D-64070

OCO (Orbiting Carbon Observatory) Project
OCO-2

# Software Interface Specification for the SDOS Level 2 Diagnostic Product

Revision C
June 20, 2015

Paper copies of this document may not be current and should not be relied on for official purposes. The current version is in Product Data Management System: https://pdms.jpl.nasa.gov.

National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology

**Prepared by:**

_____ _____

Charles Avis Date
Manager, OCO-2 Science Data Operations System

**Reviewed by:**

_____ _____

Bruce Vollmer Date
GES DISC Mission Support Lead

*** Original signature page on file in project physical repository ***

© 2015 California Institute of Technology. Government sponsorship acknowledged.

# Change Log

| Revision | Date | Sections Changed | Author |
|---|---|---|---|
| Initial | May 15, 2014 | | |
| Rev A | July 29, 2014 | 1, 3, 4.1,4.2, 5, 6 | Chafin |
| Rev B | March 15, 2015 | 1, 5, 6, Appendix 1, 2 | C. Avis |
| Rev C | June 20, 2015 | 1 (applicable version), 3 (changed reference documents to those accessible to public), 4.2 (added CalibType), 5 (9 new eof3… fields in RetrievalResults groups), 9 new …spacing…fields in DispersionResults group, update to bit 4 of sounding_qual_flag) | C. Avis |

# Table of Contents

1 Product Identification and Software Version ..... 1
2 Background information ..... 1
2.1 NASA Data Levels ..... 1
2.2 Product Pedigree and Destination ..... 1
2.3 Suggested Tools to Read Product ..... 2
3 Reference Documents (at http://disc.sci.gsfc.nasa.gov/OCO-2/documentation) ..... 2
4 Product Description ..... 2
4.1 Format and Size ..... 2
4.2 Naming Convention ..... 2
5 Specification Table ..... 4
6 Appendix 1: Shape Descriptions ..... 24
7 Appendix 2: Acronyms ..... 25

# 1 Product Identification and Software Version

This document describes the specification of one of the data products generated by the OCO-2 Science Data Operations System (SDOS). This document applies to the following product and system version:

| | |
|---|---|
| Product Name: | Level 2 Diagnostic Product |
| Short Name: | OCO2_L2_Diagnostic |
| SDOS System Version: | B7.0.00 and later |
| GES DISC Version: | Version 7 and Version 7r and later |
| Product Description: | Geolocated retrieved state vectors with CO2-column averaged dry air mole fraction using 3-band full physics retrieval (includes Full-physics algorithm results that provide details of algorithm performance) |

SDOS System Bn.0.00 generates products either with predictive calibration parameters (Version n) or with parameters derived via analysis of past instrument performance (Version nr). Therefore, nr is considered of higher quality. Analyses mixing the two sets should be undertaken with a degree of caution. The product specifications for n and nr are identical and this document applies to both.

# 2 Background information

The OCO-2 SDOS converts telemetry downloaded from the Observatory into data products that provide comprehensive mission results as well as material for further research and investigation. The SDOS generates products from Level 0 through Level 2, some of which are available for distribution to both the scientific community and the general public. All products are available to users of the SDOS computing cluster.

## 2.1 NASA Data Levels

The following table provides the definitions of the data levels used in this document. These definitions are standard within the NASA community

| Level | Description |
|---|---|
| Packet data | Telemetry data stream as received at the ground station, with science and engineering data embedded |
| Level 0 | Instrument science data (e.g., raw voltages, counts) at full resolution, time ordered, with duplicates and transmission errors removed |
| Level 1A | NASA Level 0 data that have been located in space and may have been transformed (e.g., calibrated, rearranged) in a reversible manner and packaged with needed ancillary and auxiliary data (e.g., radiances with the calibration equations applied) |
| Level 1B | Irreversibly transformed (e.g., resampled, remapped, calibrated) values of the instrument measurements (e.g., radiances, magnetic field strength) |
| Level 2 | Geophysical parameters, generally derived from NASA Level 1 data, and located in space and time commensurate with instrument location, pointing, and sampling |

## 2.2 Product Pedigree and Destination

This product is generated within the nominal SDOS pipeline by the Diagnostic Product Generator PGE using the following input data:

- Full Physics output files
- A-Band Preprocessor product
- IMAP-DOAS Preprocessor product
- Level 1B Science product

This product is expected to be an input to the following PGE's within the nominal SDOS pipeline:

- Subfielder PGE

## 2.3 Suggested Tools to Read Product

The following set of tools can be used to open and examine this HDF-5 product on Linux systems. Other tools may be available.

