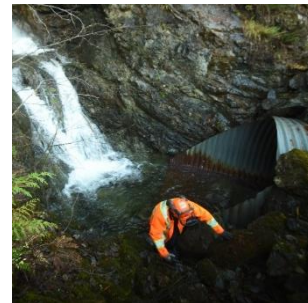


Accounting for Climate Change Impacts in the Design of Resource Road Crossings

Webinar 1 of 3: Updates and Developments in Climate Change
Tools for B.C. + Case Study from the Southern Interior



June 18th, 2020

Matt Kurowski Research Engineer, FPInnovations

Kari Tyler User Engagement and Training Specialist, Pacific Climate Impacts Consortium

Mel Reasoner Climate Scientist, Climate Resources Consulting

Join at

slido.com

#fpi

- The session will start at 10:00 PST / 13:00 EST
- All lines will be muted during presentations
- This webinar will be recorded and posted to FLRNORD website
- **Interact! Vote on polls and ask/upvote questions – all anonymous by default**

www.slido.com event code: **fpi** (any browser – smartphone or computer)

FPInnovations 

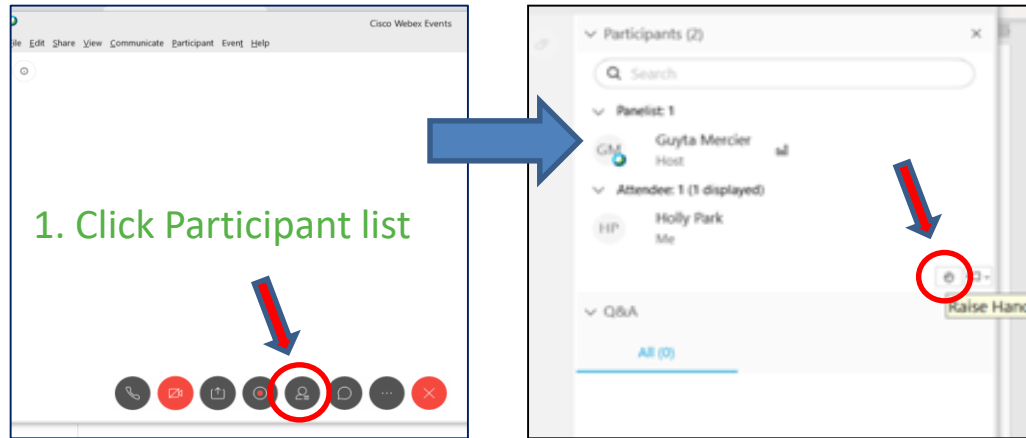


Ministry of
Forests, Lands, Natural
Resource Operations
and Rural Development

Speaking & Login ID Questions/Comments

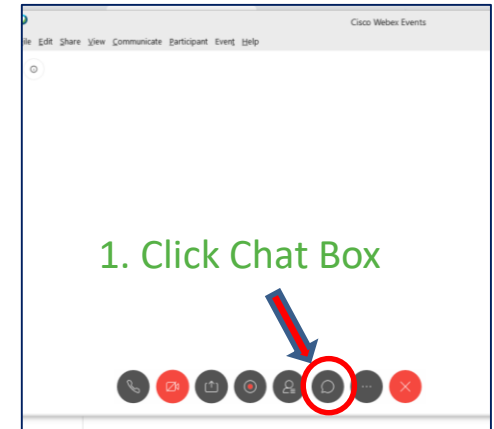
1. Use WebEx to voice a comment/question

2. A Menu pops up – click “raise hand”



2. Use WebEx Chat to

- ask tech support questions
- comment/question using WebEx login ID (publicly or privately)



Anonymous Questions/Comments

Join at
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Influence the presentation:

- Vote on polls
- Ask/upvote questions
- Anonymous by default

**Joining as a
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Webinar Overview

- Brian Chow, Chief Engineer, FLNRORD (a few minutes)
- Matt Kurowski (20 minutes)
- Kari Tyler (10 minutes)
- Mel Reasoner (30 minutes)
- Discussion (~30 minutes)



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Small watershed crossings and climate change



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and Rural Development



- **Orientation:** updates on topics from first series (Matt Kurowski)
 - **A first look:** the new Plan2Adapt tool (Kari Tyler)
 - **Review:** use of two tools that were not included in the first series (Columbia Basin Climate Source and climatedata.ca), a prototype tool that calculates risk probabilities of climate indices, as well as a case study crossing in Southeast B.C. that applies these tools (Mel Reasoner)
-

