



*Supplement of*

## **Directionally dependent Lambertian-equivalent reflectivity (DLER) of the Earth's surface measured by the GOME-2 satellite instruments**

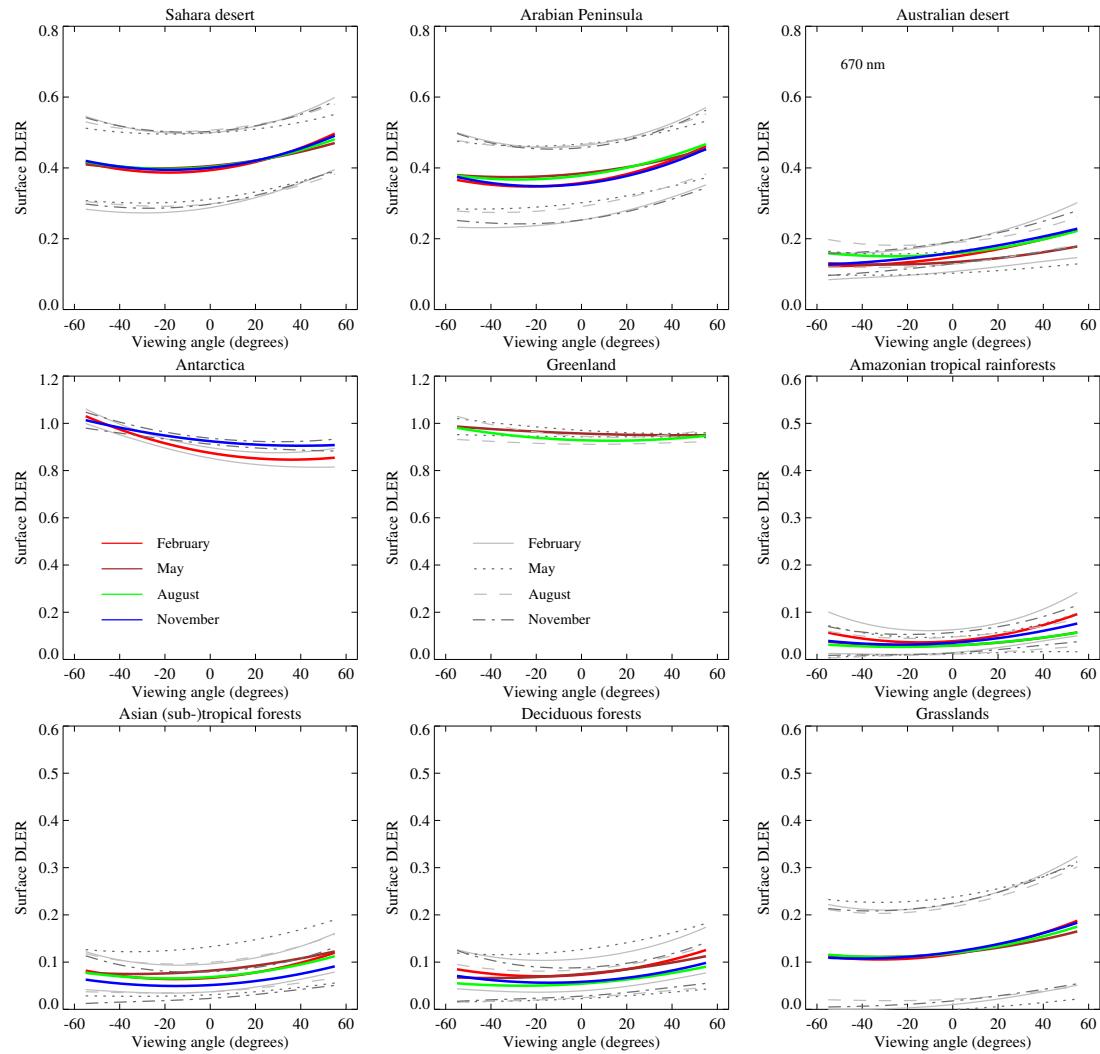
