.1
10 min	8.1	10.8	12.5	14.6	16.2	17.8
15 min	10.6	14.1	16.4	19.3	21.5	23.6
30 min	15.8	21.4	25.1	29.7	33.1	36.5
1 hour	21.1	27.9	32.3	37.8	41.9	45.9
2 hour	31.4	41.7	48.2	56.6	62.7	68.8
6 hour	50.1	66.0	76.2	89.1	98.6	108.1
12 hour	64.0	82.0	93.6	108.2	119.1	129.8
24 hour	79.3	102.1	116.8	135.3	149.0	162.7

Table 72: 90th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	4.3	5.6	6.4	7.5	8.3	9.0
10 min	6.7	8.8	10.1	11.9	13.1	14.4
15 min	8.7	11.4	13.3	15.6	17.3	19.0
30 min	12.7	17.1	20.1	23.7	26.5	29.2
1 hour	17.5	22.8	26.3	30.7	34.0	37.2
2 hour	25.9	33.9	39.2	45.8	50.8	55.7
6 hour	41.6	53.9	62.1	72.4	80.1	87.7
12 hour	54.4	68.4	77.6	89.3	98.0	106.6
24 hour	67.1	84.9	96.6	111.4	122.4	133.3
90th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	5.4	6.9	7.9	9.2	10.1	11.0
10 min	8.5	11.0	12.6	14.6	16.1	17.6
15 min	11.1	14.4	16.5	19.3	21.3	23.3
30 min	16.6	21.8	25.2	29.6	32.8	36.0
1 hour	22.1	28.4	32.5	37.7	41.5	45.4
2 hour	32.9	42.3	48.5	56.4	62.2	68.0
6 hour	52.4	67.0	76.6	88.8	97.8	106.8
12 hour	66.6	83.1	94.1	107.9	118.1	128.3
24 hour	82.7	103.6	117.4	134.9	147.9	160.8
90th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	6.2	8.1	9.3	10.9	12.1	13.2
10 min	9.7	12.8	14.8	17.4	19.3	21.2
15 min	12.7	16.8	19.6	23.1	25.6	28.2
30 min	19.1	25.7	30.1	35.6	39.7	43.8
1 hour	25.2	33.1	38.3	44.9	49.8	54.7
2 hour	37.5	49.4	57.3	67.3	74.7	82.1
6 hour	59.5	78.0	90.3	105.8	117.2	128.6
12 hour	74.7	95.7	109.6	127.1	140.1	153.0
24 hour	92.9	119.4	137.0	159.2	175.7	192.1

Schefferville

Table 73: Median of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	3.7	5.5	6.7	8.3	9.4	10.6
10 min	5.2	7.6	9.2	11.1	12.6	14.1
15 min	6.0	8.6	10.3	12.4	13.9	15.5
30 min	7.5	10.4	12.4	14.8	16.7	18.5
1 hour	10.1	13.4	15.6	18.4	20.5	22.6
2 hour	13.4	17.4	20.0	23.3	25.8	28.3
6 hour	22.4	28.8	33.1	38.5	42.6	46.5
12 hour	28.9	37.1	42.5	49.4	54.5	59.6
24 hour	36.7	48.8	56.7	66.8	74.3	81.7
Projected IDF Data, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	5.0	7.3	8.8	10.7	12.2	13.6
10 min	6.9	9.8	11.8	14.3	16.1	17.9
15 min	7.8	11.0	13.1	15.7	17.7	19.7
30 min	9.5	13.2	15.7	18.8	21.1	23.4
1 hour	12.4	16.6	19.3	22.9	25.5	28.1
2 hour	16.1	21.1	24.4	28.6	31.7	34.8
6 hour	26.8	34.9	40.3	47.1	52.2	57.2
12 hour	34.5	44.8	51.7	60.3	66.8	73.1
24 hour	44.9	60.1	70.1	82.8	92.2	101.5
Projected IDF Data, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	5.6	8.0	9.5	11.5	13.0	14.4
10 min	7.7	10.7	12.7	15.3	17.2	19.0
15 min	8.6	11.9	14.1	16.8	18.8	20.8
30 min	10.5	14.3	16.8	20.0	22.4	24.7
1 hour	13.5	17.8	20.7	24.3	27.0	29.6
2 hour	17.5	22.6	26.0	30.3	33.5	36.7
6 hour	29.0	37.4	42.9	49.9	55.1	60.2
12 hour	37.3	47.9	55.0	63.8	70.4	77.0
24 hour	49.1	64.6	74.9	87.9	97.6	107.2

Table 74: 10th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	3.7	5.5	6.7	8.3	9.4	10.6
10 min	5.2	7.6	9.2	11.1	12.6	14.1
15 min	6.0	8.6	10.3	12.4	13.9	15.5
30 min	7.5	10.4	12.4	14.8	16.7	18.5
1 hour	10.1	13.4	15.6	18.4	20.5	22.6
2 hour	13.4	17.4	20.0	23.3	25.8	28.3
6 hour	22.4	28.8	33.1	38.5	42.6	46.5
12 hour	28.9	37.1	42.5	49.4	54.5	59.6
24 hour	36.7	48.8	56.7	66.8	74.3	81.7
10th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	4.4	6.2	7.4	9.0	10.1	11.2
10 min	6.2	8.5	10.1	12.0	13.5	14.9
15 min	7.1	9.6	11.2	13.3	14.9	16.4
30 min	8.7	11.6	13.5	15.9	17.7	19.5
1 hour	11.4	14.7	16.9	19.7	21.7	23.7
2 hour	15.0	18.9	21.5	24.8	27.3	29.7
6 hour	25.0	31.4	35.6	40.9	44.9	48.8
12 hour	32.2	40.3	45.7	52.5	57.5	62.5
24 hour	41.6	53.5	61.3	71.3	78.7	86.0
10th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	4.7	6.7	8.1	9.7	10.9	12.2
10 min	6.6	9.2	10.9	13.0	14.6	16.1
15 min	7.5	10.2	12.1	14.3	16.0	17.7
30 min	9.1	12.4	14.5	17.2	19.1	21.1
1 hour	12.0	15.6	18.0	21.0	23.3	25.5
2 hour	15.7	20.0	22.9	26.5	29.1	31.8
6 hour	26.1	33.1	37.8	43.6	47.9	52.2
12 hour	33.5	42.5	48.4	55.8	61.3	66.8
24 hour	43.6	56.7	65.4	76.2	84.3	92.2

Table 75: 90th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	3.7	5.5	6.7	8.3	9.4	10.6
10 min	5.2	7.6	9.2	11.1	12.6	14.1
15 min	6.0	8.6	10.3	12.4	13.9	15.5
30 min	7.5	10.4	12.4	14.8	16.7	18.5
1 hour	10.1	13.4	15.6	18.4	20.5	22.6
2 hour	13.4	17.4	20.0	23.3	25.8	28.3
6 hour	22.4	28.8	33.1	38.5	42.6	46.5
12 hour	28.9	37.1	42.5	49.4	54.5	59.6
24 hour	36.7	48.8	56.7	66.8	74.3	81.7
90th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	5.6	8.7	10.7	13.2	15.1	17.0
10 min	7.7	11.6	14.2	17.5	20.0	22.4
15 min	8.7	12.9	15.7	19.2	21.8	24.4
30 min	10.5	15.4	18.7	22.8	25.9	28.9
1 hour	13.5	19.1	22.8	27.4	30.9	34.3
2 hour	17.5	24.2	28.5	34.1	38.2	42.3
6 hour	29.1	39.9	47.0	56.0	62.7	69.3
12 hour	37.4	51.1	60.1	71.6	80.1	88.6
24 hour	49.2	69.2	82.5	99.3	111.8	124.1
90th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	7.2	9.8	11.6	13.8	15.6	17.5
10 min	9.7	13.1	15.4	18.3	20.6	22.9
15 min	10.8	14.5	16.9	20.0	22.5	25.0
30 min	13.0	17.3	20.2	23.8	26.7	29.6
1 hour	16.4	21.2	24.5	28.5	31.8	35.1
2 hour	20.9	26.7	30.5	35.4	39.3	43.2
6 hour	34.6	44.0	50.3	58.1	64.4	70.9
12 hour	44.4	56.4	64.3	74.3	82.3	90.5
24 hour	59.5	77.0	88.6	103.3	115.0	127.0

St. Alban's

Table 76: Median of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	4.6	5.9	6.8	7.9	8.7	9.5
10 min	7.0	8.8	9.9	11.4	12.5	13.6
15 min	8.7	11.0	12.5	14.5	15.9	17.3
30 min	12.6	15.0	16.7	18.7	20.2	21.7
1 hour	17.4	20.9	23.1	26.0	28.1	30.2
2 hour	26.6	30.2	32.5	35.6	37.8	40.0
6 hour	47.5	53.1	56.8	61.5	64.9	68.4
12 hour	64.3	77.0	85.4	96.1	104.0	111.8
24 hour	81.7	106.3	122.7	143.3	158.7	173.9
Projected IDF Data, 2041-2070 (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	5.2	7.0	8.1	9.6	10.7	11.8
10 min	7.8	10.2	11.7	13.7	15.2	16.6
15 min	9.8	12.9	14.9	17.4	19.3	21.2
30 min	13.7	17.0	19.2	21.9	23.9	25.9
1 hour	19.0	23.6	26.6	30.4	33.3	36.1
2 hour	28.2	33.0	36.2	40.2	43.2	46.2
6 hour	50.1	57.6	62.5	68.8	73.5	78.1
12 hour	70.2	87.2	98.4	112.6	123.1	133.5
24 hour	93.1	126.0	147.8	175.3	195.7	216.0
Projected IDF Data, 2071-2100 (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	5.4	7.2	8.3	9.8	10.9	11.9
10 min	8.1	10.4	12.0	14.0	15.4	16.9
15 min	10.1	13.2	15.2	17.7	19.6	21.5
30 min	14.1	17.3	19.5	22.2	24.2	26.2
1 hour	19.5	24.1	27.1	30.9	33.7	36.5
2 hour	28.7	33.5	36.7	40.7	43.7	46.6
6 hour	50.9	58.4	63.3	69.5	74.2	78.8
12 hour	72.0	88.9	100.1	114.3	124.8	135.2
24 hour	96.6	129.4	151.1	178.6	199.0	219.2