- **Crossing case studies in Coastal and Northern B.C. ranging in drainage size:** how data and methods used in design flood hydrology relate to uncertainties of climate projections from various tools, and how climate projections can inform design (Lee Deslauriers and Paul Mysak)
-

- **Introduction:** a data portal from the Pacific Climate Impacts Consortium that provides streamflow for a range of future climate conditions in sub-basins of the Peace, Fraser and Columbia (Arelia Schoeneberg)
- **Facilitated conversation with designers:** applied use of climate tools (Kari Tyler)

June 18 (Thursday)

Updates and Developments in Climate Change Tools for B.C. + Case Study from the Southern Interior

Matt Kurowski EIT (FPIInnovations), Kari Tyler (Pacific Climate Impacts Consortium), Mel Reasoner (Climate Resources Consulting)

June 23 (Tuesday)

Case studies from the Coast and Northern B.C.

Lee Deslauriers P.Eng., RPF (StoneCroft Engineering), Paul Mysak P.Eng. (Onsite Engineering Ltd.)

June 25 (Thursday)

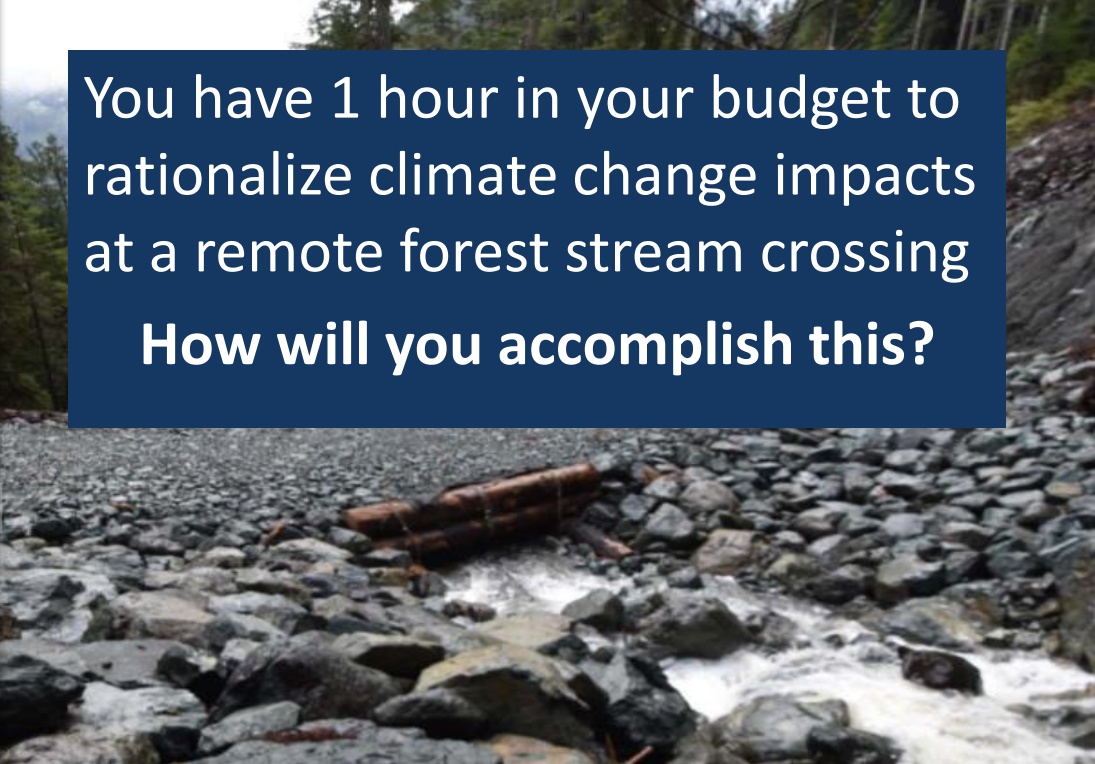
From Snowmelt to Streamflow: Data Portals for Future Hydrologic Conditions + Discussion: Climate Change Tools Needs for Crossings Design

Arelia Schoeneberg, Kari Tyler (both from Pacific Climate Impacts Consortium)

**USING CLIMATE TOOLS TO
RATIONALIZE CLIMATE CHANGE
IMPACTS ON DESIGN FLOOD
HYDROLOGY IN SMALL AND
REMOTE STREAM CROSSINGS**

Matt Kurowski

June 2020 – Draft 5



**You have 1 hour in your budget to
rationalize climate change impacts
at a remote forest stream crossing**

How will you accomplish this?

