

Climate Patterns, Trends, and Projections for the Omineca, Skeena, and Northeast Natural Resource Regions, British Columbia

2016



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Vanessa Foord



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ISBN 978-0-7726-6967-4 – Print version

ISBN 978-0-7726-6968-1 – Digital version

Citation

Foord, V. 2016. Climate patterns, trends, and projections for the Omineca, Skeena, and Northeast Natural Resource Regions, British Columbia. Prov. B.C., Victoria, B.C. Tech. Rep. 097. www.for.gov.bc.ca/hfd/pubs/Docs/Tr/Tro97.htm

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Copies of this report may be obtained, depending upon supply, from:

Crown Publications, Queen's Printer
2nd Floor, 563 Superior Street
Victoria, BC V8W 9V7
1-800-663-6105
www.crownpub.bc.ca

For more information on other publications in this series, visit www.for.gov.bc.ca/scripts/hfd/pubs/hfdcatalog/index.asp

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ACKNOWLEDGEMENTS

The author would like to thank Diane Roberge and Stafford Shuman for assisting with Figure 1 and Dave Spittlehouse and Alex Woods for providing reviews.

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FIGURE

1 North Area natural resource regions and district boundaries, and Environment Canada weather stations 1

INTRODUCTION

This document summarizes baseline climate, trends, and projections for the three natural resource regions within the North Area of the British Columbia Ministry of Forests, Lands and Natural Resource Operations (FLNRO): the Omineca, Skeena, and Northeast Natural Resource Regions. This information is intended to support the goals outlined in FLNRO's Climate Change Strategy (www.for.gov.bc.ca/het/climate/strategy/index.htm) and to aid in climate change action and adaptation planning for regions and districts within the North Area. Region and district baseline climate summaries were created using daily recorded data from Environment Canada weather stations from the time weather station recording began in 1886 up to 2008 (Figure 1). Climatic projections for the base climate stations were developed using the ClimateBC spatial software (Wang et al. 2012).

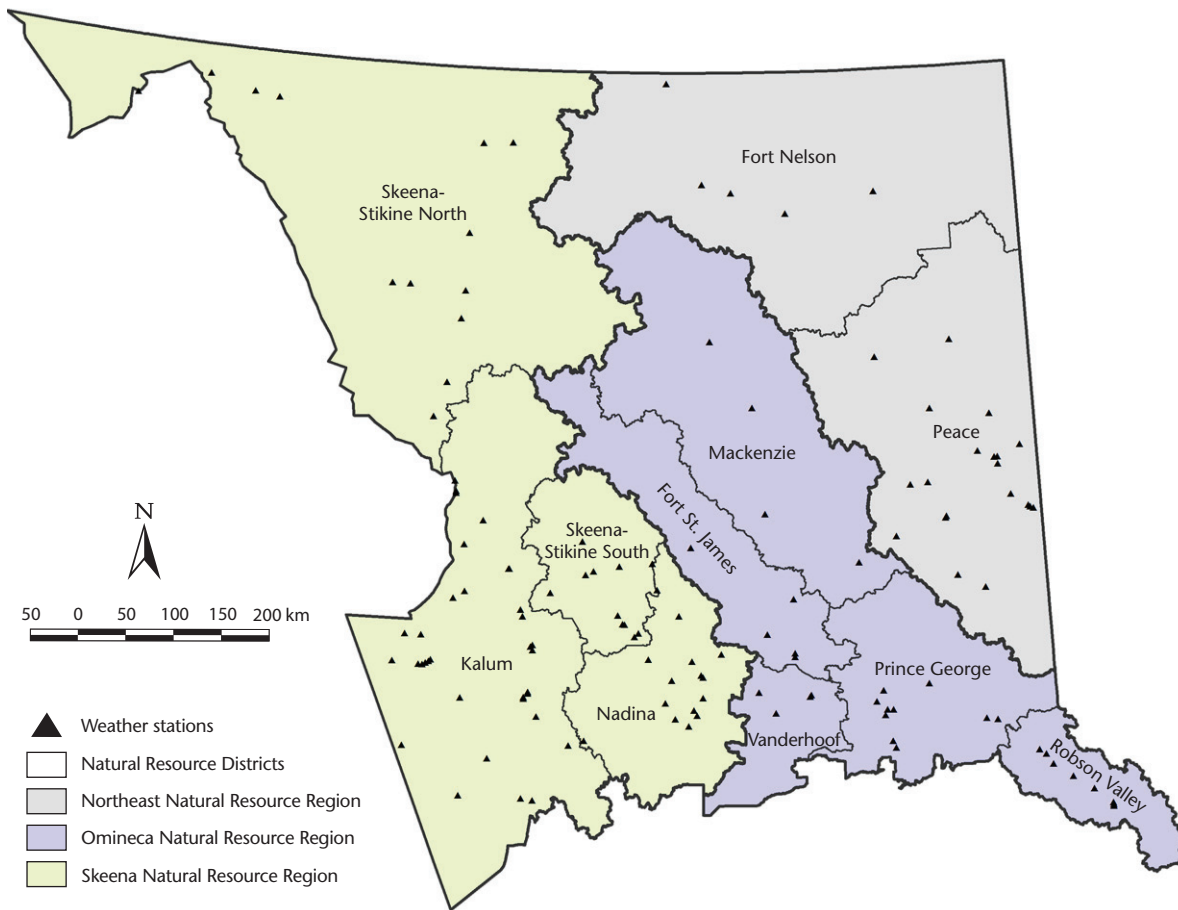


FIGURE 1 North Area natural resource regions and district boundaries, and Environment Canada weather stations.

