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Performance of the AOTF-based NO_2 camera for urban pollution imaging

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An instrument capable of imaging the field of NO_2 in various open-air situations has been designed, manufactured, and tested. It is an improved version of the NO_2 camera relying on an AOTF (acousto-optical tunable filter) which has demonstrated, amongst other things, its capability to quantify the NO_2 released by power plant smokestacks. The improved version which is presented has a larger field of view, a higher frame rate, and better spectral registration performance.

The working principle of the instrument has been preserved: by driving the AOTF with the appropriate acoustic frequency, a spectral image of the scene captured by the camera is recorded at a particular wavelength. The recording of a number of spectral images allows to form an hypercube: two spatial dimensions, and a spectral one.

While the earlier instrument was relying on a handful of wavelengths to quantify the slant column density of NO_2 observed in each pixel line of sight, the new instrument can now record "continuous" portions of the visible-light spectrum, typically between 440, and 460nm, where the NO_2 exhibits some of its largest absorption lines.

When the target is stable, like the air observed above a city skyline, the NO_2 camera has enough time to build a large hypercube, and the spectrum measured in each pixel can be processed by the DOAS (differential optical absorption spectroscopy) method. This approach is better suited when NO_2 is expected across the entire scene, not just in the plume of a smokestack for instance.

The new instrument will be presented, and results of measurements performed in an urban context will be shown. The performance of the NO_2 camera will be discussed based on the results of an intercomparison with the MAX-DOAS of Uccle, Brussels, and other air quality stations.