PCIC UPDATE 27/06/2014

PROJECT FOCUS: STATISTICALLY DOWNSCALING CLIMATE SCENARIOS ACROSS NORTH AMERICA

New global climate projections (CMIP5) and regional climate projections (NARCAPP and CORDEX) have been released by the climate modelling community. These new products provided PCIC an opportunity to work with Environment Canada to produce an updated suite of statistically-downscaled climate projections. Statistical downscaling is a method for producing high-resolution climate information by determining a statistical relationship between observations and climate model simulations during the past and then applying the same relationship to future climate model projections to obtain downscaled future projections at high resolution.

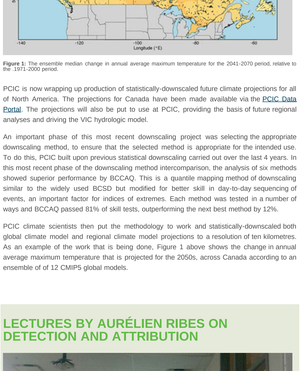

Figure 1: The ensemble median change in annual average maximum temperature for the 2041-2070 period, relative to the 1971-2000 period.

PCIC is now wrapping up production of statistically-downscaled future climate projections for all of North America. The projections for Canada have been made available via the PCIC Data Portal. The projections will also be put to use at PCIC, providing the basis for regional impact analyses and driving the VIC hydrologic model.

An important phase of this most recent downscaling project was selecting the appropriate downscaling method, to ensure that the selected method is appropriate for the intended use. To do this, PCIC built upon previous statistical downscaling carried out over the last 4 years. In this most recent phase of the downscaling method intercomparison, the analysis of six methods showed superior performance by BCCAQ. This is a quantile mapping method of downscaling similar to the widely used BCSD but modified for better skill in day-to-day sequencing of events, an important factor for indices of extremes. Each method was tested in a number of ways and BCCAQ passed 81% of skill tests, outperforming the next best method by 12%.

PCIC climate scientists then put the methodology to work and statistically-downscaled both global climate model and regional climate model projections to a resolution of ten kilometres. As an example of the work that is being done, Figure 1 above shows the change in annual average maximum temperature that is projected for the 2050s, across Canada according to an ensemble of of 12 CMIP5 global models.

LECTURES BY AURÉLIEN RIBES ON DETECTION AND ATTRIBUTION

Figure 2:Aurélien Ribes delivers a talk on the detection and attribution of climate change, at UVic's Bob Wright Centre.

Visiting researcher Aurélien Ribes delivered two lectures on the detection and attribution of the causes of climate change in May. The first talk, on Tuesday May 20th, focused largely on the results of Dr. Ribes's research. He began by noting that the global mean temperature is the sum of internal variability and external forcings, including greenhouse gases, other anthropogenic forcings and natural forcings. Estimating the warming that is due to greenhouse gases alone could provide better estimates of the sensitivity of the Earth's climate to greenhouse gases and improve projections of future climate. Presently this is usually done using statistical regression techniques, but climate science presents several unique challenges to these approaches, such as the extremely large sizes of typical climate data sets.

Using a new technique, called regularized optimal fingerprinting, Dr. Ribes confirmed that the separation of the effects of natural forcings and anthropogenic forcings on global mean temperature is quite robust, with most of the observed warming being human-induced. However, separating the influence of greenhouse gas emissions and other anthropogenic forcings (primarily aerosols) is difficult, because their response patterns share common features. As industry has grown, emissions of greenhouse gases and other anthropogenic forcings, such as aerosols, have increased in tandem (i.e. they are highly colinear). Dr. Ribes also explained that, when regularized optimal fingerprinting is applied to the output of climate models, the method is better able to separate greenhouse gas forcings from other anthropogenic forcings than when it is applied to observations. This is due to limitations on the ability of current climate models to simulate the response patterns, in space and time, to each of these forcings.

Dr. Ribes's second talk, on May 22nd, focused on the technical aspects of the statistical techniques that are currently being developed for the detection and attribution of changes in the Earth's climate. Specifically, the lecture covered the statistical models of varying levels of complexity that are used in detection and attribution, and recent approaches for including the uncertainty from climate models explicitly in the analysis.

Dr. Ribes has concluded his visit to PCIC and returned to France. His visit was a productive one and we look forward to future collaborations.

