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The impact of the stratospheric correction on tropospheric NO2 measurements from satellites

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Satellite measurements of tropospheric NO2 have proven to be a useful tool in investigating NOx emissions and their changes. For quantitative applications, assessment and reduction of the uncertainty of these measurements is an important factor.
One problem in using satellite measurements is the fact that the signal is a combination of tropospheric and stratospheric contributions. In order to determine the tropospheric NO2 abundance from the data, the stratospheric column needs to be removed. This is often done by subtracting data from a reference sector which is assumed to have little or no tropospheric NO2. The basic assumption is that in the stratosphere, the NO2 amounts only depend on latitude, not on longitude. This introduces an uncertainty which is investigated in this study.
Here, output from the stratospheric Bremen 3D Chemical Transport Model is used to correct for the stratospheric influence on measured NO2 column densities from Scanning Imaging Absorption Spectrometer for Atmospheric ChartographY (SCIAMACHY) measurements. To reduce biases between model and measurement, the model data is scaled to the satellite data over clean regions.
This method of stratospheric correction is compared to the simpler method of subtracting a Pacific Ocean reference sector from measurements, showing the advantages of not assuming a longitudinally homogeneous NO2 distribution in the stratosphere. The errors introduced by the simple reference sector method are quantified and uncertainties of the model based approach are discussed.