BASELINE CLIMATE

Climate monitoring stations in northern British Columbia are sparse compared to the southern half of the province, and monitoring at those stations has been inconsistent. Consequently, data record periods differ among regions and districts (Table 1). To create the climate summaries, data from weather stations with at least 10 years of consecutive records were used. Annual and seasonal baseline climate was summarized using weighted averages, where a weight was applied to the record length (i.e., a climate station with 100 years of records was given more weight in the calculation of the regional average than a climate station with 10 years of records) (Egginton 2005).

TABLE 1 *Weather station record periods for North Area natural resource regions and districts*

Region/District	Data record
Omineca Natural Resource Region	1895–2008
Fort St. James District	1895–2008
Mackenzie District	1951–2008
Vanderhoof District	1916–2008
Prince George District	1912–2008
Robson Valley District	1914–2008
Skeena Natural Resource Region	1886–2008
Kalum District	1886–2008
Nadina District	1926–2008
Skeena–Stikine District (south – Skeena)	1912–2008
Skeena–Stikine District (north – Stikine)	1905–2008
Northeast Natural Resource Region	1910–2008
Peace District	1910–2008
Fort Nelson District	1937–2008

To create the seasonal summaries, winter was defined as the months of December, January, and February; spring included March, April, and May; summer included June, July, and August; and fall included September, October, and November. Maximum temperatures were based on the extreme maximum values; minimum temperatures were based on the extreme minimum values.

Baseline climate was summarized for regions and districts. Most districts are represented as currently defined; however, some adjustments were made to more accurately represent climate variation across the north. For example, the old Robson Valley District was kept separate from the Prince George District, the Stuart–Nechako District was based on the old Fort St. James and Vanderhoof District boundaries, and the Skeena–Stikine was split into south (Skeena) and north (Stikine) portions.

Omineca Natural Resource Region

The climate of the Omineca Natural Resource Region is mainly continental but is moderated by warm, moist Pacific air. Mean annual precipitation is 583 mm (more in mountainous areas not shown here), and precipitation occurs fairly evenly across the seasons (Table 2). Winters are long and overtake early spring and late fall months with below-freezing temperatures. Summers are warm and typically dominated by convective storms. Mean annual temperature is 3.2°C. Temperatures can rise above 30°C in the summer and come close to -40°C in the winter.

TABLE 2 *Baseline climate of the Omineca Natural Resource Region and districts*

Omineca Region				
Seasonal/Annual	Precipitation (mm)	Mean temperature (°C)	Maximum temperature (°C)	Minimum temperature (°C)
Winter	154.5	-8.6	8.3	-35.7
Spring	102.3	3.9	25.7	-21.6
Summer	163.2	14.1	31.6	-0.8
Fall	163.6	3.6	24.7	-20.5
Annual	583.3	3.2	31.8	-37.7
Fort St. James District				
Winter	129.3	-9.9	7.9	-36.9
Spring	84.8	2.6	24.1	-24.1
Summer	138.1	13.4	30.4	-1.5
Fall	135.6	3.0	23.4	-21.0
Annual	486.5	2.2	30.6	-38.4
Mackenzie District				
Winter	141.3	-12.1	6.1	-39.4
Spring	88.7	2.0	23.9	-26.1
Summer	161.6	13.2	30.0	-1.4
Fall	143.2	1.6	22.4	-24.2
Annual	532.0	1.1	30.3	-41.0
Vanderhoof District				
Winter	121.4	-8.9	9.6	-37.1
Spring	79.5	3.9	25.8	-22.4
Summer	144.8	14.0	31.5	-1.0
Fall	130.7	3.8	25.2	-20.4
Annual	475.6	3.2	31.8	-39.5
Prince George District				
Winter	170.5	-7.5	9.7	-35.1
Spring	116.7	4.7	26.9	-20.0
Summer	185.9	14.7	32.2	-0.2
Fall	186.2	4.3	25.6	-19.6
Annual	656.4	4.1	32.4	-36.9
Robson Valley District				
Winter	172.5	-7.2	7.4	-33.4
Spring	113.3	4.5	26.1	-19.4
Summer	163.7	14.3	32.4	-0.9
Fall	179.4	4.0	25.3	-19.6
Annual	632.8	3.9	32.5	-35.7

Skeena Natural Resource Region

The climate of the Skeena Natural Resource Region is dominated mainly by the influence of warm Pacific moisture. Mean annual precipitation is 1393 mm, with higher amounts occurring in the mountains (Table 3). Most precipitation occurs in fall due to incoming low-pressure systems from the coast. Summers are the driest season, but there is still a considerable amount of rainfall. Extreme temperatures are more moderate than in the other regions in the North Area; they are typically below 30°C in the summer and do not drop below -30°C in the winter. Mean annual temperature is 4.2°C.

TABLE 3 *Baseline climate of the Skeena Natural Resource Region and districts*

Skeena Region				
Seasonal/Annual	Precipitation (mm)	Mean temperature (°C)	Maximum temperature (°C)	Minimum temperature (°C)
Winter	444.4	-5.6	8.2	-25.9
Spring	250.2	4.0	22.8	-15.6
Summer	213.2	13.4	29.3	1.0
Fall	498.8	4.7	22.5	-13.6
Annual	1393.0	4.2	29.5	-27.2
Kalum District				
Winter	715.9	-1.0	9.2	-16.6
Spring	410.3	6.1	22.9	-7.8
Summer	289.1	14.3	29.0	3.6
Fall	808.6	7.0	22.5	-7.2
Annual	2202.3	6.6	29.3	-17.8
Nadina District				
Winter	203.7	-7.9	8.0	-31.9
Spring	104.9	2.3	22.6	-21.6
Summer	141.1	12.5	29.4	-1.2
Fall	206.3	3.4	23.1	-17.4
Annual	652.0	2.6	29.6	-33.6
Skeena District				
Winter	136.9	-7.2	8.4	-30.8
Spring	80.8	4.4	25.1	-17.5
Summer	140.6	13.9	31.4	-0.6
Fall	165.3	4.3	24.3	-16.2
Annual	520.4	3.9	31.5	-32.4
Stikine District				
Winter	160.8	-12.8	5.8	-37.3
Spring	73.4	0.5	20.6	-26.2
Summer	125.0	12.0	28.2	-1.4
Fall	178.3	0.8	19.9	-22.9
Annual	529.5	0.1	28.3	-38.3

