Halifax Workshop Report

Introduction

The IDFCC tool Halifax workshop was held at the Westin Nova Scotian, in Halifax, Nova Scotia on December 5, 2014. A total of 20 individuals representing various municipalities, provincial and federal ministries, conservation authorities, financial institutions and private consulting firms registered for the event. Nineteen participants attended the event.

The workshop was five hours in length, following roughly this schedule:

- 8:30-9:30 am: Background presentation
- 9:30-11:30 pm: Practical/hands-on portion
- 11:30 to 1:00 pm: Discussion session

Attendees

As provided in Table 1, a total of 19 attendees participated in the Halifax workshop. Participants represented municipalities, government agencies, utilities, consulting companies, environmental non-governmental organizations, and university researchers.

Table 1: Toronto, October 17, 2014 Workshop Attendees

Last Name	First Name	Title	Institution
Ellis	David	Manager, Wastewater, Stormwater Infrastructure	Halifax Water
Blades	David	Modeling Engineer	Halifax Water
Gray	Kevin	Manager of Approvals, Engineer	Halifax Water
Maynard	Peter	Project Engineer	Halifax Water
Baxter	Brad	Engineering Technologist	Halifax Water
Rice	Greg	Project Engineer	Halifax Water
Lines	Gary	Climate Change Meteorologist	CimAction Services
Cooper	John	Policy Analyst	Nova Scotia Environment
Ellis	Derek	Research Assistant	UPEI Climate Research Lab
Arnold	Stephanie	Project Assistant	UPEI Climate Research Lab
Jardine	Don	Project Manager	UPEI Climate Research Lab
Mohammed	Orooba	Traffic Engineer	PEI Transportation and Infrastructure Renewal, Transportation PEI
White	Tyler	Municipal Engineer	AMEC
Mooers	Eva	Water Resources Engineer	Dalhousie
Greenwood	Mark	Water Resources Engineer	Dalhousie
Schnare	Kelly	Director of Sustainability	Fusion Halifax (and CWN Rep)
White	Brittany	Policy Analyst	Nova Scotia Environment
Deacoff	Cameron	Environmental Officer	Halifax (municipality)
Lynch	Alex	Project Coordinator	Clean Foundation

Workshop Outline

The workshop began with a one-hour presentation outlining the purpose of the workshop, providing background on the IDFCC tool methods and outlining the IDFCC tool. Participants were informed that the two primary purposes of the workshop were to receive practical user feedback on the draft version of the tool and to educate and inform potential users about the tool.

As part of the introductory presentation, participants were encouraged to focus on opportunities to improve practical aspects of the tool (e.g., identification of means to improve the user interface) during the workshop. However, discussion on the methodological background was welcomed. Participants were also apprised of the background, context, objectives and status of the IDFCC tool project during the introductory presentation.

The bulk of the presentation focussed on the technical background and methods of the IDFCC tool. Topics covered in this portion of the presentation included a background to global climate modelling, a description of Representative Concentration Pathways (RCPs) and their role in climate modelling, a description of Global Climate Models (GCMs), GCM downscaling methods including methods used to downscale GCM data for the purposes of generating IDF curves in the IDFCC tool, and methods used to generate skill scores for GCMs included in the IDFCC tool.

Users were also presented an outline of tool implementation, including an outline of the database, user interface and methods within the tool used to generate IDF curves. A brief outline of the user interface was also provided.

Working Session

The majority of the time of the workshop was allocated to the working session. After a brief introduction to the IDFCC tool user interface, workshop attendees were assigned a number of tasks to complete using the IDFCC tool. Participants were encouraged to complete the tasks on their own using the available user guide.

Tasks assigned to participants during the working portion included:

- Creation and activation of a user account;
- Exploring map functions;
- Selection of a pre-loaded Environment Canada (EC) rain station, and exploring its IDF curve based on historical data;
- Selection of a GCM and exploration of a climate-change impacted IDF curve;
- Generating a user-created station, and;
- Generating IDF curves for the user-created station.

During the working portion, project team members circulated through the room to answer question and record any difficulties users had with completing assigned tasks.

