

Recent Trends in Forecasted and Observed O₃, NO₂, and PM2.5 Surface Concentrations in Canada

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Environment and Climate Change Canada's operational air quality (AQ) forecasting program began 18 years ago and has evolved from O₃-only forecasts for eastern Canada to Canada-wide O₃, NO₂, and PM2.5 forecasts. Since 2007 AQ forecasts for Canadian urban centres have been communicated via the Air Quality Health Index (AQHI), which takes into account the three aforementioned pollutants. ECCC's Canadian Meteorological Centre Operations (CMCO) division runs a number of operational AQ related systems that revolve around the Regional Air Quality Deterministic Prediction System (RAQDPS). The RAQDPS generates 48-hour AQ forecasts and outputs hourly concentration fields of O₃, PM2.5, NO₂, and a number of other pollutants twice daily on a North American grid with 10-km horizontal grid spacing and 80 vertical levels.

In this presentation, trends in forecasted and observed O₃, PM2.5 and NO₂, and surface concentrations over North America for the period from 2009 to 2017 will be discussed and the model's sensitivity to different inputs and model components will be analyzed. These include sensitivity to anthropogenic emission inventories, intermittent wildfire emissions, chemical and meteorological model library updates, horizontal and vertical model resolution changes, and chemical lateral boundary conditions. Since urban environments are particularly subject to air pollution, this presentation will focus on AQ forecasts and trends in major Canadian cities. The CMCO's operational AQ forecast system also benefits from a statistical post-processing model called UMOS-AQ that is applied to reduce bias and enhance forecast reliability at point locations, and recent UMOS-AQ results for large urban centres will be shown. Finally, current challenges and future directions of the Canadian operational AQ program will be presented, including the development of a high-resolution AQ prediction capability for urban areas in Canada.