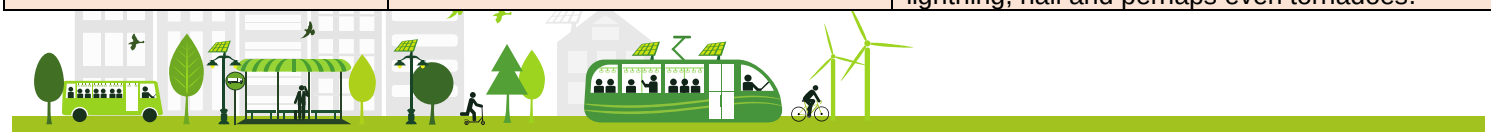
Niagara Region Climate Modeling Project

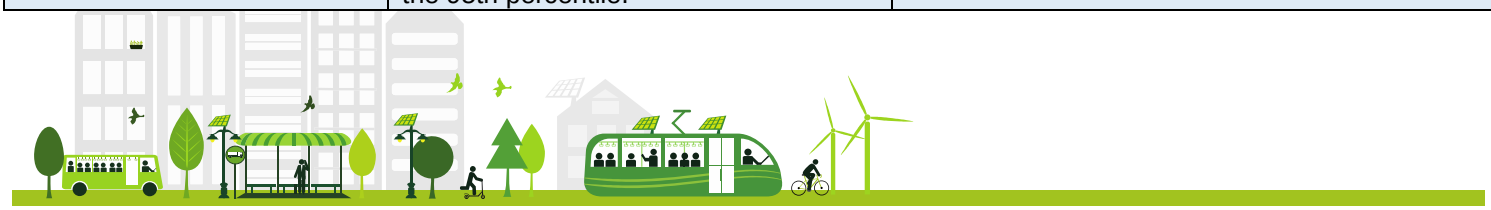
List of **Proposed** Climate Parameters

Please note: **Bolded** climate parameters indicate essential and/or strongly recommended.

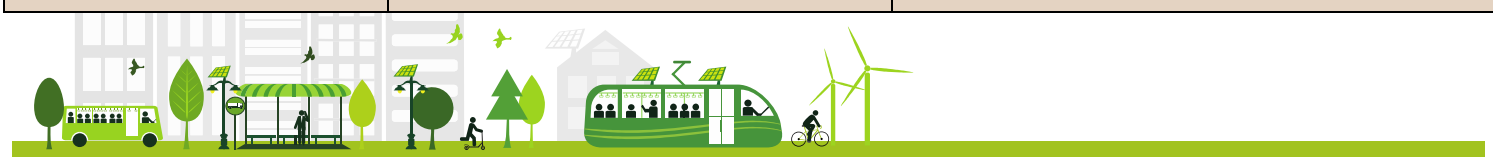
Climate Parameter	Definition	Why Consider Including Parameter in Study
Temperature Parameters		
Mean Air Temperature (°C)	The mean temperature in degrees Celsius (°C) is defined as the average of the maximum and minimum temperature at a location for a specified time interval	The temperature range we expect within a season or year is a very important aspect of climate. Changes in average and extreme temperatures can dramatically affect our everyday lives as well as a wide range of planning and policy decisions. The average highest temperature is an environmental indicator with many applications in agriculture, engineering, health, energy management, recreation, and more **Please note:** Maximum and minimum temperatures can be provided both annually and seasonally
Mean Maximum Air Temperature (°C)	The average of the maximum temperature in degrees Celsius (°C) observed at the location for that month	
Mean Minimum Air Temperature (°C)	The average of the minimum temperature in degrees Celsius (°C) observed at the location for that month	
Maximum Temperature (°C)	The highest temperature in degrees Celsius (°C) observed at a location for a specified time interval	
Minimum Temperature (°C)	The lowest temperature in degrees Celsius (°C) observed at a location for a specified time interval	
Extreme Maximum Air Temperature (°C)	The highest daily maximum temperature in degrees Celsius reached at a specific location for that month	
Extreme Minimum Air Temperature (°C)	The lowest daily minimum temperature in degrees Celsius reached at a specific location for that month	
Extreme Heat Parameters		
Days Above 35˚C	The sum of days in a given period of time when the temperature rises to at least 35˚C	High temperatures determine if plants and animals can thrive, they limit or enable outdoor activities, define how we design our buildings and vehicles, and shape our transportation and energy use. It is useful to know how high summer temperatures are likely to become in the future, to make sure that our cooling and air-conditioning systems can reliably deal with these extremes. When temperatures are very hot, people - especially the elderly - are much more likely to suffer from heat exhaustion and heat stroke. Many outdoor activities become dangerous or impossible. In general, Canadians are not used to extremely hot summers, and further warming will bring new and unusual risks as well as a very different experience of the summer season. High, persistent temperatures increase the risk of drought, which can severely impact food production and increases the risk of wildfire. High temperatures can also lead to more thunderstorms, which means increased risks of flash flooding, lightning, hail and perhaps even tornadoes.
Days Above 30˚C	The sum of days in a given period of time when the temperature rises to at least 30˚C	
Days Above 25˚C	The sum of days in a given period of time when the temperature rises to at least 25˚C	
Tropical Nights	A tropical night occurs when the lowest temperature of the day does not go below 20˚C	