FALL LAUNCH OF PCIC SEMINAR SERIES

Starting in September, PCIC and our sister organization, the Pacific Institute for Climate Solutions, will be co-hosting another Pacific Climate Seminar Series, running from September 2014 through May 2015. Recognized experts in disciplines within and closely associated with climate science will share their knowledge and recent research findings, with a focus on issues of interest to stakeholders in British Columbia. Dr. Daniel Peters from Environment Canada will present the first talk, titled, *Environmental Flows in a Changing Climate* on September 10th. The full line-up of speakers and topics will be announced in the fall.

IPCC WORKING GROUP III REPORT APPROVED

The IPCC has just released the most recent report from Working Group III, which focuses on climate change mitigation. The report was developed by hundreds of leading experts from across the world and has been approved, line-by-line, by Working Group III and the IPCC's member governments.

Read more about the IPCC Working Group III Report.

NEW REPORT AND SUMMARY: THE MONTHLY DROUGHT CODE AS A METRIC FOR FIRE WEATHER IN SOUTHEAST BC

Work by PCIC researchers on evaluating the monthly drought code as a simple metric for fire weather in southeast BC has found that there are significant correlations between the monthly drought code and the annual area burned at all five locations that were tested. Researchers found that the monthly drought code is a simple, but effective metric for simulating wildfire severity that requires comparatively little input data. PCIC researchers have also created a suite of future projections of fire weather for southeast British Columbia.

Read more about these reports.

CONGRATULATIONS TO PCIC RESEARCHER CHRISTIAN SEILER ON HIS SUCCESSFUL PHD DEFENSE

Congratulations to PCIC researcher Christian Seiler, who has successfully defended his doctoral thesis and earned a PhD in Earth System Science from Wageningen University in the Netherlands. Dr. Seiler's dissertation subject was, The Sensitivity of Tropical Forests to Climate Variability and Change in Bolivia. At PCIC, Dr. Seiler analyzes climate model simulations of coastal storms in Canada as part of the Marine Environmental Observation Prediction and Response Network (MEOPAR).

PCIC WELCOMES NEW PROGRAMMER ANALYST AND NEW RESEARCH ASSOCIATE

We welcome two new staff members to PCIC. Shaham Sharifian has recently joined us as a co-op student programmer analyst. He is working with our hydrologists to provide programming support for the development of our hydrologic modeling technology. Our new Research Associate, Dr. Sanjiv Kumar, has joined PCIC to perform detection and attribution analysis on snow and sea ice data as part of the Canadian Sea Ice and Snow Evolution (CanSISE) Network.

NEWSWORTHY SCIENCE

PCIC has released two new Science Briefs. The first one covers two articles in the journal *Atmosphere-Ocean* that examine future ocean conditions for BC's continental shelf. The authors find potential surface warming, an overall decrease in surface salinity and that Haida Eddies, the Vancouver Island Coastal Current and freshwater discharges into the coast may all strengthen.

Read this Science Brief.

The second Science Brief covers two papers in the journals *Nature Climate Change* and *Science*, on how crop yield may be affected by climate change, drought and adaptation. The first paper is a meta-analysis of 1,722 crop yield simulations by Challinor et al. (2014). The authors find that, without adaptation, projected corn, rice and wheat production is reduced when areas experience 2.0 °C or more of local warming and that crop-level adaptations are projected to be able to increase yields when compared to similar scenarios that do not utilize adaptation. The second paper, by Lobell and colleagues (2014) uses using field-level data from the central US and simulations from the Agricultural Productions Systems Simulator (APSIM) model to determine the sensitivity of corn yield to drought stress. They find that both corn yield has and the sensitivity of the yields to drought stress have increased over the historical period, and that the largest factor contributing to drought sensitivity are changes in vapour pressure deficit. Lobell et al. note that if the sensitivity of corn yields to vapour pressure deficit remains constant or increases, then yields may decrease.

Read this Science Brief.

RECENT PAPERS AUTHORED BY PCIC STAFF

Donat, M., J. Sillmann, S. Wild, L. Alexander, T. Lippmann, and **F. Zwiers**, 2014: Consistency of Temperature and Precipitation Extremes across Various Global Gridded In Situ and Reanalysis Datasets. *Journal of Climate*. doi:10.1175/JCLI-D-13-00405.1, in press.

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