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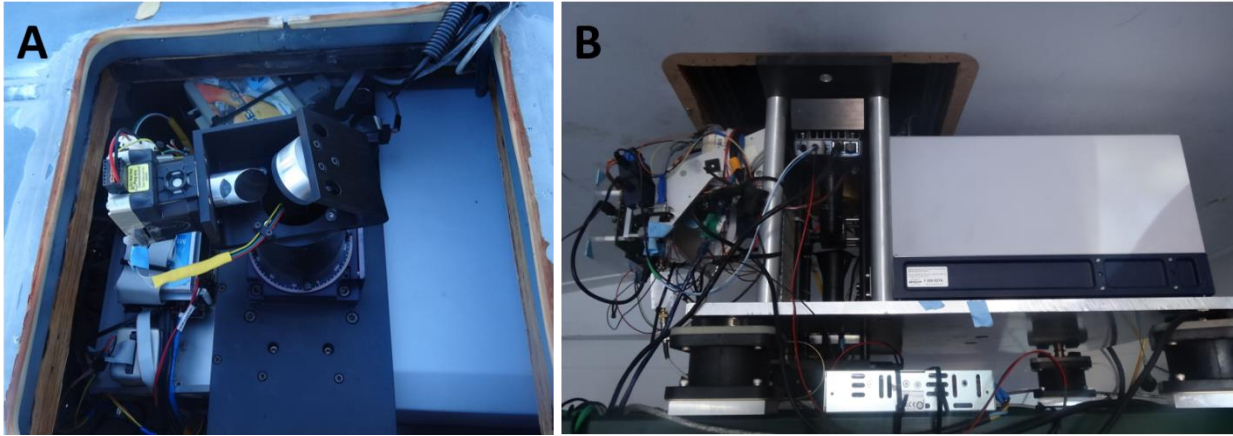
*Supplement of*