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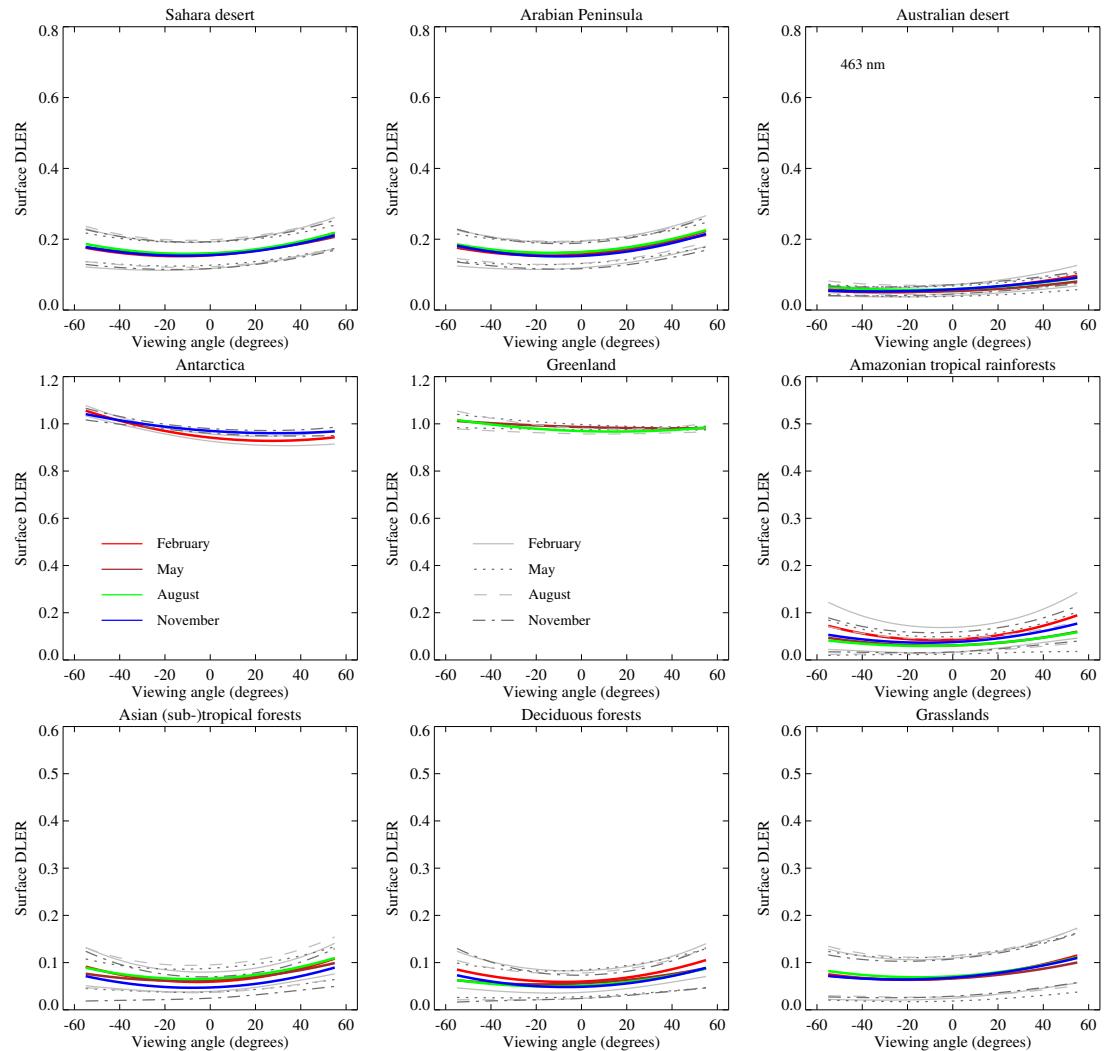
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## S1 Dependence on surface type and time