Table 77: 10th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	4.6	5.9	6.8	7.9	8.7	9.5
10 min	7.0	8.8	9.9	11.4	12.5	13.6
15 min	8.7	11.0	12.5	14.5	15.9	17.3
30 min	12.6	15.0	16.7	18.7	20.2	21.7
1 hour	17.4	20.9	23.1	26.0	28.1	30.2
2 hour	26.6	30.2	32.5	35.6	37.8	40.0
6 hour	47.5	53.1	56.8	61.5	64.9	68.4
12 hour	64.3	77.0	85.4	96.1	104.0	111.8
24 hour	81.7	106.3	122.7	143.3	158.7	173.9
10th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	4.9	6.4	7.4	8.7	9.6	10.6
10 min	7.3	9.4	10.8	12.5	13.7	15.0
15 min	9.2	11.8	13.6	15.8	17.4	19.1
30 min	13.0	15.9	17.8	20.1	21.9	23.6
1 hour	18.1	22.1	24.7	28.0	30.4	32.9
2 hour	27.2	31.4	34.2	37.7	40.2	42.8
6 hour	48.5	55.1	59.4	64.8	68.9	72.8
12 hour	66.7	81.5	91.2	103.5	112.6	121.6
24 hour	86.2	115.1	133.9	157.7	175.3	192.8
10th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	5.0	6.6	7.7	9.0	10.0	11.0
10 min	7.5	9.7	11.1	12.9	14.3	15.6
15 min	9.4	12.2	14.1	16.4	18.2	19.9
30 min	13.3	16.3	18.3	20.8	22.7	24.5
1 hour	18.4	22.6	25.4	28.9	31.5	34.1
2 hour	27.5	32.0	34.9	38.6	41.4	44.1
6 hour	49.0	56.0	60.6	66.4	70.6	74.9
12 hour	67.8	83.6	93.9	107.0	116.6	126.2
24 hour	88.4	119.1	139.2	164.4	183.2	201.8

Table 78: 90th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	**Return Interval (years)**					
	2	**5**	**10**	**25**	**50**	**100**
5 min	4.6	5.9	6.8	7.9	8.7	9.5
10 min	7.0	8.8	9.9	11.4	12.5	13.6
15 min	8.7	11.0	12.5	14.5	15.9	17.3
30 min	12.6	15.0	16.7	18.7	20.2	21.7
1 hour	17.4	20.9	23.1	26.0	28.1	30.2
2 hour	26.6	30.2	32.5	35.6	37.8	40.0
6 hour	47.5	53.1	56.8	61.5	64.9	68.4
12 hour	64.3	77.0	85.4	96.1	104.0	111.8
24 hour	81.7	106.3	122.7	143.3	158.7	173.9
90th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	**Return Interval (years)**					
	2	**5**	**10**	**25**	**50**	**100**
5 min	5.5	7.4	8.7	10.4	11.6	12.8
10 min	8.2	10.8	12.5	14.7	16.4	18.0
15 min	10.3	13.6	15.9	18.8	20.9	23.0
30 min	14.2	17.8	20.3	23.3	25.6	27.8
1 hour	19.7	24.8	28.1	32.4	35.6	38.7
2 hour	28.9	34.3	37.8	42.3	45.7	49.0
6 hour	51.2	59.5	65.0	72.1	77.3	82.4
12 hour	72.8	91.6	104.1	120.0	131.8	143.5
24 hour	98.1	134.6	158.9	189.7	212.6	235.3
90th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	**Return Interval (years)**					
	2	**5**	**10**	**25**	**50**	**100**
5 min	5.7	7.6	8.9	10.6	11.9	13.1
10 min	8.5	11.0	12.8	15.1	16.8	18.5
15 min	10.6	13.9	16.2	19.2	21.4	23.6
30 min	14.6	18.1	20.6	23.8	26.1	28.5
1 hour	20.2	25.1	28.6	33.1	36.4	39.6
2 hour	29.5	34.6	38.3	43.0	46.5	49.9
6 hour	52.1	60.1	65.8	73.0	78.4	83.8
12 hour	74.7	92.9	105.9	122.4	134.6	146.8
24 hour	101.8	137.1	162.3	194.3	218.1	241.7

St. Anthony

Table 79: Median of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	NA	NA	NA	NA	NA	NA
10 min	NA	NA	NA	NA	NA	NA
15 min	NA	NA	NA	NA	NA	NA
30 min	NA	NA	NA	NA	NA	NA
1 hour	18.8	24.9	29.0	34.1	37.9	41.7
2 hour	21.9	27.2	30.7	35.0	38.3	41.5
6 hour	32.9	39.7	44.3	50.0	54.3	58.5
12 hour	43.1	49.2	53.2	58.2	61.9	65.7
24 hour	49.2	57.0	62.1	68.6	73.4	78.2
Projected IDF Data, 2041-2070 (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	NaN	NaN	NaN	NaN	NaN	NaN
10 min	NaN	NaN	NaN	NaN	NaN	NaN
15 min	NaN	NaN	NaN	NaN	NaN	NaN
30 min	NaN	NaN	NaN	NaN	NaN	NaN
1 hour	24.2	32.8	38.4	45.6	50.9	56.1
2 hour	26.6	33.9	38.8	44.9	49.4	53.9
6 hour	39.0	48.6	54.9	62.9	68.9	74.8
12 hour	48.5	56.9	62.5	69.5	74.7	79.9
24 hour	56.1	66.9	74.1	83.1	89.9	96.5
Projected IDF Data, 2071-2100 (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	NaN	NaN	NaN	NaN	NaN	NaN
10 min	NaN	NaN	NaN	NaN	NaN	NaN
15 min	NaN	NaN	NaN	NaN	NaN	NaN
30 min	NaN	NaN	NaN	NaN	NaN	NaN
1 hour	30.9	42.2	49.7	59.2	66.2	73.2
2 hour	32.3	42.0	48.4	56.5	62.5	68.5
6 hour	46.4	59.1	67.5	78.1	86.0	93.8
12 hour	55.0	66.2	73.6	82.9	89.8	96.7
24 hour	64.5	78.9	88.4	100.4	109.3	118.1

Table 80: 10th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	NA	NA	NA	NA	NA	NA
10 min	NA	NA	NA	NA	NA	NA
15 min	NA	NA	NA	NA	NA	NA
30 min	NA	NA	NA	NA	NA	NA
1 hour	18.8	24.9	29.0	34.1	37.9	41.7
2 hour	21.9	27.2	30.7	35.0	38.3	41.5
6 hour	32.9	39.7	44.3	50.0	54.3	58.5
12 hour	43.1	49.2	53.2	58.2	61.9	65.7
24 hour	49.2	57.0	62.1	68.6	73.4	78.2
10th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	NA	NA	NA	NA	NA	NA
10 min	NA	NA	NA	NA	NA	NA
15 min	NA	NA	NA	NA	NA	NA
30 min	NA	NA	NA	NA	NA	NA
1 hour	17.1	23.2	27.2	32.2	36.0	39.7
2 hour	20.5	25.7	29.1	33.5	36.7	39.8
6 hour	31.0	37.8	42.3	47.9	52.1	56.3
12 hour	41.5	47.5	51.4	56.4	60.1	63.7
24 hour	47.1	54.8	59.8	66.2	71.0	75.7
10th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	NA	NA	NA	NA	NA	NA
10 min	NA	NA	NA	NA	NA	NA
15 min	NA	NA	NA	NA	NA	NA
30 min	NA	NA	NA	NA	NA	NA
1 hour	20.5	26.9	31.2	36.6	40.6	44.6
2 hour	23.4	28.9	32.6	37.2	40.6	44.0
6 hour	34.7	42.0	46.8	52.8	57.3	61.8
12 hour	44.8	51.1	55.3	60.7	64.6	68.5
24 hour	51.3	59.5	64.9	71.8	76.8	81.9

Table 81: 90th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	NA	NA	NA	NA	NA	NA
10 min	NA	NA	NA	NA	NA	NA
15 min	NA	NA	NA	NA	NA	NA
30 min	NA	NA	NA	NA	NA	NA
1 hour	19.1	26.3	31.1	37.2	41.6	46.1
2 hour	22.2	28.3	32.3	37.4	41.2	44.9
6 hour	33.3	41.5	46.9	53.7	58.8	63.8
12 hour	43.5	50.1	54.5	60.0	64.1	68.2
24 hour	49.9	59.1	65.2	72.9	78.6	84.3
90th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	NA	NA	NA	NA	NA	NA
10 min	NA	NA	NA	NA	NA	NA
15 min	NA	NA	NA	NA	NA	NA
30 min	NA	NA	NA	NA	NA	NA
1 hour	31.2	41.5	48.3	56.9	63.3	69.6
2 hour	32.5	41.3	47.2	54.6	60.0	65.5
6 hour	46.7	58.3	65.9	75.6	82.7	89.9
12 hour	55.3	65.5	72.2	80.7	87.0	93.2
24 hour	64.9	77.9	86.6	97.5	105.6	113.6
90th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	NA	NA	NA	NA	NA	NA
10 min	NA	NA	NA	NA	NA	NA
15 min	NA	NA	NA	NA	NA	NA
30 min	NA	NA	NA	NA	NA	NA
1 hour	41.7	57.2	67.4	80.3	90.0	99.7
2 hour	41.6	54.8	63.6	74.6	82.9	91.2
6 hour	58.5	75.9	87.4	101.9	112.7	123.5
12 hour	65.7	80.9	91.0	103.8	113.3	122.8
24 hour	78.2	97.8	110.8	127.1	139.4	151.6

Stephenville

Table 82: Median of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	4.5	6.2	7.3	8.7	9.7	10.7
10 min	6.7	9.4	11.1	13.4	15.0	16.7
15 min	8.4	11.6	13.7	16.4	18.3	20.3
30 min	12.1	16.7	19.8	23.7	26.6	29.5
1 hour	16.8	22.6	26.5	31.3	34.9	38.5
2 hour	22.8	29.6	34.1	39.8	44.1	48.2
6 hour	38.5	50.1	57.7	67.4	74.6	81.8
12 hour	47.5	61.6	71.0	82.8	91.6	100.3
24 hour	59.8	79.4	92.4	108.8	120.9	133.0
Projected IDF Data, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	5.4	7.1	8.3	9.8	10.9	12.0
10 min	8.1	10.9	12.8	15.2	16.9	18.7
15 min	10.1	13.4	15.7	18.5	20.6	22.7
30 min	14.5	19.4	22.7	26.9	30.0	33.0
1 hour	19.8	26.0	30.0	35.2	39.1	42.9
2 hour	26.3	33.6	38.4	44.4	48.9	53.4
6 hour	44.4	56.7	64.9	75.2	82.9	90.5
12 hour	54.7	69.7	79.7	92.3	101.6	110.9
24 hour	69.8	90.7	104.5	121.9	134.9	147.7
Projected IDF Data, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	6.2	8.6	10.2	12.1	13.6	15.1
10 min	9.5	13.2	15.7	18.9	21.2	23.6
15 min	11.7	16.2	19.2	22.9	25.7	28.5
30 min	16.9	23.5	27.9	33.4	37.5	41.6
1 hour	22.8	31.0	36.4	43.3	48.4	53.5
2 hour	29.8	39.5	45.9	53.9	59.9	65.8
6 hour	50.4	66.8	77.7	91.5	101.7	111.8
12 hour	62.0	82.0	95.3	112.1	124.5	136.9
24 hour	79.9	107.7	126.1	149.4	166.6	183.7