## **Development of a digital mobile solar tracker**

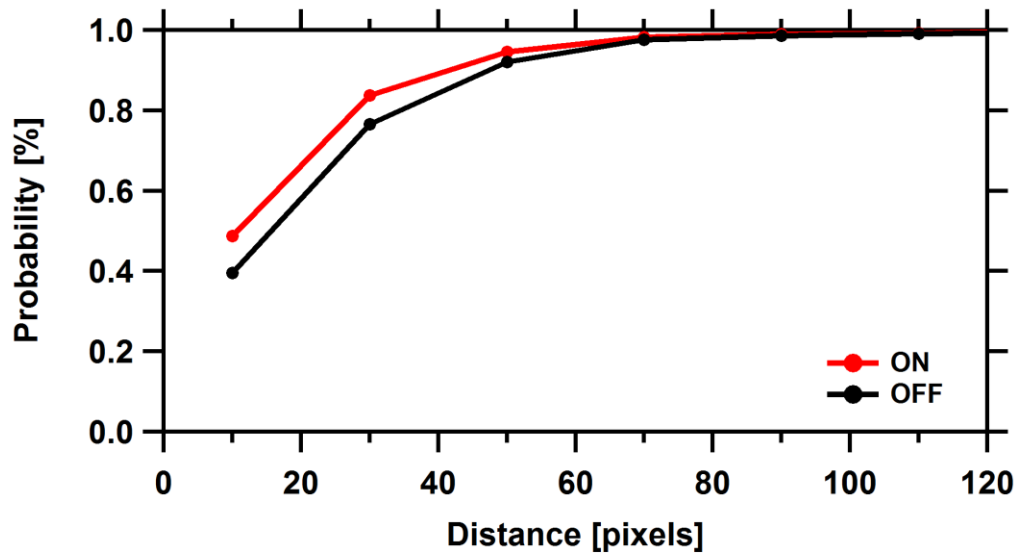
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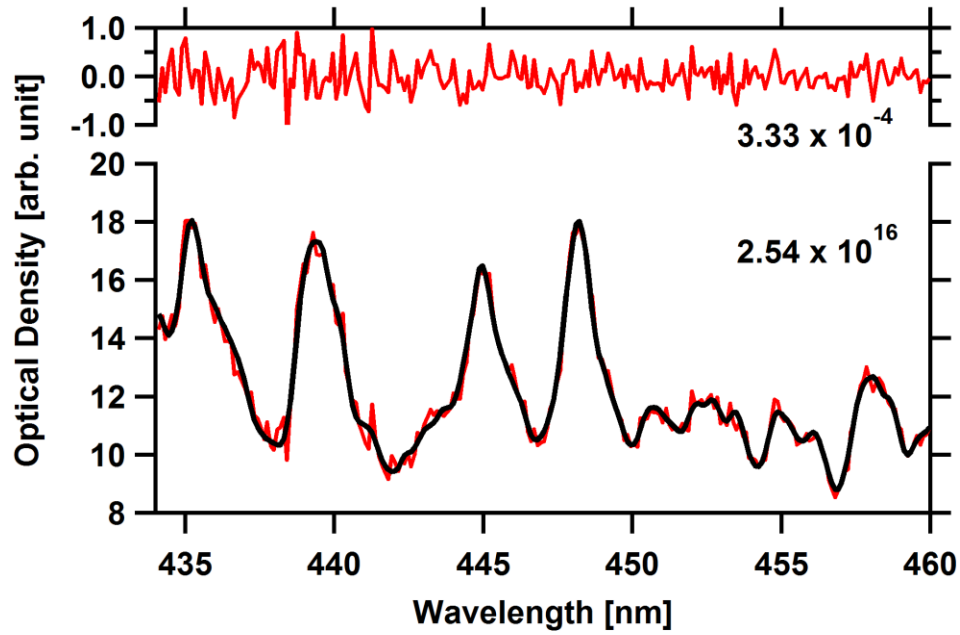
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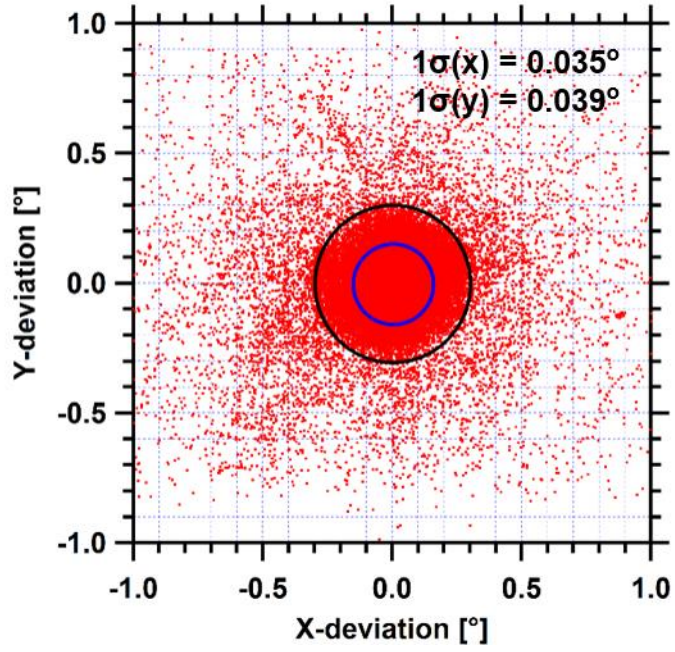
**Figure S1:** The digital solar tracker mounted inside the roof hatch of the mobile laboratory during FRAPPE 2014. (A) top view from the roof; (B) side view inside the mobile laboratory.