- h5dump
- hdfview

# 3 Reference Documents (at http://disc.sci.gsfc.nasa.gov/OCO-2/documentation)

1. Level 2 Full Physics Retrieval ATBD
2. Data Users Guide
3. Data Quality Statement

# 4 Product Description

## 4.1 Format and Size

This product is in HDF-5 format. For most nominal orbits, the product will use up to 1.0 gigabytes.

## 4.2 Naming Convention

oco2_[*ProductId*][*Mode*]_[*Orbit*][*ModeCounter*]_[*AcquisitionDate*]_[*ShortBuildId*][*CalibType*]_[*ProductionDateTime*].h5

| *Field* | Description | Format | Selection |
|---|---|---|---|
| *ProductId* | A mnemonic indicating a file type. | String | L2Dia - Level 2 Diagnostic Product |
| *Mode* | The acquisition Mode associated with the data. | Two character string | GL - Sample Glint |
| | | | ND - Sample Nadir |
| | | | TG - Sample Target |

| | | | |
|---|---|---|---|
| | | | XS - Sample Transition |
| *Orbit* | The Orbit on which the associated data were acquired. If the Orbit number is less than 10,000, zeros are prepended to the number to ensure that the field is five digits long. | nnnnn | Actual Orbit number for data acquired during operations |
| *ModeCounter* | This field indicates how many times an acquisition Mode occurs in an Orbit. If a mode occurs only once, ModeCounter is set to "a". | Single character | a, b, c, … |
| *AcquisitionDate* | The date (UTC) the data were acquired. | yymmdd | |
| *ShortBuildId* | The identification of the related software build | Bstuu | s = ID of major build cycle<br>t = ID of scheduled build within a major build cycle<br>uu = ID of incremental or patch build |
| *CalibType* | Indicates whether processing used predictive or retrospective calibration | Single character if retrospective;<br>Not present if predictive | r = retrospective calibration used |
| *ProductionDateTime* | The date and time (UTC) that the file was produced. | yymmddhhmmss | |

# 5 Specification Table

The HDF file structure consists of a large number of Data Elements with values. These Elements (a.k.a., 'fields') may be of various types (e.g., arrays, scalars) and are organized into Groups. Groups are utilized in various ways, such as to combine Elements/values generated by different PGE's.

Description of column headers in the following tables:

| | |
|---|---|
| Data Element | The name of the Data Element |
| Shape | See Appendix 1 |
| Type | The data type of the values |
| Units | The SI units of the values, if any |
| Minimum value | The lowest possible value. In some cases, this is the lowest safe value (i.e., a 'red' limit) |
| Maximum value | The highest possible value. In some cases, this is the highest safe value (i.e., a 'red' limit) |
| Comments | Descriptive information about the Element |
| (no value = n/a) | |

**L2_Diagnostic Product HDF specification**

| **Group** | **Metadata** | | | | | |
|---|---|---|---|---|---|---|
| **Group description** | Granule-level Metadata | | | | | |
| **Data Element** | **Shape** | **Type** | **Units** | **Minimum value** | **Maximum value** | **Comments** |
| Standard Metadata | See OCO-2 Standard Metadata specification table below | | | | | |
| AbscoCO2Scale | Spectrum_Array | Float32 | | | | Empirical scaling factors for CO2 ABSCO tables. Values should be different for the 1.6 micron and 2.06 micron bands and were chosen to provide agreement of retrieved XCO2 with TCCON XCO2. |
| AbscoH2OScale | Spectrum_Array | Float32 | | | | Empirical scaling factor for H2O ABSCO tables. Currently should be 1.0. |
| AbscoO2Scale | Spectrum_Array | Float32 | | | | Empirical scaling factor for O2 ABSCO tables. Values chosen to improve agreement between retrieved surface pressure and independent estimates from a numerical weather prediction model. |
| AcquisitionMode | Scalar | String | | | | The instrument mode in which the data in the product were collected. Valid values are: 'Glint', 'Nadir', 'Target', 'Sample Dark Calibration', 'Sample Lamp Calibration', 'Sample Solar/limb Calibration', 'Single-Pixel Dark Calibration', 'Single-Pixel Lamp Calibration', 'Single-Pixel Solar/limb Calibration' |
| ActualFrames | Scalar | Int32 | | | | Actual number of frames reported in this product |
| ActualGoodRetrievals | Scalar | Int32 | | | | Actual number of reported retrievals with a "Good" quality flag |
| ActualRetrievals | Scalar | Int32 | | | | Actual number of retrievals reported in the product |
| ARPAncillaryDatasetDescriptor | Scalar | String | | | | The name of the Ancillary Radiometric Product file used to calibrate this file |
| AscendingEquatorCrossingDate | Scalar | String | | | | The date of the equator crossing of the spacecraft ground track in the ascending direction |

