Hydrogen cyanide in the upper troposphere

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We investigate the spatial and temporal distribution of hydrogen cyanide through numerical simulations and comparison with observations from a space-based instrument. To perform the simulations, we used the Global Environmental Multi-scale Air Quality model (GEM-AQ), which is based on the 3-D global variable-resolution multi-scale model developed by the Meteorological Service of Canada for operational weather prediction. The version of GEM-AQ used in this study incorporates on-line gas phase chemistry for 51 gas-phase species and no aerosols. The model was run for the period 2004–2006 on a $4° \times 4°$ 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. Fire emission fluxes of gas species were generated by using year-specific inventories of carbon emissions with 8-day temporal resolution from the Global Fire Emission Database version 2. The model output is compared with HCN profiles measured by the Atmospheric Chemistry Experiment (ACE) infrared Fourier Transform Spectrometer instrument onboard the Canadian SCISAT-I satellite. Our results show a good correlation between model and measurements, however, there is a negative bias in the model which suggests that (1) there might be an unaccounted source of HCN (possibly biogenic), (2) the biomass burning emission factors used are too low, or (3) the ocean sink is too strong in the model.