Table 83: 10th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	**Return Interval (years)**					
	2	**5**	**10**	**25**	**50**	**100**
5 min	4.5	6.2	7.3	8.7	9.7	10.7
10 min	6.7	9.4	11.1	13.4	15.0	16.7
15 min	8.4	11.6	13.7	16.4	18.3	20.3
30 min	12.1	16.7	19.8	23.7	26.6	29.5
1 hour	16.8	22.6	26.5	31.3	34.9	38.5
2 hour	22.8	29.6	34.1	39.8	44.1	48.2
6 hour	38.5	50.1	57.7	67.4	74.6	81.8
12 hour	47.5	61.6	71.0	82.8	91.6	100.3
24 hour	59.8	79.4	92.4	108.8	120.9	133.0
10th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	**Return Interval (years)**					
	2	**5**	**10**	**25**	**50**	**100**
5 min	4.8	6.6	7.6	8.7	9.6	10.4
10 min	7.2	10.1	11.6	13.4	14.8	16.1
15 min	8.9	12.5	14.2	16.4	18.0	19.6
30 min	12.8	18.0	20.6	23.8	26.2	28.5
1 hour	17.8	24.2	27.4	31.4	34.4	37.3
2 hour	23.9	31.5	35.3	39.9	43.4	46.8
6 hour	40.3	53.2	59.6	67.6	73.5	79.4
12 hour	49.8	65.4	73.3	83.0	90.2	97.3
24 hour	63.0	84.7	95.6	109.0	119.0	128.9
10th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	**Return Interval (years)**					
	2	**5**	**10**	**25**	**50**	**100**
5 min	5.7	7.7	8.9	10.3	11.4	12.5
10 min	8.6	11.8	13.6	16.0	17.7	19.4
15 min	10.7	14.5	16.7	19.5	21.5	23.6
30 min	15.4	21.0	24.2	28.3	31.4	34.4
1 hour	21.0	27.9	31.9	37.0	40.8	44.5
2 hour	27.7	35.8	40.5	46.5	50.9	55.3
6 hour	46.8	60.6	68.6	78.8	86.4	93.8
12 hour	57.7	74.4	84.2	96.6	105.8	115.0
24 hour	73.9	97.2	110.8	128.0	140.8	153.4

Table 84: 90th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	4.5	6.2	7.3	8.7	9.7	10.7
10 min	6.7	9.4	11.1	13.4	15.0	16.7
15 min	8.4	11.6	13.7	16.4	18.3	20.3
30 min	12.1	16.7	19.8	23.7	26.6	29.5
1 hour	16.8	22.6	26.5	31.3	34.9	38.5
2 hour	22.8	29.6	34.1	39.8	44.1	48.2
6 hour	38.5	50.1	57.7	67.4	74.6	81.8
12 hour	47.5	61.6	71.0	82.8	91.6	100.3
24 hour	59.8	79.4	92.4	108.8	120.9	133.0
90th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	5.8	7.5	8.8	10.5	11.7	12.9
10 min	8.7	11.6	13.6	16.2	18.2	20.1
15 min	10.8	14.2	16.7	19.8	22.1	24.4
30 min	15.6	20.6	24.2	28.7	32.1	35.5
1 hour	21.2	27.4	31.8	37.5	41.7	45.9
2 hour	28.0	35.2	40.4	47.1	52.0	57.0
6 hour	47.2	59.5	68.5	79.8	88.2	96.6
12 hour	58.1	73.2	84.0	97.8	108.1	118.4
24 hour	74.6	95.4	110.5	129.6	143.9	158.1
90th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	6.8	9.5	11.4	13.8	15.7	17.5
10 min	10.4	14.6	17.7	21.6	24.5	27.4
15 min	12.8	17.8	21.5	26.2	29.6	33.1
30 min	18.5	25.9	31.3	38.2	43.3	48.4
1 hour	24.8	34.0	40.7	49.3	55.6	61.9
2 hour	32.2	43.0	50.9	60.9	68.3	75.7
6 hour	54.4	72.8	86.3	103.3	116.0	128.5
12 hour	66.9	89.4	105.8	126.6	142.0	157.3
24 hour	86.7	117.9	140.7	169.5	190.8	212.0

St. John's

Table 85: Median of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	4.6	6.2	7.3	8.6	9.6	10.6
10 min	7.0	9.3	10.8	12.7	14.1	15.5
15 min	8.9	11.8	13.7	16.1	17.8	19.6
30 min	13.0	17.1	19.8	23.2	25.7	28.2
1 hour	18.7	24.6	28.5	33.5	37.1	40.7
2 hour	25.8	34.1	39.5	46.4	51.5	56.6
6 hour	44.1	56.1	64.1	74.1	81.6	89.0
12 hour	56.2	71.3	81.3	94.0	103.4	112.7
24 hour	67.1	84.9	96.7	111.6	122.7	133.7
Projected IDF Data, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	5.7	7.6	8.8	10.4	11.5	12.6
10 min	8.6	11.2	12.9	15.1	16.8	18.4
15 min	10.9	14.2	16.4	19.2	21.3	23.3
30 min	15.9	20.5	23.6	27.6	30.5	33.4
1 hour	22.8	29.7	34.2	39.9	44.1	48.3
2 hour	31.5	41.1	47.4	55.4	61.4	67.2
6 hour	52.5	66.4	75.6	87.3	95.9	104.5
12 hour	66.7	84.2	95.9	110.5	121.4	132.2
24 hour	79.5	100.1	113.8	131.1	144.0	156.7
Projected IDF Data, 2071-2100. (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	6.1	8.1	9.4	11.1	12.4	13.6
10 min	9.1	11.9	13.8	16.2	18.0	19.8
15 min	11.5	15.1	17.5	20.6	22.8	25.1
30 min	16.7	21.8	25.2	29.5	32.7	35.9
1 hour	24.1	31.5	36.5	42.7	47.4	52.0
2 hour	33.3	43.7	50.7	59.4	65.9	72.4
6 hour	55.0	70.2	80.3	93.1	102.5	111.9
12 hour	69.9	89.1	101.8	117.9	129.8	141.6
24 hour	83.2	105.8	120.8	139.8	153.8	167.8

Table 86: 10th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	**Return Interval (years)**					
	2	**5**	**10**	**25**	**50**	**100**
5 min	4.6	6.2	7.3	8.6	9.6	10.6
10 min	7.0	9.3	10.8	12.7	14.1	15.5
15 min	8.9	11.8	13.7	16.1	17.8	19.6
30 min	13.0	17.1	19.8	23.2	25.7	28.2
1 hour	18.7	24.6	28.5	33.5	37.1	40.7
2 hour	25.8	34.1	39.5	46.4	51.5	56.6
6 hour	44.1	56.1	64.1	74.1	81.6	89.0
12 hour	56.2	71.3	81.3	94.0	103.4	112.7
24 hour	67.1	84.9	96.7	111.6	122.7	133.7
10th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	**Return Interval (years)**					
	2	**5**	**10**	**25**	**50**	**100**
5 min	5.3	7.0	8.2	9.6	10.7	11.8
10 min	7.9	10.4	12.1	14.1	15.7	17.2
15 min	10.1	13.2	15.3	17.9	19.8	21.8
30 min	14.7	19.1	22.1	25.8	28.5	31.2
1 hour	21.2	27.6	31.9	37.2	41.2	45.1
2 hour	29.2	38.2	44.2	51.7	57.3	62.8
6 hour	49.1	62.2	70.9	81.9	90.0	98.0
12 hour	62.5	79.0	89.9	103.7	113.9	124.0
24 hour	74.5	94.0	106.9	123.1	135.1	147.1
10th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	**Return Interval (years)**					
	2	**5**	**10**	**25**	**50**	**100**
5 min	5.3	7.4	8.7	10.4	11.7	13.0
10 min	8.0	10.9	12.9	15.3	17.1	18.8
15 min	10.2	13.9	16.3	19.4	21.6	23.9
30 min	14.9	20.1	23.5	27.8	31.0	34.2
1 hour	21.4	29.0	33.9	40.2	44.9	49.5
2 hour	29.6	40.1	47.1	55.9	62.4	68.9
6 hour	49.6	65.0	75.1	87.9	97.4	106.8
12 hour	63.1	82.5	95.3	111.4	123.3	135.2
24 hour	75.2	98.1	113.1	132.2	146.3	160.3

Table 87: 90th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	4.6	6.2	7.3	8.6	9.6	10.6
10 min	7.0	9.3	10.8	12.7	14.1	15.5
15 min	8.9	11.8	13.7	16.1	17.8	19.6
30 min	13.0	17.1	19.8	23.2	25.7	28.2
1 hour	18.7	24.6	28.5	33.5	37.1	40.7
2 hour	25.8	34.1	39.5	46.4	51.5	56.6
6 hour	44.1	56.1	64.1	74.1	81.6	89.0
12 hour	56.2	71.3	81.3	94.0	103.4	112.7
24 hour	67.1	84.9	96.7	111.6	122.7	133.7
90th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	6.4	8.6	10.0	11.9	13.2	14.6
10 min	9.5	12.6	14.7	17.3	19.2	21.1
15 min	12.1	16.0	18.6	21.9	24.3	26.8
30 min	17.6	23.1	26.8	31.4	34.8	38.3
1 hour	25.3	33.4	38.7	45.5	50.5	55.4
2 hour	35.0	46.3	53.8	63.2	70.3	77.2
6 hour	57.5	74.0	84.9	98.7	108.9	119.0
12 hour	73.1	93.8	107.5	124.9	137.8	150.5
24 hour	87.0	111.4	127.6	148.1	163.3	178.3
90th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	Return Interval (years)					
	2	5	10	25	50	100
5 min	6.4	8.6	10.1	12.0	13.4	14.8
10 min	9.5	12.7	14.8	17.5	19.5	21.4
15 min	12.1	16.1	18.8	22.2	24.7	27.1
30 min	17.6	23.2	27.0	31.7	35.3	38.8
1 hour	25.3	33.5	39.0	46.0	51.1	56.2
2 hour	35.0	46.5	54.2	63.9	71.1	78.3
6 hour	57.5	74.3	85.5	99.6	110.1	120.6
12 hour	73.1	94.2	108.3	126.1	139.3	152.5
24 hour	87.0	111.9	128.5	149.5	165.1	180.6