| | | | | | | |
|---|---|---|---|---|---|---|
| AscendingEquatorCrossingLongitude | Scalar | Float32 | Degrees | -180 | 180 | The longitude of the equator crossing of the spacecraft ground track in the ascending direction |
| AscendingEquatorCrossingTime | Scalar | String | | | | The time of the equator crossing of the spacecraft ground track in the ascending direction |
| EphemerisType | Scalar | String | | | | The source of the spacecraft ephemeris data that were utilized to generate this data file |
| EquatorCrossingDate | Scalar | String | | | | The date of the equator crossing of the spacecraft ground track in the descending direction |
| EquatorCrossingLongitude | Scalar | Float32 | Degrees | -180 | 180 | The longitude of the equator crossing of the spacecraft ground track in the descending direction |
| EquatorCrossingTime | Scalar | String | | | | The time of the equator crossing of the spacecraft ground track in the descending direction |
| ExpectedFrames | Scalar | Int32 | | | | Nominal number of frames in this product |
| FirstSoundingId | Scalar | Int64 | | | | The ID of the first sounding in this file |
| L2FullPhysicsAlgorithmDescriptor | Scalar | String | | | | Identification of the algorithm and version used to generate this product |
| L2FullPhysicsDataVersion | Scalar | String | | | | The source of the data used by the Full-physics algorithm: 'r01' - initial processing; 'r02', 'r03', etc. - reprocessed data |
| L2FullPhysicsExeVersion | Scalar | String | | | | The build version number of the Full-physics algorithm used to generate this product |
| L2FullPhysicsProductionLocation | Scalar | String | | | | Facility in which Full Physics code was run, typically: 'JPL', 'Pleiades' |
| L2FullPhysicsInputPointer | L2FullPhysicsInputPtr_Array | String | | | | Pointer to one or more data granules and auxilliary files that provide the major input that was used to generate this product |
| LastSoundingId | Scalar | Int64 | | | | The ID of the last sounding in this file |
| ModeCounter | Scalar | String | | | | The Nth occurrence of this particular mode for this orbit, indicated by letter ('a', 'b', 'c', 'd', etc.) |
| OperationMode | Scalar | String | | | | The two-letter abbreviation of the AcquisitionMode: GL, ND, TG, DS, LS, SS, BS, NP, GP, TP, DP, LP, SP, BP, XS, XP, MS, MP, SB |
| OrbitEccentricity | Scalar | Float32 | | | | The eccentricity of the spacecraft orbital path |
| OrbitInclination | Scalar | Float32 | Degrees | 0 | 180 | The angle between the plane of the spacecraft orbital path and the Earth equatorial plane |
| OrbitParametersPointer | OrbitParamPtr_Array | String | | | | The data files that provided the orbit parameters used to generate this product |
| OrbitPeriod | Scalar | Float32 | Seconds | | | The time span between two consecutive descending node crossings |
| OrbitSemiMajorAxis | Scalar | Float32 | Meters | | | The length of the semimajor axis of the spacecraft orbit |
| OrbitStartDate | Scalar | String | | | | The date of the equator crossing of the spacecraft nadir track in the descending direction |
| OrbitStartLongitude | Scalar | Float32 | Degrees | -180 | 180 | The longitude of the equator crossing of the spacecraft ground track in the descending direction |
| OrbitStartTime | Scalar | String | | | | The time of the equator crossing of the spacecraft ground track in the descending direction |
| RadianceConversionFactor | Scalar | Float32 | Ph sec^{-1} W^{-1} | | | Multiplicative factor used to convert W m^{-2} sr^{-1} um^{-1} to Ph sec^{-1} m^{-2} sr^{-1} um^{-1} at 760 nm (38.228x10^17) |

