An integrated public health approach for heat waves in Québec
Context:

The Québec government’s 2006-2012 Climate Change Action Plan (PACC) included an adaptation component with a number of health-related projects. The plan started for good in late 2007. It has been recently renewed until 2020.
8 million people
(about 50% around Montreal)
18 health regions

GHG reduction similar to Europe (electric power being 98% from hydro sources)
Our approach is illustrative of what can be done at a province or state level. It includes:

Research/
Emergency preparedness/
Preventive actions
Emergency preparedness

- Informal guide for heat waves (2004) and official mandate from Ministry (2005) to 7 southern regions to operate a heat watch system by 2007 at the latest.
- Official intervention guide for all health regions (2006)
Many priority actions in the PACC had deliverables focused on surveillance systems

- for heat waves (2010)
- for all other extreme meteorological events (2012)
- for zoonotic and vector-borne diseases (no specific date)
A Common Platform

- We also decided early on that we would prepare not just for heat waves but for all other Extreme Meteorological Events (EME) as we hadn’t really applied surveillance to those matters in the past
- A common platform for all EME became a natural conclusion
Methodology

An open source web application for the surveillance and prevention of the impacts on public health of extreme meteorological events: the SUPREME system

Steve Toutant¹, Pierre Gosselin¹,²,³ *, Diane Bélanger²,³, Ray Bustinza¹ and Sonia Rivest⁴

* Corresponding author: Pierre Gosselin pierre.gosselin@inspq.qc.ca

For all author emails, please log on.

Published: 25 May 2011

Abstract

Background


The strengthening of monitoring systems included a research component, as well as improving forecasts in collaboration with Environment Canada and universities on various R&D projects. This includes transfer/adaptation to low-income countries such as Morocco and Niger within the IRIACC-FACE initiative of the IDRC in Canada.
Historical analyses of excess mortality as a function of heat episodes and the setting of new alert levels by geographic region (four regions with enough daily deaths).

A general and flexible methodology to define thresholds for heat health watch and warning systems, applied to the province of Québec (Canada)

Fateh Chebana, Barbara Martel, Pierre Gosselin, Jean-Xavier Giroux, Taha B. M. J. Ouarda
Grouping regions to get enough daily deaths for analysis...
Research Projects

- Notion of extreme heat (historic heat waves with mortality $\geq 60\%$ over baseline), not Environment Canada’s humidex of 40 used elsewhere in Canada
- Weighted over 3 days based on forecasts, and three levels depending on regions:
  - $T_{max} = 33\, ^\circ C$ $T_{min} = 20\, ^\circ C$
  - $T_{max} = 31\, ^\circ C$ $T_{min} = 18\, ^\circ C$
  - $T_{max} = 31\, ^\circ C$ $T_{min} = 16\, ^\circ C$
- Check Humidex after forecast
Research Projects

Modelling of air pollution, heat and deaths/hospitalizations, current and future

http://www.ij-healthgeographics.com/content/10/1/7

RESEARCH

Modelling the variation of land surface temperature as determinant of risk of heat-related health events

Yan Kestens1,2,3,*, Allan Brand4, Michel Fournier3, Sophie Goudreau3, Tom Kosatsky5, Matthew Maloley6, Audrey Smargiassi4,7,8
Research Projects

- Adaptation to heat in 3500 families living in the most deprived DA of our 9 most important cities (and a comparison between public housing and regular housing), in a multilevel analysis, due 2014.
- Virtual cohort on cardiovascular disease and weather/climate (1996+), includes hospital admissions, deaths, medical visits; in progress, due 2015.
BME-LUR for days (9h-17h) of the summers 2006-2009
Adam-Poupart, Brand, Smargiassi et coll

Mean ozone levels

Standard errors

Do not cite or reproduce – under review
Automated calls for vulnerable people receiving home care (as determined locally) for smog and heat alerts (from the SUPREME system); detailed evaluation of behaviours and services consumption compared to control group. Due 2015.
Système de surveillance et de prévention des impacts sanitaires des événements météorologiques extrêmes
Current indicators (province-wide): all warnings for weather, forest fires, floods, smog, etc.; current air pollution levels; urban heat islands 20m resolution; flooding areas; historic extremes; population density; chronic diseases index; deprivation index; age distribution; recent immigrants numbers; air conditioning by DA; location of swimming pools, cooling centers, green spaces; dwelling quality; location of all public institutions; daily deaths, hospital admissions, emergency room visits; infoHealth calls; ambulance calls; implemented steps in emergency plan; other contextual geographic info.
A vulnerability tool was developed within the SUPREME
By health region or for the whole province
All variables can be parameterized
By proportion or by number of people affected
Shows dissemination areas (DA) in the defined segment (e.g. top 10%)
Pilot projects to reduce UHI in deprived urban areas