St. Lawrence

Table 88: Median of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	5.5	6.6	7.3	8.3	9.0	9.7
10 min	8.5	10.5	11.8	13.5	14.8	16.0
15 min	10.6	13.4	15.2	17.5	19.2	20.8
30 min	15.8	20.4	23.5	27.4	30.3	33.1
1 hour	23.1	30.0	34.6	40.5	44.8	49.0
2 hour	32.5	42.0	48.3	56.2	62.1	68.0
6 hour	51.6	65.8	75.1	87.0	95.7	104.5
12 hour	62.6	76.8	86.3	98.2	107.0	115.8
24 hour	71.0	88.1	99.3	113.6	124.2	134.7
Projected IDF Data, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	6.2	7.7	8.7	9.9	10.9	11.8
10 min	9.9	12.5	14.3	16.5	18.1	19.7
15 min	12.5	16.1	18.5	21.5	23.7	25.9
30 min	19.0	25.1	29.1	34.2	38.0	41.8
1 hour	27.8	37.0	43.0	50.7	56.4	62.0
2 hour	39.0	51.5	59.7	70.2	78.0	85.7
6 hour	61.2	79.9	92.2	107.8	119.4	130.9
12 hour	72.3	91.1	103.5	119.2	130.8	142.4
24 hour	82.6	105.1	120.0	138.8	152.7	166.5
Projected IDF Data, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	6.7	8.5	9.6	11.1	12.2	13.2
10 min	10.7	13.8	15.9	18.5	20.4	22.3
15 min	13.6	17.9	20.7	24.2	26.9	29.5
30 min	20.9	28.1	32.9	38.9	43.3	47.7
1 hour	30.8	41.5	48.7	57.7	64.3	71.0
2 hour	43.0	57.7	67.4	79.7	88.8	97.9
6 hour	67.3	89.2	103.7	122.0	135.6	149.1
12 hour	78.4	100.4	115.0	133.5	147.1	160.7
24 hour	89.9	116.3	133.8	155.9	172.2	188.5

Table 89: 10th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	5.5	6.6	7.3	8.3	9.0	9.7
10 min	8.5	10.5	11.8	13.5	14.8	16.0
15 min	10.6	13.4	15.2	17.5	19.2	20.8
30 min	15.8	20.4	23.5	27.4	30.3	33.1
1 hour	23.1	30.0	34.6	40.5	44.8	49.0
2 hour	32.5	42.0	48.3	56.2	62.1	68.0
6 hour	51.6	65.8	75.1	87.0	95.7	104.5
12 hour	62.6	76.8	86.3	98.2	107.0	115.8
24 hour	71.0	88.1	99.3	113.6	124.2	134.7
10th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	5.8	7.1	7.9	9.0	9.8	10.6
10 min	9.0	11.4	12.9	14.9	16.3	17.7
15 min	11.3	14.5	16.6	19.3	21.2	23.2
30 min	17.1	22.4	26.0	30.5	33.8	37.1
1 hour	25.0	33.0	38.3	45.1	50.1	55.0
2 hour	35.0	46.0	53.3	62.5	69.4	76.1
6 hour	55.4	71.8	82.7	96.4	106.6	116.7
12 hour	66.4	82.9	93.9	107.7	117.9	128.1
24 hour	75.6	95.4	108.4	125.0	137.2	149.4
10th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	6.3	7.9	8.9	10.2	11.1	12.1
10 min	10.0	12.8	14.6	16.9	18.6	20.3
15 min	12.7	16.5	18.9	22.1	24.4	26.7
30 min	19.4	25.7	29.9	35.2	39.1	43.0
1 hour	28.4	37.9	44.2	52.1	58.0	63.9
2 hour	39.8	52.7	61.3	72.2	80.2	88.2
6 hour	62.5	81.8	94.6	110.7	122.7	134.6
12 hour	73.5	93.0	105.8	122.1	134.2	146.2
24 hour	84.1	107.4	122.8	142.3	156.7	171.1

Table 90: 90th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	5.5	6.6	7.3	8.3	9.0	9.7
10 min	8.5	10.5	11.8	13.5	14.8	16.0
15 min	10.6	13.4	15.2	17.5	19.2	20.8
30 min	15.8	20.4	23.5	27.4	30.3	33.1
1 hour	23.1	30.0	34.6	40.5	44.8	49.0
2 hour	32.5	42.0	48.3	56.2	62.1	68.0
6 hour	51.6	65.8	75.1	87.0	95.7	104.5
12 hour	62.6	76.8	86.3	98.2	107.0	115.8
24 hour	71.0	88.1	99.3	113.6	124.2	134.7
90th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	6.8	8.7	9.9	11.4	12.6	13.7
10 min	10.9	14.2	16.4	19.1	21.1	23.2
15 min	13.9	18.4	21.3	25.1	27.9	30.6
30 min	21.4	29.0	34.0	40.3	45.0	49.7
1 hour	31.5	42.8	50.3	59.8	66.9	73.9
2 hour	43.9	59.5	69.7	82.7	92.3	101.9
6 hour	68.7	91.8	107.1	126.4	140.8	155.0
12 hour	79.8	103.0	118.4	137.9	152.3	166.7
24 hour	91.6	119.4	137.9	161.2	178.5	195.6
90th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	7.1	9.2	10.6	12.4	13.7	15.0
10 min	11.5	15.2	17.7	20.8	23.2	25.5
15 min	14.6	19.7	23.1	27.4	30.6	33.8
30 min	22.6	31.3	37.0	44.3	49.6	55.0
1 hour	33.3	46.3	54.9	65.8	73.8	81.8
2 hour	46.4	64.2	75.9	90.8	101.8	112.7
6 hour	72.4	98.8	116.3	138.5	154.9	171.3
12 hour	83.5	110.1	127.7	150.0	166.6	183.0
24 hour	96.1	127.9	149.0	175.7	195.5	215.2

Twillingate

Table 91: Median of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	5.1	6.7	7.8	9.2	10.2	11.2
10 min	8.2	11.9	14.3	17.4	19.7	22.0
15 min	9.8	14.8	18.2	22.3	25.5	28.5
30 min	12.2	16.6	19.5	23.2	25.9	28.6
1 hour	17.8	22.0	24.9	28.4	31.1	33.7
2 hour	25.4	30.0	33.1	36.9	39.8	42.6
6 hour	35.9	41.7	45.6	50.4	54.0	57.5
12 hour	44.0	53.3	59.4	67.2	72.9	78.6
24 hour	52.5	65.8	74.6	85.7	93.9	102.1
Projected IDF Data, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	6.6	8.5	9.7	11.3	12.5	13.6
10 min	11.5	15.9	18.7	22.4	25.0	27.7
15 min	14.1	19.8	23.5	28.2	31.7	35.2
30 min	16.2	21.5	25.0	29.4	32.6	35.9
1 hour	23.0	29.6	34.0	39.5	43.6	47.7
2 hour	30.8	37.7	42.2	48.0	52.2	56.4
6 hour	43.3	52.4	58.5	66.2	71.9	77.5
12 hour	53.7	66.2	74.5	84.9	92.6	100.3
24 hour	64.7	80.6	91.1	104.3	114.2	124.0
Projected IDF Data, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	7.1	9.1	10.5	12.2	13.5	14.8
10 min	12.7	17.4	20.5	24.5	27.4	30.3
15 min	15.6	21.8	25.9	31.0	34.8	38.6
30 min	17.6	23.4	27.2	32.0	35.5	39.0
1 hour	24.8	32.0	36.8	42.8	47.3	51.7
2 hour	32.7	40.1	45.1	51.3	56.0	60.6
6 hour	45.7	55.7	62.3	70.7	76.9	83.1
12 hour	57.1	70.7	79.7	91.0	99.5	107.8
24 hour	68.9	86.2	97.7	112.2	122.9	133.5

Table 92: 10th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	5.1	6.7	7.8	9.2	10.2	11.2
10 min	8.2	11.9	14.3	17.4	19.7	22.0
15 min	9.8	14.8	18.2	22.3	25.5	28.5
30 min	12.2	16.6	19.5	23.2	25.9	28.6
1 hour	17.8	22.0	24.9	28.4	31.1	33.7
2 hour	25.4	30.0	33.1	36.9	39.8	42.6
6 hour	35.9	41.7	45.6	50.4	54.0	57.5
12 hour	44.0	53.3	59.4	67.2	72.9	78.6
24 hour	52.5	65.8	74.6	85.7	93.9	102.1
10th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	6.1	8.1	9.5	11.2	12.4	13.5
10 min	10.4	15.0	18.1	21.9	24.5	27.1
15 min	12.8	19.1	23.2	28.5	32.1	35.6
30 min	14.8	20.3	24.0	28.5	31.7	34.8
1 hour	20.3	25.7	29.2	33.6	36.7	39.7
2 hour	28.2	33.9	37.7	42.5	45.8	49.0
6 hour	39.4	46.6	51.4	57.4	61.6	65.6
12 hour	49.5	61.1	68.8	78.5	85.1	91.6
24 hour	60.4	77.0	88.0	101.8	111.4	120.6
10th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	6.4	8.5	9.9	11.7	13.0	14.3
10 min	11.0	15.8	18.9	22.9	25.9	28.8
15 min	13.6	20.1	24.4	29.8	33.9	37.8
30 min	15.5	21.2	25.0	29.8	33.3	36.8
1 hour	21.0	26.6	30.2	34.8	38.2	41.6
2 hour	28.9	34.9	38.8	43.8	47.4	51.1
6 hour	40.3	47.8	52.8	59.0	63.7	68.2
12 hour	51.0	63.1	71.0	81.0	88.4	95.8
24 hour	62.6	79.8	91.2	105.5	116.1	126.6

Table 93: Median of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	5.1	6.7	7.8	9.2	10.2	11.2
10 min	8.2	11.9	14.3	17.4	19.7	22.0
15 min	9.8	14.8	18.2	22.3	25.5	28.5
30 min	12.2	16.6	19.5	23.2	25.9	28.6
1 hour	17.8	22.0	24.9	28.4	31.1	33.7
2 hour	25.4	30.0	33.1	36.9	39.8	42.6
6 hour	35.9	41.7	45.6	50.4	54.0	57.5
12 hour	44.0	53.3	59.4	67.2	72.9	78.6
24 hour	52.5	65.8	74.6	85.7	93.9	102.1
90th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	7.7	10.0	11.6	13.6	15.1	16.6
10 min	14.0	19.3	22.9	27.4	30.8	34.1
15 min	17.7	25.0	29.8	36.0	40.6	45.1
30 min	19.1	25.5	29.7	35.1	39.2	43.2
1 hour	24.5	30.7	34.7	40.0	43.9	47.8
2 hour	32.7	39.3	43.7	49.4	53.6	57.8
6 hour	45.1	53.4	58.9	66.1	71.4	76.7
12 hour	58.6	72.0	80.9	92.4	100.9	109.4
24 hour	73.4	92.6	105.3	121.7	133.9	146.0
90th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	8.3	10.7	12.4	14.6	16.3	17.9
10 min	15.3	20.8	24.6	29.6	33.3	36.9
15 min	19.5	27.0	32.2	39.0	44.0	48.9
30 min	20.6	27.2	31.8	37.8	42.2	46.5
1 hour	26.0	32.4	36.8	42.6	46.8	51.1
2 hour	34.3	41.1	46.0	52.1	56.7	61.3
6 hour	47.1	55.7	61.8	69.6	75.4	81.1
12 hour	61.8	75.7	85.4	97.9	107.2	116.4
24 hour	78.0	97.9	111.8	129.7	142.9	156.1

