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**

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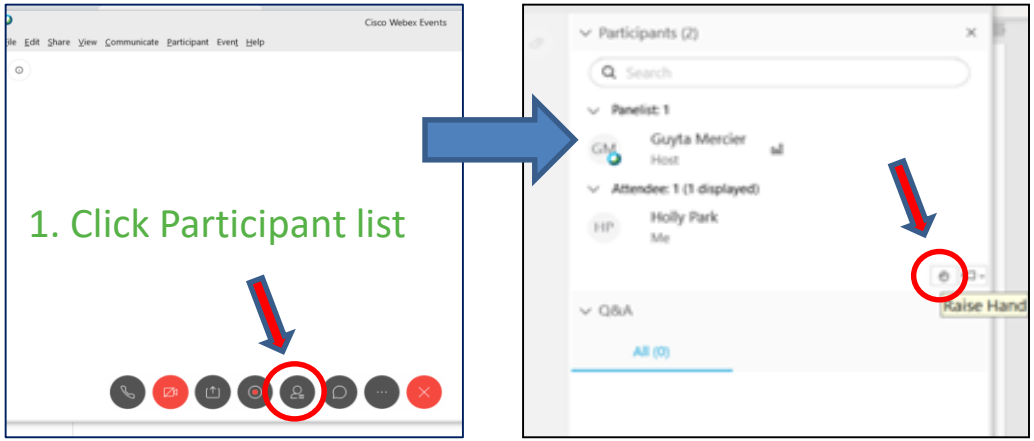
BRITISH COLUMBIA | Ministry of Forests, Lands, Natural Resource Operations and Rural Development

Speaking & Login ID Questions/Comments

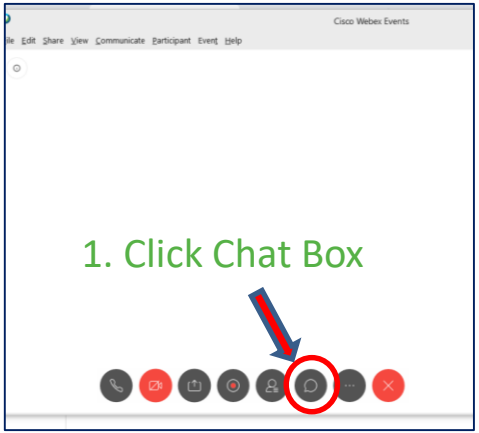
1. Use WebEx to voice a comment/question

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)



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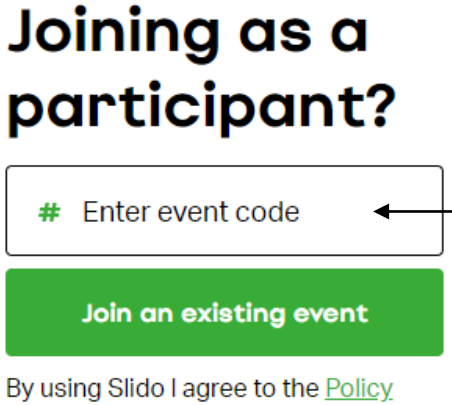

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Webinar Overview

- 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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PACIFIC CLIMATE IMPACTS CONSORTIUM

CRC Climatic Resources Consulting

BRITISH COLUMBIA | Ministry of Forests, Lands, Natural Resource Operations and Rural Development

Small watershed crossings and climate change

BRITISH COLUMBIA | Ministry of Forests, Lands, Natural Resource Operations 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)

June 18 (Thursday)
Updates and Developments in Climate Change Tools for B.C. + Case Study from the Southern Interior
Matt Kurowski EIT (FPInnovations), Kari Tyler (Pacific Climate Impacts Consortium), Mel Reasoner (Climate Resources Consulting)

- **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)

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.)

- **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 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)

