GOMOS ozone profile validation using ground-based and balloon sonde measurements

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The validation of ozone profiles retrieved by satellite instruments through comparison with data from ground-based instruments is important to monitor the evolution of the satellite instrument, to assist algorithm development and to allow multi-mission trend analyses.

In this study we compare ozone profiles derived from GOMOS night-time observations with measurements from lidar, microwave radiometer and balloon sonde. Collocated pairs are analysed for dependence on several geophysical and instrument observational parameters. Validation results are presented for the operational ESA level 2 data (GOMOS version 5.00) obtained during nearly seven years of observations and a comparison using a smaller dataset from the previous processor (version 4.02) is also included.

The profiles obtained from dark limb measurements (solar zenith angle >107°) when the provided processing flag is properly considered match the ground-based measurements within ±2 percent over the altitude range 20 to 40 km. Outside this range, the pairs start to deviate more and there is a latitudinal dependence: in the polar region where there is a higher amount of straylight contamination, differences start to occur lower in the mesosphere than in the tropics, whereas for the lower part of the stratosphere the opposite happens: the profiles in the tropics reach less far down as the signal reduces faster because of the higher altitude at which the maximum ozone concentration is found compared to the mid and polar latitudes. Also the bias is shifting from mostly negative in the polar region to more positive in the tropics

Profiles measured under "twilight" conditions are often matching the ground-based measurements very well, but care has to be taken in all cases when dealing with "straylight" contaminated profiles.

For the selection criteria applied here (data within 800 km, 3 degrees in equivalent latitude, 20 h (5 h above 50 km) and a relative ozone error in the GOMOS data of 20% or less), no dependence was found on stellar magnitude, star temperature, nor the azimuth angle of the line of sight. No evidence of a temporal trend was seen either in the bias or frequency of outliers, but a comparison applying less strict data selection criteria might show differently.

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