Climate Tools

- Definition
- BC context
- Use in typical crossings
- Updates
- Trends



What is a “climate tool”?

- Interactive map that shows or uses summary climate indices derived from climate models
 - In design flood hydrology (DFH): can help to rationalize climate change impacts to a design flood

What is a “climate tool”?

- Interactive map that shows or uses summary *climate indices* derived from *climate models*
 - In design flood hydrology (DFH): can help to rationalize climate change impacts to a design flood

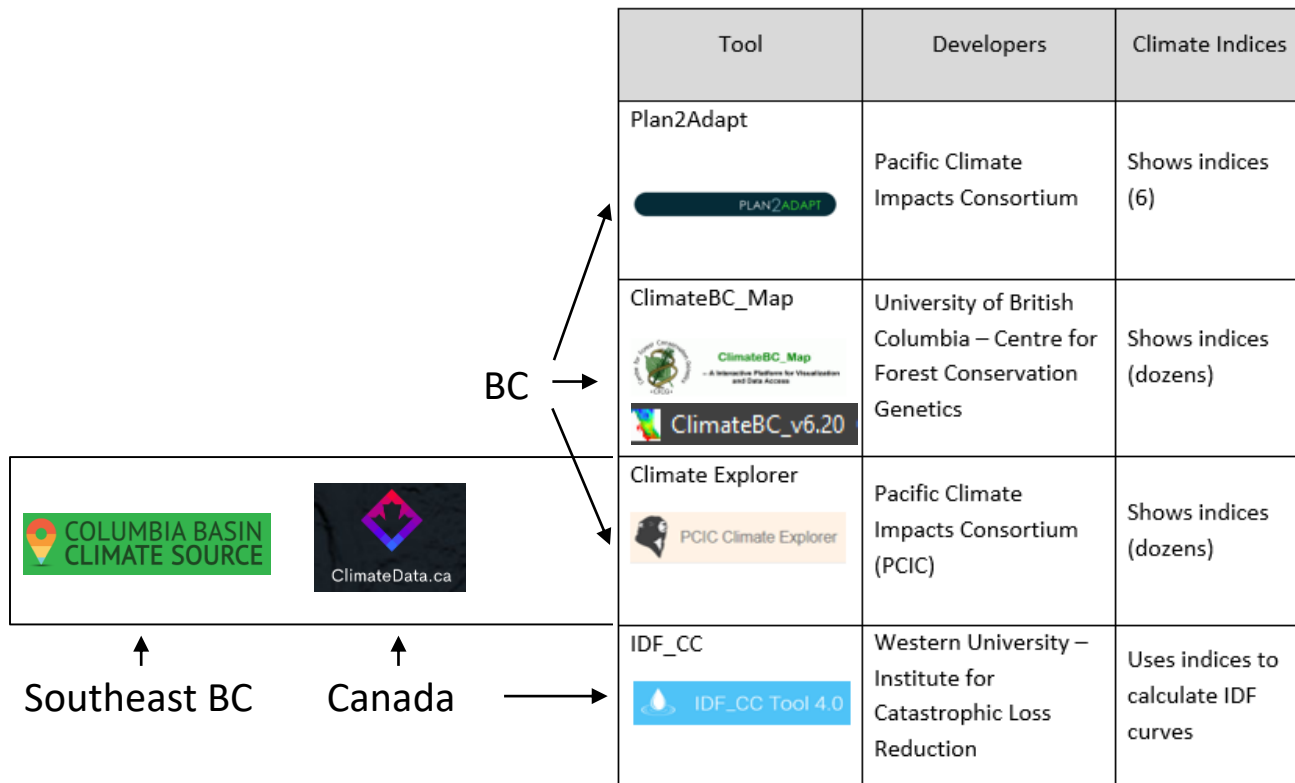
climate models

- There are ~40 global climate models (GCMs)
 - Low spatial resolution: ~10 000 km² daily/monthly grid
- GCM simulations have embedded up to four possible futures
 - Standardized range from best to worst case (green house gas emissions)
- Statistical methods can combine regional/local data with GCMs to “downscale” to historic and future climate model grids:
 - ~60 km² grid with daily resolution for BC – temperature and precipitation 1950-2100 (available for download from Pacific Climate Consortium)

climate indices

- Statistical summaries of climate – examples:
 - maximum consecutive days with no rain
 - daily maximum precipitation
 - average number of days/year that reach 20 degrees
 - 5-day daily antecedent rain >15mm