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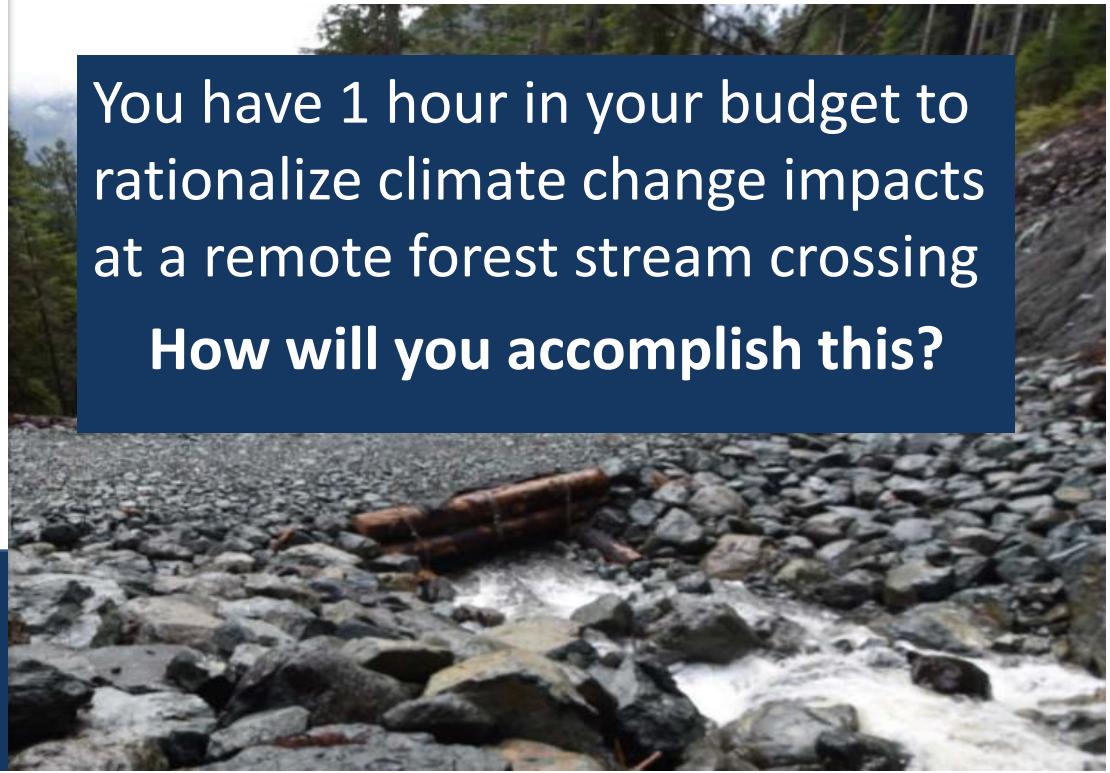
USING CLIMATE TOOLS TO RATIONALIZE CLIMATE CHANGE IMPACTS ON DESIGN FLOOD HYDROLOGY IN SMALL AND REMOTE STREAM CROSSINGS

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 km^2 daily/monthly gird
- 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 km^2 grid with daily resolution for BC – temperature and precipitation 1950-2100 (available for download from Pacific Climate Consortium)

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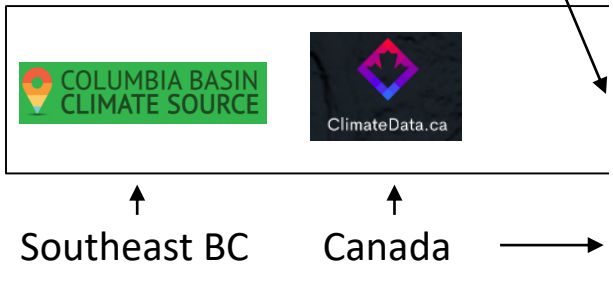
climate indices

- 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



BC →

Tool	Developers	Climate Indices
Plan2Adapt	Pacific Climate Impacts Consortium	Shows indices (6)
ClimateBC_Map	University of British Columbia – Centre for Forest Conservation Genetics	Shows indices (dozens)
Climate Explorer	Pacific Climate Impacts Consortium (PCIC)	Shows indices (dozens)
IDF_CC	Western University – Institute for Catastrophic Loss Reduction	Uses indices to calculate IDF curves

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

Scenario(s): 2.6, **4.5**, 6.0, **8.5**
Time period: 2025, **2055**, **2085**
Baseline reference: **1961-1990**
other periods

define location

Pick from list of areas
Select region

PLAN2ADAPT

Draw/Import Area

PCIC Climate Explorer

Click map point

ClimateBC_Map
-- A Interactive Platform for Visualization and Data Access

Click station point
Click ungauged point

IDF_CC Tool 4.0

Steps to using climate tool

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: - ~1000km^2 down to ~55km^2 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

