Geophysical Research Abstracts,
Vol. 10, EGU2008-A-06902, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-06902
EGU General Assembly 2008

Observing the diurnal variation of NOx chemistry and emissions from space

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We will present a comparison of tropospheric NO_2 columns measured by OMI aboard Aura (13:30 local overpass time) and SCIAMACHY aboard Envisat (10:00 overpass). The NO_2 columns have been retrieved with nearly identical algorithms under similar cloud-free conditions, allowing for an examination of the consistency between the two instruments under tropospheric background conditions and the effect of different observing times. For most of the world, SCIAMACHY and OMI agree within their detection limits. Over the polluted regions of the world we find that SCIAMACHY observes $\sim$30% higher NO_2 at 10:00 local time than OMI at 13:30. We find similar 10.00-13.30 decreases in spatially and temporally coinciding surface NO_2 concentrations measured within Israeli cities, and from surface NO_2 measured throughout the urban, northeastern United States. Using a global 3-D chemical transport model (GEOS-Chem), we show that the 10:00-13:30 decrease in tropospheric NO_2 columns over fossil fuel source regions can be explained by photochemical loss, dampened by the diurnal cycle of anthropogenic emissions that has a broad daytime maximum. In contrast, SCIAMACHY observes $\sim$30% lower NO_2 columns than OMI over biomass burning regions in the tropics. The observed 10:00-13:30 NO_2 column increase over tropical biomass burning regions points to a sharp midday peak in emissions, and is consistent with a diurnal cycle of emissions derived from geostationary satellite fire counts. We will discuss the results in the context of recent NO_2 retrievals from

GOME-2 with an overpass time of 09:30.