



Impact of Trans-Boundary Emissions on Modelled Air Pollution in Canada

Radenko Pavlovic (1), Mike Moran (2), Junhua Zhang (2), Qiong Zheng (2), Sylvain Menard (1), David Anselmo (1), and Didier Davignon (1)

(1) Air Quality Modeling Applications Section, Environment Canada, Montreal, Quebec, Canada (Contact e-mail: radenko.pavlovic@ec.gc.ca), (2) Air Quality Research Division, Environment Canada, Toronto, Ontario, Canada

The operational air quality model GEM-MACH is run twice daily at the Canadian Meteorological Centre in Montreal, Quebec to produce 48-hour forecasts of hourly O₃, NO₂, and PM2.5 fields over a North American domain. The hourly gridded anthropogenic emissions fields needed by GEM-MACH are currently based on the 2006 Canadian emissions inventory, a 2012 projected U.S. inventory, and the 1999 Mexican inventory. The Sparse Matrix Operator Kernel Emissions (SMOKE) processing package was used to process these three national emissions inventories to create the GEM-MACH emissions fields.

While Canada is the second-largest country in the world by total area, its population and its emissions of criteria contaminants are both only about one-tenth of U.S. values and roughly 80% of the Canadian population lives within 150 km of the international border with the U.S. As a consequence, transboundary transport of air pollution has a major impact on air quality in Canada. To quantify the impact of non-Canadian emissions on forecasted pollutant levels in Canada, the following two tests were performed: (a) all U.S. and Mexican anthropogenic emissions were switched off; and (b) anthropogenic emissions from the southernmost tier of U.S. states and Mexico were switched off. These sensitivity tests were performed for the summer and winter periods of 2012 or 2011. The results obtained show that the impact of non-Canadian sources on forecasted pollution is generally larger in summer than in winter, especially in south-eastern parts of Canada. For the three pollutants considered in the Canadian national Air Quality Health Index, PM2.5 is impacted the most (up to 80%) and NO₂ the least (<10%). Emissions from the southern U.S. and Mexico do impact Canadian air quality, but the sign may change depending on the season (i.e. increase vs. decrease), reflecting chemical processing en route.