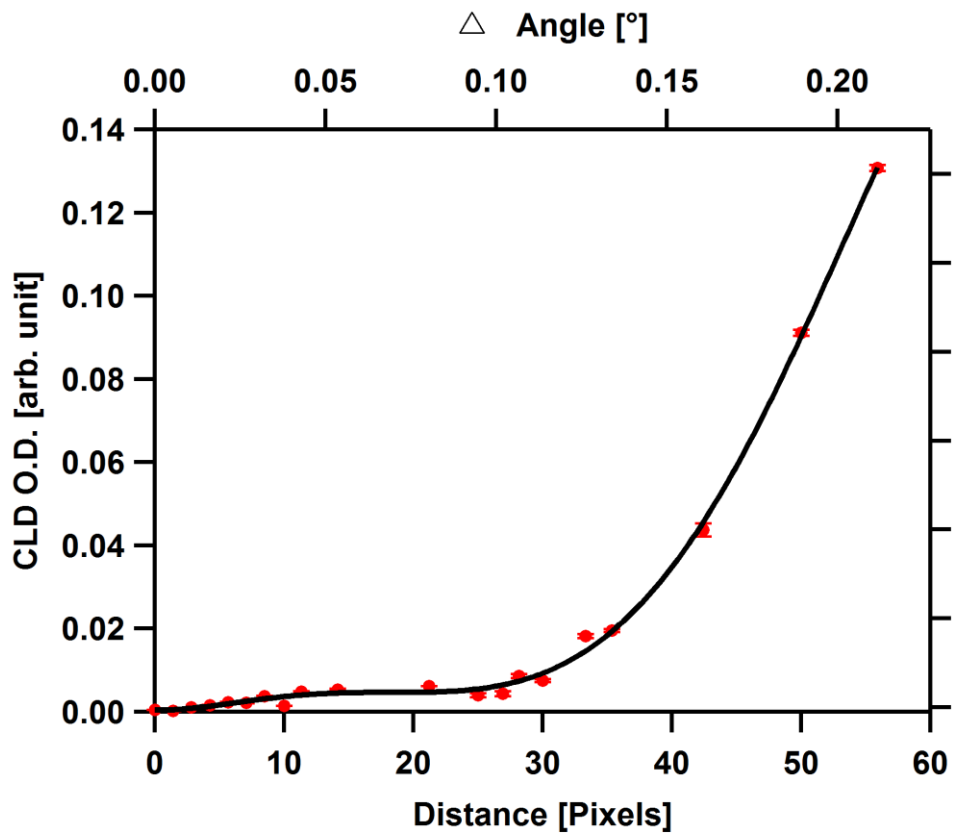
**Figure S2:** Cumulative distribution of distance (in pixels) between the centers of the solar disk and the aperture for (A) when correction for real time pitch and roll was applied (red) and (B) correction was not applied (black). An improvement of up to 23% (relative) was observed when the correction based on real time pitch and roll was applied.