Climate Parameter	Definition	Why Consider Including Parameter in Study
Extreme Cold Parameters		
Days Below -20˚C	The sum of days in a given period of time when the temperature drops to at least -20˚C	Cold weather is an important aspect of life in Canada, and many places in Canada are well adapted to very cold winters. It is especially important to know how our winters will change in the future, because cold temperatures affect our health and safety, determine what plants and animals can live in the area, limit or enable outdoor activities, define how we design our buildings and vehicles, and shape our transportation and energy use
Days Below -10˚C	The sum of days in a given period of time when the temperature drops to at least -10˚C	
Days Below -5˚C	The sum of days in a given period of time when the temperature drops to at least -5˚C	
Days Below 0˚C (Frost Days)	The sum of days in a given period of time when the coldest temperature of the day is lower than 0˚C. Under these conditions, frost might form at ground level or on cold surfaces	The number of frost days is an indicator of the length and severity of the winter season. A location with a large number of frost days is also likely to have a short growing season, since frost is harmful to many plants
Precipitation Parameters		
Total Annual Precipitation (mm/year)	The sum of the total rainfall and the water equivalent of the total snowfall in millimeters (mm), observed at the location during a specified time interval[1]. Winter is defined as DJF, spring as MAM, summer as JJA, and fall as SON.	Precipitation patterns are critical for many important issues, including water availability, crop production, electricity generation, wildfire suppression, snow accumulation, seasonal and flash-flooding, and short- and long-term drought risk
Total Winter Precipitation (mm/season)		
Total Spring Precipitation (mm/season)		
Total Summer Precipitation (mm/season)		
Total Fall Precipitation (mm/season)		
Extreme Precipitation Parameters		
Maximum Precipitation in one day (mm)	The maximum amount of precipitation (mm) in one day over a given period of time	Precipitation patterns are critical for many important issues, including water availability, crop production, electricity generation, wildfire suppression, snow accumulation, seasonal and flash-flooding, and short- and long-term drought risk
Extreme Precipitation Days (days with more than 25 mm)	The sum of days in a given period of time when at least a total of 25 mm of rain or frozen precipitation falls. Frozen precipitation is measured according to its liquid equivalent: 10 cm of snow is usually about 10 mm of precipitation	Heavy rainfall events can create many challenges. In cities and towns, heavy rainfalls can overwhelm storm drains and cause flash flooding. They can also cause problems in rural areas by drowning crops, eroding topsoil, and damaging roads. Heavy snowfall events can disrupt ground transportation, and very heavy snowfall events can cause damage to buildings if their roofs become overburdened.
Annual Simple Daily Intensity Index (SDII) (mm/day)	Average intensity (mm/day) over a given period of time, calculated as total wet day precipitation divided by the total number of wet days	
Winter SDII (mm/day)		
Spring SDII (mm/day)		
Summer SDII (mm/day)		
Fall SDII (mm/day)		
95th Percentile Precipitation (mm)	The percent of the total precipitation when precipitation is greater or equal to the 95th percentile.	



