

Disrupt Climate Data Challenge

Post-Training Report

May 2017

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Introduction

Climate change remains one of the most important issues of our time. Access to reliable climate data that is easy to understand and use, yet captures the complexities and uncertainty of the climate models is paramount to effectively reduce climate impacts and risk. Practitioners of various backgrounds in Ontario are implementing climate change adaptation interventions to reduce the adverse impact of climate change. Those specific programs or projects are based on climate information often provided by scientists, consultants, and/or specific information centers.

Access to reliable climate data and usable climate projections has been identified by some of these practitioners to be key to devise relevant and region specific climate change interventions. Furthermore, many users in Ontario have encountered difficulty in understanding the climate data they can obtain online — and, in particular, the uncertainties associated with it. Geographic information systems and maps (e.g., www.ontarioccdp.ca) have been used to display and communicate climate data, but the data and its uncertainty remain a difficult aspect to incorporate and interpret in these types of communication materials.

The Disrupt Climate Data Challenge provided an opportunity for innovators to develop creative tools that assist in improving users' access and understanding of climate data. This competition also provided students with an opportunity to be trained in the practical issues of climate data, while competing for an award of up to \$5,000, which was sponsored by the OCC and the Insurance Bureau of Canada.

It is anticipated that the solutions presented through this challenge could lead to a better user experience, which could support the efforts of informing practitioners in sectors that are vulnerable to climate change impacts. Most importantly, the data challenge engaged students from various disciplines (e.g., math, computer science, environmental sciences) who could be influential in the future development of tools to effectively manage and communicate climate data.

The Challenge

The challenge posed to the competing teams was to disrupt the way climate data is currently displayed online, to make it more accessible and understandable. The OCC encouraged student teams to read up in advance of the challenge and to understand status quo, and consider new and innovative ways to display, communicate and represent the data and the uncertainty within a climate dataset. Our hope was that through this challenge, the teams could create the start of a tool, a widget, a graph, a framework, or a type of visual through technology that could be used with or embedded in existing data portals online to improve users' experience and understanding of climate change.

About the Climate Dataset Provided to the Competitors

The competitors were provided with 25km resolution modeled historical and future Mean Air Temperature (deg C) and Total Precipitation (mm/day) data from one model grid cell over York University. The complete dataset was created by the University of Region and funded by the Ministry of the Environment and Climate Change (MOECC) and is accessible online (www.ontarioccdp.ca).

This data is from a Dynamically-downscaled climate projections study by the RegCM model under RCP 8.5 emissions scenario, driven by boundary conditions from CanESM2, HadGEM2-ES, GFDL-ESM2M, IPSL-CM5A-LA, and MPI-ESM-MR.

A. Guidelines

The following summarizes the guidelines that were circulated a month and a half in advance of the Disrupt Climate Data Challenge in-person event to all teams registered, and the OCC particularly encouraged teams to start brainstorming, researching or developing a solution right away to bring to the challenge in person on May 11th and 12th:

- Additional data specific guidance and meta-data specific to the climate dataset provided was circulated in the form of a PDF file and a Climate Dataset Excel file, which were circulated along with this Registration Package (Appendix I).
- The teams were encouraged to begin to work on a solution before the competition in-person date; however, mentors were only available to the teams on the day of the in-person event. The in-person event included approximately six hours to develop or adjust their solution and aligned with the two days during which the Annual Ontario Climate Symposium took place (May 11th and 12th, 2017).
- Desk space, meals and internet access was provided for the teams at the event.
- Each team brought any materials they needed to develop their solution (e.g., laptop, charger, software, scripts, copies of the registration package, notebook, and/or notes).
- Teams were allowed to build their solution from scratch or leverage existing software available to them.
- The teams were expected to have any needed software to develop their solution pre-installed (licenses or software was not provided).

B. Promotion

The challenge was promoted through all online channels of the OCC, including its website (www.climateconnection.ca), social media accounts, newsletter, and directly through the OCC academic network. Academics from universities across Ontario were provided with slides that described the challenge; these were included in their lectures as an invitation for students to register. The OCC's social media channels were also updated live during the in-person event.