Northeast Natural Resource Region

The climate of the Northeast Natural Resource Region is dominated mainly by continental (dry, cool) air masses. Mean annual precipitation is 494 mm, and about 40% of that falls during the summer, mostly due to convective storms (Table 4). Winter is usually the driest season. Mean annual temperature is 1.0°C, with winters typically reaching -40°C and summers reaching 30°C. Mean temperatures in November to March are typically well below freezing.

TABLE 4 Baseline climate of the Northeast Natural Resource Region and districts

Northeast Region				
Seasonal/Annual	Precipitation (mm)	Mean temperature (°C)	Maximum temperature (°C)	Minimum temperature (°C)
Winter	85.8	-13.4	9.0	-39.2
Spring	90.8	1.7	25.0	-27.5
Summer	209.9	14.0	30.2	-0.3
Fall	109.8	1.4	24.3	-26.0
Annual	494.2	1.0	30.4	-40.0
Peace District				
Winter	89.0	-12.0	9.3	-38.4
Spring	91.6	2.2	25.3	-26.5
Summer	204.9	14.0	30.2	-0.2
Fall	111.3	2.2	24.6	-24.8
Annual	496.8	1.7	30.4	-39.1
Fort Nelson District				
Winter	75.7	-17.4	7.9	-41.5
Spring	88.2	0.4	24.4	-30.7
Summer	225.9	14.0	30.2	-0.4
Fall	104.9	-0.9	23.4	-29.5
Annual	486.2	-1.0	30.4	-42.3

CLIMATE TRENDS

Linear regression was used to conduct trend analyses for each annual and seasonal climate variable for each weather station. Weighted averages were used to create district/region values, with weights based on weather station record period (Egginton 2005). The record period for each region and district summary was the same as that used for the baseline climate summaries (Table 1). Bold values in Tables 5–7 are statistically significant ($p < 0.05$). Noteworthy changes are highlighted in the following summaries.

Omineca Natural Resource Region (1895–2008)

The Omineca Natural Resource Region has become warmer and wetter over approximately the last century (Table 5). Precipitation has increased by approximately 20% in spring, summer, and fall. Precipitation has increased the most in the Vanderhoof District (e.g., up to approximately 40% in summer) and the least in the Mackenzie District. Winters have been getting increasingly drier in the Vanderhoof District.

Mean annual temperature has increased the most ($> 2^{\circ}\text{C}$) in the Fort St. James District and the least in the Robson Valley ($< 1^{\circ}\text{C}$). Winters have warmed the most in the Mackenzie District (3.8°C) and the least in the Robson Valley (no significant trend). The greatest increase in mean spring,

summer, and fall temperatures has occurred in the Fort St. James District (approximately 2°C each). Extreme maximum temperatures have increased significantly in the Fort St. James and Mackenzie Districts during winter, in the Robson Valley during spring, and in the Mackenzie and Prince George Districts during summer. The annual extreme minimum temperature has increased by 2.9–5.7°C across the region, likely because Arctic air movements through the region have become less frequent because the jet stream has been moving northward (Hartmann et al. 2013). Increases in spring extreme minimum temperatures have been large (up to 9.3°C in the Fort St. James District), and seem to follow an east-to-west trend across the Omineca. Summer minimum temperatures have increased by slightly more than 1°C in most districts. Fall minimum temperatures have increased significantly in the Fort St. James and Mackenzie Districts (4.6 and 3.3°C, respectively).

TABLE 5 *Climate trends in the Omineca Natural Resource Region and districts (1895–2008). Bold values are statistically significant ($p < 0.05$).*

Omineca Region Seasonal/Annual	Change in:			
	Precipitation (%)	Mean temperature (°C)	Maximum temperature (°C)	Minimum temperature (°C)
Winter	-1.5	2.2	0.3	3.5
Spring	20.0	1.2	0.6	3.9
Summer	21.5	1.1	0.7	1.7
Fall	19.4	0.7	0.5	2.2
Annual	13.3	1.3	0.8	4.5
Fort St. James District				
Winter	13.9	2.6	2.0	4.9
Spring	17.8	2.4	1.2	9.3
Summer	29.4	2.1	-0.2	4.3
Fall	23.6	1.6	0.1	4.6
Annual	24.6	2.2	0.1	5.1
Mackenzie District				
Winter	-14.8	3.8	0.3	3.8
Spring	10.6	1.5	-0.3	4.2
Summer	9.2	1.2	0.7	1.1
Fall	9.2	0.7	0.0	3.3
Annual	3.7	1.7	1.1	3.7
Vanderhoof District				
Winter	-9.5	3.2	1.2	2.3
Spring	31.2	1.5	0.1	3.6
Summer	39.7	1.1	1.1	1.1
Fall	23.9	0.8	0.8	2.4
Annual	18.9	1.5	0.6	5.0
Prince George District				
Winter	-17.0	2.1	0.1	5.1
Spring	17.9	1.1	0.7	2.7
Summer	13.9	0.9	1.7	1.0
Fall	19.4	0.8	1.5	2.3
Annual	7.1	1.3	1.6	5.7
Robson Valley District				
Winter	13.3	0.8	-0.9	1.3
Spring	22.1	0.5	1.9	2.2
Summer	21.9	0.6	0.0	1.5
Fall	19.1	-0.1	-0.2	0.3
Annual	14.5	0.6	0.5	2.9

**Skeena Natural
Resource Region
(1886–2008)**

The Skeena Natural Resource Region has become warmer and wetter over approximately the last century (Table 6). Mean annual precipitation has increased 5.2%. Most significantly, summer precipitation has increased by more than 10%. In the Stikine (northern) portion of the Skeena–Stikine District, the increase in summer precipitation is close to 20%. Spring precipitation has also increased in most of the region, most notably in the Skeena–Stikine District. Winter precipitation has declined only in the Nadina District (by 19.5%). The largest increases in precipitation have occurred in the Skeena (southern) portion of the Skeena–Stikine District.

