Climate Model Makes Most of RWIS

project summary

Objectives

This research examined the feasibility of adapting a local climatological model (LCM), originally developed for Swedish conditions, to conditions in Ontario, Canada. The feasibility study outlines needed adaptations in the LCM, as well as a plan for implementing the model in Ontario.

What is the LCM?

The LCM is a set of computer algorithms that model or predict pavement temperatures along roads by considering the significant climatological impacts of local topography along each stretch of road.

The LCM primarily uses data on air and road surface temperatures and cloud cover. Pavement temperature information is available only where road weather information system (RWIS) field stations are located. Ideally, the conditions reported by these stations represent the range of conditions across the maintenance area.

The information from the model may be combined with a meteorological forecast to predict temperatures for the coming four to six hours, as well as the risk of road slipperiness, not only at RWIS locations but also for the entire area covered by the model. Armed with detailed guidance, the road maintenance supervisor is able to make better decisions about using anti-icing and snow-fighting resources.

From Sweden to Canada

The LCM was originally developed for Swedish conditions. To apply the model in North America, various system parameters and formulas needed to be changed.

To determine the feasibility of adapting the LCM into a new area, several factors must be considered.

Data required for establishing algorithms and road segments

In order to establish the background information needed to model the temperature variations along stretches of road, different types of recordings are used. The data are obtained from the following sources:

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Aurora

working to advance road weather information systems technology

RESEARCH PROJECT TITLE
Adaption of the Local Climatological Model in New Areas
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PROJECT TEAM
Swedish Road Administration
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Meteorological Services of Canada
University of Gothenberg, Sweden

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MORE INFORMATION
Chris Albrecht
Iowa State University – CTRE
2711 S. Loop Drive, Suite 4700
Ames, IA 50010-8664
Phone: 515-294-7684
Fax: 515-294-0467
Email: calbrech@iastate.edu

ABOUT AURORA
Aurora is an international partnership of public agencies performing joint research, evaluation, and deployment initiatives related to road weather information systems (RWIS).

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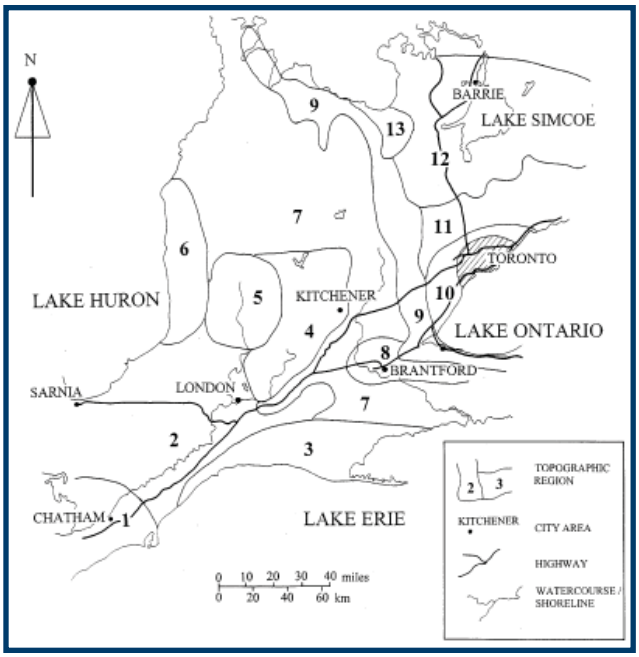
- Thermal mapping of road sections by use of instruments attached to a vehicle
- RWIS field stations, preferably located in different climatological environments along road sections
- Field and map analyses of topography, vegetation, and geographical factors (see figure below)



Southern Ontario, with its different topographical domains

Supporting technologies and other resources required

Input data requirements

The LCM requires observations from RWIS field stations, in particular, air and road surface temperatures, humidity, and wind speed and direction. Ideally, these observations should be updated every 30 minutes. In addition, a cloud forecast assists in predicting road temperature.

The quality and accuracy of the calculations performed by the LCM is to a certain degree dependent on the number of field stations from which data are received. As a rough guideline, minimum acceptable coverage would be 10 to 15 field stations in an area 200 by 200 km (approximately 125 by 125 mi). However, this figure depends on the topographical and climatological conditions. To determine what constitutes adequate instrumentation for a particular target area, a thorough analysis of local topography and climatology is recommended.

Data format and storage requirements

It is an advantage if the data from the RWIS network are stored in a database that is updated continually and that will give access to historical information. The latter is of great value when developing new forecast tools. Data should be stored in ASCII format, which can be handled by the model.

Data presentation

Effective presentation of the LCM output is a key to ensuring that the data are used and valued. Several steps are required to adapt a presentation system for the target area:

1. The important geographic features must be digitized and prepared in the proper format for integration into the display system.
2. The on-screen text and all associated documentation must be translated.
3. Tuning of certain features (e.g., alarm levels) may need to be done to support operational practices in southern Ontario.
4. Existing data streams (e.g., for RWIS observations) must be adapted or new ones created to feed data into the LCM and the display system.

Training of operational personnel

For maintenance personnel, some training in climatology and interpretation of the LCM displays may be needed. If weather forecasters are to have access to the data (recommended), then they will also need some training in providing the best possible guidance to maintenance personnel.

LCM transfer implementation plan

To proceed with the trial implementation of the LCM in a target area in southern Ontario, the following sequence of activities was recommended:

1. Identify and assess the study area.
2. Prepare the study area.
3. Prepare the LCM.
4. Train operational personnel.
5. Conduct an operational test of the LCM.
6. Validate the LCM test results.
7. Prepare a final report and recommendations.