Climate tools for BC



Climate tool use in smaller watersheds

1. Use IDF_CC
 - and be aware of assumptions in downscaling and stationarity (Engineers and Geoscientists BC, 2016), which applies to any tool – especially when working with <24h temporal resolution
2. Use other climate tools – with professional guidance and judgement
 - assumption: the magnitude and direction of known average precipitation index projections will be related to changes in higher temporal resolution precipitation average and intensity metrics for the same area (Engineers and Geoscientists BC, 2016)
 - temporal resolutions lower than 24 hours start to contain too much uncertainty to be useful due to the sparse and short historic records of sub-daily extreme precipitation data; use daily extreme climate change metrics with professional judgement (PCIC, 2015)
3. Use no climate tools
 - when a small watershed has little or no local historic data, a designer can account for climate change by increasing flow by an additional 20% (Engineers and Geoscientists BC, 2018)



define
future

define
location

use CC
indices

calculate &
compare

Steps to using a climate tool

1. Define the required input parameters, or be aware of assumptions
 - global climate models (GCMs) in relation to downscaled models
 - regional concentration pathways (RCPs), and
 - time periods that define a historic baseline to compare against a future period
2. Define the location of interest
3. Select from tool's output climate indices those that impact design floods and interpret
4. Calculate the change in flow and compare results to outputs from other methods

Steps to using climate tool

define future

GCM(s): **CNRM-CM5-r1**

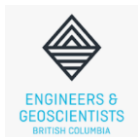
CanESM-r1

ACCESS-0-r1

inmcm4-r1

Ensemble

ipcc



ENGINEERS &
GEOSCIENTISTS
BRITISH COLUMBIA



PACIFIC CLIMATE
IMPACTS CONSORTIUM

Scenario(s): 2.6, **4.5**, 6.0, **8.5**

Time period: 2025, **2055**, **2085**

Baseline reference: **1961-1990**

other periods

Pick from list of areas
Select region

Draw/Import Area

Click map point

Click station point

Click ungauged point

define location

PLAN2ADAPT



PCIC Climate Explorer

ClimateBC_Map

-- A Interactive Platform for Visualization
and Data Access



IDF_CC Tool 4.0

Steps to using climate tool

calculate & compare

use CC indices

- If rainfall defines the design flood

Climate Tool	Best climate index(s)	Temporal resolution	Spatial resolution
Plan2Adapt	Total precipitation (rain and snow)	Seasonal (reported as daily average)	400 m ² grid BC projection
ClimateBC_Map	Total precipitation (rain)	Monthly (reported as daily average)	800 m ² grid BC projection
Climate Explorer	Yearly max daily precipitation (rain)	Monthly return periods of daily a threshold value	~ 55 km ² grid latitude and longitude coordinates
	50-year return period max daily precipitation (rain)	Yearly return periods of monthly threshold value (reported as daily average)	~ 800 m ² grid latitude and longitude coordinates
IDF_CC	Does not display climate indices but rather uses them to calculate IDF curves – reported in mm and mm/h (rain)	5 mins to 24 hrs: Mins – 5, 10, 15, 30 Hrs – 1, 2, 6, 12, 24	No grid exists that is a basis of a continuous surface; each new point is calculated dynamically, which involves mathematical relationships between several grids and point networks: <ul style="list-style-type: none"> - ~1000km² down to ~55km² grids and grid-derived products - 10 or 25 nearest points from ~500 Environment Canada stations, and influence from user-inputted observation stations that have more than 10 years of data latitude and longitude coordinates

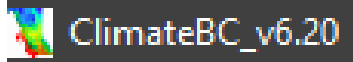
Climate tools for BC: the Latest Updates

PLAN2ADAPT



ClimateBC_Map

-- A Interactive Platform for Visualization and Data Access



PCIC Climate Explorer



IDF_CC Tool 4.0

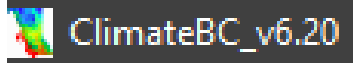


Climate tools for BC: the Latest Updates



ClimateBC_Map

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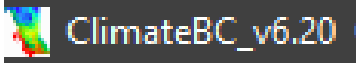
PCIC Climate Explorer




IDF_CC Tool 4.0

Climate tools for BC: the Latest Updates

 **ClimateBC_Map**
-- A Interactive Platform for Visualization and Data Access

 ClimateBC_v6.20

 PCIC Climate Explorer

 IDF_CC Tool 4.0

ClimateBC_v6.20 Copyright (2019) UBC. All rights reserved.

