Introduction

Data from the Suomi NPP Ozone Mapping and Profiler Suite (OMPS) Limb Profiler (LP) have been processed to create an aerosol extinction coefficient product (AER675) based on 675 nm radiance measurements. Since this test product is being released for evaluation and comment, it has been given the designation Version 0.5 (V0.5). The files provided here contain a subset of the overall retrieval information generated in the orbital Level 2 processing. The daily product is an aggregation of retrieval results for all orbits whose starting time falls within a single calendar day, and is referred to as LP-L2-AER675-DAILY in this document.

There are typically 180 observations (or “frames”) during a single orbit, although measurements at the start or end of an orbit may not be useful for science products. For the AER675 product, retrievals were only performed for observations with solar zenith angle SZA < 85°. There are $N_{time}$ observations during a complete day.

LP-L2-AER675-DAILY data files are provided in the HDF5 data format. The product file name follows the pattern of the sample below for data collected on April 2, 2012:

```
OMPS-NPP_LP-L2-AER675-DAILY_v0.5_2012m0402_2016m0106t122554.h5
```

---Product name---           ---Measurement Date---     ---Processing Time---

These files contain three primary groups: AncillaryData, DataFields, and GeolocationFields. Descriptions of the fields within each group are given below.
Description of Fields in AncillaryData Group

OMPS LP processing uses data from the NASA GSFC Global Modelling Assimilation Office (GMAO) Forward Processing-Information Team (FP-IT) GEOS 5.9.1 product to create reference temperature and pressure profiles. The GMAO grid point (Δlatitude = 0.5°, Δlongitude = 0.625°) nearest the LP tangent point location is selected, and the closest profiles in time (Δt = 3 hours) are interpolated to the LP observation time.

AtmospherePressure. Pressure profile for each event created from GMAO ancillary data.

TerrainAltitude. The altitude of the surface above sea level at the tangent point.

TropopauseAltitude. The tropopause altitude is derived from the GMAO temperature data that are ingested during LP processing.

Summary Table of AncillaryData Contents

<table>
<thead>
<tr>
<th>Dataset Name</th>
<th>Description</th>
<th>Units</th>
<th>Dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>AtmospherePressure</td>
<td>Pressure profile from ancillary data input</td>
<td>hPa</td>
<td>(Ntime, 41)</td>
</tr>
<tr>
<td>TerrainAltitude</td>
<td>Altitude of surface at tangent point</td>
<td>km</td>
<td>(Ntime)</td>
</tr>
<tr>
<td>TropopauseAltitude</td>
<td>Derived tropopause altitude</td>
<td>km</td>
<td>(Ntime)</td>
</tr>
</tbody>
</table>
Description of Fields in DataFields Group

ASI. We create a quantity called the aerosol scattering index (ASI) from LP radiance data, defined as the difference between the measured radiance ($I_{\text{meas}}$) and a forward model calculation with no aerosol correction ($I_{\text{calc0}}$):

$$ASI(\lambda,z) = \frac{I_{\text{meas}}(\lambda,z)}{I_{\text{calc0}}(\lambda,z)} - 1$$

ASI profiles are provided at six nominal wavelengths: 353, 510, 675, 750, 870, 1000 nm. The exact wavelengths used for these observations are listed in the Wavelengths field. Note that because of occasional changes in the sample table used to define LP data collection on-orbit, 1000 nm data are not available for some portions of the S-NPP mission.

CloudHeight. If the radiance ratio defined below exceeds 0.15 at any level [$\text{LnR}(z) > 0.15$], this field records the altitude of the maximum value of $\text{LnR}$. More description of this algorithm is given in Chen et al. [2015, under review].

ErrorCode. A non-zero value means that no valid aerosol profile was retrieved for that event.

ExtinctCoeffError. The calculated uncertainty in the retrieved extinction coefficient.

FrameNumber. The frame number represents the position of each frame during each orbit sequence, beginning at 1 and ending at the last frame for that orbit. A typical orbit contains 180 frames.

RadianceRatio. The radiance ratio profile quantity is calculated from LP measured radiances for every event.

$$\text{LnR}(z) = \frac{d\text{Ln}I_{\text{meas}}(674 \text{ nm},z)}{dz} - \frac{d\text{Ln}I_{\text{meas}}(868 \text{ nm},z)}{dz}$$

Altitudes below 5.5 km are filled with -999.0. This quantity is used to evaluate the presence of clouds.

Reflectance. The calculated Lambert-equivalent reflectivity at each nominal wavelength.

RetrievedExtinction. The retrieved extinction coefficient profile at 675 nm for each event.

TH_Altitude. The altitude grid for the aerosol extinction coefficient profiles covers 0.5-40.5 km in 1 km steps.