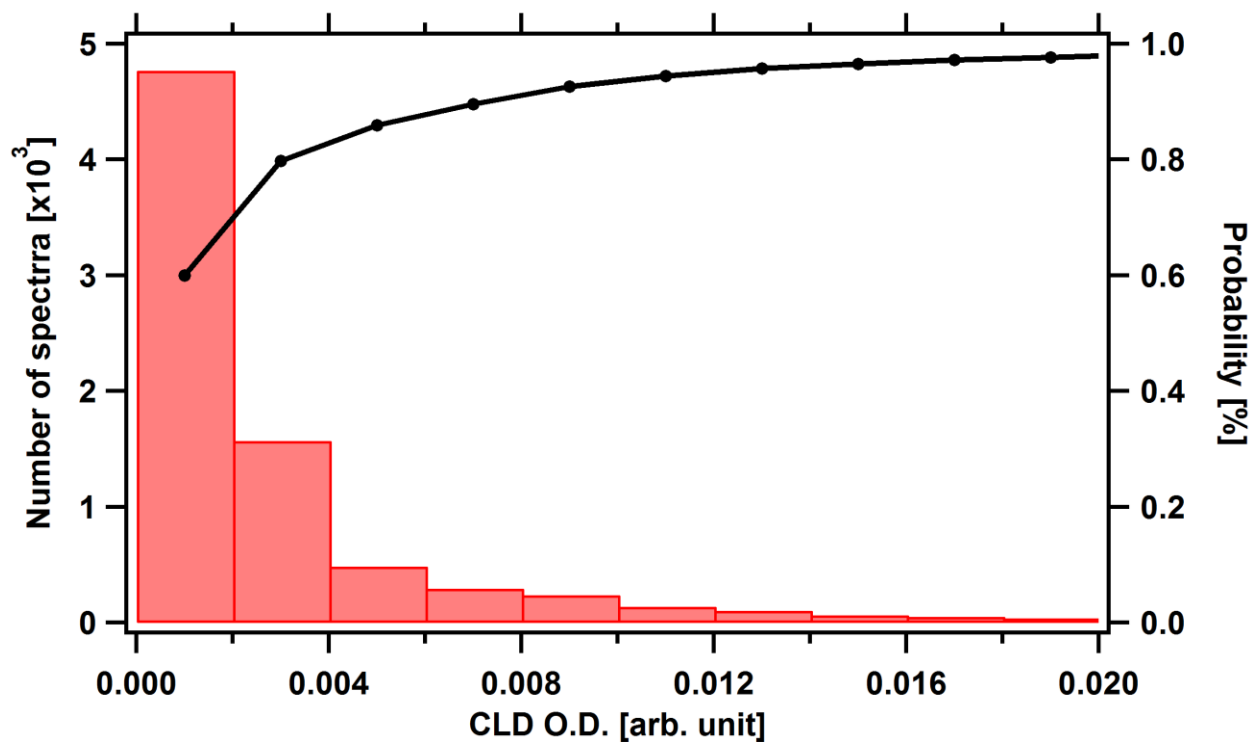
**Figure S3:** Spectral fits of NO<sub>2</sub> and corresponding residual (top panel) from the DOAS fit. The spectrum was taken at 16:59:00 UTC (SZA = 37.4°) during the RD#11 on August 13, 2014. The red line represents the measured spectrum and black line is the fitted cross section. The retrieved NO<sub>2</sub> dSCD and RMS for the DOAS fit are also shown.



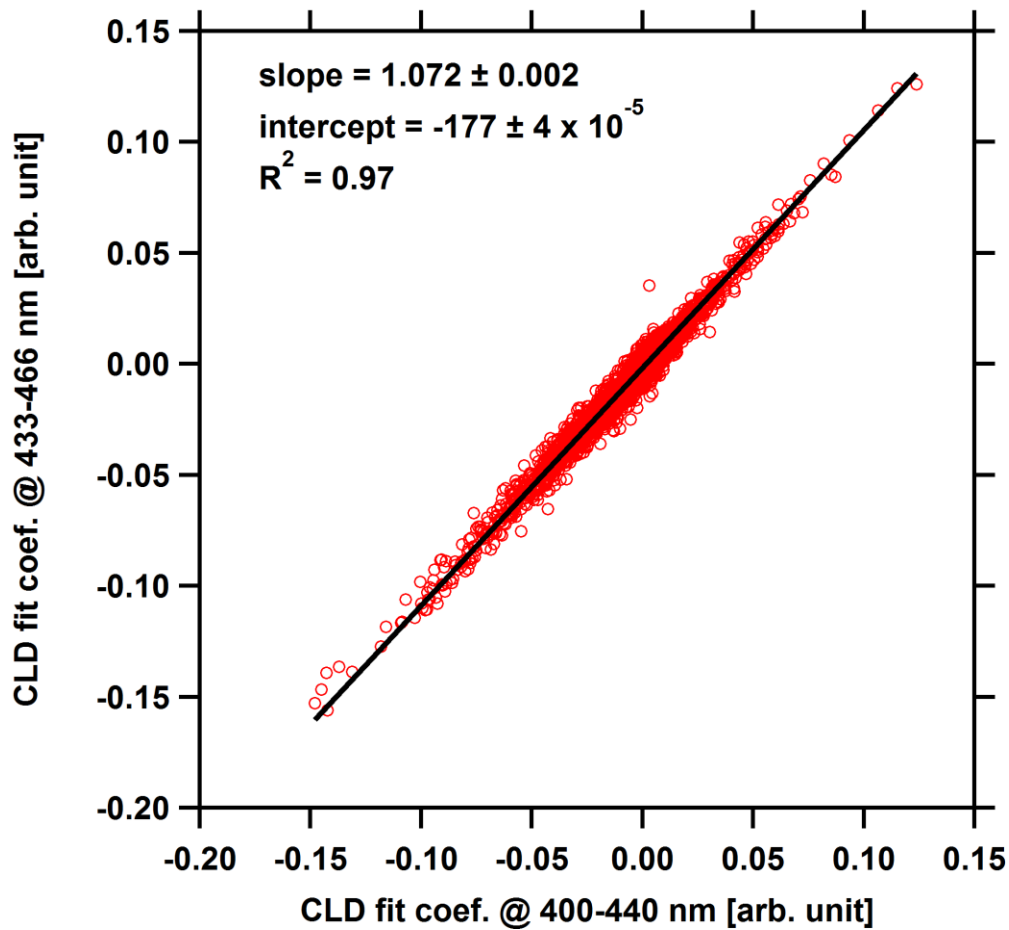
**Figure S4:** Position of the centers of the solar disk on the aperture plate during the RD#11 on 13 August 2014.



