



Implementation of fully coupled "online" chemistry within the GEM model

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GEM-MACH, a fully coupled "online" weather prediction and chemical transport model, is under development at Environment Canada. The short-term goal of this project is the replacement of the current operational off-line air quality forecast model, CHRONOS, that is used by Environment Canada to provide two-day forecasts of ozone and PM_{2.5} (particulate material smaller than 2.5 microns in diameter).

To construct GEM-MACH, chemistry modules are being implemented directly inside the GEM multi-scale meteorological forecast model. The chemistry embedded in GEM will be equivalent to the chemistry in CHRONOS using the gas-phase chemical mechanism of ADOM-II for the processes involved in ozone formation. The physical and chemical treatments of the emission, formation, and evolution of atmospheric particles, including those composing PM_{2.5} and PM₁₀, will be improved over the basic bulk treatment used in CHRONOS. In the sectional approach that has been adopted, the particle size distribution is approximated by a discrete number of internally-mixed size sections.

Physical and chemical processes related to air quality will be solved on GEM's "native" grid, with no needs to interpolate in space or in time. Furthermore, the air quality component of the model will be fully consistent with the meteorological component since both use the same semi-Lagrangian advection scheme and the same physics schemes for subgrid-scale transport. This new online air quality forecast model will also be able to exploit the massively parallel supercomputer via the parallelism options (MPI) already implemented in GEM.

CHRONOS : Canadian Hemispherical Regional Ozone and NO_x System

GEM : Global Environmental Multiscale model / Global Environnemental Multi-échelle modèle

GEM-MACH : Global Environmental Multiscale model – Modelling Air quality and Chemistry / Global Environnemental Multi-échelle - Modélisation de la qualité de l'Air et de la CHimie