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The determination of the total ozone column using satellite measurements in the Chappuis ozone absorption bands over highly reflective underlying surfaces

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The total ozone column (TOC) is retrieved using multiple optical satellite instrumentation (including TOMS, OMI, TROPOMI, GOME, GOME-2, and SCIAMACHY, to name a few). The spatial resolution of total ozone satellite measurements is quite low (e.g., 7x3.5km for TROPOMI, 13x24km for OMI, and 30x60km for SCIAMACHY). In some cases (say, close to the ozone hole boundary) it is of importance to have information on the total ozone at a higher spatial resolution. In this work we propose the use of multiple optical instruments performing the measurements in the ozone Chappuis ozone bands (400-650nm) for the total ozone column determination. This makes it possible to extend the number of instruments, which can be used for the total ozone determination (say, also using current/historic measurements by MODIS/Aqua&Terra, S-GLI/SCOM-C, VIIRS/Suomi-NPP, MSI/S-2, OLCI/S-3, MERIS/ENVISAT). In particular, MERIS and SCIAMACHY have been operated from the same satellite platform and had similar swaths (960km for SCIAMACHY and 1150km for MERIS). This means the method of total ozone retrieval based on combination of SCIAMACHY (30x60km) and MERIS (0.3x0.3km) observations over highly reflective ground (say, in Antarctica, where the ozone hole is located) is of value. The total ozone retrievals using Chappuis ozone bands is based on the fact that the top-of-atmosphere reflectance observed over a highly reflective ground (say, snow) has a minimum in the visible located around 600nm. This feature is due to due to the absorption of light by the atmospheric ozone (Gorshelev et al., 2014). The contribution of both ground and atmospheric light scattering to the top-of-atmosphere (TOA) does not have extrema in the vicinity of 600nm. Therefore, there is a possibility to remove both atmospheric and ground light scattering effects to the TOA reflectance over highly reflective underlying surface and derive the atmospheric transmittance due to the ozone absorption effects, which can be used for the TOC determination. Such a method has been explored using MERIS/ENVISAT (Jolivet et al., 2016) and OLCI/S-3 (Kokhanovsky et al., 2020) in the past. This paper is aimed at further improvement of the technique as applied to OLCI/S-3A,B. We have performed intercomparisons of OLCI TOC retrievals with TOC derived from ground and other satellite (e.g., OMI, TROPOMI, GOME-2) measurements. The TOC retrievals using OLCI have been performed over entire Antarctica allowing the generation of TOC at various spatial resolutions including standard 1x1 degree resolution.

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