C. In-Person Event

The in-person event was held during the Ontario Climate Consortium’s 2017 Symposium. The location for the challenge was the student lounge at the Health, Nursing and Environmental Studies Faculty in York University. During the two days of the in-person event, the teams were provided mentorship by climate change practitioners in both the public and private sector, and on the second day evaluated through a series of “pitch” presentations to a panel of judges (see Appendix II for list of Mentors and Judges).

During the in-person event the teams had an hour to engage with various mentors, and approximately 6 hours to develop or finalize their solution. Each team had 30 minutes to have a conversation with two judges, which helped them calibrate their pitch prior to the final judging round and allowed the judges to better understand the motivations behind the team’s work. During the final round each team was given ten minutes to present their pitches in front of the panel of judges (see Appendix II).

Table 1 Agenda for the in-person portion of the Training Session

| Day One: May 11, 2017 | |
|------------------------------|-----------------------------------|
| 4:30 PM – 4:45 PM | Registration |
| 4:45 PM – 5:30 PM | Introduction & Overview |
| 5:30 PM – 6:30 PM | Meeting with Mentors |
| 6:30 PM – 7:30 PM | Time to Build Your Solution |
| Day Two: May 12, 2017 | |
| 9:00 AM – 12:00 PM | Time to Build Your Solution |
| 12:00 PM – 1:00 PM | Working Lunch (Provided) |
| 1:00 PM – 3:15 PM | Time to Build Your Solution |
| 3:15 PM – 4:00 PM | First Evaluation Round |
| 4:00 PM – 5:00 PM | Presentation of Pitches to Judges |
| 5:00 PM – 5:15 PM | Winners Announced |

D. The Climate Dataset

Climate data was provided to the students immediately after each group registered online, along with the Registration Package (see Appendix I). In this way, groups had the option to dive right in to the challenge and examine the data. The following table summarizes the metadata that each group received along the data in tabular Excel form:

Student teams were also encouraged to go back to the original data portal and explore how their solution could fit into a format where climate model data is available at various other grid cells. They

were free to go above and beyond by downloading additional raw climate data and finding a broader solution with spatial interpolation and other methods, but it was not required for the challenge.

Table 2 Information about the climate dataset provided to teams competing.

| | |
|-----------------------------------|--|
| Source of Data: | Daily time series data was extracted from the portal funded by the Ministry of Environment and Climate Change (MOECC) and created by the University of Regina: The Ontario Climate Change Data Portal (OCCDP) |
| Data Portal: | http://ontarioccdp.ca/index_rcp8.5.html |
| Data Description: | Climate projections provided were dynamically-downscaled from General Circulation Models (GCMs). Spatial resolution is 25km x 25km. The scenario was RCP8.5, and projections were driven by boundary conditions from the following 5 climate models: CanESM2, HadGEM2-ES, GFDL-ESM2M, IPSL-CM5A-LA, and MPI-ESM-MR. |
| Data Format: | Data was summarized and provided in an Excel file for easy reference and download. However, participants were free to export and access it from any other file types which were more comfortable (e.g., .txt, .dat, .nc, etc.). Raw climate data in text file format was available through the data portal above. |
| Emissions Scenario: | RCP8.5, often referred to as the Business-as-Usual Emissions Scenario |
| Climate Model Ensemble: | Five Climate Models were included (and labeled individually) in the file, but together they make up an "Ensemble". It was up to the participants to display the range and uncertainty for the same climate variables projected by these five different models. |
| Climate Variables [Units]: | Data for two climate variables were provided in this file: 1) Mean Air Temperature [°C] and 2) Total Precipitation [mm/day]. They were not required to use the data from both, though your solution will be evaluated for how scalable or applicable it is to a wider variety of climate variables so using both variables was an advantage. |
| Spatial Location: | All climate data was provided for one particular location (one model grid cell). Therefore, no spatial averaging or interpolation was required. For reference, the climate data is representative of York University, with the centre of the grid cell at the following coordinates: 43.76, 280.41 |
| Time Periods: | Data was provided <i>daily</i> for two time periods: 1) Historical (Baseline) from 1986-2005; and 2) Future from 2040-2069 |

About The Solutions

Based on the provided dataset described above, teams created a final product in various forms including a webpage, a mobile application, and an application flow layout. The submitted final solutions were open-sourced by the Ontario Climate Consortium (OCC) and are hosted on its website (www.climateconnections.ca).

