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DOAS retrieval of tropospheric NO_2 from space using Pacific earthshine reference spectra

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Here we propose a new NO_2 DOAS retrieval algorithm optimised for a purely nadir-viewing satellite instrument which uses earthshine spectra collected from the Pacific as a reference, instead of the standard solar reference. We use a combination of modelled spectra created by the radiative transfer model, SCIATRAN, as well as L1B earthshine radiance data retrieved by the NASA/KNMI OMI instrument (Levelt et al, 2006) to test this.

We determine whether using earthshine reference spectra retrieved over the Pacific can be used as an estimate for the SCD enhancement caused by stratospheric NO_2. This would therefore allow for the tropospheric NO_2 SCD to be directly retrieved from the DOAS fit with only a minimal need for the model assimilation or spatial filtering techniques to correct for residual biases. The impact this technique has on traditional sources of error such as striping is also discussed, along with biases resulting from reference region placement and cloud clearing.

We also find that this technique reveals absorption over the Sahara and similar regions characteristic of soil absorption, as first discovered in GOME-2 DOAS retrievals (Richter et al, AMT, 2011). Preliminary comparison of NO_2 SCDs retrieved with this method over Europe during June 2006 suggests that the errors in NO_2 SCD are similar to those typically retrieved by the OMI DOMINO algorithm (Boersma et al, AMT, 2011).