

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

2016



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

Vanessa Foord



The use of trade, firm, or corporation names in this publication is for the information and convenience of the reader. Such use does not constitute an official endorsement or approval by the Government of British Columbia of any product or service to the exclusion of any others that may also be suitable. Contents of this report are presented for discussion purposes only. Funding assistance does not imply endorsement of any statements or information contained herein by the Government of British Columbia. Uniform Resource Locators (URLs), addresses, and contact information contained in this document are current at the time of printing unless otherwise noted.

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

Prepared by

Vanessa Foord
B.C. Ministry of Forests, Lands
and Natural Resource Operations
Omineca Region
Prince George, B.C.

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

© 2016 Province of British Columbia

When using information from this report, please cite fully and correctly.

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.

CONTENTS

| | |
|---|-----|
| Acknowledgements | iii |
| Introduction | 1 |
| Baseline Climate | 2 |
| Omineca Natural Resource Region | 3 |
| Skeena Natural Resource Region | 4 |
| Northeast Natural Resource Region | 5 |
| Climate Trends | 5 |
| Omineca Natural Resource Region (1895–2008) | 5 |
| Skeena Natural Resource Region (1886–2008) | 7 |
| Northeast Natural Resource Region (1910–2008) | 8 |
| Climate Projections | 9 |
| Annual Climate Projections (Anomalies) | 9 |
| Omineca Natural Resource Region | 10 |
| Skeena Natural Resource Region | 11 |
| Northeast Natural Resource Region | 12 |
| Seasonal Climate Projections (Anomalies) | 13 |
| Omineca Natural Resource Region | 13 |
| Skeena Natural Resource Region | 13 |
| Northeast Natural Resource Region | 16 |
| Conclusion | 17 |
| Literature Cited | 17 |

TABLES

1 Weather station record periods for North Area natural resource regions and districts 2

2 Baseline climate of the Omineca Natural Resource Region and districts 3

3 Baseline climate of the Skeena Natural Resource Region and districts 4

4 Baseline climate of the Northeast Natural Resource Region and districts ... 5

5 Climate trends in the Omineca Natural Resource Region and districts 6

6 Climate trends in the Skeena Natural Resource Region and districts 7

7 Climate trends in the Northeast Natural Resource Region and districts..... 8

8 Annual climate projections (anomalies) for 2055 in the Omineca Natural Resource Region and districts..... 10

9 Annual climate projections (anomalies) for 2055 in the Skeena Natural Resource Region and districts..... 11

10 Annual climate projections (anomalies) for 2055 in the Northeast Natural Resource Region and districts..... 12

11 Seasonal climate projections (anomalies) for 2055 in the Omineca Natural Resource Region and districts..... 12

12 Seasonal climate projections (anomalies) for 2055 in the Skeena Natural Resource Region and districts..... 13

13 Seasonal climate projections (anomalies) for 2055 in the Northeast Natural Resource Region and districts..... 16

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).