Please note that if the code developed during the data challenge is to be used, proper acknowledgement to the team and its members should be included in any final product or release.

Overview of Participants

Eleven teams registered for the climate data challenge representing various Universities across Ontario as well as Upper Canada College (See Appendix II). All teams received the climate data and support from the OCC secretariat to scope-out potential solutions via email leading up to the in-person event. Eight teams screened themselves out of competition, after attempting to work on a solution in the dates prior to the in-person event. The in-person final challenge had three teams and a total of 12 student competitors.

Summary of Pitches and Ideas

A. Team Datalytics

The first presentation was from Upper Canada College. The group highlighted its focus on the importance of user accessibility and user friendly application interface. This team prepared a presentation showing the flow of the functionality of an app that they envisioned and discussed how it could then be developed. The interface prepared was targeted to end users of climate data, with a particular focus on the general public. The identified characteristics of the app were innovating, disruptive, scalable and applicable. The features of the app included temperature and precipitation as climate variables. The app displayed present data and future projections of the identified variables (temperature and precipitation). Additional features included a link to the background analysis to let users know how the displayed data was calculated. The application ensured the communication of uncertainty, variability and fluctuation of climate projection to users.

The team emphasized how this tool could be used to inform people of climate change and help them understand climate projections. One of the core principles that were mentioned that guided the app framework development was personalization to users. Thus, the group included a “What can you do?” section, to provide information on how to adapt to a changing climate. The app included a link to a blog which would provide a broader description on climate information and the developed app itself. The envisioned app was very user-friendly, well thought out, and the team delivered an engaging presentation.

B. Team Limecat

The second presentation was delivered by a team of three undergraduate students from McMaster University. This team developed a mobile app on android platform with a very clean user interface. The app used the provided climate dataset’s average daily temperature and precipitation and calculates the average of each variable to provide user focused and friendly information. More specifically, the app

calculates and compares weekly average of the climate variables (temperature and precipitation). The weekly average from any assigned date in the past could be compared to any date in future. The team understood this timeframe was not consistent with the climate normal (usually calculated by a 30 year period), but they felt that a weekly value could be better understood by the user. They highlighted how further analysis could be done to arrive at a timeframe that is both scientifically valid and relatable to by the users. The app user interface is simple, sleek and user-friendly.

This group targeted the general public as their audience, who in this team's opinion, are not well aware of the climate change information. The team envisioned this app being used to raise awareness on climate change trends, by representing complex datasets in simple, interactive visualizations. The unique feature of this solution is the in-built ability to modify the climate dataset on the cloud making it light for the device that the user would be using. This solution provides a freedom to choose, select and replace datasets even for users who are not experts in the field of computer applications. This app was positioned as a user-friendly design and smart data storage tool.

C. Team Codebusters

The team provided context by stating that the current data navigation in online websites/portals is complex and tedious. This team developed a website application that helped to simplify the information displayed online while targeting the stakeholders who use these services. The dataset was used to calculate maximum, minimum, and mean temperature and precipitation for the future. They also calculated the median for each variable. They argued that the max and min values of each variable could be very useful for engineers when designing their structure in an increasingly uncertain climate. The website was designed to help address the issue of variability in the data. This team also targeted to address the issue of uncertainty prevalent in different climate models. The focus of the tool was in seasonal data analysis rather than the long term data averages.

Evaluating the Team's Solutions

Criteria for evaluating solutions were also circulated to teams in advance, along with the Registration Package and climate dataset. In this way, teams could understand more specifically what the judges would be looking for in their pitches and in their solutions. The panel of judges each received an evaluation sheet to provide a score for each team. The judges evaluated the solutions and pitches using the following criteria:

- The solution is technically valid/correct;
- The solution is creative and disrupts current methods of displaying data/uncertainty;
- The solution is applicable to multiple climate variables (i.e. not just mean temperature, or not just precipitation);
- The solution is easy to understand for non-technical users;

- The solution can also be embedded within an online data portal or be linked to it somehow; and
- Ideally, the solution is also scalable (i.e., it can be applied for one climate model grid cell, but also many grid cells).