Mean annual temperature has increased in the region by 0.8°C. Extreme minimum temperatures have increased the most, especially in the Nadina District (2.9°C). Seasonally, winter temperatures have increased the most throughout the region, by about 2°C. The Skeena (southern) portion of the Skeena–Stikine District does not have many significant trends in temperature compared to the other districts; however, large increases in precipitation have likely moderated increases in temperature. Summers, overall, are getting warmer in the region. Spring temperatures are increasing in the Kalum District. Fall maximum temperatures have declined significantly in the Skeena–Stikine and the Nadina Districts (–0.9 and –1.6°C, respectively).

TABLE 6 *Climate trends in the Skeena Natural Resource Region and districts (1886–2008). Bold values are statistically significant ($p < 0.05$).*

Skeena Region Seasonal/Annual	Change in:			
	Precipitation (%)	Mean temperature (°C)	Maximum temperature (°C)	Minimum temperature (°C)
Winter	2.8	1.8	0.6	2.4
Spring	9.2	0.8	0.3	1.6
Summer	10.6	0.6	0.7	0.9
Fall	4.8	0.1	–0.7	0.1
Annual	5.2	0.8	0.7	1.7
Kalum District				
Winter	2.0	1.9	0.9	2.9
Spring	9.3	1.0	0.8	1.5
Summer	6.0	0.7	1.0	0.9
Fall	–1.0	0.3	–0.1	–0.4
Annual	2.3	0.9	1.0	2.1
Nadina District				
Winter	–19.5	2.1	–0.3	3.0
Spring	–3.8	0.5	–0.7	2.8
Summer	10.0	0.4	–0.2	1.2
Fall	6.3	0.1	–1.6	1.5
Annual	–0.7	0.8	0.0	2.9
Skeena District				
Winter	16.3	0.7	0.5	0.8
Spring	18.6	0.3	0.2	0.8
Summer	17.4	0.5	0.7	0.6
Fall	19.6	–0.2	–1.0	0.4
Annual	12.4	0.2	0.5	–0.1
Stikine District				
Winter	18.2	2.3	0.9	2.2
Spring	14.5	1.1	0.1	1.4
Summer	19.8	0.8	0.9	0.9
Fall	6.5	–0.1	–0.9	–0.3
Annual	14.0	0.9	0.7	1.4

**Northeast Natural
Resource Region
(1910–2008)**

The Northeast Natural Resource Region has been getting warmer over approximately the last century (Table 7). Winter precipitation has decreased by more than 15% in the region. Marginal increases in precipitation have occurred in spring, summer, and fall; however, the only statistically significant increase has occurred in summer in the Fort Nelson District (~14%).

Winter temperatures have warmed the most (by more than 2°C), driven mainly by increases in extreme minimum temperatures. Temperature trends are stronger in the Fort Nelson District than in the Peace District due to increases in winter, spring, and summer mean temperatures. In the Peace District, extreme minimum temperatures in the fall have increased significantly (2.7°C).

TABLE 7 *Climate trends in the Northeast Natural Resource Region and districts (1910–2008). Bold values are statistically significant ($p < 0.05$).*

Northeast Region Seasonal/Annual	Change in:			
	Precipitation (%)	Mean temperature (°C)	Maximum temperature (°C)	Minimum temperature (°C)
Winter	-15.4	2.1	1.0	2.5
Spring	5.0	0.6	-0.6	1.0
Summer	3.9	0.5	-0.1	-0.4
Fall	3.9	0.2	-0.8	2.7
Annual	2.2	0.7	-0.2	2.8
Peace District				
Winter	-12.6	2.0	0.9	2.3
Spring	2.4	0.4	-0.5	0.7
Summer	0.7	0.4	-0.2	0.4
Fall	5.3	0.2	-0.8	2.7
Annual	0.2	0.5	-0.3	2.7
Fort Nelson District				
Winter	-24.3	2.5	1.2	3.0
Spring	13.1	1.0	-0.9	1.9
Summer	14.1	0.8	0.1	0.6
Fall	-0.7	0.4	-0.9	2.5
Annual	8.4	1.1	0.1	3.1

CLIMATE PROJECTIONS

Climate projections for the North Area regions and districts were made for 2055 (2041–2070). The most recent version of ClimateBC was used to predict annual and seasonal climate variables (Omineca: v 5.03; Skeena: 5.04; Northeast Region: v 5.10) (Wang et al. 2012). For consistency, the co-ordinates and elevations of the weather stations used for the baseline climate and current trends summaries were run in ClimateBC to generate the climate projections. An average of four different models (CanESM, CCSM4, HadGem2-ES, MRI-CGCM3) from two different emissions scenarios (Representative Concentration Pathway [RCP] 4.5 and 8.5), totalling eight model runs, were used to generate the projections. RCP 8.5 is based on rising radiative forcing leading to 8.5 W/m² in 2100 (worst case); RCP 4.5 is based on stabilization of 4.5 W/m² radiative forcing around 2050 (best case). Current radiative forcing is at about 2 W/m² (IPCC 2014).

