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Alaskan and western Canadian wildfires in the summer 2004: GEM–AQ simulations and comparison with ACE satellite measurements

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From June to September, 2004, almost 6,000,000 ha of boreal forest and peatlands burned in Alaska and western Canada (mainly in the Yukon). Trace gases and particles generated as a result have been observed from both space-based and ground-based instruments. Important issues surrounding biomass burning events are emission factors and lofting heights of emissions. We have used the Global Environmental Multi-scale Air Quality model (GEM–AQ) to investigate these issues by comparing our simulation results with data from the Atmospheric Chemistry Experiment Fourier Transform Spectrometer (ACE-FTS) onboard the Canadian SCISAT-I satellite.

GEM–AQ is based on the 3-D global variable-resolution multi-scale model developed by the Meteorological Service of Canada for operational weather prediction, and incorporates online air quality modules including gas phase chemistry and size-resolved multi-component aerosols. The model was run for the period between 15 June and 31 July on a $1.5^\circ \times 1.5^\circ$ global grid with 28 hybrid vertical levels from the surface up to 10 hPa. Objective analysis data were used to update the meteorological fields every 24 hours. Daily fire emission fluxes of gas species were generated by using year-specific monthly inventories of carbon emissions from the Global Fire Emission Database version 2 and daily MODIS fire counts to convert to daily emissions.

The model output is compared with upper-tropospheric CO, HCN, C_2H_6, CH_3OH, and HCOOH measurements from the ACE instrument. Analysis to date, corroborated with aircraft measurements from the INTEX-A campaign and CO data from MOPITT, indicates that, while about half of the emissions was released in the boundary layer, the other half was injected into the free troposphere (with 40% of mass up to 400 hPa and 10% in the upper troposphere).