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Investigating fire NOx emissions with TROPOMI

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Most of the anthropogenic emissions of nitrogen oxides (NOx = NO_2 + NO) are linked to burning of fossil fuels for energy production, transportation or industrial processes. However, biomass burning and in particular large wild fires in tropical and sub-tropical regions can also be large sources of nitrogen oxides at least locally. Depending on the size of the fires, particles and gases can be lifted into the free troposphere and even higher, increasing the atmospheric lifetime of NOx and enabling long range transport.

The TROPOMI instrument on board of Sentinel 5 precursor (S5p) is a nadir viewing UV/vis imaging spectrometer launched in October 2017 and operationally providing data since July 2018. One of the main products that can be retrieved from TROPOMI spectra is tropospheric and total column NO_2. Compared to previous UV/vis satellite instruments such as GOME, SCIAMACHY, GOME2 and OMI, TROPOMI has a higher spatial resolution of 3.5 x 5.5 km^2. This reduced foot print size enables detection and evaluation of more localised sources such as individual fires and their plumes, and better separation of different contributions to the overall NO_2 loading.

In this presentation, IUP-Bremen TROPOMI NO_2 retrievals are evaluated for biomass burning signatures during the years 2018 to 2020, three years with very different burning seasons. The amounts and spatial distributions of NO_2 from fires are compared between the years and between different fire regions, and their impact on regions downwind of the sources is investigated.