Sector ▸ Transportation

Climate Change Thresholds in the Transportation Sector

Everything has a breaking point. Historically, Canada's transportation infrastructure was built to withstand a wide range of climate and weather averages and extremes. This includes our highways, railways, airports, seaports, ice roads and more. Now, we need to consider a changing climate. Will a warmer, stormier, and less predictable climate system push our infrastructure beyond a safe operating limit?

ClimateData.ca was developed with the expressed intent of helping to answer these types of questions by providing decision makers with high-resolution climate data. ***ClimateData.ca's Analyze page*** helps the people who design, build, and maintain our transportation infrastructure by allowing them to download data using custom climate threshold values. For example, they can get data on the number of days per year exceeding a certain maximum temperature (e.g. 30°C) or a certain amount of rainfall (e.g. 15 mm). These are examples of context-specific limits beyond which impacts, including damage, disruption, or increased operating costs, may be felt.

While using the Analyze page to download a custom selection of climate data is simple, determining what climate threshold value(s) you should use may not be. There are many factors that dictate what the safe temperature and precipitation limits are for a specific mode of transportation, including location, future time horizon, materials used, and levels of risk the decision maker is willing to accept. More information on what thresholds to use in your specific context may be available from relevant transportation authorities, from provincial guidelines, or from academic research. The Table below outlines some examples of climate thresholds in Canada.

What is the take away? Planning for climate change is not a simple process. Understanding how our local transportation systems might be impacted by changes in temperature, precipitation, and other aspects of the climate, requires a great deal of applied research. Working together, our goal is to provide researchers, engineers, planners, and decision makers with the tools and datasets they need to understand the impacts of climate change.

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Mode	Component	Hazard	Threshold	Impact
	Rail/track	Extreme heat	≥ 37.7 °C	When track temperatures on the Metrolinx (ON) rail network exceed the Preferred Rail Laying Temperature (37.7°C), the track can buckle and kink, requiring slower travel speeds for safety. This can cause commuter delays.[6]
	Rail/track	Extreme cold	≤-23 °C	When southern Ontario experiences extreme cold temperatures, this can cause railway track to crack. This poses safety concerns and leads to increased maintenance costs.[7]
	Runway asphalt	Freeze-thaw	5 to >30 per year	Increasing freeze-thaw cycles can cause airport runways to prematurely degrade, shortening their life span, and costing more for maintenance and replacement.[8]
	Aircraft lift	High temperatures	-	In hotter air, planes generate less lift, increasing fuel costs or decreasing the safe airplane weight (see example to the right).
	Concrete	Extreme heat	~ 36.5 °C	When the City of Winnipeg experiences extreme heat, this can cause strong internal temperature gradients to form within Jointed Plain Concrete Pavement slabs, which in turn can lead to transverse cracking of, or other damage, to the concrete. This can cause mobility delays and increased maintenance and replacement costs.[1,2,3]
	Road safety	Precipitation	10 mm	Precipitation can cause the flooding of roadways, pavement washouts, reduced mobility, and an increasing risk of vehicle collisions. Studies have shown that for every 10 mm of rainfall, the risk of collision increased by 3%.[4,5]

Cleared for take-off? Calculating safe temperature thresholds in the aviation industry

The temperature thresholds that may cause hot weather delays or weight restrictions at your local airport will depend on many factors, including size and type of aircraft, airport elevation, and length of runway.[9]