Wavelength. Actual wavelengths used for each LP observation.
### Summary Table of DataFields Contents

<table>
<thead>
<tr>
<th>Dataset Name</th>
<th>Description</th>
<th>Units</th>
<th>Dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASI</td>
<td>Aerosol scattering index at each wavelength</td>
<td>none</td>
<td>(Ntime, 6, 41)</td>
</tr>
<tr>
<td>CloudHeight</td>
<td>Altitude for maximum value of radiance ratio when cloud is identified</td>
<td>km</td>
<td>(Ntime)</td>
</tr>
<tr>
<td>ErrorCode</td>
<td>Quality flag for successful retrieval</td>
<td>none</td>
<td>(Ntime)</td>
</tr>
<tr>
<td>ExtinctCoeffError</td>
<td>Calculated error for retrieved extinction profile</td>
<td>km⁻¹</td>
<td>(Ntime, 41)</td>
</tr>
<tr>
<td>FrameNumber</td>
<td>Frame index for each event</td>
<td>none</td>
<td>(Ntime)</td>
</tr>
<tr>
<td>RadianceRatio</td>
<td>Profile of radiance ratio for cloud detection</td>
<td>none</td>
<td>(Ntime, 41)</td>
</tr>
<tr>
<td>Reflectance</td>
<td>Lambert-equivalent reflectivity at each wavelength</td>
<td>none</td>
<td>(Ntime, 6)</td>
</tr>
<tr>
<td>RetrievedExtinction</td>
<td>Extinction coefficient profile at 675 nm</td>
<td>km⁻¹</td>
<td>(Ntime, 41)</td>
</tr>
<tr>
<td>TH_Altitude</td>
<td>Altitude scale for extinction coefficient profiles</td>
<td>km</td>
<td>(41)</td>
</tr>
<tr>
<td>Wavelength</td>
<td>Measurement wavelengths for each event</td>
<td>nm</td>
<td>(Ntime, 6)</td>
</tr>
</tbody>
</table>
Description of Fields in GeolocationFields Group

Date. The date of each observation in year/month/day format (YYYYMMDD).

Latitude. The latitude for each event where the tangent point altitude corresponds to 25 km.

Longitude. The longitude for each event where the tangent point altitude corresponds to 25 km.

OrbitNumber. The orbit number for the Suomi NPP spacecraft since its launch on 28 October 2011.

SingleScatteringAngle. The single scattering angle for each event where the tangent point altitude corresponds to 25 km.

SolarZenithAngle. The solar zenith angle for each event where the tangent point altitude corresponds to 25 km.

SwathLevelQualityFlags. The swath level quality flag contains five values in the form ‘abcde’, with the following definitions.

a: SAA (South Atlantic Anomaly)
   0 = estimated SAA effects at satellite location are < 5% of nominal maximum value, based on OMPS LP climatology
   1 = estimated SAA effects at satellite location are 5-40% of nominal maximum value
   2 = estimated SAA effects at satellite location are 40-75% of nominal maximum value
   3 = estimated SAA effects at satellite location are > 75% of nominal maximum value

b: Moon
   0 = does not appear in any slit (based on calculated ephemeris)
   1 = appears in left slit
   2 = appears in center slit
   3 = appears in right slit

c: SolarEclipse
   0 = none
   1 = solar eclipse on day side of Earth at time of measurement

d: OtherPlanets
   0 = does not appear in any slit (based on calculated ephemeris)
   1 = appears in left slit
   2 = appears in center slit
   3 = appears in right slit

e: NonNominalAttitude
   0 = nominal spacecraft attitude
   1 = attitude shift due to planned spacecraft maneuver (such as roll or yaw) or other reason

Time. Measurement time of each event.
Summary Table of GeolocationFields Contents

<table>
<thead>
<tr>
<th>Dataset Name</th>
<th>Description</th>
<th>Units</th>
<th>Dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>Date in format YYYYMMDD</td>
<td>none</td>
<td>(Ntime)</td>
</tr>
<tr>
<td>Latitude</td>
<td>Latitude at tangent point [25 km]</td>
<td>degrees</td>
<td>(Ntime)</td>
</tr>
<tr>
<td>Longitude</td>
<td>Longitude at tangent point [25 km]</td>
<td>degrees</td>
<td>(Ntime)</td>
</tr>
<tr>
<td>OrbitNumber</td>
<td>Orbit number for Suomi NPP spacecraft</td>
<td>none</td>
<td>(Ntime)</td>
</tr>
<tr>
<td>SingleScatteringAngle</td>
<td>Scattering angle at tangent point [25 km]</td>
<td>degrees</td>
<td>(Ntime)</td>
</tr>
<tr>
<td>SolarZenithAngle</td>
<td>Solar zenith angle at tangent point [25 km]</td>
<td>degrees</td>
<td>(Ntime)</td>
</tr>
<tr>
<td>SwathLevelQualityFlags</td>
<td>Flags for satellite location and orientation</td>
<td>none</td>
<td>(Ntime)</td>
</tr>
<tr>
<td>Time</td>
<td>Measurement time of event [UT]</td>
<td>seconds</td>
<td>(Ntime)</td>
</tr>
</tbody>
</table>

References