Climate Parameter	Definition	Why Consider Including Parameter in Study
99th Percentile Precipitation (mm)	The percent of the total precipitation when precipitation is greater or equal to the 99th percentile.	See description above
Drought Parameters		
Total Annual Dry Days	Total annual number of days where precipitation was less than 0.2 mm.	Total annual dry days and the maximum consecutive dry days are useful indicators for predicting drought in the future. This is useful for municipalities who have a large agricultural sector, such as Niagara Region.
Maximum Total Consecutive Dry Days	The number of consecutive days where annual total number of days where precipitation was less than 0.2 mm.	
Agricultural Parameters		
Growing Degree Days (Base 0°C)	Growing Degree Days (GDD) provide an index of the amount of heat available for the growth and maturation of plants and insects. Different base temperatures (0, 4, 5, 10, 15°C) are used to capture results for organisms that demand different amounts of heat.	GDDs accumulate whenever the daily mean temperature is above a specified threshold temperature. Generally, 5°C GDDs are used for assessing the growth of canola and forage crops; 10°C GDDs are more appropriate for assessing the growth of corn and beans; and 15°C GDDs are used to assess the growth and development of insects and pests.
Growing Degree Days (Base 4°C)		
Growing Degree Days (Base 5°C)		
Growing Degree Days (Base 10°C)		
Growing Degree Days (Base 15°C)		
Growing Season Length (also referred to as Frost Free Days)	Number of frost-free days is calculated based on the last occurrence of frost in spring and the first occurrence of frost in autumn.	The average length of the growing season (and its year-to-year variability) is an important consideration when selecting or predicting what plants might grow well in a region. A longer frost-free season means plants and crops have a longer window to grow and mature. This is an especially important parameter for agriculture, because the variability in the number of frost-free days is crucial for many agricultural activities such as planting and harvesting.
Growing Season Start Date	The first day after 5 consecutive minimum temperatures above 5°C	Changes in the length and timing of the frost-free season affect plant and animal life, but also our social, psychological, and physical experience of the changing seasons. The growth of most plants and crops is limited by the temperature of the air and soil. Since crops and plants need time to mature, the later in the fall they experience freezing temperatures, the more likely it is that they will be able to mature to their full potential. The time available for growth, maturity and productivity of these plants is determined by the Growing Season Start and End date, which together determine the length of the frost-free season.
Growing Season End Date	The first day after 5 consecutive maximum temperatures below 5°C	



Climate Parameter	Definition	Why Consider Including Parameter in Study
Corn Heat Unit (CHU)	CHU is a temperature-based index often used by farmers and agricultural researchers to estimate whether the climate is warm enough (but not too hot) to grow corn. Corn typically requires a minimum of a daily temperature of 10˚C, and of a nightly temperature of 4.4˚C. Generally, at least 2200 CHUs are required to mature most varieties of corn in a region.	The CHUs expected in a region's growing season are used to assess whether corn, or a particular variety of corn, is likely to fully mature in that region. It is important to note that this index is only based on temperature and does not consider the availability of water to grow the crop.
Ice Parameters		
Freeze-Thaw Cycles	A simple count of days when the air temperature fluctuates between freezing and non-freezing temperatures. Under these conditions, it is likely that some water at the surface was both liquid and ice at some point during the 24-hour period.	Freeze-thaw cycles can have major impacts on infrastructure. Water expands when it freezes, so the freezing, melting and re-freezing of water can over time cause significant damage to roadways, sidewalks, and other outdoor structures. Potholes that form during the spring, or during mid-winter melts, are good examples of the damage caused by this process.
Ice Potential	Number of days where minimum temperature is greater than -2˚C and maximum temperature is under 2˚C.	Number of days in which air temperature does not rise above freezing is a good indicator of the length and severity of the winter season. It is especially important to know how our winters will change in the future, because cold temperatures affect our health and safety, determine what plants and animals can live in the area, limit or enable outdoor activities, define how we design our buildings and vehicles, and shape our transportation and energy use.