calculate& compare

Climate tools for BC: the Latest Updates

PLAN2ADAPT

Centre for Forest Conservation Genetics
•CFCG•

ClimateBC_Map
-- A Interactive Platform for Visualization and Data Access

ClimateBC_v6.20

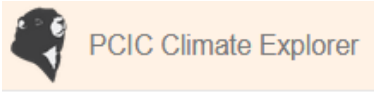
PCIC Climate Explorer

IDF_CC Tool 4.0

COLUMBIA BASIN CLIMATE SOURCE

ClimateData.ca

Climate tools for BC: the Latest Updates



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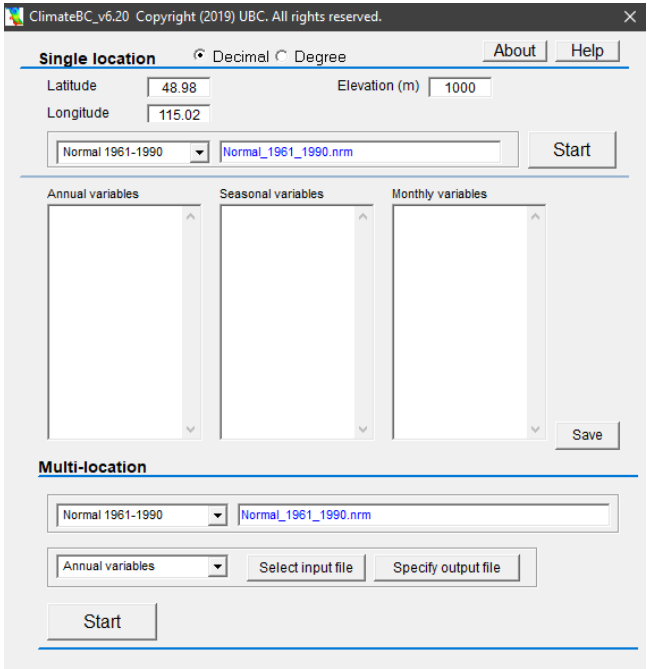

Climate tools for BC: the Latest Updates

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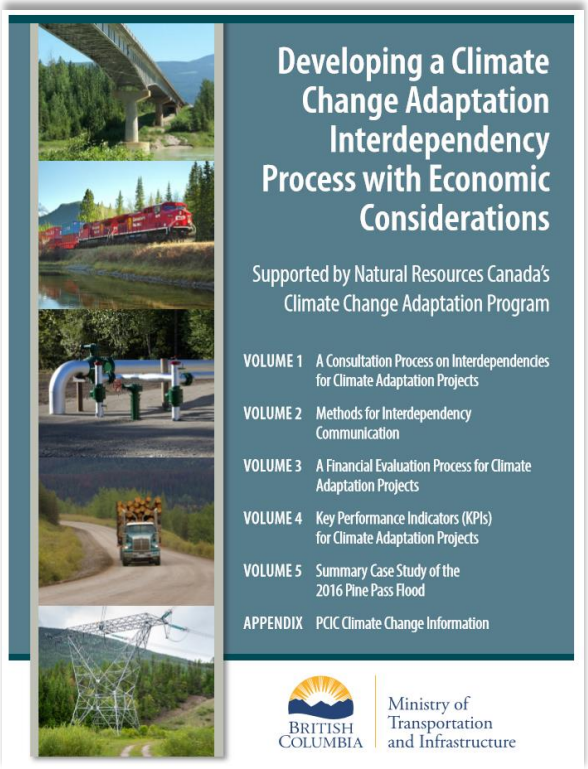
April 2020



Climate tools for BC: the Latest Updates

FPInnovations 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

Centre for Forest Conservation Genetics •CFCG•

ClimateBC_Map

-- A Interactive Platform for Visualization and Data Access

ClimateBC_v6.20

PCIC Climate Explorer

IDF_CC Tool 4.0

ASCE

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

Abhishek Gaur[1]; Andre Schardong[2]; and Slobodan P. Simonovic, F.ASCE[3]

water

MDPI

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. Simonovic [1], Abhishek Gaur [2] and Dan Sandink [3]

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

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check for updates

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%	-MoTI practices -EGBC recommendations -PCIC regional reports -IDFCC -Consultant Reports
SIR	100-200yr	+10% to +**20%**	-MoTI practices -EGBC recommendations -PCIC -Consultant Reports
SCR	200yr	+11% to +15%	-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%**	- IDFCC - Consultant reports
SIR	100-200yr	+10%	- MoTI - EGBC recommendations - Consultant Reports
SCR	50-200yr	+3.6% to +**25%**	- EGBC recommendations - PCIC - IDF_CC - Consultant Reports

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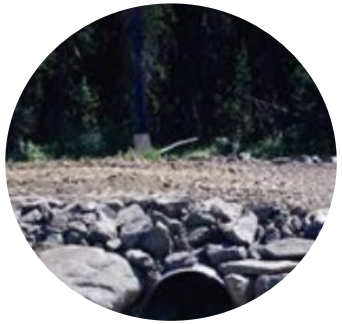
Thank you



Matt Kurowski
Researcher
FPInnovations

matt.kurowski@fpinnovations.ca