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An improved retrieval of tropospheric NO2 columns from the Ozone Monitoring Instrument

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Recent studies using Dutch OMI NO2 (DOMINO) retrievals have established the current data quality and provided information on how to improve future retrievals. OMI generally shows modest to good agreement with independent observations, but appears to be biased high by 0%-40%. We improve retrievals with more accurate radiative transfer calculations that better account for the sensitivity in the lowest atmosphere model layer, and use a more realistic set of atmospheric pressure and temperature profiles, surface albedos and surface pressure levels. The improved representation of radiative transfer alone leads to a reduction in tropospheric columns of 10%-20% in polluted regions. A better representation of terrain height in the retrieval (based on 3 x 3 km2 elevation data rather than the 3° x 2° model data) increases tropospheric columns (up to 10%) in valleys that were previously attributed too high a terrain height (such as the Po Valley, Beijing area), and reduces NO2 columns over elevated areas that previously had too low terrain height (Mexico City, Highveld Plateau). The implementation of a new surface reflectivity database from OMI shows that the frequently higher surface reflectivity in the OMI than in the TOMS/GOME dataset leads to lower cloud fractions and higher cloud pressures in the cloud-retrieval. We will show the direct impact of better surface albedos on retrievals (clear-sky scenes) as well as the impact via the cloud correction (partly clouded scenes). A better representation of vertical mixing of NO2 in the TM4 model results in a better match with observed NO2 profiles; the impact of this improvement but also the effect of a priori NO2 profiles with better spatial resolution (CHIMERE) on retrievals will be discussed. We conclude by proposing a simple method (vicarious calibration) to evaluate and correct for the stripes apparent in the OMI NO2 retrievals. The combined effect of all improvements is anticipated to lead to a significantly improved retrieval that will be evaluated against validation sets including DANDELIONS, CINDI, INTEX-B, and independent data from North America, the Po Valley, and China.