Judging and Awards

The panel of judges discussed the different scores for each finalist. Ultimately, the judging panel decided that the three finalists targeted important components of the issue of communication and translation of climate data and awarded 3 equal awards amounting to \$5,000. During the awarding of the prizes during the closing remarks of the OCC Symposium the judges highlighted the skills of team Datalytics in thinking through the various components that would make an effective tool, they acknowledged the achievement of team Limecat in developing a functional application from start to end, and the deeper understanding of the real-world problems that team Codebusters presented during their pitch.

Key Takeaways from the Challenge

Raising awareness across various groups (including students) on climate change is important to build capacity and consensus needed to act. There are levels and layers of climate awareness targeting different sets of general public that is needed to build capacity and eventually build a critical mass. It is sensible to raise awareness and inform students on climate change issues in anticipation of them becoming better informed practitioners. Well targeted information activities are key to transformational change and this data challenge proved to be one of the ways to introduce climate change information at the post-secondary level in a practical way.

The data challenge established a growing enthusiasm about climate change data at the post-secondary level with the teams involved, which included disciplines that commonly wouldn't be exposed to this work (e.g., computer science, computer engineering, entrepreneurship, mathematics, and political science). It also provided a clear idea of how these young minds relate to current issues and technological challenges associated with climate change data enabling action.

Some other takeaways include:

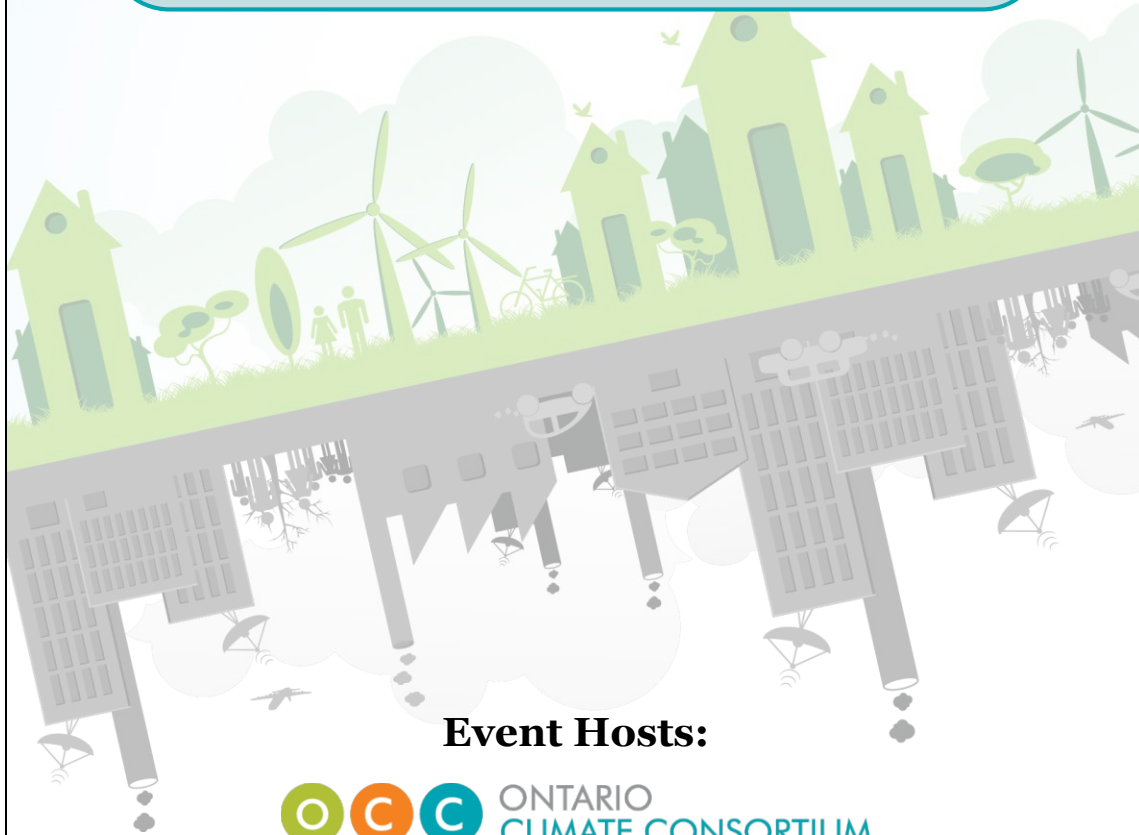
- The concept of uncertainty in climate modeling is a complex issue that is difficult to relate to by various disciplines.
- Participants struggled with the complexities of climate and it was clear that the conversation of climate change is not difficult; however, including the concepts of uncertainty and its presence in tools requires much more effort from the participants. Extensive mentorship for each team is key to include in future events.

