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DOAS measurements of NO2 and H2CO at Kinshasa and Comparisons with Satellites Observations

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Africa experiences a fast urban inhabitants growth, caused by the largest population boom in the world, combined with rural exodus. Many cities are heavily affected by air pollution. It is therefore essential to monitor the concentrations of the various polluting species such as NO_2, HCHO, O_3 and aerosols, which have a direct impact on the population health. The sources of pollutant in Africa are different from those found in Europe. For example, forest fires and household cooking largely contribute to the NO_2 and HCHO burdens in Central Africa. However, many large African cities, such as the City of Kinshasa, capital of the Democratic Republic of Congo, do not have atmospheric measurement instruments.

In order to tackle the lack of measurements in Kinshasa, the Royal Belgian Institute of Space Aeronomy (BIRA-IASB) has, in collaboration with the University of Kinshasa (UniKin), installed an optical remote sensing instrument on the UniKin site (-4.42°S, 15.31°E). Installed in May 2017, the instrument has been in operation until today and provides data to measure the column amounts of several polluting species in the atmosphere of Kinshasa. The instrument is based on a compact AVANTES spectrometer covering the spectral range 290 - 450 nm with 0.7 nm resolution. The spectrometer is a Czerny-Turner type with an entry slit of 50 µm wide, and an array of 1200 l/mm. A 10 m long and 600 µm diameter optical fiber is connected to the spectrometer to receive the incident light beam from the sky. Measurements were mainly made by looking in a fixed direction until November 2019. Since then, a Multi-Axis geometry (MAX-DOAS) has been implemented.

The measurements provided by this DOAS instrument allowed us to start studying the atmosphere of Kinshasa using the QDOAS software, which allows us to find the oblique columns of different observed species. This poster will present the instrument, the database and the procedure used to convert these oblique columns into vertical columns, using the air mass factors calculated with the radiative transfer model. We also present our first MAX-DOAS results, analyzed using the retrieval tools of the ESA FRM4DOAS project. The study of current results clearly shows the signature of polluting species such as NO_2, HCHO in the atmosphere of Kinshasa. We also use simulations by the GEOS-Chem chemistry transport model to evaluate the magnitude of the

emissions needed to explain the observed column amounts. These observations made in Kinshasa could contribute to the validation of satellite products and the refinement of models. We present a first comparison of Kinshasa's ground-based observations with those of the OMI and TROPOMI satellites