Wabush Lake

Table 94: Median of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	4.2	6.0	7.2	8.8	9.9	11.0
10 min	5.8	8.2	9.8	11.8	13.3	14.8
15 min	7.0	9.8	11.6	13.9	15.7	17.4
30 min	9.6	13.5	16.1	19.4	21.9	24.3
1 hour	11.7	16.3	19.4	23.3	26.1	29.0
2 hour	14.7	20.2	23.8	28.4	31.8	35.2
6 hour	21.2	27.6	31.8	37.1	41.0	45.0
12 hour	28.3	36.0	41.0	47.5	52.2	56.9
24 hour	35.2	43.9	49.6	56.9	62.3	67.6
Projected IDF Data, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	5.6	7.8	9.2	11.0	12.4	13.7
10 min	7.7	10.5	12.4	14.8	16.5	18.3
15 min	9.1	12.4	14.6	17.3	19.4	21.4
30 min	12.6	17.3	20.4	24.2	27.1	30.0
1 hour	15.2	20.7	24.3	28.9	32.3	35.7
2 hour	18.9	25.4	29.7	35.1	39.1	43.1
6 hour	26.1	33.6	38.6	44.9	49.5	54.1
12 hour	34.2	43.3	49.2	56.8	62.4	68.0
24 hour	41.9	52.1	58.9	67.5	73.8	80.1
Projected IDF Data, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	***5***	***10***	***25***	***50***	***100***
5 min	7.1	9.7	11.5	13.7	15.3	16.9
10 min	9.7	13.1	15.4	18.2	20.4	22.5
15 min	11.4	15.4	18.1	21.4	23.9	26.3
30 min	15.9	21.5	25.2	29.9	33.4	36.9
1 hour	19.1	25.7	30.1	35.6	39.8	43.8
2 hour	23.5	31.3	36.5	43.1	48.0	52.8
6 hour	31.4	40.5	46.5	54.1	59.7	65.3
12 hour	40.5	51.5	58.8	68.0	74.8	81.5
24 hour	49.1	61.5	69.7	80.0	87.7	95.4

Table 95: 10th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records (mm)						
Duration	***Return Interval (years)***					
	2	**5**	**10**	**25**	**50**	**100**
5 min	4.2	6.0	7.2	8.8	9.9	11.0
10 min	5.8	8.2	9.8	11.8	13.3	14.8
15 min	7.0	9.8	11.6	13.9	15.7	17.4
30 min	9.6	13.5	16.1	19.4	21.9	24.3
1 hour	11.7	16.3	19.4	23.3	26.1	29.0
2 hour	14.7	20.2	23.8	28.4	31.8	35.2
6 hour	21.2	27.6	31.8	37.1	41.0	45.0
12 hour	28.3	36.0	41.0	47.5	52.2	56.9
24 hour	35.2	43.9	49.6	56.9	62.3	67.6
10th Percentile of Projection Ensemble, 2041-2070 (mm)						
Duration	***Return Interval (years)***					
	2	**5**	**10**	**25**	**50**	**100**
5 min	4.6	6.2	7.2	8.5	9.5	10.4
10 min	6.4	8.4	9.8	11.5	12.7	14.0
15 min	7.6	10.0	11.6	13.5	15.0	16.4
30 min	10.6	13.9	16.1	18.9	20.9	22.9
1 hour	12.8	16.7	19.3	22.6	25.0	27.4
2 hour	16.0	20.7	23.7	27.6	30.5	33.3
6 hour	22.8	28.1	31.7	36.2	39.5	42.8
12 hour	30.2	36.6	40.9	46.3	50.3	54.3
24 hour	37.3	44.6	49.5	55.6	60.1	64.6
10th Percentile of Projection Ensemble, 2071-2100 (mm)						
Duration	***Return Interval (years)***					
	2	**5**	**10**	**25**	**50**	**100**
5 min	5.1	6.8	7.9	9.3	10.4	11.4
10 min	7.1	9.3	10.7	12.5	13.9	15.3
15 min	8.4	11.0	12.6	14.8	16.4	17.9
30 min	11.6	15.2	17.6	20.6	22.8	25.1
1 hour	14.1	18.3	21.1	24.6	27.3	29.9
2 hour	17.5	22.6	25.9	30.1	33.2	36.3
6 hour	24.5	30.3	34.1	39.0	42.6	46.2
12 hour	32.3	39.3	43.9	49.8	54.1	58.4
24 hour	39.7	47.6	52.9	59.5	64.4	69.3

Table 96: 90th percentile of IDF projections; RCP 8.5.

Historical IDF, 2015 Update to Observational Records						
Duration	***Return Interval (years)***					
	2	**5**	**10**	**25**	**50**	**100**
5 min	4.15	5.99	7.21	8.76	9.9	11.04
10 min	5.81	8.21	9.8	11.81	13.31	14.79
15 min	6.96	9.75	11.6	13.94	15.67	17.39
30 min	9.6	13.54	16.14	19.43	21.87	24.29
1 hour	11.66	16.3	19.37	23.25	26.13	28.99
2 hour	14.7	20.19	23.82	28.41	31.82	35.2
6 hour	21.19	27.55	31.76	37.09	41.03	44.95
12 hour	28.28	35.95	41.03	47.45	52.21	56.93
24 hour	35.2	43.87	49.61	56.87	62.25	67.59
90th Percentile of Projection Ensemble, 2041-2070						
Duration	***Return Interval (years)***					
	2	**5**	**10**	**25**	**50**	**100**
5 min	6.7	9.45	11.26	13.56	15.26	16.95
10 min	9.14	12.71	15.08	18.07	20.29	22.5
15 min	10.83	14.98	17.73	21.21	23.79	26.35
30 min	15.05	20.9	24.78	29.67	33.3	36.91
1 hour	18.09	24.99	29.56	35.33	39.62	43.87
2 hour	22.3	30.47	35.88	42.71	47.78	52.81
6 hour	30	39.47	45.74	53.66	59.54	65.37
12 hour	38.9	50.32	57.88	67.44	74.52	81.56
24 hour	47.21	60.12	68.66	79.46	87.47	95.42
90th Percentile of Projection Ensemble, 2071-2100						
Duration	***Return Interval (years)***					
	2	**5**	**10**	**25**	**50**	**100**
5 min	9.51	12.76	14.91	17.63	19.65	21.65
10 min	12.8	17.04	19.84	23.39	26.01	28.62
15 min	15.08	20.01	23.26	27.38	30.43	33.47
30 min	21.05	27.97	32.56	38.36	42.66	46.93
1 hour	25.16	33.33	38.74	45.58	50.65	55.69
2 hour	30.67	40.34	46.74	54.83	60.83	66.79
6 hour	39.7	50.92	58.34	67.72	74.68	81.59
12 hour	50.6	64.13	73.08	84.39	92.78	101.11
24 hour	60.44	75.72	85.84	98.62	108.1	117.52

Appendix A: Data & Methods

Introduction

In the five years since the last climate projections report was prepared for the province of Newfoundland and Labrador (Finnis, 2013; CPR13), a number of new datasets and analysis tools have been developed for the purposes of regional/local scale climate prediction. At the time CPR13 was completed, the only high-resolution projections available were based on climate change scenarios and General Circulation Models (GCMs) used in the 3rd Coupled Model Intercomparison Project (CMIP3), completed in the early 2000s and used to inform the 4th Intergovernmental Panel on Climate Change Report (IPCC; 2007). Now, a selection of high-resolution products are available, based on an updated set of GCMs and greenhouse gas scenarios (CMIP5) used to inform the 5th IPCC report (IPCC, 2013). There have also been significant advances in bias correction techniques and the projection of extreme events. Together, these advances provide an opportunity to better explore likely regional/local scale climate impacts and quantify associated uncertainty.

The following Appendix describes the data sets and methods used to generate the 2018 update to CPR13.

Data and Methods

Summary of Previous Report (CPR13)

CPR13 relied on the North American Regional Climate Change Assessment Program (NARCCAP; Mearns et al., 2009) for 21st-century projections; at the time, this represented the best available source of regionally downscaled climate projections. NARCCAP offered an ensemble of dynamically downscaled interpretations of CMIP3 output; that is, NARCCAP was produced by running higher resolution Regional Climate Models (RCMs) covering North America with RCM boundaries provided by GCM output. Projections were based on the Special Report on Emissions Scenarios (SRES) A2 greenhouse gas emissions scenario for the 21st century (Nakicenovic, 2000), chosen because this most closely reflected recent observations and the state of international action to control emissions. The project provided data for the period 2038-2070, at a resolution of 50km; while most data was provided for daily time-steps, some 3-hourly data was also provided. At the time of CPR13, seven GCM/RCM combinations were available; the full set was used to explore uncertainty in the resulting projections. Station data used to ground model projections was taken primarily from the Adjusted Homogenized Canadian Climate Data (AHCCD) archive (Mekis & Vincent, 2011; Vincent et al., 2012), consisting of station data corrected for various instrumentation- and location-related sources of error. Environment Canada Intensity-Duration-Frequency

(IDF) data was also used in extreme precipitation analyses for specific stations, when available.

Before any climate change modelling data are applied for practical purposes, some accounting of model biases is necessary. CPR13 addressed this in two ways. First, by focusing on projected changes in gridded maps. This approach assumed that biases in simulations of the recent past: that is, model recreations of the period 1968-2000 (P1) and the projected future (2038-2070; P2) were constant:

$$V_{True}^{P} = V_{model}^{P} + V_{bias} \quad (1)$$

where V^P is a variable of interest during period *P*, *True* indicates the real climatological value, *model* indicates the model predicted climatological value, and V_{bias} is the model's bias (assumed constant). The change in the value between two periods is then

$$V_{True}^{2} - V_{True}^{1} = (V_{model}^{2} + V_{bias}) - (V_{model}^{1} + V_{bias}) \quad (2)$$

$$V_{True}^{2} - V_{True}^{1} = V_{model}^{2} - V_{model}^{1} \quad (3)$$

This first approach was used when presenting gridded maps showing spatial distributions of expected change.

A second approach was used to produce tables of bias-corrected climate projections for specific observing stations. Here, a statistical distribution was fit to available station data (seasonal or annual time series); in most cases, the normal distribution was used, based on estimates of the station mean (μ) and standard deviation (σ). For extreme precipitation analyses (intensity-duration-frequency, or IDF analyses), the Gumbel distribution was used, based on location (μ) and scale (β) parameters. Similar distribution parameters were estimated for model projections for 1970-2005 and 2038-2070. Bias-corrected distributions for 2038-2070 were then calculated by applying the projected change in distribution parameters to the values calculated from station data; e.g.

$$\mu_{True}^{P2} = \mu_{True}^{P1} + (\mu_{model}^{P2} - \mu_{model}^{P1}) \quad (4)$$

The adjusted P2 distribution parameters can then be used to estimate bias-corrected outcomes for P2. This approach assumes i) that models accurately predict the relative change in probability distributions, and ii) that the normal and Gumbel distributions are a good fit to the variables being examined.

