Geophysical Research Abstracts,
Vol. 11, EGU2009-9213-2, 2009
EGU General Assembly 2009

Investigating Future Air Quality: Combining AURAMS and the CRCM to project future ozone and particulate matter concentrations over North America

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Climate change can impact gas- and aerosol-phase chemistry, transport, and cloud processes which, consequently, may impact the formation and distribution of both ozone and particulate matter, two key indices for air quality. Recently, regional climate models have been used to provide the driving meteorology for air pollution models, showing how air pollution may be affected by future climate regimes. Many studies employing constant current emissions have projected increases in regional ozone concentration due to climate change alone that are as large, or larger, than the projected increase in regional ozone concentration expected to result from future 'worst case' increases in emissions. One study has found that climate change, combined with projected emission reductions for 2050, resulted in significant decreases in regional ozone concentrations. The impact of climate change on air quality, in combination with changes in future emissions, is not often considered in policy advice and could potentially have a large impact.

The work to be described here merges two existing numerical models, the Canadian Regional Climate Model (CRCM) and A Unified Regional Air-quality Modelling System (AURAMS), to study the effects of climate change on air quality at a 42km resolution over North America. AURAMS is a comprehensive air-pollution model including size (12 bin) and species-resolved particles, inorganic and organic heterogeneous chemistry, gas-phase chemistry, transport, and removal. Here, AURAMS is driven using meteorology from the CRCM, itself a limited - area model driven at the boundary by fields from the Canadian Coupled General Circulation Model. The ultimate goal of the work is to simulate air quality under different climate scenarios and for different projections of future emissions. The first stage of the project is the simulation of air pollution for summers with the current climate. Subsequent stages will examine the changes to ozone concentrations and other pollutants resulting from the combination of future climate and current emissions, and future climate with projected emissions.

In addition to providing an overview of the combined CRCM-AURAMS system, this presentation will focus on our progress on the first stage; the comparison of current climate air pollution simulations with measurements. These comparisons are made on the basis of climatological averages, since, unlike the case of the driving meteorology being provided by a weather forecast model, the climate model is free running. A brief review on the importance of future climate change on air quality will also be provided, adding perspective to planned future activities.