Annual and seasonal climate anomalies are calculated as the difference between the 2055 (2041–2070) climate projections and 1961–1990 climate normals. The anomalies (i.e., the amount of change between the 1961–1990 climate normal period and the 2055 climate projection period) are shown in Tables 8–13 for each natural resource region within the North Area. These changes are based on the mean values of the eight model runs, as described above. For conciseness, the range around these mean anomalies from the different model runs is not discussed here but is available upon request. This information is meant to be used as guidance for future climate action and adaptation planning at a district or regional level. Anomalies from the projections for each region are briefly summarized.

Annual Climate Projections (Anomalies)

Annual climate variables

MAT	mean annual temperature (°C)
MWMT	mean warmest month temperature (°C)
MCMT	mean coldest month temperature (°C)
TD	temperature difference between MWMT and MCMT, or continentality (°C)
MAP	mean annual precipitation (mm)
MAP (%)	MAP expressed as percent change from historical MAP
MSP	mean summer precipitation (mm)
AHM	annual heat moisture index
SHM	summer heat moisture index
DD < 0	degree-days below 0°C, chilling degree-days
DD > 5	degree-days above 5°C, growing degree-days
DD < 18	degree-days below 18°C, heating degree-days
DD > 18	degree-days above 18°C, cooling degree-days
NFFD	number of frost-free days
bFFP	day of the year on which FFP begins
eFFP	day of the year on which FFP ends
FFP	frost-free period
PAS	precipitation as snow (mm) between August in previous year and July in current year
EMT	extreme minimum temperature over 30 years
EXT	extreme maximum temperature over 30 years
Eref	Hargreaves reference evaporation (mm)
CMD	Hargreaves climatic moisture deficit (mm)
%PAS	precipitation as snow expressed as percent change from historical PAS

Omineca Natural Resource Region

Mean annual temperature in the Omineca Natural Resource Region is projected to increase by 3.5°C with minimum temperatures increasing more than maximum temperatures (Table 8). Mean annual precipitation is projected to increase by 7%, less so in the Robson Valley. Any increases will likely be as rainfall because precipitation as snow is projected to decrease by about 30% (ranging from -10% in Mackenzie District to -40% in the Robson Valley). The number of growing degree-days will increase, and the number of frost-free days will increase. Evaporation and climate moisture deficit will increase despite moderate increases in growing-season precipitation.

TABLE 8 Annual climate projections (anomalies) for 2055 in the Omineca Natural Resource Region and districts

District	MAT	MWMT	MCMT	TD	MAP	MAP (%)	MSP	AHM	SHM
Fort St. James	3.5	4.2	3.6	0.7	44.8	9.2	11.0	4.2	14.8
Mackenzie	3.5	4.2	3.8	0.3	41.8	7.9	11.9	4.8	13.5
Vanderhoof	3.4	4.3	3.5	0.8	35.2	7.4	9.8	4.7	15.4
Prince George	3.5	4.3	3.4	0.9	46.0	7.0	10.1	3.4	12.3
Robson Valley	3.4	4.4	3.1	1.3	28.5	4.5	-0.6	4.2	18.2
Region average	3.5	4.2	3.6	0.7	41.9	7.2	10.7	4.3	14.0

District	DD < 0	DD < 5	DD < 18	DD > 18	NFFD	bFFP	eFFP	FFP	PAS
Fort St. James	-450	673	-1189	93	44	-26	21	47	-55.4
Mackenzie	-497	654	-1216	84	42	-26	22	48	-32.7
Vanderhoof	-417	687	-1133	122	42	-26	20	46	-43.9
Prince George	-380	710	-1096	154	42	-21	20	42	-81.1
Robson Valley	-342	746	-1070	175	45	-23	21	44	-75.2
Region average	-436	681	-1158	113	42	-25	21	46	-53.3

District	EMT	EXT	Eref	CMD	%PAS
Fort St. James	5.1	4.4	99.4	68.3	-28.8
Mackenzie	4.4	4.0	85.7	65.4	-10.0
Vanderhoof	5.0	4.5	120.5	76.0	-26.6
Prince George	5.3	4.3	127.2	71.1	-37.5
Robson Valley	5.3	4.3	126.5	89.0	-39.8
Region average	4.9	4.3	108.2	70.2	-28.6

Skeena Natural Resource Region

Mean annual temperature in the Skeena Natural Resource Region is projected to increase by 3.1°C (ranging from 3.0°C in the Kalum District to 3.4°C in the Stikine), with minimum temperatures increasing more than maximum temperatures (Table 9). Mean annual precipitation for the region is projected to increase by 7%, ranging from 5% in the Nadina District to 11% in the Stikine. Increases will likely be as rainfall because precipitation as snow is projected to decrease by about 35%. For the Kalum District, which is closest to the coast, precipitation as snow is projected to decrease by 72%. The number of growing degree-days will increase, and the number of frost-free days will increase. Evaporation and climate moisture deficit will increase despite moderate increases in summer precipitation.