In both cases, a Monte Carlo subsampling approach was applied to each of the 7 NARCCAP GCM/RCM combinations, in order to better quantify uncertainty. That is, projected changes (in *V* and distribution parameters) were recalculated one hundred times, based on subsamples of P1 and P2. Each subsample gives a slightly different estimate of change, and the full set describes a GCM/RCM combination's expected range of outcomes.

Current Project: Overview of Changes

The current project delivers more than a simple update of CPR13, using the latest models: it explores a wider range of climate projections, and requires fewer assumptions regarding statistical distributions of relevant climate variables. The most significant improvement is the inclusion of new statistically downscaled climate projections, produced by establishing statistical relationships between GCM output and a high-resolution climatology covering North America. By contrast, CPR13 used exclusively dynamically downscaled projections, produced by driving a high-resolution RCM with lower resolution GCM output: effectively, driving one complex physical model with output from another complex physical model. Both approaches have strengths and weaknesses (e.g. Wilby & Wigley, 1997), and are widely used. Dynamic downscaling is grounded in current understanding of physical processes; this means all results are physically consistent with one another. It's important to note that the quality of the RCM results can be limited by biases in the GCM output driving them; while an RCM may be able to reduce some biases, they may preserve (or even amplify) others. There may also be concerns related to conservation laws (Roberts & Snelgrove, 2015) and best modeling practices (e.g. Dai et al., 2010; Lo, Yang & Pielke, 2008). Statistical downscaling is often less expensive to implement but requires assumptions regarding relationships between GCM output and the observed climate, and how these relationships change as climate shifts. This approach also requires reliable information about the current climate (e.g. from climate stations); this can be a problem over much of Canada, where available observations are often sparse. Using results of both downscaling approaches will help better quantify likely climate outcomes, and identify robust features of projected change.

Data

Dynamically Downscaled Data

NARCCAP has now been superseded by the North American Coordinated Regional Climate Downscaling Experiment (NA-CORDEX; Giorgi, 2015). Updates include: i) the use of newer GCM and RCM versions, ii) projections based on the CMIP5 suite of simulations, iii) a handful of GCM/RCM combinations running at higher resolution (~25km rather than 50km; however, many combinations remain limited to ~50km), iv) coverage of the full 21st century, and v) the use of multiple greenhouse emissions scenarios. Results are based on Representative Concentration Pathways (RCP) emissions scenarios 4.5 and 8.5, where the numbers reflect the additional radiative forcing produced by the end of the century (Moss et al, 2010). RCP 4.5 is a more optimistic scenario, and assumes international cooperation to limit CO_2 emissions. RCP 8.5 is effectively a 'business as usual' scenario, assuming continued emissions growth and limited international control. Like NARCCAP, the majority of NA-CORDEX output is available as once-daily data. A small number of projections (three, currently) are available at hourly intervals. This subdaily output has not been used in the current study; rather than focusing on a small number of subdaily simulations, we have instead extrapolated subdaily information from daily information taken from a larger number of simulations. A summary of the GCM/RCM runs used in the current study is given in Table A1.

Statistically Downscaled Data

In addition to NA-CORDEX data, new data products from the Pacific Climate Impacts Consortium (PCIC) were examined. Rather than increasing resolution through the use of a regional model (dynamic downscaling), PCIC approached downscaling by establishing statistical relationships between GCM output and a high-resolution climatology covering North America (Hopkinson et al., 2011). This statistical downscaling was constructed

Table A1: Summary of NA-CORDEX simulations used in the current study. Shading indicates a particular GCM, RCM, and resolution(0.44° and 0.22° lat/lon, or ~50km/25km) combination was used in the assessment of a climate scenario's impacts (RCP4.5 and RCP8.5)

Frequency	GCM	RCM	Resolution	RCP4.5	RCP8.5
Daily	CanESM2	CanRCM4	**0.22°**	(shaded)	(shaded)
		CanRCM4	**0.44°**	(shaded)	(shaded)
		CRCM5	**0.44°**	(shaded)	(shaded)
	MPI-ESM-LR	RegCM4	**0.22°**		(shaded)
	EC-EARTH	RCA4	**0.44°**	(shaded)	
	GFDL-ESM2M	RegCM4	**0.22°**		(shaded)
	HadGEM2	RegCM4	**0.22°**		(shaded)

using a hybrid of Bias Correction/Constructed Analogues (BCCA; Maurer et al., 2010) and quantile mapping (see below), referred to as BCCAQ (Werner & Cannon, 2015). PCIC offers daily data (minimum temperature, maximum temperature, and precipitation) at roughly 10km resolution, covering the full 1950-2101 period, based on simulations from twelve GCMs, forced with both RCP 4.5 and 8.5 scenarios. PCIC also includes projections for the very optimistic RCP 2.6 scenario; this scenario was not examined, as current emissions and geopolitical trends suggest it is a much less likely outcome than 4.5 or 8.5.

Station Data

As with CPR13, AHCCD daily station data was used to produce bias corrected projections for available observation stations whenever available (Table A3). In some cases, this has been supplemented by daily precipitation and temperature data taken directly from Environment & Climate Change Canada's Historical Climate Data Archive; this is the uncorrected station data that informs the AHCCD archive. Using the uncorrected daily station data may produce some errors related to instrument error, station movement, or changes in standardized equipment; however, it was necessary to use these to get projections for all stations examined in CPR13 and the 2015 provincial IDF update (Conestoga-Rovers & Associates, 2015). Data quality concerns are balanced by the benefits associated with increased spatial coverage and compatibility across Government of Newfoundland & Labrador climate documents.

Daily data was used to calculate shifts in a selection of extreme climate indices (Table A4) between 1976-2005 (20C) and 2041-2070 (21Ca)/2070-2100 (21Cb). Twenty-four hour extreme precipitation events were also examined, including consideration of 2, 5, 20, 25, 50, and 100-year events. Uncertainty associated with i) emissions scenarios (two RCPs), ii) choice of downscaling product (statistical versus dynamic), and iii) model choice (GCM or GCM/RCM) can be explored with the data provided. Thirty year periods are being compared here; while this is the period Environment and Climate Change Canada (ECCC) uses to define standard climatologies (climate normals), it is a relatively short period for the assessment of extremes: this can lead to considerable uncertainty when estimating very rare events (e.g. 100-year return periods). However, it is not uncommon for official ECCC estimates of 100-year events to be based on shorter periods, with comparable statistical uncertainty.

Table A2: List of GCMs used in PCIC statistical downscaling. Tier 1 represents the priority PCIC models in the current study.

	Name	**Country of**
Used	CanESM2	Canada
	CNRM-CM5	France
	CCSM4	United States
	HadGEM2-ES	United
	MRI-CGCM3	Japan
	MPI-ESM-LR	Germany
Available, but Unused	CCSM4	United States
	ACCESS1-0	Australia
	inmcm4	Russia
	GFDL-ESM2G	United States
	HadGEM2-CC	United
	MIROC5	Japan

Table A3: Locations of station data examined in the current project. Locations with available AHCCD precipitation, AHCCD temperature, and historic IDF data are indicated with shading.

Name	Latitude	Longitude	AHCCD Precipitation	AHCCD Temperatures	Historic IDF Data
ARGENTIA (AUT)	47.29	-53.99			■
BAY D'ESPOIR GEN STN	47.98	-55.80	■	■	
BURGEO	47.62	-57.62	■		■
CARTWRIGHT	53.71	-57.04	■	■	
CHURCHILL FALLS	53.53	-63.97	■	■	■
COMFORT COVE	49.27	-54.88			■
CORNER BROOK	48.95	-57.95	■	■	
DANIELS HARBOUR	50.24	-57.58		■	■
DEER LAKE A	49.22	-57.40	■	■	■
EXPLOITS DAM	48.77	-56.60		■	
GANDER INT'L A	48.95	-54.58		■	■
GOOSE A	53.32	-60.42		■	■
GRAND FALLS	48.93	-55.67	■	■	
ISLE AUX MORTS	47.58	-58.97			
LA SCIE	49.92	-55.67			■
MARY'S HARBOUR A	52.30	-55.83	■		■
NAIN A	56.55	-61.68	■	■	■
NORTH HARBOUR	47.13	-53.67	■		
PLUM POINT	51.07	-56.88	■	■	
PORT AUX BASQUES	47.57	-59.15		■	■
SPRINGDALE	49.50	-56.08	■		
ST ALBANS	47.87	-55.85	■		■
ST ANTHONY	51.38	-56.10		■	■
ST JOHN'S A	47.62	-52.74	■	■	■
ST LAWRENCE	46.92	-55.38			■
STEPHENVILLE A	48.53	-58.55	■	■	■
TWILLINGATE (AUT)	49.68	-54.80			■
WABUSH LAKE A	52.93	-66.87	■	■	■
SCHEFFERVILLE A	54.80	-66.82	■		■

Table A4: Climate indices to be provided i) in maps and ii) for stations listed in Table A3.

Short Name	Long Name	Units	Calculation Type
TAV	Average Daily Mean Temperature	ºC	Average
TNAV	Mean Daily Minimum Temperature	ºC	Average
TXAV	Mean Daily Maximum Temperature	ºC	Average
TCDD	Cooling Degree Day	Degree Day	Sum
THDD	Heating Degree Day	Degree Day	Sum
TGDD	Growing Degree Day	Degree Day	Sum
TNFD	Number of Frost Days	Days	Sum
TXFD	Number of Frost Free Days	Days	Sum
TXHWD	Maximum Heat Wave Duration	Days	Maximum
PAV	Mean Daily Precipitation	mm	Average
PINT	Mean Intensity of Precipitation Events	mm/day	Average
PQ90	90th Percentile of Precipitation Events	mm	Alternate
PX3D	Maximum 3-day Precipitation	mm	Maximum
PX5D	Maximum 5-day Precipitation	mm	Maximum
PX10D	Maximum 10-day Precipitation	mm	Maximum
PN10mm	Number of Days With 10mm or More of Precipitation	Days	Sum
PXCDD	Maximum Number of Consecutive Dry Days	Days	Maximum
PDSAV	Average Dry Spell Length	Days	Average
PDSMED	Median Dry Spell Length	Days	Alternate
PDSSDV	Standard Deviation of Dry Spell Length	Days	Alternate

Subdaily extreme precipitation estimates were extrapolated from daily precipitation data for all projection sources: this includes 5, 10, 15, and 30 minute durations, along with 1, 2, 6, and 12 hours; again, 2, 5, 20, 25, 50, and 100-year return events were estimated. The same station data used in recent updates to provincial IDF curves was employed for this purpose (Conestoga-Rovers & Associates, 2015).