| | | | | | | |
|---|---|---|---|---|---|---|
| ReportedSoundings | SoundingPosition_Array | Int8 | | 0 | 1 | Indicates the inclusion of each footprint in the data: 0 - not included, 1 - included |
| RetrievalIterationLimit | Scalar | Int32 | | | | Maximum number of iterations allowed before the algorithm gives up and sets the outcome_flag to 3 |
| SpectralChannel | Spectrum_Array | String | | | | A description of the spectral channels used for the measurements |
| VMRO2 | Scalar | Float32 | Mole Mole^{-1} | | | The volume mixing ratio of atmospheric $O_2$ |
| | | | | | | |
| **Group** | **L1bScSoundingReference** | | | | | |
| **Group description** | Metadata applying to every sounding in source L1bSc product | | | | | |
| **Data Element** | **Shape** | **Type** | **Units** | **Minimum value** | **Maximum value** | **Comments** |
| sounding_id_l1b | Frame_Sounding_Array | Int64 | | | | Unique identifier for each sounding |
| sounding_qual_flag | Frame_Sounding_Array | UInt64 | | | | Bit flags indicating the quality of the data in sounding: 0 - Good, non-zero - see documentation |
| packaging_qual_flag | Frame_Sounding_Array | UInt8 | | | | Bit flags recording errors during packaging of L2 Full-physics and preprocessing output into retrieval arrays: 0 - Good, non-zero - see documentation |
| retrieval_index | Frame_Sounding_Array | Int32 | | | | The index into the Retrieval dimension of arrays in the RetrievalResults, RetrievedStateVector, and SpectralParameters groups for soundings associated with retrievals |
| | | | | | | |
| **Group** | **L1bScSpectralParameters** | | | | | |
| **Group description** | Spectral parameters derived in the L1b process applying to every sounding in source L1bSc product | | | | | |
| **Data Element** | **Shape** | **Type** | **Units** | **Minimum value** | **Maximum value** | **Comments** |
| snr_o2_l1b | Retrieval_Array | Float32 | | | | The mean signal-to-noise ratio of the good samples in the band falling between the 98th and 99th percentile for signal level |
| snr_weak_co2_l1b | Retrieval_Array | Float32 | | | | The mean signal-to-noise ratio of the good samples in the band falling between the 98th and 99th percentile for signal level |
| snr_strong_co2_l1b | Retrieval_Array | Float32 | | | | The mean signal-to-noise ratio of the good samples in the band falling between the 98th and 99th percentile for signal level |
| spike_eof_bad_colors_o2 | Retrieval_Array | Int16 | | | | Number of bad colors in the ABO2 spectrum |
| spike_eof_bad_colors_weak_co2 | Retrieval_Array | Int16 | | | | Number of bad colors in the WCO2 spectrum |
| spike_eof_bad_colors_strong_co2 | Retrieval_Array | Int16 | | | | Number of bad colors in the SCO2 spectrum |
| max_declocking_factor_o2 | Retrieval_Array | Float32 | | | | Maximum clocking correction factor of the ABO2 spectrum |
| max_declocking_factor_weak_co2 | Retrieval_Array | Float32 | | | | Maximum clocking correction factor of the WCO2 spectrum |
| max_declocking_factor_strong_co2 | Retrieval_Array | Float32 | | | | Maximum clocking correction factor of the SCO2 spectrum |