TABLE 9 Annual climate projections (anomalies) for 2055 in the Skeena Natural Resource Region and districts

District	MAT	MWMT	MCMT	TD	MAP	MAP (%)	MSP	AHM	SHM
Kalum	3.0	3.4	3.1	0.3	151.0	6.9	15.7	1.0	6.1
Nadina	3.2	3.8	3.1	0.6	33.4	5.1	10.3	4.3	14.2
Skeena	3.2	3.7	3.2	0.5	36.7	7.1	11.9	4.0	12.4
Stikine	3.4	3.6	3.6	0.0	59.6	11.2	16.9	3.9	11.9
Region average	3.1	3.5	3.2	0.4	95.8	6.9	14.2	2.6	9.6

District	DD < 0	DD < 5	DD < 18	DD > 18	NFFD	bFFP	cFFP	FFP	PAS
Kalum	-193	703	-992	109	52	-33	22	56	-218.7
Nadina	-390	603	-1084	65	45	-29	19	49	-70.8
Skeena	-345	664	-1052	116	46	-28	19	46	-63.0
Stikine	-513	570	-1177	57	41	-25	20	45	-49.5
Region average	-305	656	-1048	93	48	-30	21	51	-139.4

District	EMT	EXT	Eref	CMD	%PAS
Kalum	6.6	3.5	71.6	32.0	-71.9
Nadina	5.1	4.2	88.9	56.0	-21.9
Skeena	5.7	4.0	95.9	59.6	-30.0
Stikine	4.8	2.9	71.0	44.2	-14.7
Region average	5.9	3.6	78.7	42.9	-34.6

**Northeast Natural
Resource Region**

Mean annual temperature in the Northeast Natural Resource Region is projected to increase by 3.3°C, with minimum temperatures increasing more than maximum temperatures (Table 10). Mean annual precipitation is projected to increase by 10%; however, precipitation as snow may decrease by 10%. The number of growing degree-days will increase and the number of frost-free days will increase. Evaporation and climate moisture deficit will increase despite a marginal increase in summer precipitation. Precipitation is projected to increase more in the Fort Nelson District than in the Peace District.

TABLE 10 Annual climate projections (anomalies) for 2055 in the Northeast Natural Resource Region and districts

District	MAT	MWMT	MCMT	TD	MAP	MAP (%)	MSP	AHM	SHM
Peace	3.2	3.9	2.8	1.1	47.6	9.6	21.3	3.9	9.4
Fort Nelson	3.4	3.7	3.2	0.5	59.1	12.2	34.3	4.1	6.2
Region average	3.3	3.9	2.9	1.0	49.8	10.1	23.8	3.9	8.8

District	DD < 0	DD < 5	DD < 18	DD > 18	NFFD	bFFP	eFFP	FFP	PAS
Peace	-438	616	-1050	116	33	-26	13	39	-23.7
Fort Nelson	-539	569	-1133	92	33	-27	12	38	-15.6
Region average	-457	607	-1066	111	33	-26	13	39	-22.1

District	EMT	EXT	Eref	CMD	%PAS
Peace	4.6	3.1	76.4	41.8	-10.5
Fort Nelson	4.1	2.5	68.6	29.4	-8.9
Region average	4.5	3.0	74.9	39.4	-9.7

**Seasonal Climate
Projections
(Anomalies)**

Seasonal climate variables

Winter (_wt)	December (prev. yr)–February
Spring (_sp)	March–May
Summer (_sm)	June–August
Autumn (_at)	September–November
Tmax_(season)	(season) mean maximum temperature (°C)
Tmin_(season)	(season) mean minimum temperature (°C)
Tave_(season)	(season) mean temperature (°C)
PPT_(season)	(season) precipitation (mm)
DD < 0_(season)	(season) degree-days below 0°C
DD < 5_(season)	(season) degree-days below 5°C
DD < 18_(season)	(season) degree-days below 18°C
DD > 18_(season)	(season) degree-days above 18°C
NFFD_(season)	(season) number of frost-free days
Eref_(season)	Hargreaves reference evaporation (mm)
PAS_(season)	(season) precipitation as snow (mm)
%PPT_(season)	(season) precipitation expressed as percent change from historical PPT
CMD_(season)	(season) Hargreaves climatic moisture deficit (mm)

**Omineca Natural
Resource Region**

In the Omineca Natural Resource Region, summers are predicted to warm more than other seasons, by 3.8°C, with minimum temperatures increasing the most (Table 11). Seasonal temperatures warm the most in the Robson Valley in the summer and the least in the Robson Valley in the winter. Precipitation is projected to increase the most in the fall (11%) and the least in the summer (Prince George and Robson Valley have slight negative projections). More precipitation will occur as rain than as snow. The greatest increase in the number of frost-free days is projected to occur in the fall.

**Skeena Natural
Resource Region**

In the Skeena Natural Resource Region, summers are predicted to warm more than other seasons, by 3.5°C, with minimum temperatures increasing the most (Table 12). Seasonal temperatures warm the most in the Stikine in the winter and the least in the Nadina in the winter. Precipitation is projected to increase the most in the fall (13%). Minor increases in summer precipitation are predicted in the Stikine District (7%); however, other areas may experience drier summers. More precipitation will occur as rain than as snow. The greatest increase in the number of frost-free days is projected to occur in the spring.

TABLE 11 Seasonal climate projections (anomalies) for 2055 in the Omineca Natural Resource Region and districts

District	Tmax_wt	Tmax_sp	Tmax_sm	Tmax_at	Tmin_wt	Tmin_sp	Tmin_sm	Tmin_at
Fort St. James	2.7	3.2	4.1	3.0	3.8	3.1	3.4	3.3
Mackenzie	2.9	2.9	4.3	3.1	4.0	3.1	3.5	3.5
Vanderhoof	2.7	3.2	4.2	3.0	3.7	3.0	3.4	3.2
Prince George	2.6	3.2	4.3	3.0	3.7	3.0	3.4	3.2
Robson Valley	2.5	3.1	4.6	3.1	3.3	2.9	3.5	3.3
Region average	2.7	3.1	4.2	3.0	3.8	3.0	3.4	3.3

District	Tave_wt	Tave_sp	Tave_sm	Tave_at	PPT_wt	PPT_sp	PPT_sm	PPT_at
Fort St. James	3.2	3.1	3.7	3.2	13.6	9.2	0.7	19.9
Mackenzie	3.4	3.0	3.9	3.3	13.7	7.8	2.8	16.3
Vanderhoof	3.2	3.1	3.8	3.1	9.6	8.3	0.0	17.6
Prince George	3.2	3.1	3.8	3.1	13.1	12.4	-2.1	20.7
Robson Valley	2.9	3.0	4.0	3.2	11.6	9.4	-6.4	11.0
Region average	3.2	3.1	3.8	3.2	12.5	9.4	0.4	18.6