Selections for the Current Study

For the current project, daily data from twelve 21st century projections were examined for RCP 8.5: six GCM/RCM combinations from the NA-CORDEX set, and six PCIC statistically downscaled projections. Due to problems with the NA-CORDEX data server, only ten projections were examined for RCP 4.5: four NA-CORDEX simulations and six PCIC simulations.

In the case of PCIC data, runs listed in Table A2 were used. These were based on GCMs contributing to CMIP5 that Cannon (2015) identified as capturing the greatest range of climate outcomes in Eastern North America, with two exceptions: one model that simulates insufficient climate variability (inmcm4) and another that fails to capture North Atlantic sea ice cover (CSIRO-Mk-6-0). These were replaced with CCSM4 and MRI-CGCM3, in an effort to better capture uncertainty without unduly exaggerating using models with relevant, well-known biases.

Daily NA-CORDEX projections were selected as follows: Higher resolution (~0.22^o, or about 25km) runs were prioritized; currently, four 0.22^o GCM/RCM combinations are available for RCP 8.5 and only one is available for RCP 4.5 (Table A2). The remaining simulations were chosen to maximize the number of lower resolution (0.44^o, or about 50km) simulations examined in both scenarios.

Methods

As with CPR13, the spatial distribution of climate change impacts is presented as a set of maps, each showing projected change in a variable between the current period (20C) and a projected future (21Ca & 21Cb). If biases are assumed constant with climate change, these outcomes can be considered a bias-corrected projection (see eqns 1-3). This is critical for NA-CORDEX results; biases have already been removed from PCIC projections, but the two data sets were treated the same way to facilitate comparison. The final deliverables present the mean expected change over all PCIC and NA-CORDEX projections being considered, along with uncertainty estimates (standard error, as estimated over all projections). GIS databases provided include the observed 20C climatology, as a further reference point. Projected climate change was assessed on the data's native grid; however, for the purposes of generating summary maps and comparing different data sources, results will be interpolated to a common 25km grid using Cressman interpolation (Cressman, 1959).

Interpolating results to a common 25km grid raises potential concerns about the impact of model resolution on downscaled input, and ensuing incompatibility of results across resolutions ('scale mismatch'). This is less of a concern for temperature related fields, but can become an issue with precipitation related values: lower resolution models will typically produce lower intensity precipitation, spreading water evenly over larger areas. Separating scale mismatch issues from model biases can be difficult, and is beyond the scope of the current work; however, a comparison of several precipitation indices (average seasonal precipitation, mean intensity) across and between PCIC (one resolution) and NA-CORDEX (two resolutions) projections suggest the problem is small: the two data sets show a comparable spread across projections, and are sufficiently close to one another. Users concerned with scale mismatch should instead use the station-specific projections (see below); the bias correction procedure used to generate these tables removes scale-related differences.

Additional bias-corrected station-scale projections are provided in a series of tables. Results are given for stations within Newfoundland and Labrador with sufficiently long and reliable daily records; the bias correction procedure used removes model-specific biases, addresses scale mismatch, and provides results that can be easily compared to existing historical records. Analysis of specific climate stations closely followed standards and procedures set forth by the Pacific Climate Impacts Consortium. NA-CORDEX and PCIC projections will be downscaled to station locations using quantile delta mapping (QDM; Cannon, Sobie & Murdock, 2015). This is an extension of quantile mapping (QM), which is often used for bias correction in weather prediction and has been proposed as a means of correcting long-term climate projections (e.g. Gudmondsson et al., 2012). QM operates by matching quantiles of simulated and observed data; QM corrected model output will have the exact statistical distribution found in observations. The original application in climate projections was as follows: a QM transformation developed using 20th-century simulations and observations is applied to 21st-century model output, producing a corrected 21st-century projection. However, these transformations can struggle to interpret values outside the range of the 20th century simulations: for example, increasing extreme precipitation events (e.g. Cannon, Sobie & Murdock, 2015). This is a problem in some of the BCCAQ-produced PCIC projections, leading to unrealistically large extreme precipitation increases in certain locations and with certain GCMs (see methodology reviews; Steve Sobie). These concerns are addressed two ways in the current proposal. First, an ensemble of models is used, reducing the impact of any extreme outliers. Secondly, extreme precipitation analyses are adjusted using an updated version of quantile mapping which avoids extrapolating beyond the original data: Quantile delta mapping (QDM). This approach focuses on projected shifts in quantiles; e.g. RCM simulations for the 20C and 21Ca/b study periods. The relative shifts in these quantiles (‘deltas’) between study periods are applied to quantiles from observations. This is roughly comparable to the bias correction approach used in CPR13 (eqn. 4), but without any underlying assumptions regarding statistical distributions (e.g. that it fits a normal or Gumbel distribution). QDM was applied to daily data for i) station observations and ii) historical and projected PCIC & NA-CORDEX data at the grid point closest to the station. Seasonal and annual climate indices were then estimated from this QDM-corrected daily data.

QDM-corrected daily data was also used to predict future precipitation IDF data, following the same procedure used by Environment and Climate Change Canada, as well as the recent IDF completed for Newfoundland and Labrador (Conestoga-Rovers & Associates, 2015): fitting a Gumbel distribution to annual maxima, then extracting precipitation quantiles associated with return periods of interest. Following this approach with QDM-corrected daily precipitation gives QDM-corrected 24 hour duration intensities for desired return periods.

A second QDM was performed prior to constructing the IDF curves, this time between annual daily maxima i) used for updated provincial IDF curves (Conestoga-Rovers & Associates, 2015) and ii) calculated by the daily QDM-corrected PCIC/NA-CORDEX data. This removes any disagreement between the station data used in the current study and those used for the 2015 IDF update, easing comparison and ensuring consistency across IDF-related products developed for the Government of Newfoundland & Labrador.

Gumbel distributions for sub-daily precipitation durations have been estimated from daily data, using an approach comparable to Srivastav et al. (2014; 2015). This approach fits nonlinear transfer functions between annual maxima simulated data (GCMs or RCMs) and observed annual maxima collected over a range of durations (e.g. 5 minutes, 10 minutes, etc, up to 24 hours). Transfer functions are optimized as follows:

i) Gumbel distributions are fit to annual maxima of i) simulated daily precipitation (P_{GCM}) and ii) observed precipitation over duration *D* (P_{Obs}).
ii) A large number of quantiles are estimated from the two Gumbel distributions (Q_{GCM} & Q_{Obs}), where Q is a function of a given occurrence probability *p*.
iii) Transfer functions (f_T) are then optimized to reduce differences between

$$Q_{\text{Obs}}[p] - f_{\text{T}}(Q_{\text{GCM}}[p])$$

That is, transfer functions match simulated daily quantiles to observed quantiles of a given (observed) duration. The transfer functions take the following form:

$$Q_{\text{Obs}} \approx f_T(Q_{GCM}) = \frac{a+Q_{GCM}}{b+cQ_{GCM}} + \frac{d}{Q_{GCM}}$$

where *a, b, c,* and *d* are function parameters set during the optimization process. In this case, a differential evolution algorithm was used for optimization (Storn & Price 1997).

iv) Estimated annual subdaily maxima are then estimated by feeding new Q_{GCM} through the transfer functions; e.g. QDM-corrected annual daily maxima from PCIC/NA-CORDEX projections for 21Ca & 21Cb.

This approach assumes a strong relationship exists between extremes observed over various durations; this is a reasonable if simplistic assumption, which may fail when short duration and long duration extremes are produced through different processes (e.g. intense thunderstorms drive durations less than an hour, but slow moving, less intense cyclones drive durations of 12-24 hours). It is also assumed that relationships between daily and subdaily durations do not change as the climate warms; this may not be the case. The results can still provide useful guidance, but uncertainty grows as projected durations decrease. With currently available data, some comparable form of daily-to-subdaily extrapolation is necessary to get subdaily IDF data, as very little sub-daily data has been made available (only three NA-CORDEX simulations at present).

Regardless of which methods and data sources are used, predicting the impacts of climate change on short duration extreme rainfall is pushing the boundaries of current climatological science (e.g. Zhang et al., 2017). Uncertainty in these results can be large, compounding problems associated with climate models, downscaling approaches, inferring short duration precipitation, and bias correction schemes. These projections may still provide useful guidance; they should, however, be interpreted cautiously.

Estimating Gumbel Distribution Parameters:

The current study diverges from past provincial IDF analyses in one critical way: preferential use of Maximum Likelihood Estimation (MLE) to fit statistical distribution parameters. Traditionally, engineering-focused IDF analysis has instead used the Method of Moments (MOM) to estimate these parameters. The following section briefly outlines the differences between the methods, highlights their strengths relative to the current project, and discusses cases where use of MOM was considered preferable.

There are a number of approaches commonly used to estimate statistical distribution parameters, but in the context of IDF analysis MOM is most often used operationally. MOM parameter estimates are relatively easy to calculate from a data sample, and can usually be calculated by hand; in the case of the Gumbel distribution used in the current

IDF analysis, the Gumbel's shape and scale parameters are calculated using the sample mean and standard deviation (the first and second 'moments' of the sample, respectively). This means that much of the information in the original data sample is removed before parameters are estimated, with all observations generalized using just two values (mean & standard deviation). As a result, MOM estimates can be sensitive to one or two unusual observations (outliers), and can give biased results; for example, one very large precipitation event may cause MOM estimates to overstate the likelihood of such an event.

Maximum Likelihood Estimation (MLE) is a commonly used alternative to MOM in statistical fields, which incorporates the full sample into parameter estimation. As a result, it is typically less sensitive to outliers. MLE seeks distribution parameters that optimize the likelihood of the full set of observations; this means that many small observations have a greater ability to balance a single large observation. Unlike MOM, MLE is impractical to calculate by hand; as a result, MOM was necessary prior to widespread availability of efficient personal computers. Although this is no longer a limitation, MOM is still used in most government and engineering IDF analyses, largely to ensure compatibility between older and newer products.

Table A5: Impacts of parameter estimation methods on 24 hour return period precipitation estimates; results are given for observations (20C) and mid-century climate projections (21Ca) for Argentia. Results from Conestoga-Rovers & Associates' 2015 IDF update are given as CRA15. Results from the current study are given in rows labeled MOM and MLE, indicating the parameter estimation scheme used.

