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First deployment of the Spectrolite Breadboard Instrument for monitoring of tropospheric NO_2 columns over Berlin

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The AROMAPEX campaign held in Berlin (April 2016) provided an ideal opportunity to test for the first time the Spectrolite Breadboard Instrument (TNO), an instrument that has been designed for future deployment from space. In order to derive tropospheric NO_2 columns, a typical DOAS retrieval approach is followed. For the calculation of air mass factors this study specifically focuses on the impact of the surface reflectance, which is derived from the radiance measurements using ground-based aerosol optical thickness measurements as prior information. It is shown that retrieved surface reflectance shows good agreement with those derived from Landsat 8 measurements performed on the same day. We introduce a method to verify that retrieved tropospheric NO_2 columns are consistent in the sense that they do not show a systematic dependence on surface reflectance, in contrast to differential slant column densities. An error budget is provided to quantify the impact of various assumptions on the accuracy of the retrieval of surface reflectance and tropospheric NO_2 columns. Both in the morning and afternoon flight a NO_2 plume is observed stretching out over Berlin from West to East. Peak values between $15 \cdot 10^{15}$ and $20 \cdot 10^{15}$ $molec/cm^2$ are detected, whereas – at much lower spatial resolution – OMI detects peak values between $9 \cdot 10^{15}$ (first overpass) and $4 \cdot 10^{15}$ $molec/cm^2$ (second overpass).