OMO3PR Release Specific Information

OMI Collection: 3
PGE Version: 1.1.0 / 1.1.1
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Main differences between version 1.0.5 and 1.1.x

- McPeters and Labow climatology (for profiles not for a-priori covariance matrix) replaces the Fortuin and Kelder climatology used in version 1.0.5.
- Fit stray light separately for UV1 and UV2 (in version 1.1.x not in version 1.0.5).
- Ignore measurements for wavelengths within 1.5 nm from the channel separation at 310.0 nm. (in version 1.1.x not in 1.0.5)
- Fit cloud albedo (1.1.x) instead of cloud fraction (1.0.5) to accommodate optically thick clouds that cover the entire pixel
- Treat surface albedo, cloud albedo and stray light as quadratic polynomials in the wavelength when they are fitted (1.1.x), whereas they are independent of wavelength or not used (1.0.5).
- Temperature and altitude are now in the product file, to accommodate comparisons with e.g. lidar data
- Product contains averaging kernel (1.1.x) not the transpose of the averaging kernel (1.0.5)

These changes improve the comparison with MLS on Aura, improve the convergence for optically thick clouds, reduce the residue of the fit by a factor of 2 or more, and provide more realistic values of the surface / cloud albedo.

A-priori profile information

In version 1.0.5 the Fortuin and Kelder climatology was used. In the new version (1.1.x) the a-priori profiles are taken from the McPeters and Labow climatology (McPeters, R. D., Labow, G. J. and Logan, J. A.: Ozone climatological profiles for satellite retrieval algorithms, J. Geophys. Res., 112 (D5), D05308, doi:10.1029/2005JD006823, 2007). The error covariance matrix for version 1.1.x is constructed as follows. Except for ozone hole conditions an a-priori error of 20% is assumed for all altitudes. This defines the diagonal part of the a priori error covariance matrix. Next a correlation length of 6 km is used to calculate the non-diagonal elements. Ozone hole conditions are assumed to occur for latitudes south of 50^{o} S during the months August through December. The error is then 60% for altitudes between 21 km and 50 km and the error is 30% for other altitudes. The correlation length remains 6 km.

Stray light

In version 1.1.x stray light is fitted separately for UV1 and UV2. This reduces oscillations when the retrieved profiles are compared with MLS on Aura in particular for pressures lower than 10 hPa and reduces the residue of the fit. It is assumed that stray light in UV1 and UV2 can be represented as a quadratic polynomial in the wavelength. This polynomial id added to the radiance and the polynomial coefficients become part of the state vector which is fitted using the optimal estimation method.

Fit cloud albedo instead of effective cloud fraction

In version 1.0.5 the cloud fraction was initially taken from the OMCLDO2 cloud product and then fitted. However, for a substantial number of pixels the brightness was so larger that a cloud fraction larger than 1.0 would be needed to fit the radiance, assuming a fixed cloud albedo of 0.80. Therefore it was decided to fit the cloud albedo instead of the cloud fraction. This makes it possible to deal with very bright clouds. Just as in version 1.0.5 there is a threshold involved for the cloud fraction. If the cloud fraction is less than 0.2 the surface albedo is fitted and the cloud albedo is kept fixed at 0.80. If the cloud fraction is larger than 0.20 the surface albedo is fixed to its a-priori value and the cloud albedo is fitted.

Spectral variation of surface albedo or cloud albedo

Using simulated measurements, tests of the ozone profile retrieval algorithm showed that the retrieved profile is sensitive to spectral variation in the surface albedo. For instance when the surface albedo varies from 0.07 at 270 nm to 0.05 at 310 nm and 0.03 at 330 nm and wavelength independent surface albedo is assumed for UV1 and UV2, it leads to errors up to 45% in the retrieved profile. Although measurements indicate that the slbedo of most surface do not vary strongly with wavelength in the UV, some wavelength dependence can be expected. Therefore, in version 1.1.x it is assumed that the surface albedo in UV1 and UV2 is a quadratic polynomial in the wavelength. The value listed in the output product is the surface albedo at the largest wavelength. The same procedure is followed for cloud albedo. However, currently the cloud albedo is not part of the output product.

Effective cloud fraction

In version 1.1.0 the effective cloud fraction is not written correctly to the output for .values larger than 0.2. This field should not be used for version 1.1.0. Note that the field StateVectorSpecies provides information whether the effective cloud fraction is less than 0.2. In that case the number of fit parameters for the surface albedo is larger than 0. In version 1.1.1 the effective cloud fraction is properly written to the output.

Output format

Currently the output format is not in line with the Aura guidelines. Ozone is reported in DU per layer and the ordering of the layers from space to ground. In later release this will be made in line with the guidelines: ozone in VMR and layers ordered from ground to space.

Temperature and altitude information

Conversion into an average number density requires information on the average temperature of the layer. The temperature used in the retrieval is based on ECMWF temperature profiles. In version 1.1.x the temperature and altitude is now written to the output product.

Retrieval options

In the current retrieval software there are options to use background aerosols, to fit the aerosol optical thickness and/or the cloud fraction instead of the surface albedo, and to include NO2 and SO2 in the fitting procedure. However, these options have not sufficiently been tested and are turned off. They may be activated later.

Latitude and longitude of groundpixels

The latitude and longitude of each pixel is given in the output product. Hence, the ozone profile is assigned to the vertical where the line of sight intersects the Earth surface. This is a zero-order approximation, which will be fairly accurate for tropospheric ozone. For stratospheric ozone the intersection with the ozone layer seems more relevant. A more detailed description of the location of the ozone that is measured remains to be written. The pixel size is approximately 13 x 48 km2 at nadir which grows to about 30 x 300 km2 near the end of the swath. The increase in pixel size towards the end of the swath is strongly non-linear.