Period	***Source***	***Return Interval (years)***					
		100	***50***	***25***	***10***	***5***	***2***
20C	***CRA 15***	200.00	177.80	155.40	125.30	101.40	65.40
	MOM	201.70	179.50	157.20	127.00	103.20	67.20
	MLE	145.90	132.50	119.20	101.10	86.80	65.20
21Ca	***CRA 15***	265.10	237.70	209.80	172.50	140.90	95.10
	MOM	212.30	190.00	167.50	137.30	113.30	77.10
	MLE	163.10	148.70	134.20	114.70	99.30	75.90

In most applications, MOM- and MLE-based IDF estimates are close enough that the choice seems unimportant. However, differences can become very pronounced when dealing with large outliers and/or small sample sizes. In the current climate change analyses, the problem can become significant in rare cases where outliers in observational data and climate projections amplify one another in the MOM approach: overestimates in the current climate may combine with overestimates in the predicted climate, leading to improbably large IDF projections. An example can be seen in the climate projections for Argentia included in the recent IDF update from Conestoga-Rovers & Associates (2015; hereafter CRA15); these were created using a tool that formed the basis for the methodology used in the current study, but with MOM parameter estimation. Projections for Argentia show the 100 year, 24 hour event increasing from 200mm to 265mm; a roughly 33% increase of an already very high estimate. While this increase isn't necessarily impossible, it is improbable given that no other CRA15 change estimates exceed 211mm. Fortunately, the current methodology appears to limit these MOM-related problems, giving more restrained 21st century IDF estimates for problem locations (compare MOM rows with CRA15 in Table A5). Still, the more restrained and less sensitive MLE approach tends to give more realistic results in several cases, reducing several very large increases (>50mm) and creating greater agreement across all locations.

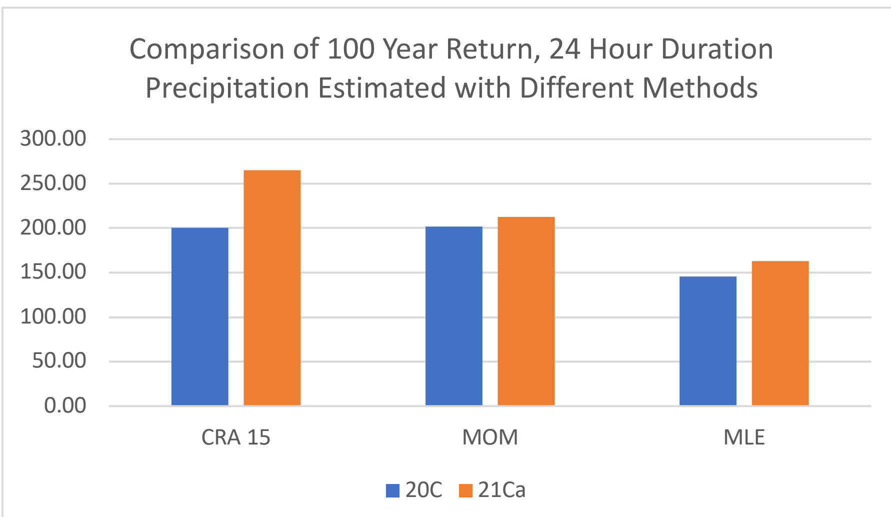

Figure A1: Graphical representation of the 100 year return data illustrated in Table A5. Although all methods show an increase from the present (20C) to mid-century (21Ca), comparing CRA15's 20C to MLE's 21Ca gives a false impression that extremes decrease into the future.

However, using MLE can produce confusing results when compared to prior observational studies. In a small number of stations, MLE-based IDF estimates from observations are significantly lower than those presented in Environment Canada's official IDFs and the recent CRA15 update: notably, the 20th century baseline IDFs for Stephenville, Daniel's Harbour, and Argentia drop considerably (>= 10mm in the 100 year, 24-hour event). The problem is most pronounced in Argentia, which has a short observational record (15 years) and one extreme outlier: a 24 hour precipitation event that produced more than 204mm of precipitation. Table A5 and Figure A1 summarize the impact of MLE and MOM for this location, highlighting potential concerns: the 100 year, 24 hour event from observational data is 202mm using MOM, but only 146mm with MLE; although this difference is large, it's worth noting that the uncertainty for the MOM estimate is even larger (~82mm uncertainty, compared to a 57mm difference between MOM & MLE). The concern isn't that these two 20C estimates are incompatible, but rather that comparing CRA15 to MLE projections produces confusing results. While all estimates show climate change increases IDF values (21C), the MLE-based projections are smaller than the CRA15 interpretation of the present (20C). A face-value comparison of the CRA15 100 year, 24 hour event to the MLE projection sees a drop from 200mm to 163.1mm, giving the false impression that climate change will reduce flooding risk in Argentia.

In order to i) avoid exaggerating climate change impacts and ii) ensure compatibility with official IDFs used in the province, a mixed MLE/MOM approach has been used in the current study. For the majority of stations, MLE has been used; five exceptions were made, for which MOM was used to ensure compatibility between the current study and CRA15:

- Stephenville
- Daniel's Harbour
- Argentia
- St. Alban's
- Twillingate

The above discussion provides a concrete example of uncertainties associated with the analysis of extreme events, even in traditional observational contexts (e.g. CRA15). Assessing climate change impacts introduces new sources of uncertainty, but it is worth noting that the spread of PCIC & NA-CORDEX projections is comparable to uncertainty in observational estimate at most stations.

Recommendations for Future Work

The basic patterns of change predicted by NARCCAP simulations used in CPR13 and the PCIC & NA-CORDEX simulations used here are very similar: there is more detail in the projections (higher resolution), and better sense of projection uncertainty (more simulations, based on multiple downscaling methods, and using two climate scenarios), however. Over the next 10 years, we can expect the volume and resolution of downscaled climate projections to increase further: however, the value gained from this additional information may be minimal, particularly given the limited climate stations available for groundtruthing and bias correction. Before commissioning a follow-up to the current climate index maps (e.g. after a successor to NA-CORDEX is completed), the province should carefully weigh the costs and benefits. Based on the current findings and the state of climate prediction research, greater benefit is likely to be realized from:

i) Re-evaluating subdaily extreme precipitation analyses
ii) Expanding the range of variables and extreme indices examined.

Research into subdaily precipitation prediction is advancing rapidly, and best practices are still a subject of debate (e.g. Zhang et al., 2017). It may be helpful to re-evaluate subdaily IDF projections in another 5-10 years using new downscaled products, particularly if more subdaily projections become available (3-hourly or shorter) or improved empirical subdaily extrapolation schemes are developed. This information has the greatest potential economic value, serving as design criteria for infrastructure and informing responsible planning.

To date, efforts to predict climate change impacts have focused primarily on temperature- and precipitation-related information; very little guidance is available regarding other variables like wind or snow. This is partly due to the lack of downscaled data relevant to these additional concerns, and partly because of limited understanding of how to best assess changes in these variables. However, relevant data is slowly becoming available; e.g. NARCCAP now has wind and some snow data, and more is expected for NA-CORDEX in the near future. This new data in turn feeds development of impacts assessment methods. The province may realize greater value by focusing future investment on adding novel complementary projections to the existing archive, funding more focused impacts assessments rather than updating existing products.

Appendix B: Abbreviations Used

	Abbreviation	Full term
Background	AHCCD	Adjusted & Homogenized Canadian Climate Data
	CCEEET	Office of Climate Change, Energy Efficiency, and Emissions Trading
	ECCC	Environment Canada
	GCM	General Circulation Model
	IDF	Intensity-Duration-Frequency
	NARCCAP	North American Regional Climate Change Assessment Project
	NARR	North American Regional Reanalysis
	NL	Newfoundland & Labrador
	RCM	Regional Circulation Model
	REA	Reliability Ensemble Average
	STARDEX	Statistical and Regional Dynamical Downscaling of Extremes for European Regions
Study Periods	DJF	Winter (December-January-February)
	MAM	Spring (March-April-May)
	JJA	Summer (June-July-August)
	SON	Autumn (September-October-November)
	ANN	Annual

Appendix C: Glossary

Bias: Disagreement between a model and the system it is intended to represent. For example, a climate model with a 'warm bias' tends to overestimate temperatures relative to observed climatology.

Boundary forcing: Regional climate models mathematically represent weather within specific region of the Earth. In order to run, they require information about the edges (boundaries) of this region; this 'boundary forcing' information is typically supplied by general circulation model with global coverage at lower resolutions.

Cooling degree day (CDD): A measure of energy required to cool a building to comfortable levels. The actual energy needed will vary with building standards, energy source, and other factors. However, an increases in CDD translates into some increase in energy spending.

Downscaling: The process of extracting information relevant at small spatial scales (high resolution) from information available at large spatial scales (low resolution).

Dry Spell: A period without measurable precipitation.

Dynamical downscaling: The process of extracting high resolution information from low resolution forecasts through the use of high resolution model; usually a regional climate model.

Ensemble: A collection of model forecasts for a single period. By including multiple model runs, an ensemble provides a sense of forecast uncertainty: if the runs agree with one another, the ensemble average forecast is considered reliable; if they diverge, the forecast is less reliable. A multi-model ensemble is generated using runs from different models.

Frost day: A day in which the minimum daily temperature drops below the freezing point; i.e. a day when freezing occurs at some point.

General Circulation Model (GCM): A model that approximates circulation of the atmosphere and/or ocean, with global coverage. These are typically low resolution models (100s of km between grid points).

Greenhouse Effect: An increase in surface temperatures due to the presence of specific gases in the atmosphere. The addition of these 'greenhouse gases' to the atmosphere by human activity is the driver of human-induced climate change.

Growing degree day (GDD): A measure of heat accumulation, used to determine whether a given plant or insect species will thrive in a region. The energy needed for plants/insects to mature can be estimated in GDD; regions with lower GDD cannot support these species.

Heating degree day (HDD): A measure of energy required to heat a building to comfortable levels. The actual energy needed will vary with building standards, heat source, and other factors. However, an increases in HDD translates into some increase in heating costs.

Heat Wave: A period of prolonged temperatures well above normal. The definition used here is a period of at least six days, in which mean temperatures are consistently 5 ^{o}C above normal.

Intensity-duration-frequency curve: A tool used to estimate extreme precipitation events, based on how much precipitation falls (intensity) in a given period of time (duration), and how often events of a given magnitude occur (frequency).

Likelihood function: A measure of how probable a series of events are, given a probability distribution. Higher likelihood implies a better match to the probability distribution. For computational purposes, the negative log likelihood (NLL) function in used in place of the standard likelihood (L) function; minimizing NLL is equivalent to maximizing L.

Median: The value in a probability distribution that has a 50% chance of being exceeded.

Percentile: A probability distribution or a series of observations can be broken into percentiles, by identifying events that are exceeded with a specific frequency. For example, the 90th percentile marks the highest number of lowest 90% of events; it has a 10% of being exceeded. The 70th percentile marks the top of the lowest 75% of events; it has a 25% chance of being exceed.

Probability distribution: A description of the frequency with which different potential outcomes occur.

Regional Climate Model (RCM): A model used provide a detailed representation of the atmosphere or ocean within s specific region of the planet. Typically run at much higher resolution than general circulation models (1-50km, typically).

Topographic: Relating to the topography, or shape of the Earth's surface. The slope, orientation, and altitude of the surface can have a strong influence on the climate of a given location.

Standard Deviation: A measure of the ‘spread’ in a probability distribution. In climatology, a greater standard deviation implies a more variable climate.

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