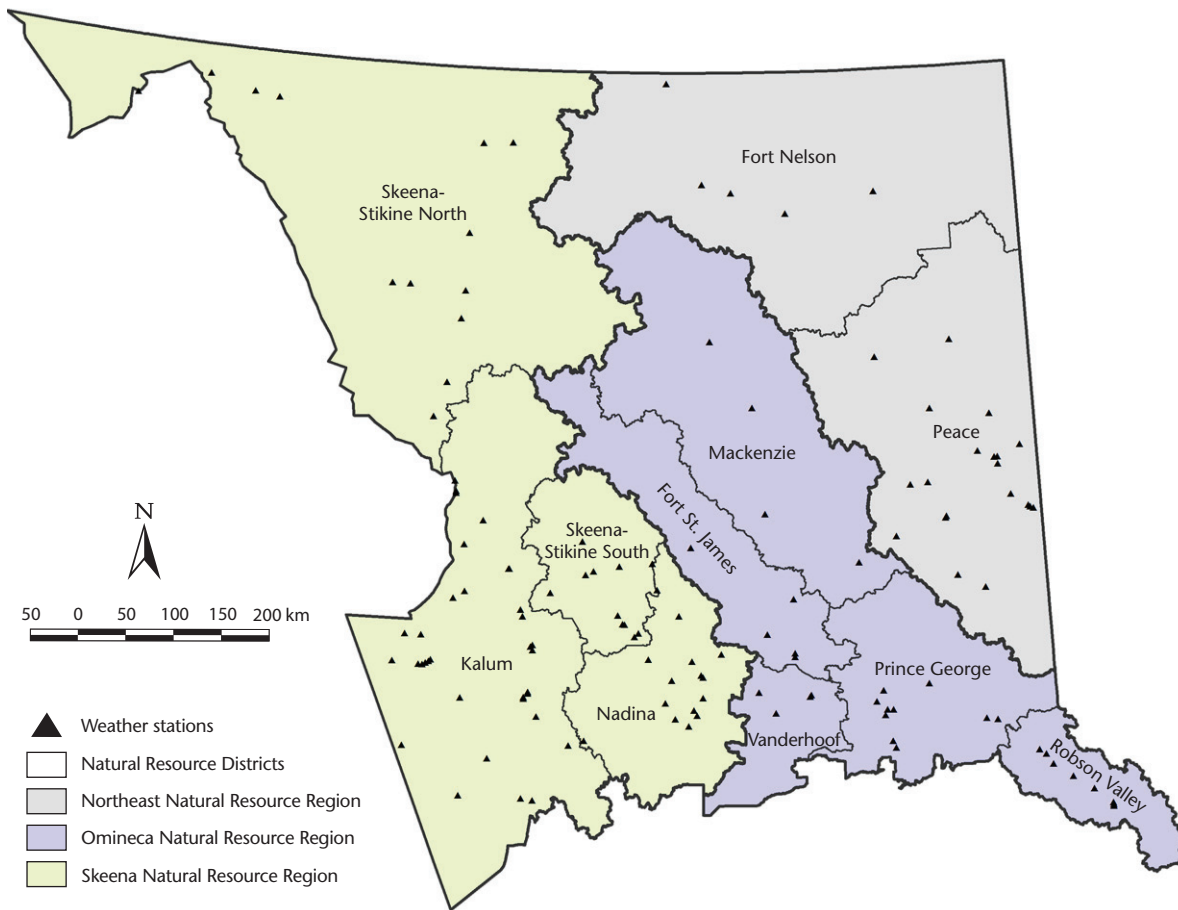


FIGURE 1 North Area natural resource regions and district boundaries, and Environment Canada weather stations.

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.

LITERATURE CITED

- Egginton, V.N. 2005. Historical climate variability from the instrumental record in northern British Columbia and its influence on slope stability. MSc thesis. Simon Fraser Univ., Burnaby, B.C.
- Hartmann, D.L., A.M.G. Klein Tank, M. Rusticucci, L.V. Alexander, S. Bronnimann, Y. Charabi, F.J. Dentener, E.J. Dlugokenchy, D.R. Easterling, A. Kaplan, B.J. Soden, P.W. Thorne, M. Wild, and P.M. Zhai. 2013. Observations: atmosphere and surface. In: *Climate change 2013: the physical science basis*. T.F. Stocker, D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex, and P.M. Midgley (editors). Contributions of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel of Climate Change. Cambridge University Press, Cambridge, U.K. and New York, N.Y.
- Intergovernmental Panel on Climate Change (IPCC). 2014. *Climate change 2014: synthesis report*. R.K. Pachauri and L.A. Meyer (editors). Contribution of Working Groups I, II, and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Geneva, Switzerland.
- Wang, T., A. Hamann, D. Spittlehouse, and T.N. Murdock. 2012. ClimateWNA – high resolution spatial data for western North America. *J. Appl. Meteorol. Climatol.* 51:16–29.