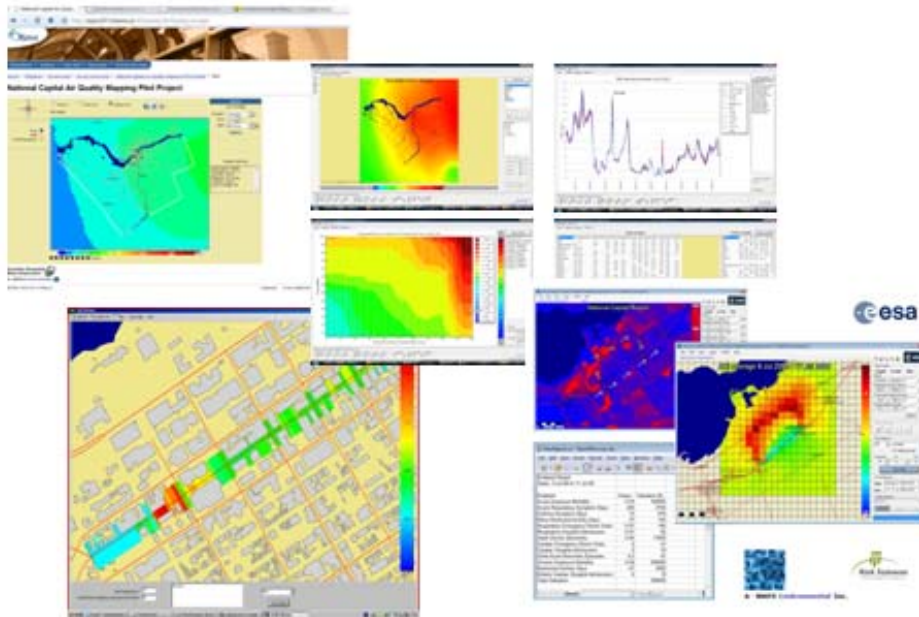


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Municipal Air Quality Information System "A la Carte"



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Air Quality Management Means Assessment of the Impacts

Air quality in major Canadian cities continues to improve but negative health impacts of the air pollution remain a serious issue. Urban development and transportation planners as well as municipal health officers realize that more is needed than just monitoring air pollutant concentration levels at a few critical sites. For a full assessment of health impacts, detailed **geospatial information** is required regarding the air pollution levels over populated areas including public spaces such as parks, schoolyards and sport fields. A range of modern effective information tools became recently available.

1. Hourly Air Pollutant Distribution Maps Online

Since 2007, the City of Ottawa is pioneering an innovative approach to municipal air quality management. In this approach, atmospheric satellite data are combined with ground level measurements and modeling. The satellite data are provided by international space agencies, while ground level data are available through national and local air quality monitoring networks. A database of air pollution distribution maps in GIS formats, resulting from this integrated approach, is the first building block of an air quality information system. The air pollutant distribution maps display the hourly concentration levels of NO₂, NO, NO_x, O₃, PM_{2.5} and CO in a 1km by 1km grid over the entire area of interest from 2004 to present time.

