

Uncertainty Improvement Optimized using the GMI Model for Umkehr Ozone Profile Retrieval

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The Umkehr measurements archived at the WMO World Ozone and UV Data Center in Toronto, Canada represent the longest ozone profile data record in existence. Understanding and reducing systematic errors in the Umkehr ozone profile retrievals is important for detection of drifts in satellites and other ground-based ozone measuring records. The standardized stray light correction (SLC) developed for Dobson Umkehr ozone profiles reduces biases with respect to the long-term satellite records in the upper stratosphere. However, the bias increases in the mid-stratosphere and low-stratosphere. Furthermore, optical characteristics of each Dobson instrument are different, thus the instrument-specific biases are not corrected and can appear as drifts (or step changes) in the long-term records.

In this study, we use NASA Global Modeling Initiative (GMI) model hourly vertical ozone profile data to determine relative biases for each instrument that comprises the station long-term record. The new value for SLC is optimized relative to the reference GMI profiles. It is then tested in the operational processing software to detect the reduction of the biases and verify the removal of the instrumental biases from the station ozone record. ESRL/GMD Dobson Umkehr historical records are re-processed. We will present the results of updated Umkehr records from several ESRL/GMD stations and show comparisons against complimentary ozone profiles for alternative measuring systems (satellites and ozonesonde, etc.) co-located at the Dobson station.

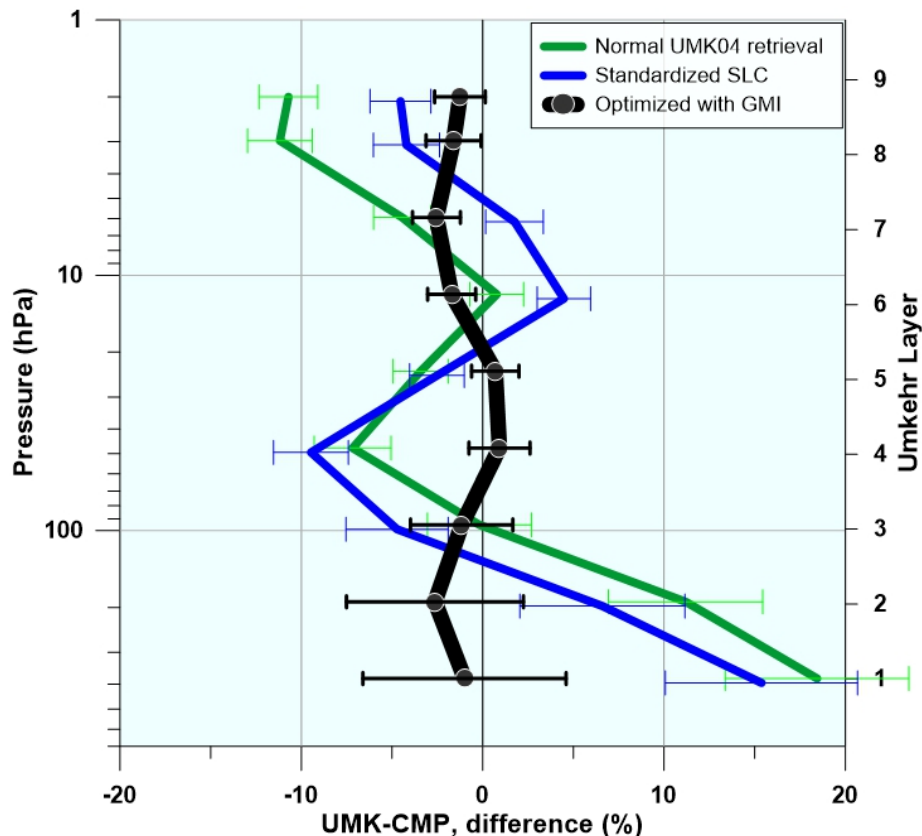


Figure 1. Mean difference of Umkehr ozone profiles is shown for three versions of the retrieval is shown. Reference is the mean of satellites (Microwave Limb Sounder [MLS], Ozone Mapping Profiler Suite [OMPS], OMPS Limb Profiler [OMPS_LP], Stratospheric Aerosol and Gas Experiment II [SAGEII], Solar Backscatter Ultraviolet Instrument [SBUV], GMI Modern-Era Retrospective analysis for Research and Applications, Version 2 [GMI_Merra2]) and Ozonesonde records. The error bar shows standard error. Umkehr ozone retrieved from the Dobson #61 measurements in Boulder between 1982 and 2017.