Single location Decimal Degree About Help

Latitude Elevation (m)
Longitude

Start

Annual variables Seasonal variables Monthly variables

Save

Multi-location

Select input file Specify output file

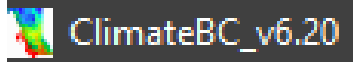
Start

Climate tools for BC: the Latest Updates



ClimateBC_Map

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PCIC Climate Explorer



IDF_CC Tool 4.0

April 2020

Developing a Climate Change Adaptation Interdependency Process with Economic Considerations

Supported by Natural Resources Canada's Climate Change Adaptation Program

- VOLUME 1 A Consultation Process on Interdependencies for Climate Adaptation Projects
- VOLUME 2 Methods for Interdependency Communication
- VOLUME 3 A Financial Evaluation Process for Climate Adaptation Projects
- VOLUME 4 Key Performance Indicators (KPIs) for Climate Adaptation Projects
- VOLUME 5 Summary Case Study of the 2016 Pine Pass Flood
- APPENDIX PCIC Climate Change Information

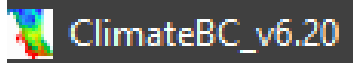
BRITISH COLUMBIA | Ministry of Transportation and Infrastructure

Climate tools for BC: the Latest Updates



ClimateBC_Map

-- A Interactive Platform for Visualization
and Data Access



PCIC Climate Explorer



IDF_CC Tool 4.0

FPIInnovations Using Climate Explorer for BC Regional Vulnerability Assessments: Forest Operations

- Getting climate index values
- Workshops: what is vulnerable
- Combining information into Reports – end of 2020 fiscal

Climate tools for BC: the Latest Updates

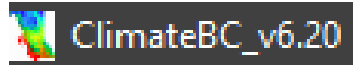
Early 2020

ASCE



ClimateBC_Map

-- A Interactive Platform for Visualization and Data Access



PCIC Climate Explorer



Gridded Extreme Precipitation Intensity–Duration–Frequency Estimates for the Canadian Landmass

Abhishek Gaur¹; Andre Schardong²; and Slobodan P. Simonovic, F.ASCE³



Article

Web-Based Tool for the Development of Intensity Duration Frequency Curves under Changing Climate at Gauged and Ungauged Locations

Andre Schardong^{1,*}, Slobodan P. Simonovic¹, Abhishek Gaur² and Dan Sandink³

¹ Faculty of Engineering, Western University, London, ON N6G 1G8, Canada; simonovic@uwo.ca

² National Research Council Canada, Ottawa, ON K1A 0R6, Canada; abhishek.gaur@nrc-cnrc.gc.ca

³ Institute for Catastrophic Loss Reduction, Toronto, ON M5C 2R9, Canada; dsandink@iclr.org

* Correspondence: aschardo@uwo.ca; Tel.: +1-226-272-0040

Received: 29 March 2020; Accepted: 24 April 2020; Published: 27 April 2020



April 2020

Trends at MOTI – Adapted Bridge Designs



Region	Return periods	Climate Change Impact on design flood	Climate Data
NR	100-200yr	+9% to +30%	<ul style="list-style-type: none"> -MoTI practices -EGBC recommendations -PCIC regional reports -IDFCC -Consultant Reports
SIR	100-200yr	+10% to +20%	<ul style="list-style-type: none"> -MoTI practices -EGBC recommendations -PCIC -Consultant Reports
SCR	200yr	+11% to +15%	<ul style="list-style-type: none"> -MoE coastal guidelines -EGBC recommendations -Consultant Reports

Trends at MOTI – Adapted Culvert Designs



Region	Return periods	Climate Change Impact on design flood	Climate Data
NR	50-200yr	+10% to + 25%	<ul style="list-style-type: none"> - IDFCC - Consultant reports
SIR	100-200yr	+10%	<ul style="list-style-type: none"> - MoTI - EGBC recommendations - Consultant Reports
SCR	50-200yr	+3.6% to + 25%	<ul style="list-style-type: none"> - EGBC recommendations - PCIC - IDF_CC - Consultant Reports

Thank you

Matt Kurowski

Researcher
FPInnovations

matt.kurowski@fpinnovations.ca