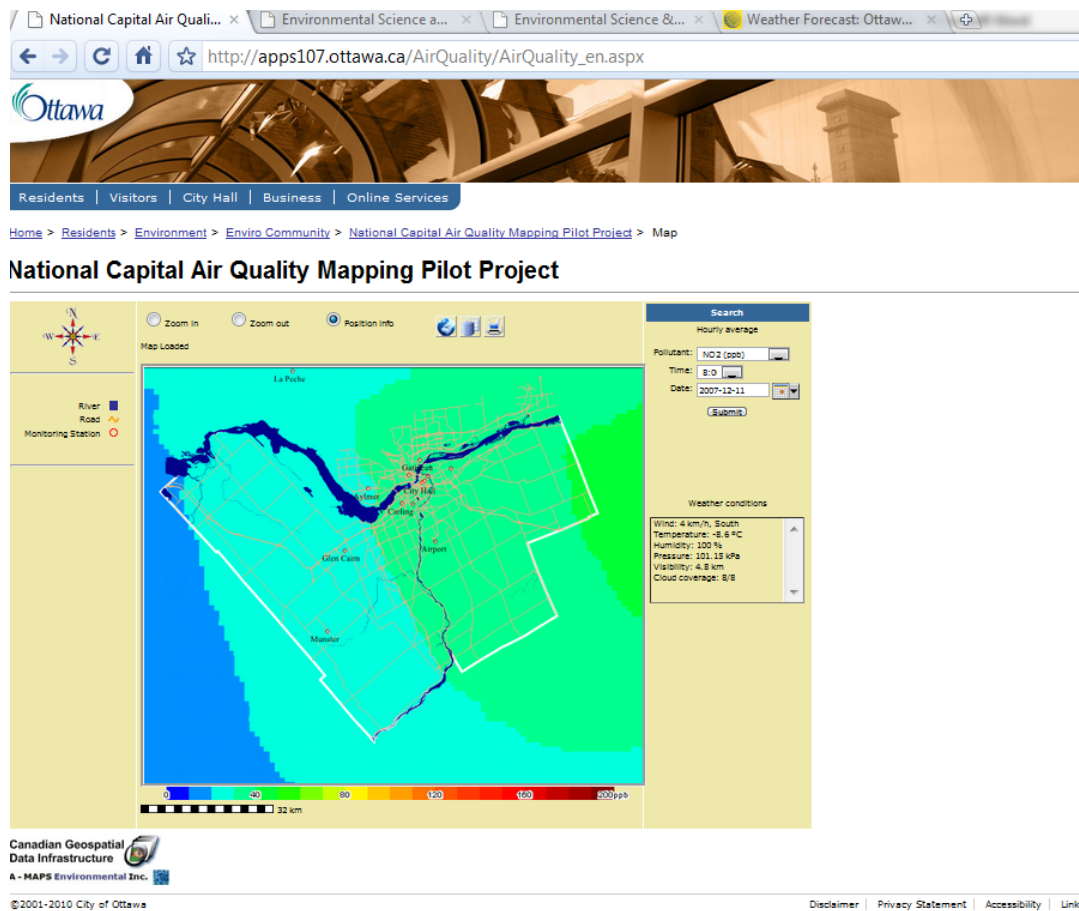


Figure 1. Air Quality information website of the City of Ottawa

2. More Information through Geospatial Analysis of the Air Pollution Data

The creation of an air pollutant distribution database is just the first step. To disclose the vast amounts of information concealed in the air pollution databases, further geospatial analysis of the data is needed. A graphical user interface was developed, enabling analyses and easy presentations of the air pollution data. The software interface includes conversion of any environmental records into GIS mapping formats. Specific time periods and areas can be selected on screen within the mapped region for processing and analyses. Moreover, series of imagery can be viewed as an animation. The analyses include standard statistical and custom designed functions such as averaging, max, min, standard deviation, percentiles and critical pollutant level exceedancies.