Discussion

A facilitated discussion was scheduled to allow users to identify and discuss practical issues identified during the working portion in a group setting. Each participant was encouraged to provide feedback in a systematic fashion. Participants were first encouraged to identify any practical issues they identified while using the tool, including issues surrounding the user interface. After a discussion of practical issues surrounding the use of the tool, a group discussion on tool methods and application of tool outputs was encouraged.

Workshop Results

Major themes of questions, discussion and comments provided by the workshop participants are summarized in Table 2. Table 2 also provides a count of the number of times particular comments were raised during the workshop discussion and working session. Similar to the Vancouver and Toronto workshops, participants were encouraged to focus on practical aspects of the IDFCC tool, including opportunities to improve the user interface, increase the usability of outputs, and provision of relevant information to users. The majority of comments and questions received during both the hands-on and discussion session related to practical aspects of the tool.

Attendees provided a variety of comments related to clarifying and providing additional information to increase the usability of the tool and increasing the usability of various tool features (e.g., provision of data when hovering over plot points). For example, it was suggested that it may be beneficial if the pop-up window that displays IDF historical and future IDF curves were to open as an additional tab in the internet browser, or possibly as an additional window. This approach would allow users to more easily scale, scroll and size plots and tables provided through the tool.

Users also provided several suggestions related to increasing the usability of the user-created rain station functions. For example, some users suggested that provision of an option that allows users to make user-created stations public using the tool would be beneficial. Providing functions that allow users to compare outputs from several different GCMs, RCPs and projection years was also requested. Users also suggested that the tool could provide greater detail on key functions and terms, including "uncertainty range," and "projection year."

Similar to discussions held at the Vancouver and Toronto workshop, users requested that the tool provide functionality that allows users to run and compare outputs from multiple GCMs, as well as compare results for multiple RCPs and projection years. It was also suggested that there should be more consideration of uncertainties associated with projection year and GCMs in the "uncertainty range" graphs developed by the tool. Users further requested provision of a function that would allow users to simultaneously run an ensemble of GCMs to produce reliable results.

Table 2: Major Themes of Discussion and Comments

Theme	Topic	Comment, issue	n
Practical considerations	Increase usability	Clarify that it is the “version date” at the bottom of the tool	1
		Standardize nomenclature for GCMs provided in the assist table and in the list made available to users	1
		Clarify differences in values provided in tables vs. those provide in plots	1
	Usability of tool features	Provide better information when “hovering” over uncertainty range	1
		Clarify how to print output plots	1
		Open results, IDF output pop up in separate tab or window	1
	User-created stations and user-inputted data	Provide function to allow users to publicly share user-inputted stations	1
		It is hard to find names of other users for the purpose of sharing user created rain stations	1
		Clarify that users must “save” inputted data in order to generate outputs	1
	Comparison of outputs – GCMs, RCPs, projection years	Incorporate uncertainties created by use of multiple GCMs in uncertainty graph	2
		Incorporate projection year differences in uncertainty range	1
	Accessibility of information on methods	Clarify what is meant by “uncertainty range” including types of information considered when developing the range	2
		Provide more detail on what the projection years means (i.e., are projections for a specific year or for decadal range around a year?)	2
Methods and tool design	GCM and RCP selection	Provide a function that allows running an ensemble of models	2
		Allow users to compare results from multiple GCMs, RCPs and projection years within the tool	TGD*
	Data quality	What criteria are used to ensure data are sufficient to be used in the tool (e.g., minimum 10 year records for rain stations, do they have to be tipping-bucket rain stations)?	1
		Indicate which statins on the map have less than 10 years of data	1
		How to handle EC stations with partial data (e.g., only 100 days used to generate daily maximums for a whole year)	1
	Parameter estimation	Small differences in historical IDF curves produced by tool vs. EC (due to method of L-moments)	1
	Input data	How up-to-date are EC stations—are they automatically updated?	1

