Spotlight on Student Research

Future Changes in Convective Precipitation & Severe Weather Environment in Western Canada

Changing Cold Regions Network

Changing Cold Regions Network (CCRN)

CCRN is a Canadian research network that aims to understand, diagnose, and predict the rapid environmental change occurring in the interior of western Canada. The Network is funded over five years (2013-2018) by the Natural Sciences and Engineering Research Council of Canada (NSERC) through its Climate Change and Atmospheric Research Initiative.

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Jennifer is currently in her last year of a Master of Science in Environment and Geography at the University of Manitoba. Working with John Hanesiak, Jennifer is focusing her research on the climatology of severe weather. She also enjoys studying remote sensing and geomatics. Outside of academics, she enjoys travel, food, and writing.

Severe convective storms are a common atmospheric phenomenon in North America that can produce high impact weather like strong winds, hail, tornadoes, lightning, and torrential rainfall. As concern has increased over the impact of global climate change on the earth system, the question has arisen of how severe convective storms will be influenced by a changing climate. An important purpose in establishing the relationship between global climate change and severe convective weather is what the potential societal and economic impacts will be in the future. From a social perspective, convective weather has impacts ranging from loss of livelihood to loss of life, and from an economic standpoint are the impacts of agricultural loss and damage to buildings and cars. Further, understanding how climate change may impact severe convective weather is important in providing information with regards to climate change mitigation and/or adaptation.

Low confidence and understanding of the future impacts of climate change on severe convective storms has partially been attributed to the inability of global climate models to resolve storms. Though they still have too coarse a spatial resolution to directly resolve severe convective storms, climate researchers have instead turned to regional climate models (RCMs) forced by global climate model (GCM) outputs to study severe weather environments. Since they cannot directly simulate convection, these studies using RCMs focus on examining large-scale environmental variables associated with severe convective storm activity. The North American Regional Climate Change Assessment Program (NARCCAP) provides such RCM simulations at a 50 km spatial resolution for a current period (1971 to 2000) and a future period (2041 to 2070).

My research uses convective and total precipitation data provided by three NARCCAP model pairings to characterize future change in these variables over our domain, which is western Canada and the central U.S. Plains. We are calculating averages and producing frequency distributions over monthly, seasonal, and annual time scales using this data. We are assessing future change by examining the difference in these statistics and frequency distributions between the current and future periods. Next, we are working to determine why future changes in convective and total precipitation are occurring by examining a number of severe weather parameters using the same three model pairings from NARCCAP. In this way, we can determine the extent to which the changes in convective and total precipitation can be attributed to the various severe weather parameters. As well, we are hoping to use the 4 km Weather Research and Forecasting (WRF) model to examine these parameters. The WRF model resolves convection directly whereas the NARCCAP model pairings use convective parameterization schemes to simulate convection. By using both the NARCCAP model pairings and the WRF model, a comparison can be made between the results from RCMs that simulate the severe weather environment and those from an RCM that directly resolves convection.