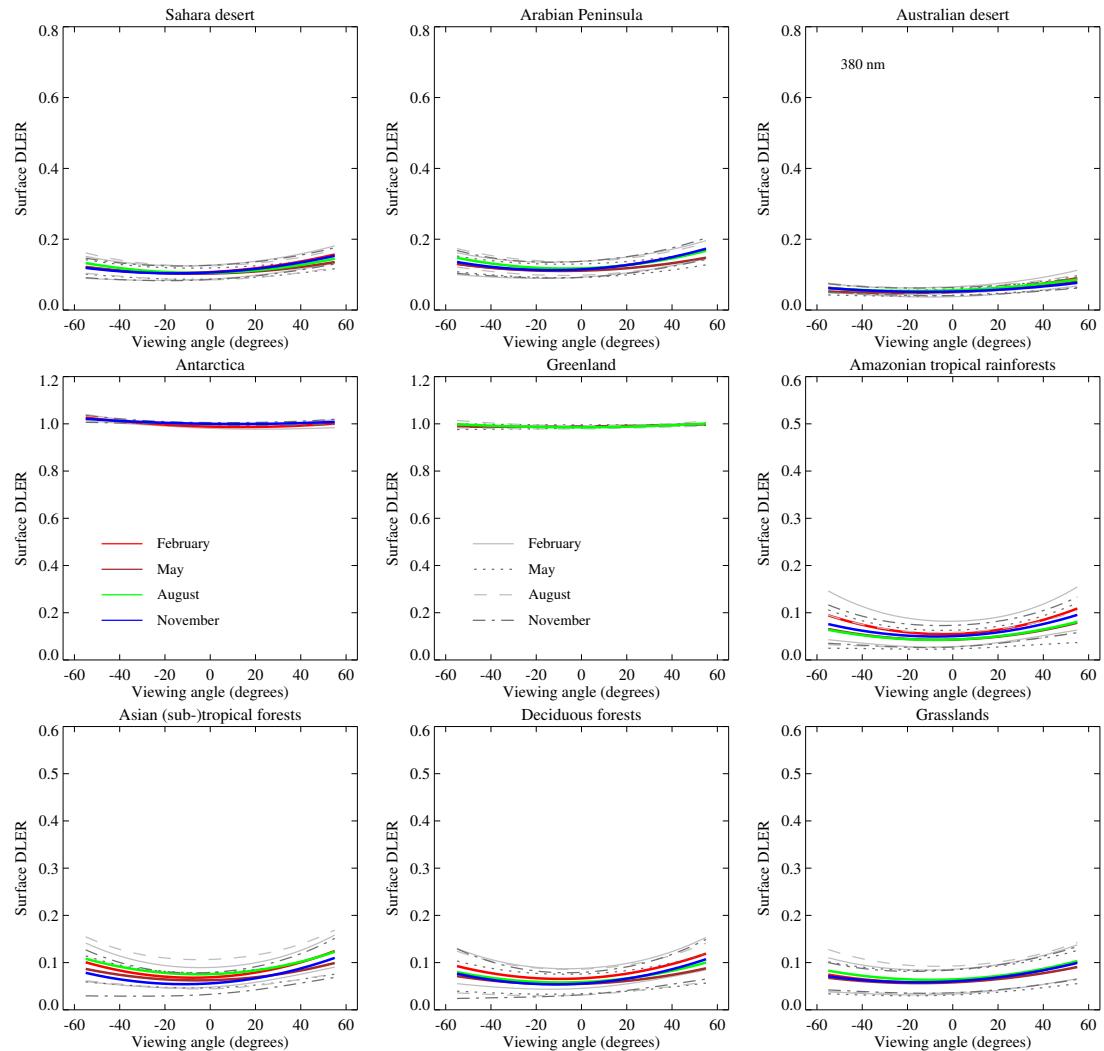
The directional dependence of the surface DLER is shown for nine surface types in Figs. S1–S3. The three figures are similar to Fig. 7 presented in Sect. 6.2 of the paper for 772 nm, but now prepared for different wavelengths: 670, 463, and 380 nm.