**Figure S5:** Relation between CLD optical density from DOAS fit and pointing deviation from the center of the solar disk. The error bars represent standard error.

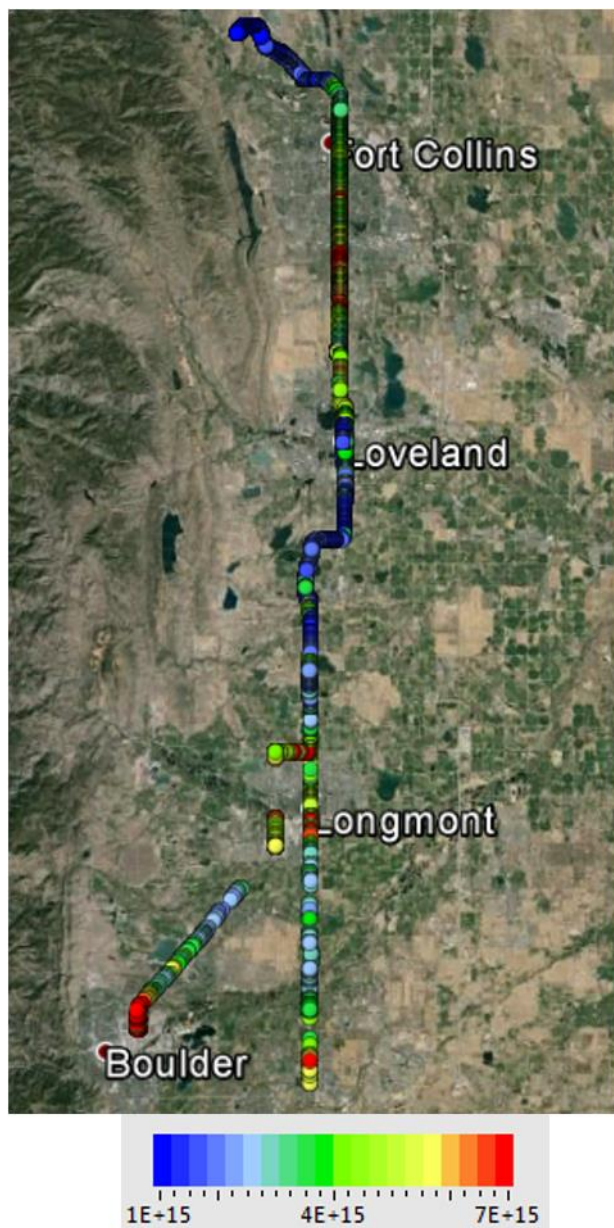


**Figure S6:** Histogram showing distribution of CLD optical density from DOAS fit for the spectra collected during the RD#11 on 13 August 2014. The black line shows the cumulative densities.