| | | | | | | |
|---|---|---|---|---|---|---|
| rad_mean_spectra_o2 | Retrieval_Array | Float32 | Ph sec^{-1} m^{-2} sr^{-1} um^{-1} | | | The mean radiance of the ABO2 spectrum |
| rad_mean_spectra_weak_co2 | Retrieval_Array | Float32 | Ph sec^{-1} m^{-2} sr^{-1} um^{-1} | | | The mean radiance of the WCO2 spectrum |
| rad_mean_spectra_strong_co2 | Retrieval_Array | Float32 | Ph sec^{-1} m^{-2} sr^{-1} um^{-1} | | | The mean radiance of the SCO2 spectrum |
| rad_stddev_spectra_o2 | Retrieval_Array | Float32 | Ph sec^{-1} m^{-2} sr^{-1} um^{-1} | | | The standard deviation of the radiance of the ABO2 spectrum |
| rad_stddev_spectra_weak_co2 | Retrieval_Array | Float32 | Ph sec^{-1} m^{-2} sr^{-1} um^{-1} | | | The standard deviation of the radiance of the WCO2 spectrum |
| rad_stddev_spectra_strong_co2 | Retrieval_Array | Float32 | Ph sec^{-1} m^{-2} sr^{-1} um^{-1} | | | The standard deviation of the radiance of the SCO2 spectrum |
| | | | | | | |
| **Group** | **RetrievalHeader** | | | | | |
| **Group description** | Metadata applying to every retrieval result | | | | | |
| **Data Element** | **Shape** | **Type** | **Units** | **Minimum value** | **Maximum value** | **Comments** |
| sounding_id | Retrieval_Array | Int64 | | | | The sounding_id of the sounding containing the spectra used to perform the retrieval |
| frame_index | Retrieval_Array | Int32 | | | | Index of the frame dimension of the corresponding sounding in L1bScSoundingReference data elements |
| sounding_index | Retrieval_Array | Int32 | | | | Index of the sounding dimension of the corresponding sounding in the L1bScSoundingReference data elements |
| retrieval_time_string | Retrieval_Array | String | | | | Data acquisition time for the retrieval based upon the three footprint times (yyyy-mm-ddThh:mm:ss.mmmZ) |
| retrieval_time_tai93 | Retrieval_Array | Float64 | Seconds | | | Data acquisition time for the retrieval based upon the three footprint times in seconds since Jan. 1, 1993 |
| | | | | | | |
| **Group** | **RetrievalGeometry** | | | | | |
| **Group description** | Geometric information that applies to individual soundings | | | | | |
| **Data Element** | **Shape** | **Type** | **Units** | **Minimum value** | **Maximum value** | **Comments** |
| retrieval_altitude | Retrieval_Array | Float32 | Meters | | | Altitude of the sounding based on Earth topography |
| retrieval_altitude_uncert | Retrieval_Array | Float32 | Meters | | | Uncertainty of the source Earth topography data |
| retrieval_aspect | Retrieval_Array | Float32 | Degrees | 0 | 360 | Orientation of the surface slope relative to the local North |
| retrieval_azimuth | Retrieval_Array | Float32 | Degrees | 0 | 360 | Angle between the LOS as defined from the sounding location to the spacecraft, and the sounding location local north direction |

