COMPLETED | PROJECT

DEVELOPMENT OF A CLIMATE GENERATOR AND ITS USE TO EXAMINE THE EFFECT OF CLIMATE CHANGE ON EXTREME FLOODS

PROJECT LENGTH

3 years • Completed in 2007

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CONTEXT

The low spatial resolution of global climate models makes it difficult to evaluate the regional hydrological repercussions of climate change. Although regional climate models now allow a finer scale, they do not apply to the "small" watersheds found in southern Quebec. Statistical approaches, especially climate generators, are a promising alternative for producing climate scenarios at the local level that are based on analyses of observed time series.

OBJECTIVES

- Design a climate generator applicable at the local and regional levels.
- Produce local and regional climate scenarios.
- Combine these scenarios with a spatialized hydrological model to quantify the effect of the anticipated climate change on the hydrology of small and medium watersheds and on the frequency distribution of extreme floods.

RESULTS

- Development of prototype software to generate climate scenarios as part of climate-change impact assessments.
- Development of the WeaGETS climate generator, which is capable of producing daily temperature and precipitation time series.
- Development of a multi-site stochastic climate generator to calculate daily precipitation and temperature at the watershed level.
- Enhancement of a scaling approach for monthly precipitation amounts via the use of a scaling factor, the dynamic portion of which is calculated on the basis of dynamic/ thermodynamic predictors selected in order to optimize results.
- Hydrological studies to assess the impact of climate change on the hydrological regimes of two watersheds. These studies allowed us to explore the possibilities of combining climate-change scenarios produced via climate generator with a hydrological model, in particular for dealing with uncertainty over simulation results.

IMPACT

- Production of more reliable climate scenarios at the watershed scale.
- Extremely advantageous in controlling floods, for example, where more effective damage-mitigation strategies could be established.
- Possible to produce a "generic" program to be used for all regions of Canada.
- Possible to generate uncertainty and risk analyses that could be used to design hydraulic structures and for environmental-impact assessments.

PARTNERS

- École de Technologie Supérieure (ÉTS)
- Hydro-Québec

FUNDING

- Natural Sciences and Engineering Research Council of Canada (NSERC)
- Ouranos

TEAM

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PROJECT OVERVIEW

- An initial climate generator was tested on climate stations representative of Quebec's climate.
- The generator was modified to accurately model the frequency and intensity of extreme precipitation, take account of geographic variability, and incorporate and test scaling algorithms in order to reduce the global climate modelled to the regional level.