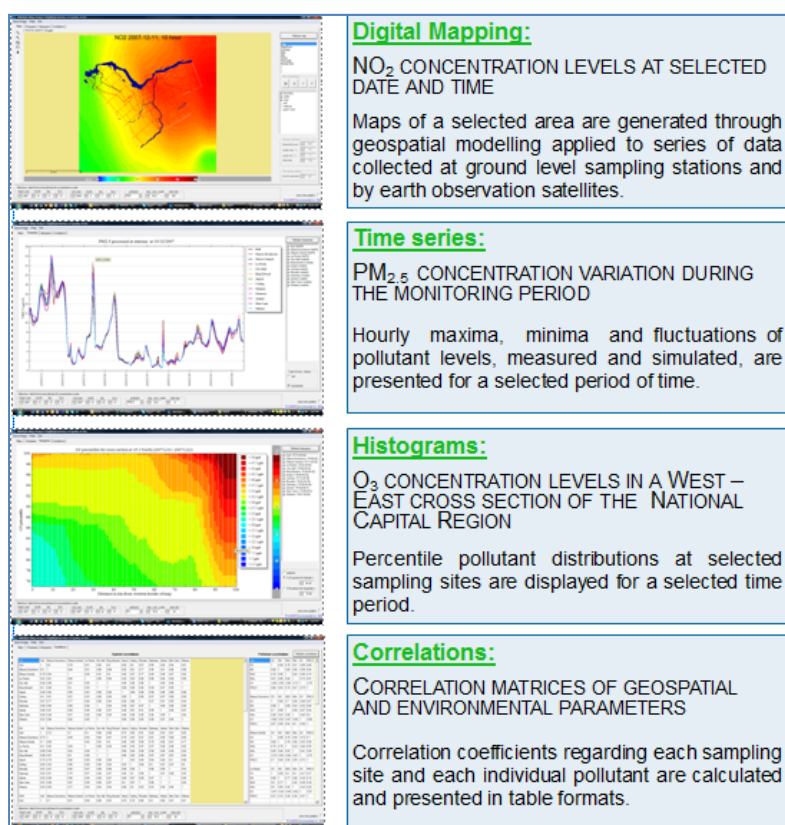


Figure 2. Examples of application of the graphical user interface MAGIQA for analyses of the air pollution records within the National Capital Region, Canada.

3. Assessments of Air Pollution Health Impacts Are Vital

One of the key concerns of municipal planners is evaluating consequences of different city development and land use scenarios. Particularly important is considering the implications dealing with public health. To respond to this urgent need, another software application and interface were developed by combining emission dispersion models with health risk models. The new interactive graphical interface makes it possible to directly assess the impacts of urban

road traffic emissions with respect to population health. Different traffic control scenarios can be tested for by modifying traffic mix, average volumes and speeds on selected roads or in entire neighbourhoods. Consequences of such changes in terms of air pollution and health impacts can be then reviewed and evaluated in mapping and tabular formats. This tool has been successfully applied for assessments impacts of downtown road construction activities in Ottawa as well as in Windsor in relation to the new bridge construction. An example of application of the interface, showing consequences of traffic rerouting from a busy highway section to a residential area in Ottawa is presented below.