- Participants at this young age were exposed to professionals and subject experts from a variety of disciplines such as climate science, environmental engineering, information management, civil engineering, etc. This interaction was successful in creating a bridge between youth and experts.
- These competitions are an engaging way to introduce climate data and its challenges to students not only to inform them, but to groom them for future careers in climate related and relevant sectors. It also provided support for their education expenses and further develops the number of engaged young people, which are often not included in advanced discussions of climate change solutions.
- The data challenge sparked new ideas on how the general public could interact with climate data and information through new age digital media.
- This challenge presented an opportunity for youth to get climate change questions answered and to hone their skills on presenting to an expert audience.
- Similar data challenge sessions could be a regular event featuring targeted audiences with the involvement of private and public stakeholders to continue closing the gap between experts, students and general public, as well as to spark collaboration and innovation.
- Participation of students with a wide range of subject disciplines (e.g. engineering, computer science, environmental science, climate science, conservation etc.) added diversity in the nature of ideas received. The diversity of study background was critical to help balance the nature of the ideas to solve the proposed challenge.

Appendix I – Challenge Registration Package

Disrupt Climate Data Challenge: Registration Package

Lounge - Health, Nursing and Environmental
Studies (HNES), York University
May 11-12, 2017



Event Hosts:



Available online here: <http://climateconnections.ca/wp-content/uploads/2017/02/Registration-Package.pdf>

Appendix II – List of Participants

A. Judges

- Kurt C. Kornelsen – McMaster University, FloodNet Canada
- Ryan Ness – Toronto and Region Conservation Authority (TRCA)
- Jeffrey Andresen – Great Lakes Integrated Science + Assessments (GLISA)
- Dianne Saxxe- Environmental Commissioner Office (ECO)
- Michael Goffin – Environment and Climate Change Canada (ECCC)
- Christine Tu – Ontario Climate Consortium (OCC)

B. Mentors

- Fabio Tonto – TRCA
- Neil Taylor – TRCA
- Glenn Milner – OCC
- Dr. Poulomi Ganguli – McMaster University, FloodNet Canada
- Prasamsa Singh – York University
- Kevin Behan – Clean Air Partnership (CAP)
- Dana Krechowicz – PWC
- Ewa Jackson – ICLEI
- Julian Cleary – ECO
- Edmundo Fausto – OCC

C. Student Teams

Team Limecat

1. Yuanlin Ma - McMaster University
2. Mingnan Su - McMaster University
3. Yang Wang - McMaster University
4. Zhe Lin - McMaster University

Team Datalytics

1. Shaan Hooey - Upper Canada College
2. Gaurav Dogra - Upper Canada College

Team Codebusters

1. Navya Sachdeva - McMaster University
2. Olivia Tinios - McMaster University
3. Evan Ansell - McMaster University

Team Bao

1. Pengshuai Shi – Ryerson University
2. Baoxin Chen – York University
3. Danny Qian – University of Toronto
4. Te Chen – University of Toronto

Team Climate2020

1. Vrushesh Patel – McMaster University
2. Adit Patel – McMaster University
3. Mahad Khokhar – McMaster University
4. Harsh Patel – McMaster University

Team Seidr

1. Sarah Shoker – McMaster University

Team Clear Skies

1. Lauren Schroeder – University of Illinois at Urbana

Team No Name #1

1. Tinny Nguyen – University of Toronto

Team Null

1. Xiaowen Lin – University of Waterloo

Team No Name #2

1. Bill Chen – University of Waterloo

Team No Name #3

2. Andy Lessard - Ryerson University