Table 2, Continued

Suggested improvements	Show GCM relevant grid, points on map	1
	Include an embed function for graphs, outputs	1
	Provide a legend on the map (to identify what the colours of groupings mean, why different rain stations are different colours)	
	Include an FAQ section in the help page	1
	Provide message centre, logbook for individual stations to allow users to track changes (e.g., for shared user created rain stations, provision of information on update of EC stations, etc.)	1
	Provide more information on models in list of models (e.g., country of origin, expand acronyms)	1
	Provide more detail in output graphs (e.g., CGM, RCP and projection year)	1
	Tool should create additional table showing absolute (numerical) difference between upper and lower bounds to increase ease of use	1
Long-term support	Tool should be maintained over time (past release date), updated to ensure it remains relevant, useful	1
	Need ongoing access to reliable input data from EC (i.e., EC needs to maintain rain stations, continually update and produce reliable IDF curve information)	1
Application of results	How to apply tool results	TGD*
	Issues surrounding liability of tool developers re: application of results	TGD*
	It is helpful to have all EC stations mapped and available through one accessible source	2
	Tool easy to use	TGD*

*Topic of Group Discussion – the specific topic resulted in a group discussion, indicting a high level of interest in the comment or topic

Workshop attendees discussed several topics related to data quality. For example, tool developers suggested that historical and future IDF curves produced for rain stations with longer records (e.g., >10 years) may be more reliable than those produced for stations with shorter records. Users requested that rain stations provided in the mapping function should be labeled in a way that identifies their length of record (i.e., whether they have more or less that 10 years of data).

How the tool handles Environment Canada rain stations with partial data was also discussed at the workshop. For example, it was reported that some rain stations might have records for only a portion of the year (e.g., 100 out of 365 days). IDFs developed based on daily maximums from these rain stations may be unreliable. Further, it was also noted that some Environment Canada rain station data might not have gone through all appropriate quality checks before being released to the public, which may inhibit the reliability of results generated by the IDFCC tool.

Users recommended several suggested improvements to the tool. These included clarifying certain types of data that are displayed to users, providing map legends and increasing the amount of information about who/where GCMs were developed in the list of GCMs provided to users. The provision of a list of “frequently asked questions” in the “Help” section of the tool, in order to address questions that were raised multiple times at the IDFCC tool workshops, was also suggested by participants.

A participant further suggested that it would be helpful to include a message centre or logbook for each of the rain stations (including user-created rain stations) provided in the tool. The logbook would help users record changes to rain stations made by multiple users (e.g., if a user created rain station were shared with multiple users with editing privileges) and could indicate the date and status of EC rain stations provided in the tool. It was further requested that more information should be included in output graphs, including the name of the rain station as well as the GCM, RCP and projection year associated with graphs produced for future IDF/climate change scenarios.

In the version of the tool presented to Halifax participants, uncertainty ranges associated with future climate scenarios are presented only in graphical format. A user suggested that the tool should provide an additional output that provides numerical data on the difference between the upper and lower bounds.

The need for long-term support for the tool was a further topic of discussion. Users noted that the tool would need to be continually updated to reflect changes in available input data (e.g., updated Environment Canada rain station data, updated GCM results). Though outside for the scope of the current project, the need for high-quality input data in the form of Environment Canada rain station data was also noted. Further, long-term limitations of Environment Canada input data serve to limit the reliability of IDFCC tool results.

Users discussed several potential applications for the IDFCC tool, discussed in the next section.

Application of Results/ Tool Use

Following a discussion of several practical elements of the tool, workshop participants were invited to discuss how they might use the IDFCC tool in their work. Participants who worked for local municipalities and government agencies were specifically encouraged to comment on potential applications for the IDFCC tool.

A representative from the municipal government of Halifax discussed the potential role of the IDFCC in a flood risk map study the municipality is currently developing. The flood risk mapping study will update existing 30-year-old flood maps for a watershed within the municipality, and the IDFCC would help the municipality incorporate climate change impacts into the assessment. The representative also indicated that the tool would provide assistance in the management of water infrastructure that is under the jurisdiction of the municipality, including updating design specs for piped water infrastructure.

It was suggested that the tool would also be used to help the municipality manage climate change impacts and city services that are not directly related to flood risk and extreme rainfall. For example, it was noted that various infrastructure and services, such as sidewalks and management of street trees, will be affected by the impacts of climate change, and the tool would have applications in these areas. The tool may also assist the City in increasing their application of green infrastructure (or LID), and would help in the management of several other climate change impacts that present a risk to Halifax, including coastal flooding, sea level rise, and increasing risk associated with wildland fire.