| | | | | | | |
|---|---|---|---|---|---|---|
| retrieval_center_offset_o2_weak_co2 | Retrieval_Array | Float32 | Meters | | | Distance between the ABO2 band footprint center and the WCO2 band footprint center |
| retrieval_center_offset_strong_co2_o2 | Retrieval_Array | Float32 | Meters | | | Distance between the SCO2 band footprint center and the ABO2 band footprint center |
| retrieval_center_offset_weak_co2_strong_co2 | Retrieval_Array | Float32 | Meters | | | Distance between the WCO2 band footprint center and the SCO2 band footprint center |
| retrieval_land_fraction | Retrieval_Array | Float32 | Percent | 0 | 100 | Percentage of land surface type within the sounding |
| retrieval_land_water_indicator | Retrieval_Array | Int8 | | 0 | 3 | Surface type at the sounding location: 0 - Land, 1 - Water, 2 - unused, 3 - Mixed land water |
| retrieval_latitude | Retrieval_Array | Float32 | Degrees | -90 | 90 | Geodetic latitude of the sounding based on Earth topography |
| retrieval_latitude_geoid | Retrieval_Array | Float32 | Degrees | -90 | 90 | Geodetic latitude of the sounding based on standard geoid |
| retrieval_longitude | Retrieval_Array | Float32 | Degrees | -180 | 180 | Longitude of the sounding based on Earth topography |
| retrieval_longitude_geoid | Retrieval_Array | Float32 | Degrees | -180 | 180 | Longitude of the sounding based on standard geoid |
| retrieval_overlap | Retrieval_Array | Float32 | Percent | 0 | 100 | Area of intersection of all three band footprints relative to average area of all three band footprints |
| retrieval_overlap_o2_weak_co2 | Retrieval_Array | Float32 | Percent | 0 | 100 | Area of intersection of the footprints of ABO2 and WCO2 relative to the average area of the two footprint |
| retrieval_overlap_strong_co2_o2 | Retrieval_Array | Float32 | Percent | 0 | 100 | Area of intersection of the footprints of ABO2 and SCO2 relative to the average area of the two footprints |
| retrieval_overlap_weak_co2_strong_co2 | Retrieval_Array | Float32 | Percent | 0 | 100 | Area of intersection of the footprints of WCO2 and SCO2 relative to the average area of the two footprints |
| retrieval_plane_fit_quality | Retrieval_Array | Float32 | Meters | | | Goodness-of-fit of surface slope: the standard deviation of the points, to which the plane is fitted, with the expected values taken as the orthogonal projection of the points onto the plane |
| retrieval_polarization_angle | Retrieval_Array | Float32 | Degrees | 0 | 360 | The angle between the accepted polarization axis of the instrument and the instrument reference plane for polarization, defined as the plane formed by the LOS and the ray from the sounding location to the local zenith |
| retrieval_relative_velocity | Retrieval_Array | Float32 | Meters Second^{-1} | | | Velocity of the spacecraft along the LOS: positive indicates spacecraft moving toward sounding location |
| retrieval_slant_path_diff_o2_weak_co2 | Retrieval_Array | Float32 | Meters | | | Difference in slant path between ABO2 and WCO2 footprints |
| retrieval_slant_path_diff_strong_co2_o2 | Retrieval_Array | Float32 | Meters | | | Difference in slant path between SCO2 and ABO2 footprints |
| retrieval_slant_path_diff_weak_co2_strong_co2 | Retrieval_Array | Float32 | Meters | | | Difference in slant path between WCO2 and SCO2 footprints |
| retrieval_slope | Retrieval_Array | Float32 | Degrees | 0 | 180 | Slope of a plane fit to points within the sounding |
| retrieval_solar_azimuth | Retrieval_Array | Float32 | Degrees | 0 | 360 | Angle between the solar direction as defined from the sounding location to the Sun, and the sounding location local North direction |
| retrieval_solar_distance | Retrieval_Array | Float64 | Meters | | | Distance between sounding location and the Sun |

| | | | | | | |
|---|---|---|---|---|---|---|
| retrieval_solar_relative_velocity | Retrieval_Array | Float32 | Meters Second^{-1} | | | Velocity of the Sun along the sounding location/Sun vector: negative indicates Sun moving toward sounding location |
| retrieval_solar_zenith | Retrieval_Array | Float32 | Degrees | 0 | 180 | Angle between the solar direction as defined from the sounding location to the Sun, and the sounding location local zenith direction |
| retrieval_surface_roughness | Retrieval_Array | Float32 | Meters | | | Standard deviation of the altitude within the sounding |
| retrieval_vertex_latitude | Retrieval_Spectrum_Vertex_Array | Float32 | Degrees | -90 | 90 | Geodetic latitude of the footprint vertices using Earth topography |
| retrieval_vertex_longitude | Retrieval_Spectrum_Vertex_Array | Float32 | Degrees | -180 | 180 | Longitude of the footprint vertices using Earth topography |
| retrieval_zenith | Retrieval_Array | Float32 | Degrees | 0 | 180 | Angle between the LOS as defined from the sounding location to the spacecraft, and the sounding location local zenith direction |
| | | | | | | |
| **Group** | **PreprocessingResults** | | | | | |
| **Group description** | Results from A-Band Retrieval Preprocessing and IMAP-DOAS Preprocessing for soundings generating retrievals | | | | | |
| **Data Element** | **Shape** | **Type** | **Units** | **Minimum value** | **Maximum value** | **Comments** |
| albedo_o2_abp | Retrieval_AlbedoWavelength_Array | Float32 | | | | $O_2$ albedo at 785 and 755 nm |
| dispersion_multiplier_abp | Retrieval_Array | Float64 | | | | A number retrieved by the ABO2 algorithm that multiplies the dispersion coefficients as given in the L1B input file to get the effective wavelength of each channel |
| reduced_chi_squared_o2_abp | Retrieval_Array | Float32 | | | | $O_2$ reduced chi squared retrieved by ABO2 preprocessing |
| reduced_chi_squared_o2_threshold_abp | Retrieval_Array | Float32 | | | | Threshold of $O_2$ reduced chi squared used to set cloud_flag |
| noise_o2_abp | Retrieval_Array | Float32 | Ph sec^{-1} m^{-2} sr^{-1} um^{-1} | | | O2 measurement noise retrieved by the ABO2 algorithm |
| signal_o2_abp | Retrieval_Array | Float32 | Ph sec^{-1} m^{-2} sr^{-1} um^{-1} | | | O2 measurement signal level retrieved by the ABO2 algorithm |
| snr_o2_abp | Retrieval_Array | Float32 | | | | O2 measurement SNR retrieved by the ABO2 algorithm |
| surface_pressure_apriori_abp | Retrieval_Array | Float32 | Pascals | | | *a priori* surface pressure used by the ABO2 algorithm |
| surface_pressure_offset_abp | Retrieval_Array | Float32 | Pascals | | | Empirically determined value to be added to the A-band retrieved surface pressure, such that their sum is unbiased in clear scenes. It is modeled as a piecewise linear function of solar zenith angle; separate functions are used for land vs. ocean pixels. |
| surface_pressure_abp | Retrieval_Array | Float32 | Pascals | | | Surface pressure retrieved by the ABO2 algorithm |
| surface_pressure_delta_abp | Retrieval_Array | Float32 | Pascals | | | The value of surface_pressure_abp minus surface_pressure_apriori_abp and surface_pressure_offset_abp |
| temperature_offset_abp | Retrieval_Array | Float32 | Kelvins | | | The offset to the prior meteorological temperature profile as retrieved by the ABO2 algorithm |