District	DD<0_wt	DD<0_sp	DD<0_sm	DD<0_at	DD<5_wt	DD<5_sp	DD<5_sm	DD<5_at
Fort St. James	-262	-81	0	-83	2	128	314	133
Mackenzie	-284	-95	0	-93	1	114	321	127
Vanderhoof	-258	-67	0	-75	3	135	316	136
Prince George	-245	-53	0	-65	5	143	321	145
Robson Valley	-221	-43	0	-60	5	154	339	154
Region average	-262	-74	0	-79	3	130	318	135

District	DD<18_wt	DD<18_sp	DD<18_sm	DD<18_at	DD>18_wt	DD>18_sp	DD>18_sm	DD>18_at
Fort St. James	-273	-266	-256	-264	0	3	60	4
Mackenzie	-286	-252	-269	-276	0	2	56	3
Vanderhoof	-267	-258	-236	-251	0	4	80	5
Prince George	-262	-253	-212	-252	0	5	106	6
Robson Valley	-242	-246	-214	-257	0	7	124	7
Region average	-272	-257	-243	-261	0	3	75	4

District	NFFD_wt	NFFD_sp	NFFD_sm	NFFD_at	Eref_wt	Eref_sp	Eref_sm	Eref_at
Fort St. James	1	16	4	17	0.0	34.5	41.3	9.8
Mackenzie	1	14	4	18	0.0	23.1	43.4	8.1
Vanderhoof	1	15	3	16	0.0	52.5	43.9	11.6
Prince George	3	16	2	16	0.0	54.2	46.4	14.1
Robson Valley	4	17	2	16	0.0	44.9	52.8	16.0
Region average	2	15	3	17	0.0	41.1	43.8	10.9

District	PAS_wt	PAS_sp	PAS_sm	PAS_at	%PPT_wt	%PPT_sp	%PPT_sm	%PPT_at
Fort St. James	-3.5	-20.1	0.0	-24.2	10.5	10.8	0.5	14.6
Mackenzie	4.3	-12.8	0.0	-20.3	9.7	8.8	1.8	11.4
Vanderhoof	-6.5	-15.0	0.0	-15.9	7.9	10.5	0.0	13.5
Prince George	-25.9	-22.4	0.0	-22.8	7.7	10.6	-1.1	11.1
Robson Valley	-27.6	-19.0	0.0	-20.0	6.7	8.3	-3.9	6.1
Region average	-7.9	-17.6	0.0	-20.8	8.5	9.8	-0.6	11.4

District	CMD_wt	CMD_sp	CMD_sm	CMD_at
Fort St. James	0.0	16.2	41.6	0.9
Mackenzie	0.0	14.7	40.8	1.5
Vanderhoof	0.0	18.8	45.5	0.5
Prince George	0.0	14.3	51.1	0.5
Robson Valley	0.0	18.2	61.6	4.0
Region average	0.0	16.0	44.8	0.9

TABLE 12 Seasonal climate projections (anomalies) for 2055 in the Skeena Natural Resource Region and districts

District	Tmax_wt	Tmax_sp	Tmax_sm	Tmax_at	Tmin_wt	Tmin_sp	Tmin_sm	Tmin_at
Kalum	2.6	3.0	3.5	2.7	3.3	3.1	3.0	2.9
Nadina	2.5	2.9	3.9	2.7	3.5	3.2	3.4	3.1
Skeena	2.5	3.0	3.9	2.8	3.6	3.3	3.4	3.1
Stikine	3.1	2.7	3.9	2.9	4.1	3.3	3.5	3.6
Region average	2.6	2.9	3.7	2.7	3.5	3.2	3.2	3.1

District	Tave_wt	Tave_sp	Tave_sm	Tave_at	PPT_wt	PPT_sp	PPT_sm	PPT_at
Kalum	3.0	3.0	3.3	2.8	36.5	21.1	-12.7	106.1
Nadina	3.0	3.0	3.7	2.9	6.0	8.6	-1.4	20.2
Skeena	3.1	3.1	3.6	3.0	6.6	7.9	-0.4	22.3
Stikine	3.6	3.0	3.7	3.2	15.3	6.9	8.9	28.5
Region average	3.1	3.0	3.5	2.9	22.5	14.4	-5.2	64.1

District	DD<0_wt	DD<0_sp	DD<0_sm	DD<0_at	DD<5_wt	DD<5_sp	DD<5_sm	DD<5_at
Kalum	-136	-27	0	-30	42	188	300	172
Nadina	-242	-74	0	-75	3	130	333	136
Skeena	-234	-46	0	-65	7	174	333	151
Stikine	-302	-103	0	-108	2	109	341	118
Region average	-197	-51	0	-56	23	162	318	153

District	DD<18_wt	DD<18_sp	DD<18_sm	DD<18_at	DD>18_wt	DD>18_sp	DD>18_sm	DD>18_at
Kalum	-266	-272	-210	-244	0	7	91	11
Nadina	-269	-277	-278	-260	0	2	58	4
Skeena	-274	-282	-233	-263	0	7	101	7
Stikine	-321	-274	-289	-293	0	3	52	2
Region average	-276	-275	-239	-258	0	5	80	8

District	NFFD_wt	NFFD_sp	NFFD_sm	NFFD_at	Eref_wt	Eref_sp	Eref_sm	Eref_at
Kalum	20	19	1	12	8.5	21.4	34.2	7.7
Nadina	3	20	4	18	0.0	36.2	41.7	11.0
Skeena	5	21	3	17	2.1	39.1	41.9	12.7
Stikine	1	16	6	18	0.0	23.3	39.9	8.1
Region average	11	19	3	15	4.5	27.4	37.7	9.2

