SO$_2$ layer height retrieval from UV backscattered measurements: application to OMI and TROPOMI and comparison with other satellite datasets

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BIRA-IASB has the responsibility of developing the SO$_2$ retrieval algorithm for the Sentinel 5 (S5) UVN prototype processor. While the retrieval of SO$_2$ vertical columns is similar as for TROPOMI/S5P (Theys et al., 2017), the S5 SO$_2$ algorithm also includes an additional module to derive an effective SO$_2$ layer height (LH) which is activated for enhanced SO$_2$ vertical columns (typically >25 DU).

In this paper, we introduce the algorithm, which is based on an iterative SO$_2$ optical depth fitting procedure. Although it makes use of a large look-up-table (of SO$_2$ optical depth spectra), the scheme is adequately fast for an operational environment. We demonstrate the technique based on synthetic spectra and apply the algorithm to OMI and TROPOMI for a number of volcanic eruptions. Results are compared to other satellite datasets, such as CALIOP attenuated backscattered profiles and SO$_2$ height estimates from MLS and IASI. In general, we find an excellent agreement with differences on the retrieved height of less than 1-2 km. The results for TROPOMI are discussed in more details because SO$_2$ plume height data derived at high spatial resolution can provide added-value information on the eruption chronology. Plans for future work, including the possible implementation in the operational processor of TROPOMI, are addressed.

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