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TROPOMI glyoxal tropospheric column retrievals as additional indicator of VOC emissions

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The instrument TROPOMI aboard the Copernicus Sentinel-5p platform is a nadir-viewing hyperspectral imager recording earthshine radiances in wavelength ranges from the ultraviolet to the shortwave infrared regions with a full daily coverage at the unprecedented spatial resolution of 3.5 x 7 km^2 (UV-VIS bands). Those measurements provide information on key atmospheric species for the understanding and monitoring of the Earth-atmosphere system, and more particularly of aspects related to ozone layer protection, air quality and climate change.

With three main structured absorption bands in the visible range, glyoxal can be retrieved from TROPOMI observations using a DOAS approach. Glyoxal is produced in the atmosphere as an intermediate product of Volatile Organic Compounds (VOC) oxidation, but also directly emitted from biomass burning events. With its short lifetime, it is a good indicator of VOC emissions and offers the potential to discriminate between different type of emissions, particularly when it is combined with other data products such as formaldehyde.

The BIRA-IASB glyoxal algorithm, successfully applied in the past to GOME-2A/B and OMI, has been transferred to TROPOMI and we present here results for more than one year of data. We illustrate the benefit of the excellent TROPOMI spatial resolution and signal-to-noise ratio to better identify and characterize the distribution of this tropospheric trace gas with respect to past sensors. We also compare the retrieved TROPOMI glyoxal data with columns simulated using the state-of-the-art CTM MAGRITTE in different regions of the world. Exceptionally large glyoxal columns have been observed during the huge Northern America wildfires of August 2018. These large columns are compared to glyoxal measurements performed using the University of Colorado airborne Solar Occultation Flux (SOF) instrument, which was deployed as part of the Biomass Burning Fluxes of Trace Gases and Aerosols (BB-FLUX) project aboard the Wyoming King Air research aircraft during the 2018 wildfire season in the Pacific Northwest (July–September 2018). Also, the glyoxal/formaldehyde ratio is often presented as a metric enabling to discriminate between different types of VOC emissions. Using the operational TROPOMI HCHO, those ratios are computed at the global scale for different seasons, and we investigate whether systematic patterns can be identified as a function of the emission type.