District	PAS_wt	PAS_sp	PAS_sm	PAS_at	%PPT_wt	%PPT_sp	%PPT_sm	%PPT_at
Kalum	-138.7	-36.9	0.0	-43.0	5.1	5.1	-4.4	13.1
Nadina	-23.1	-23.3	0.0	-24.4	3.0	8.2	-1.0	9.8
Skeena	-27.5	-14.1	0.0	-21.4	4.9	9.8	-0.3	13.5
Stikine	-2.6	-13.7	0.0	-33.4	9.5	9.3	7.1	16.0
Region average	-77.7	-27.2	0.0	-34.5	5.6	8.1	0.4	13.1

District	CMD_wt	CMD_sp	CMD_sm	CMD_at
Kalum	0.0	7.0	25.0	0.0
Nadina	0.0	11.6	43.1	1.3
Skeena	0.0	16.8	42.3	0.9
Stikine	0.0	13.3	31.0	0.4
Region average	0.0	10.4	32.2	0.4

**Northeast Natural
Resource Region**

In the Northeast Natural Resource Region, mean temperatures in spring are projected to warm more than during the other seasons (3.8°C), and more so in the Fort Nelson District than in the Peace District (Table 13). Fall is projected to warm the least. Summer maximum temperatures are projected to increase the most. The greatest increase in minimum temperatures is projected to occur in the spring. Contrary to the current climate trends, winter precipitation is projected to increase by about 3%. Decreases in snowfall are forecast for the spring, summer, and fall. Total precipitation is projected to increase in spring, summer, and fall; the greatest increase will occur in the spring (29%). The greatest increase in the number of frost-free days is projected to occur in spring.

TABLE 13 Seasonal climate projections (anomalies) for 2055 in the Northeast Natural Resource Region and districts

District	Tmax_wt	Tmax_sp	Tmax_sm	Tmax_at	Tmin_wt	Tmin_sp	Tmin_sm	Tmin_at
Peace	2.7	3.6	4.0	1.9	3.7	3.9	3.5	2.4
Fort Nelson	3.2	3.7	3.7	1.9	4.0	4.1	3.6	2.6
Region average	2.8	3.6	3.9	1.9	3.8	3.9	3.5	2.5

District	Tave_wt	Tave_sp	Tave_sm	Tave_at	PPT_wt	PPT_sp	PPT_sm	PPT_at
Peace	3.2	3.7	3.7	2.2	8.3	24.5	3.6	11.3
Fort Nelson	3.6	4.0	3.6	2.3	8.9	27.3	14.3	8.7
Region average	3.3	3.8	3.7	2.2	8.4	25.1	5.7	10.8

District	DD<0_wt	DD<0_sp	DD<0_sm	DD<0_at	DD<5_wt	DD<5_sp	DD<5_sm	DD<5_at
Peace	-272	-110	0	-56	3	167	344	101
Fort Nelson	-320	-133	0	-86	1	154	331	83
Region average	-282	-114	0	-61	3	165	342	98

District	DD<18_wt	DD<18_sp	DD<18_sm	DD<18_at	DD>18_wt	DD>18_sp	DD>18_sm	DD>18_at
Peace	-288	-333	-235	-194	0	9	102	4
Fort Nelson	-322	-356	-248	-207	0	9	81	3
Region average	-295	-338	-237	-196	0	9	98	4

District	NFFD_wt	NFFD_sp	NFFD_sm	NFFD_at	Eref_wt	Eref_sp	Eref_sm	Eref_at
Peace	1	19	2	11	0.0	28.1	42.5	5.8
Fort Nelson	0	18	3	12	0.0	29.7	35.7	3.5
Region average	1	19	2	12	0.0	28.4	41.2	5.4

District	PAS_wt	PAS_sp	PAS_sm	PAS_at	%PPT_wt	%PPT_sp	%PPT_sm	%PPT_at
Peace	1.3	-16.2	-1.4	-7.6	9.3	26.8	1.8	10.2
Fort Nelson	7.7	-12.2	-2.0	-9.4	11.8	30.9	6.3	8.3
Region average	2.5	-15.4	-1.5	-7.9	10.5	28.9	4.0	9.2

District	CMD_wt	CMD_sp	CMD_sm	CMD_at
Peace	0.0	-1.6	39.6	4.0
Fort Nelson	0.0	5.9	21.1	2.1
Region average	0.0	-0.2	36.0	3.6

CONCLUSION

Significant changes in climate have occurred in the three North Area natural resource regions (Omineca, Skeena, and Northeast) over the historical record. Similar climate changes are projected to continue but at a more rapid rate. Overall, the North Area has become warmer, with the greatest temperature increases occurring in the winter and in both annual and seasonal extreme minimum temperatures. The North Area has also become marginally wetter, with the greatest increases occurring in the summer; however, significant decreases in winter precipitation have occurred in the Northeast Natural Resource Region and the Vanderhoof and Nadina Districts. Climate projections suggest that in the next 50 years the increase in temperatures will be more than double that of the past century. The current climate trends show that the greatest increases have been in minimum temperature and it is projected they will increase at a faster rate over the next 40-50 years. Precipitation projections are less clear, and show only marginal annual increases. Decreases in precipitation are projected in the summers for all three regions as well as spring and fall in the Northeast. Further warming will cause increased evaporation; therefore, the North Area will likely need much larger increases in precipitation than those experienced to date to create wetter conditions on the ground. Approximately 10–35% less precipitation is projected to fall as snow throughout most of the region, but there may be up to a 70% decrease closer to the coast.

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