**Figure S1.** Surface DLER at 670 nm versus viewing angle for nine surface types and four calendar months. The coloured curves represent the average GOME-2 surface DLER. The grey curves provide an indication of the spread in surface DLER over the selected regions.



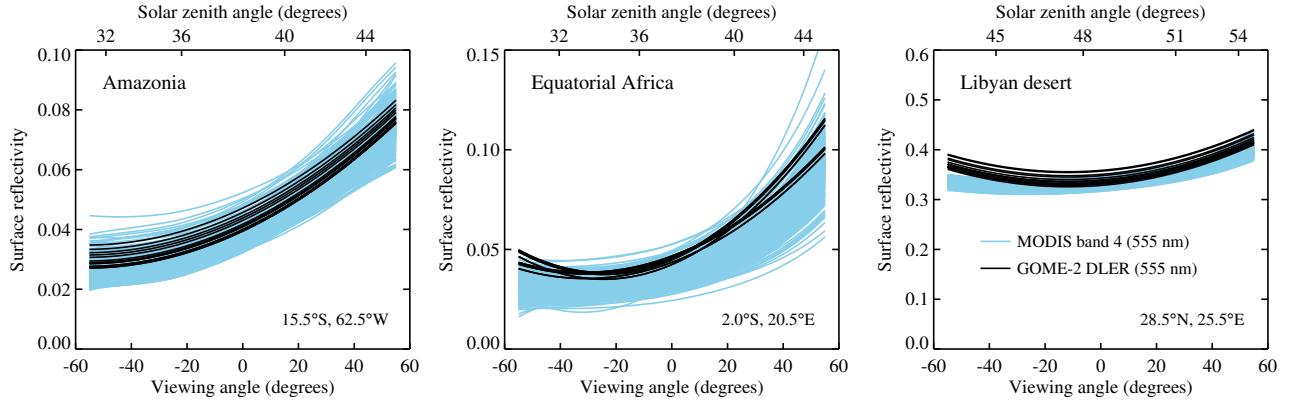
**Figure S2.** Surface DLER at 463 nm versus viewing angle for nine surface types and four calendar months. The coloured curves represent the average GOME-2 surface DLER. The grey curves provide an indication of the spread in surface DLER over the selected regions.



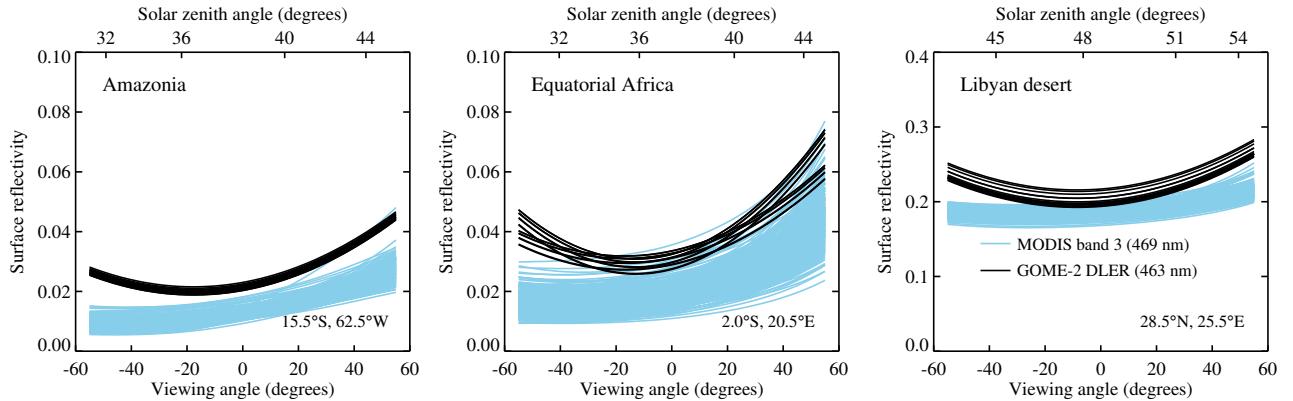
**Figure S3.** Surface DLER at 380 nm versus viewing angle for nine surface types and four calendar months. The coloured curves represent the average GOME-2 surface DLER. The grey curves provide an indication of the spread in surface DLER over the selected regions.

