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Five years of NO_2 Mobile-DOAS measurements in Europe: an overview

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Since the CINDI campaign held in the Netherlands in July 2009, BIRA-IASB has been operating a car-based mobile-DOAS system, primarily dedicated to tropospheric NO_2 measurements. The instrument is based on two similar compact spectrometers and records scattered light spectra simultaneously in the zenith direction and 30° above the horizon, following the MAX-DOAS approach. After CINDI, Mobile-DOAS measurements were performed on a routine basis between March 2010 and August 2011, mostly across Belgium, but also in Luxembourg, France, and Germany. From 2011, another BIRA-IASB mobile-DOAS instrument, using a single zenith channel, was operated in Romania through a collaboration with the University of Galati. In June 2013, these two mobile-DOAS instruments took part in the MADCAT campaign in Mainz, Germany, together with the MPIC mobile-DOAS system, based on a mini MAX-DOAS.

We describe the BIRA-IASB instruments, our strategy to retrieve the NO_2 tropospheric column, and the large database that was constituted. The latter is particularly interesting for its size: it covers some 500 hours of measurements and 20 000 km, including rural, periurban and urban areas with different air quality conditions. A 2011 cloud-free subset of the measurements is compared with OMI data. We also present preliminary results of an intercomparison between the three mobile-DOAS instruments operated during MADCAT. The high spatial frequency of the measurements (around 100 m) makes them valuable to study the NO_2 horizontal gradients in polluted areas. This has implications in the context of air quality satellite validation studies, in which the variability of NO_2 inside a satellite pixel must be taken into account.