| | | | | | | |
|---|---|---|---|---|---|---|
| dry_air_column_apriori_idp | Retrieval_Array | Float32 | Molecules Meters^{-2} | | | Integrated vertical column of dry airmass derived from meteorological data |
| co2_column_weak_band_idp | Retrieval_Array | Float32 | Molecules Meters^{-2} | | | CO2 vertical column density (from WCO2 band) |
| co2_column_weak_band_apriori_idp | Retrieval_Array | Float32 | Molecules Meters^{-2} | | | *a priori CO2 vertical column density from ECMWF forecast* |
| co2_column_weak_band_uncert_idp | Retrieval_Array | Float32 | Molecules Meters^{-2} | | | 1-sigma error in the CO2 vertical column density (from WCO2 band) |
| co2_column_strong_band_idp | Retrieval_Array | Float32 | Molecules Meters^{-2} | | | CO2 vertical column density (from SCO2 band) |
| co2_column_strong_band_apriori_idp | Retrieval_Array | Float32 | Molecules Meters^{-2} | | | *a priori* CO2 vertical column density from ECMWF forecast |
| co2_column_strong_band_uncert_idp | Retrieval_Array | Float32 | Molecules Meters^{-2} | | | 1-sigma error in the CO2 vertical column density (from SCO2 band) |
| co2_weak_band_processing_flag_idp | Retrieval_Array | Int8 | | 0 | 2 | Indicator of whether the WCO2 analysis succeeded: 0 - 'Processing succeeded', 1 - 'Processing failed', 2 - 'Processing skipped', all other values undefined |
| co2_strong_band_processing_flag_idp | Retrieval_Array | Int8 | | 0 | 2 | Indicator of whether the SCO2 analysis succeeded: 0 - 'Processing succeeded', 1 - 'Processing failed', 2 - 'Processing skipped', all other values undefined |
| cloud_flag_idp | Retrieval_Array | Int8 | | -2 | 3 | Cloud flag derived from IMAP-DOAS algorithm: -2 - 'Measurement unusable', -1 - 'Did not converge', 0 - "Definitely cloudy', 1 - 'Probably cloudy', 2 - 'Probably clear', 3 - 'Very clear', all other values undefined. |
| co2_ratio_idp | Retrieval_Array | Float32 | | | | Ratio of retrieved CO2 column (no scattering code) in WCO2 and SCO2 bands |
| h2o_ratio_idp | Retrieval_Array | Float32 | | | | Ratio of retrieved H2O column (no scattering code) in WCO2 and SCO2 bands |
| h2o_ratio_uncert_idp | Retrieval_Array | Float32 | | | | 1-sigma error in the ratio of retrieved H2O column (no scattering code) in WCO2 and SCO2 bands |
| o2_ratio_idp | Retrieval_Array | Float32 | | | | Ratio of retrieved and ECMWF O2 column |
| fluorescence_qual_flag_idp | Retrieval_Array | UInt8 | | | | Indicator of the quality of the IMAP DOAS fluorescence retrieval for each sounding: 0 - good, 1 - bad |
| fluorescence_offset_relative_757nm_idp | Retrieval_Array | Float32 | | | | Fraction of continuum level radiance explained by an additive offset term in the 757nm spectral window (unitless). In the absence of instrumental errors, this will be only caused by fluorescence. Rotational Raman scattering should be negligible over typical vegetated surface and moderate solar zenith angles (<65 degrees). |
| fluorescence_offset_relative_771nm_idp | Retrieval_Array | Float32 | | | | Fraction of continuum level radiance explained by an additive offset term in the 771nm spectral window (unitless). In the absence of instrumental errors, this will be only caused by fluorescence. Rotational Raman scattering should be negligible over typical vegetated surface and moderate solar zenith angles (<65 degrees). |
| fluorescence_radiance_757nm_idp | Retrieval_Array | Float32 | Ph sec^{-1} m^{-2} sr^{-1} um^{-1} | | | Radiance generated by fluorescence at 757nm |