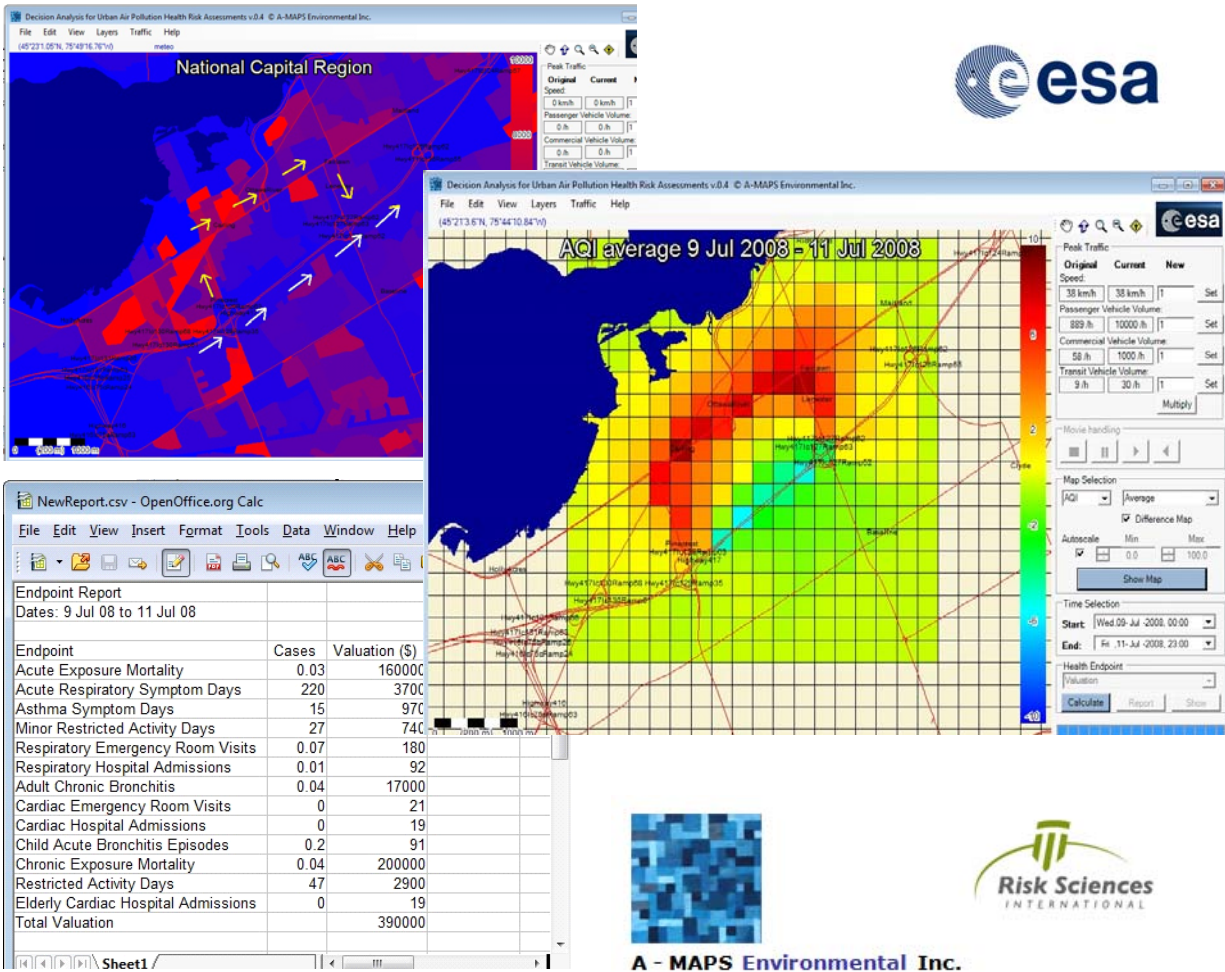


Figure 3. The upper display shows rerouting traffic from Hwy 417 (white arrows) through a densely populated residential area in the western part of Ottawa (yellow arrows) with several school, sport, and medical facilities. Displayed on the central map is average change in Air Quality Index (AQI) for a three day period in July 2008 in the area surrounding the affected roads. Pollutant concentration levels decreased (blue-green colors) in the vicinity of the closed highway section, but increased (yellow-red colors) along the roads to which the traffic was rerouted. The AQI scaling, original and modified traffic parameters and the dates are indicated in the legend on the right hand side. In the lower panel, a report displays health impacts on the local population. The health benefits in the areas along the closed highway section are

overshadowed by the adverse impacts on the population health in the densely populated residential area, where the pollutant levels have significantly increased.

4. Anticipating Consequences of Climate Change

In the process of generating a full Air Quality Information system for the National Capital Region, other urgent issues were identified. If our climate changes, what air quality and associated public health consequences this will bring? How can municipal planners anticipate such consequences in terms of industrial, traffic and residential emissions control? To answer these tough questions another new software application with a user interface was developed. This new application allows testing and evaluation of different Climate Change and emission control scenarios and hence to contribute to the municipal Climate Change management plans. An example of climate change impacts for Ottawa downtown and surrounding areas is presented in Figure 4.