Halifax Water (a utility providing water, wastewater and stormwater services for Halifax) attendees noted the significant deficit in storm and wastewater infrastructure in Halifax, and indicated that Halifax Water will be updating a substantial amount of infrastructure over the coming years. It was discussed that the tool gives them "something to start with" to help appropriately size new infrastructure and incorporate climate change impacts in infrastructure planning and design.

I was stated that Halifax Water is also working on improving service levels for existing, built-up areas of the municipality of Halifax. For example, the utility is building large capacity underground stormwater infrastructure (e.g., stormwater pipes with 1 in 100 yr flow capacities) to service areas that do not have major systems. It was reported that these are multi-million dollar projects, and it will be important to ensure that new infrastructure can accommodate the impacts of climate change. It was further noted that there are also significant costs associated with ensuring many parts of the city are appropriately retrofitted to meet existing minor system standards, and the utility must ensure that they are not undersizing (or oversizing) infrastructure.

A Halifax Water attendee further reported that his was the first utility that had stormwater under its jurisdiction. Management of both stormwater and wastewater within the same utility was intended to help Halifax Water appropriately manage inflow and infiltration (I&I) problems experienced in Halifax. The attendee reported that the tool will help the utility plan for all of this work, and will help ensure that the infrastructure that is built in the next few years will continue to provide an appropriate service level over the long term (e.g., 100 year period).

An attendee from the Climate Change Unit of Nova Scotia Environment suggested that the IDFCC tool would assist in the management of the province's Flood Assessment Fund. The attendee reported that the tool would help in the evaluation of proposals for program funding. The attendee further reported that he would notify municipalities about the tool, and would indicate how the tool might be used to improve proposals made for funding as well as assist municipalities in conducing flood risk assessment work.

An attendee from PEI Transportation and Infrastructure Renewal suggested that the tool would be helpful in updating policies for new development and subdivisions. The attendee was specifically interested in how the province can accommodate climate change in stormwater management policy, with particular interest in the design of stormwater retention/detention ponds. The attendee noted concerns with respect to liability associated with using historical 1 in 100 year return periods for stormwater infrastructure design, and noted that some jurisdictions are applying a 20% increase in 1 in 100 yr return period storms without appropriate studies to support this increase. The attendee indicated that she would suggest the tool to consultants and designers.

Attendees asked the IDFCC team about examples of other municipalities adapting stormwater management design criteria to accommodate climate change. It was suggested that updating IDF curves to account for climate change is occurring to varying degrees across the country. Prof. Simonovic provided detail on his experience in the development of climate change affected IDF curves fro the City of London. Other examples from Ontario, including the cities of Ottawa and Barrie, were also discussed.

An attendee from the municipality of Halifax noted an example of climate change adaptation being applied to accommodate the impacts of sea-level rise. The example included consideration of a number of different climate change scenarios in the development of a standard to require increasing the height of new residential structures to protect residents from storm surge under climate change conditions. The attendee further reported that, due to risk averse attitudes, many developers are consistently exceeding the minimum design standards set by the municipality. The example was meant to illustrate how municipalities might accommodate uncertainties associated with climate change in design standards.

A further topic of discussion with respect to applying tool results was liability issues. For example, several participants were curious about who would be liable for the outputs of the tool, should they be used in the planning and design of infrastructure. It was suggested that this issue should be considered in the wording of disclaimers associated with the tool, and perhaps it should be noted that any outputs of the tool should be reviewed and approved by a licenced engineer before application. Participants further noted that there are several small Nova Scotia municipalities that may not have a professional engineer on staff, leading to potential difficulties in safely applying tool results.

Conclusion

Though participants noted a few technical issues with respect to the user interface and made several suggestions with respect to increasing the usability of the IDFCC tool, participants generally reported that the tool, in its current form, was easy to use. Indeed, many of the findings of the Halifax workshop mirror those from the Vancouver and Toronto workshops.

The participants generated several valuable insights about how the tool might be used when it is completed. One of the most notable suggestions for the IDFCC tool was incorporation of the ability to compare results from multiple GCMs, RCPs and projection years and run an ensemble of GCMs—a suggested made at both of the previous workshops. Users made several novel suggestions to improve the usability of the tool and including the provision of numeric values for uncertainty ranges and provisions of logs for rain stations. Workshop participants also made several important comments about data quality and identified several important issues related to the long-term maintenance and usability of the tool.