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Feasibility of quantifying the seasonal variability of the NO_2/CO and NO_2/HCHO boreal fire emission ratios using satellite data

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Boreal forest fires emit large quantities of pollutants during the summer, especially in the high-fire years. The quantity of emissions, and the chemical composition of those emissions, are determined by complex interactions among fuel and fire behavior properties. Combustion phase strongly affects the composition of species emitted during the fires, with smoldering combustion generating higher emissions of CO and HCHO but lower emissions of NO_x, relative to flaming combustion. Recent evidence indicates that later in the burning season an increased amount of fuel is consumed via smoldering combustion, due to the progressive drying of surface organic layers leading to higher fuel consumption. Hence, a state-of-the-art Boreal Wildland-Fire Emissions Model (BWEM) predicts a significant decrease in the NO_x/CO fire emission ratio as the fire season progresses. This decrease is supported by observations of dNO_y/dCO ratios in aged boreal fire plumes sampled at the Pico Mountain observatory in the central North Atlantic. In this work we will assess the feasibility of detecting the seasonal change in the fire-emitted species by simulating ratios of NO_2/CO and NO_2/HCHO from the Ozone Monitoring Instrument and the Atmospheric Infrared Sounder over the boreal fire source regions using FLEXPART and the BWEM emissions inventory. The magnitude of the seasonal change in emission ratios and the potential for observing these changes using satellite observations will be assessed for the 2005 North American fires.