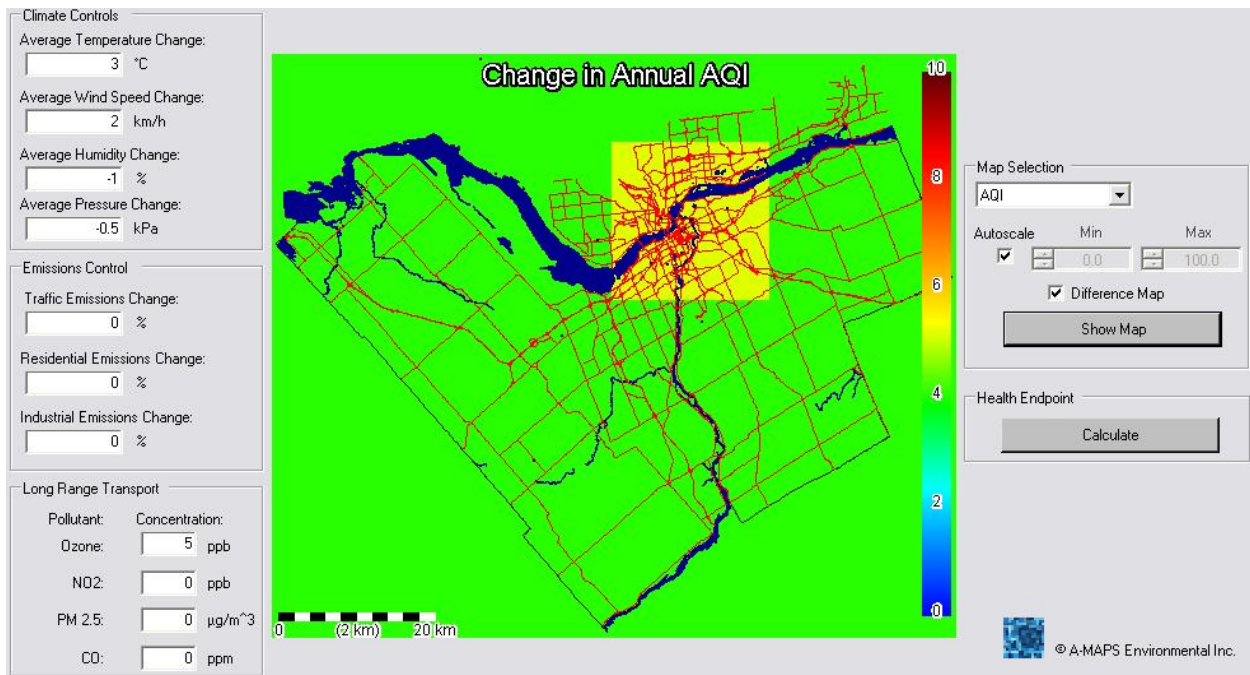


Figure 4. Interactive interface for assessments of Climate Change impacts regarding urban air pollution and associated public health risks. Air Quality Index increase in Ottawa-Gatineau downtown and surrounding areas is displayed.

5. Traffic Planning to Mitigate Street Level Air Pollution and Associated Health Risks

City officials are frequently dealing with health related complaints of citizens living and working in streets with busy traffic. Also here, the modern air pollution mapping technology can help in search for dependable solutions. A high resolution interface to a 3D Street Level Air Quality model has been developed for the City of Ottawa, which will allow on screen simulation of car,

truck and bus traffic volumes in order to find the least harmful solution with respect to health risks. An example of a screen shot is shown below.



Figure 5. Example of display of increased NOx emissions due to busy traffic in Slater Street downtown Ottawa.

Dependable Tools Require Validation of the Solutions

Of course, development and application of any innovation requires intensive collaboration among partners representing industrial, academic and user organisations. The Air Quality Information System and its components were (and are being) developed, tested and validated during large cooperative programs participated by the City of Ottawa, Universities of Ottawa, Waterloo and Windsor, Ontario Ministry of the Environment, Health Canada, Transport Canada, Natural Resources Canada, European Space Agency and Risk Sciences International Inc. In particular, research funding by European Space Agency, Natural Resources Canada and Precarn Inc. is gratefully acknowledged.

A-MAPS Environmental can deliver dependable, validated and cost effective solutions to municipal air quality management as well as to the assessments of impacts of the air pollution.