## S2 Validation: Case studies

Figures S4 and S5 present the results from comparisons between GOME-2 surface DLER and MODIS surface BRDF for three surface type cases. The figures are similar to Fig. 8 presented in Sect. 7.1 of the paper for 640 nm, but now prepared for different wavelengths: 555 and 463 nm. These DLER wavelengths correspond to MODIS bands 4 and 3, respectively.



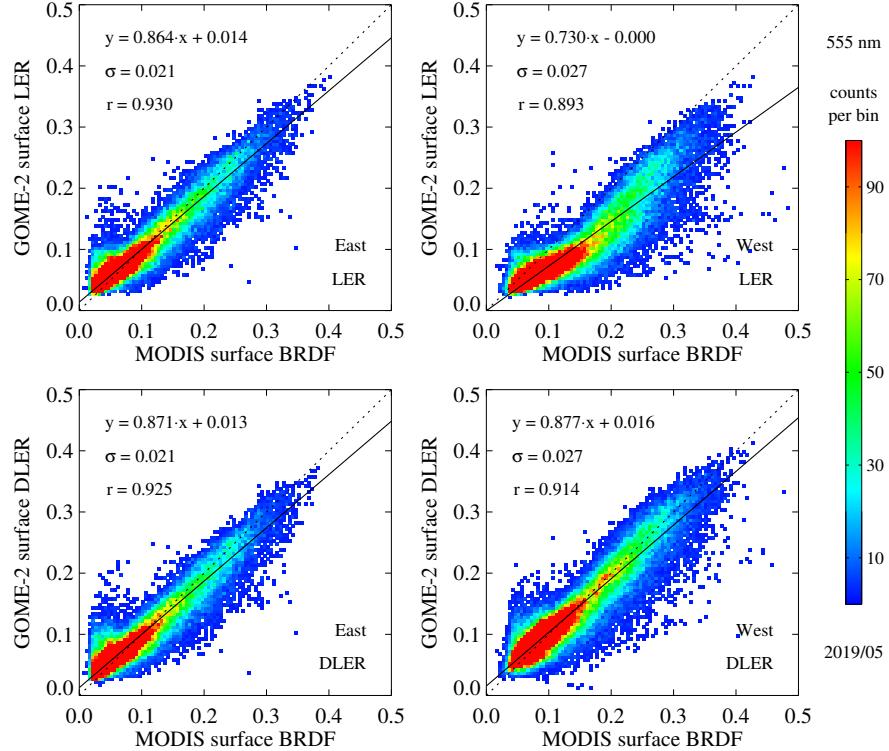
**Figure S4.** Surface reflectivity around 555 nm according to the GOME-2 surface DLER database (black curves) and the MODIS surface BRDF product (blue curves), as a function of the viewing angle, for the Amazonian rainforest (left window), equatorial Africa (middle window), and the Libyan desert (right window). Results are representative for 15 March 2008 and correspond to a one-by-one degree latitude/longitude box with the indicated central coordinates. Similar to Fig. 8 of the paper.