$15 M for 38 projects with 2 to 1 co-funding (around $ 45 M worth)

Included white/green roofs; school yards; child care units; public housing; parkings; alleys and public spaces; urban agriculture.
Prevention projects

Urban Heat Island Mitigation Strategies

http://www.inspq.qc.ca/pdf/publications
Prevention projects
Prevention projects

Avant

Après
Prevention projects

- Evaluation of cooling effect through numerical modelling of urban atmosphere (with Environment Canada)
- On site temperature/humidity, before/after
- Questionnaires on perception of cooling effects and usability for tenants
Thermal images on the 5th July 2008 and the 14th of July 2011 at 10h30 LST (Landsat 5TM)

Air temperature at 2 m simulated using urbanGEM-SURF at a resolution of 120 m on the 6th of July 2008 at 01h LST

SHI and CLHI
Spatial variability
### Simulation pour le site de Calixa-Lavallée

<table>
<thead>
<tr>
<th>Nature de la surface</th>
<th>Superficie avant (%)</th>
<th>Superficie avant (Nombre de pixels de 5x5 m²)</th>
<th>Superficie après (%)</th>
<th>Superficie après (Nombre de pixels de 5x5 m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalte (sans revêtement)</td>
<td>40</td>
<td>922</td>
<td>21</td>
<td>484</td>
</tr>
<tr>
<td>Bituclair (asphalte sans bitume avec liant de couleur claire) – terrain de basket-ball</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>69</td>
</tr>
<tr>
<td>Dalles et marches de béton (sans coloration)</td>
<td>2</td>
<td>46</td>
<td>1</td>
<td>23</td>
</tr>
<tr>
<td>Pavé de béton gris pâle</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Caoutchouc bleu (piste de course)</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>138</td>
</tr>
<tr>
<td>Sol nu (déblai non végétalisé)</td>
<td>14</td>
<td>323</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Criblure de pierre et sable</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>92</td>
</tr>
<tr>
<td>Mur de pierres</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Revêtement StreetBond sur asphalte ou béton</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>46</td>
</tr>
<tr>
<td>Surface plantées d’arbustes et graminées</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>46</td>
</tr>
<tr>
<td>Gazon</td>
<td>24</td>
<td>553</td>
<td>37</td>
<td>852</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>80</strong></td>
<td><strong>1844</strong></td>
<td><strong>76</strong></td>
<td><strong>1760</strong></td>
</tr>
</tbody>
</table>
Prevention projects

Standard on parking planning and improvement for CC

Bureau de normalisation du Québec
Prevention projects

- Several guides for institutional building adaptation, including hospitals
- A first adaptation plan (including costs over next 10 years) for hospitals and clinics in UHIs will be produced by the end of 2013.
- Risk maps for various endusers will also be produced in the coming year.
- So what do we do now?
Lessons learned from use in heat waves (and more):

- Portal very useful and appreciated by end users as a common and shared source of alerts, at risk areas (e.g. UHI) and vulnerabilities (age, poor housing, etc.); used for preparedness AND preventive actions (e.g. greening)
- Integration for the end user is the key concept behind the whole approach
Lessons learned

- The UHIs map is now used by Ministry of Transport, as is the parking standard
- Same for municipalities throughout province
- Demand and enthusiasm for greening projects is higher than ever, very visible and appreciated by the political class, so we are developing a greening consortium...
One lesson not yet learned is to reduce GHG

- Petroolism can be treated if not cured
- And we have known the available treatment regimens for quite a while, just forgot them:
Remedies against petrooolism

- train (invented in 1804)
- bicycle (1817)
- tramway (1832)
- taxes (~2400 years)
- Forestry (~8 000 y)
- Urban planning of the pre-1945 variety, (~10 000 y)
- Boat transport (~15 000 y)
- Walking (~2 000 000 y)
Thank you

pierre.gosselin@inspq.qc.ca