Bombardier CRJ200, Air Canada Jazz Livery. Photo source: Wikipedia

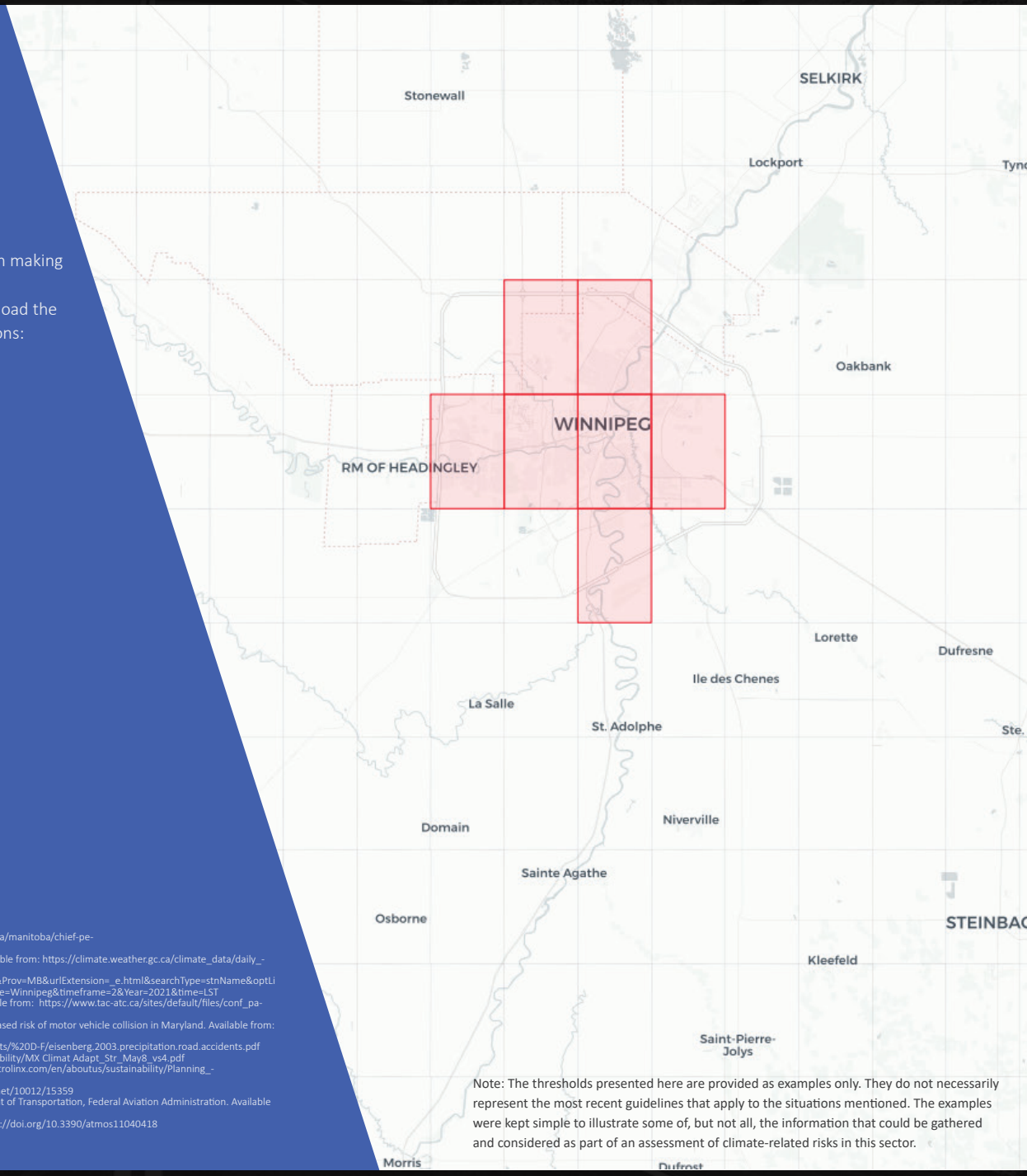
For example, consider the Bombardier CRJ200, a medium-range aircraft flown by Air Canada Jazz. Air temperatures may have to reach or exceed 45°C at Vancouver International Airport (YVR) before this Category 2 aircraft won't be able to liftoff at full weight. However, this same fully loaded aircraft flying out of Saskatoon's airport (YXE), which has a shorter runway, will be hampered by temperatures beyond just 26°C.[9,10]

Analyze Page on ClimateData.ca

ClimateData.ca makes it easy to obtain detailed climate data that can support you in making good climate risk management decisions. When you know the thresholds that are important to your organization, go to the Analyze Page on Climate Data.ca to download the climate data most relevant to your organization. Just follow the on-screen instructions:

1. Select climate dataset (more datasets are coming online all the time!)
2. Select your location from the map (coming soon: custom shapefile analysis!)
3. Select a variable and input your custom threshold value(s)
4. Select a start year and end year for the analysis
5. Select the desired models, climate scenarios, percentile calculations of interest, and temporal frequency (annual, monthly, seasonal)
6. Select your preferred data format (NetCDF or CSV), and enter your email address. We'll send you your data as soon as it's ready!

Need additional help or support? ***Contact us today.***



Note: The thresholds presented here are provided as examples only. They do not necessarily represent the most recent guidelines that apply to the situations mentioned. The examples were kept simple to illustrate some of, but not all, the information that could be gathered and considered as part of an assessment of climate-related risks in this sector.

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