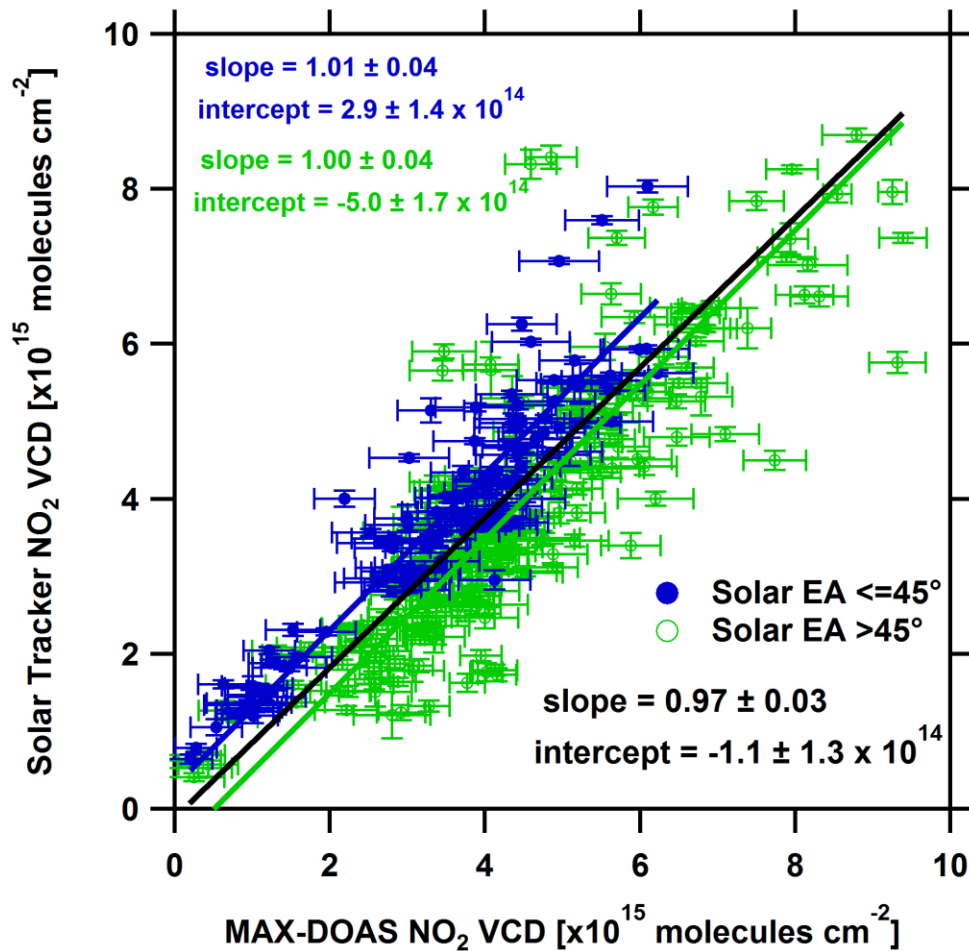


**Figure S7:** Correlation of CLD fit coefficients retrieved at 400-440 nm and 433-466 nm DOAS fit windows.





**Figure S8:** Map of NO<sub>2</sub> vertical column measured along the drive track during RD#14 on 18 August 2014 in Northern Colorado.



**Figure S9:** Correlation of  $\text{NO}_2$  vertical column measured by the DS-DOAS (solar tracker) and MAX-DOAS instruments during RD#14 on 18 August 2014 in Northern Colorado. The lines show orthogonal distance least square fit to all data (black), for Solar EA  $\leq 45^\circ$  (blue) and for Solar EA  $> 45^\circ$  (green). The error bars represent  $1\sigma$  fit error for respective instruments. The DS-DOAS data were averaged for 20 seconds in time to the MAX-DOAS timestamp.