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A Synoptic Weather Typing Approach and Its application to Assess Climate Change Impacts on Extreme Weather Events at Local Scale in South-Central Canada

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The synoptic weather typing approach has become popular in evaluating the impacts of climate change on a variety of environmental problems. One of the reasons is its ability to categorize a complex set of meteorological variables as a coherent index, which can facilitate analyses of local climate change impacts. The weather typing method has been successfully applied in Environment Canada for several research projects to analyze climatic change impacts on a number of extreme weather events, such as freezing rain, heavy rainfall, high-/low-flow events, air pollution, and human health. These studies comprise of three major parts: (1) historical simulation modeling to verify the extreme weather events, (2) statistical downscaling to provide station-scale future hourly/daily climate data, and (3) projections of changes in frequency and intensity of future extreme weather events in this century. To achieve these goals, in addition to synoptic weather typing, the modeling conceptualizations in meteorology and hydrology and a number of linear/nonlinear regression techniques were applied. Furthermore, a formal model result verification process has been built into each of the three parts of the projects. The results of the verification, based on historical observations of the outcome variables predicted by the models, showed very good agreement. The modeled results from these projects found that the frequency and intensity of future extreme weather events are projected to significantly increase under a changing climate in this century.

This talk will introduce these research projects and outline the modeling exercise and result verification process. The major findings on future projections from the studies will be summarized in the presentation as well. One of the major conclusions from the studies is that the procedures (including synoptic weather typing) used in the studies are useful for climate change impact analysis on future extreme weather events. The implication of the significant increases in frequency and intensity of future extreme weather events would be useful to be considered when revising engineering infrastructure design standards and developing adaptation strategies and policies.