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NO_2 observations from space: digging beyond the mean

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Since two decades, satellite measurements of UV/Vis spectra allow for the global retrieval of tropospheric NO_2. This dataset has tremendously increased our understanding on the spatial (maps) and temporal patterns (trends, seasonal or weekly cycles) of NO_x sources. Nowadays, a main application is the quantification of NO_x emissions from the observed mean NO_2 column via inversion or assimilation techniques, involving CTMs.

Due to the long time series available, temporal means provide a robust measure for average conditions. But beyond the mean, also higher orders of the temporal distribution, in particular variance and skewness, can be analyzed. Here we present temporal statistics for various regions of the world, compare it to the respective statistics of a regional CTM (with focus on Europe), analyze how far the temporal variance is driven by transport or chemistry, and discuss what could be learned from temporal statistics on NO_x transport, chemistry, or emissions.