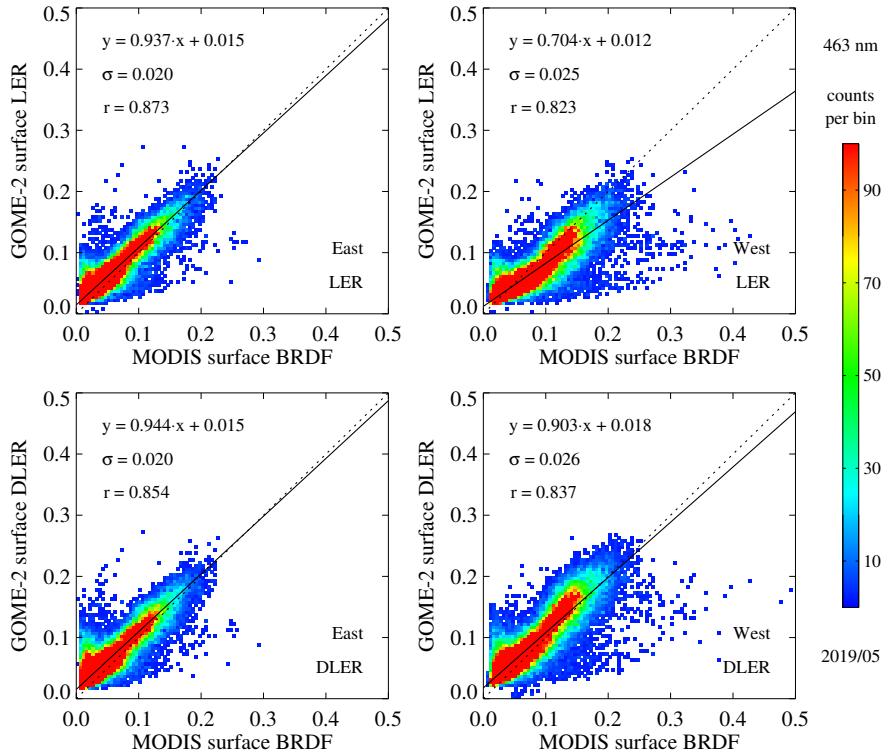
**Figure S5.** Surface reflectivity around 463 nm according to the GOME-2 surface DLER database (black curves) and the MODIS surface BRDF product (blue curves), as a function of the viewing angle, for the Amazonian rainforest (left window), equatorial Africa (middle window), and the Libyan desert (right window). Results are representative for 15 March 2008 and correspond to a one-by-one degree latitude/longitude box with the indicated central coordinates. Similar to Fig. 8 of the paper.

### S3 Validation: Global comparisons

Figures S6 and S7 present the results from global comparisons between GOME-2 surface DLER and MODIS surface BRDF. The figures are similar to Fig. 9 presented in Sect. 7.2 of the paper for 640 nm, but now prepared for different wavelengths: 555 and 463 nm, respectively. These DLER wavelengths correspond to MODIS bands 4 and 3, respectively.



**Figure S6.** Global comparisons between GOME-2 surface (D)LER and MODIS surface BRDF for the period 10–19 May 2019. Top row: GOME-2 non-directional surface LER at 555 nm versus MODIS surface BRDF from band 4 (centred around 555 nm), for eastern and western sides of the orbit swath. Bottom row: GOME-2 directional surface DLER versus MODIS surface BRDF. For the western side of the orbit swath the directional database agrees much better with MODIS than the non-directional one. Similar to Fig. 9 of the paper.



**Figure S7.** Global comparisons between GOME-2 surface (D)LER and MODIS surface BRDF for the period 10–19 May 2019. Top row: GOME-2 non-directional surface LER at 463 nm versus MODIS surface BRDF from band 3 (centred around 469 nm), for eastern and western sides of the orbit swath. Bottom row: GOME-2 directional surface DLER versus MODIS surface BRDF. For the western side of the orbit swath the directional database agrees much better with MODIS than the non-directional one. Similar to Fig. 9 of the paper.