| | | | | | | |
|---|---|---|---|---|---|---|
| fluorescence_radiance_757nm_uncert_idp | Retrieval_Array | Float32 | Ph sec^{-1} m^{-2} sr^{-1} um^{-1} | | | Standard deviation of the radiance generated by fluorescence at 757nm |
| fluorescence_radiance_771nm_idp | Retrieval_Array | Float32 | Ph sec^{-1} m^{-2} sr^{-1} um^{-1} | | | Radiance generated by fluorescence at 771nm |
| fluorescence_radiance_771nm_uncert_idp | Retrieval_Array | Float32 | Ph sec^{-1} m^{-2} sr^{-1} um^{-1} | | | Standard deviation of the radiance generated by fluorescence at 771nm |
| selection_priority | Retrieval_Array | Int8 | | 0 | 20 | Indicator of the likelihood of generating a good retrieval from the sounding: 0 = most likely, 20 = least likely |
| cloud_flag_abp | Retrieval_Array | Int8 | | 0 | 2 | Indicator of whether the sounding contained clouds: 0 - 'Classified clear', 1 - 'Processing failed', 2 - 'Not classified', all other values undefined |
| | | | | | | |
| **Group** | **RetrievalResults** | | | | | |
| **Group description** | Results from L2 Full-physics retrievals | | | | | |
| **Data Element** | **Shape** | **Type** | **Units** | **Minimum value** | **Maximum value** | **Comments** |
| num_active_levels | Retrieval_Array | Int16 | | | | Number of levels in atmospheric model |
| num_state_vector_elements | Retrieval_Array | Int16 | | | | Number of elements in retrieved state vector |
| surface_type | Retrieval_Array | String | | | | Type of model used for the Earth's surface: 'Lambertian' or ' Coxmumk,Lambertian' |
| outcome_flag | Retrieval_Array | Int8 | | | | Indicator of retrieval results: 1 - 'Passed internal quality check', 2 - 'Failed internal quality check', 3 - 'Reached maximum allowed iterations', 4 - 'Reached maximum allowed divergences' |
| vector_pressure_levels_ecmwf | Retrieval_ECMWFLevel_Array | Float32 | Pascals | | | Pressure altitude corresponding to each ECMWF atmospheric level |
| temperature_profile_ecmwf | Retrieval_ECMWFLevel_Array | Float32 | Kelvins | | | ECMWF temperature profile interpolated to observation location, time |
| specific_humidity_profile_ecmwf | Retrieval_ECMWFLevel_Array | Float32 | Kilograms Kilogram^{-1} | | | ECMWF specific humidity profile interpolated to observation location, time |
| surface_pressure_fph | Retrieval_Array | Float32 | Pascals | | | Surface pressure retrieved by Full-physics algorithm |
| surface_pressure_apriori_fph | Retrieval_Array | Float32 | Pascals | | | *a priori* surface pressure retrieved by Full-physics algorithm |
| surface_pressure_uncert_fph | Retrieval_Array | Float32 | Pascals | | | Uncertainty in the surface pressure retrieved by the Full-physics algorithm |
| vector_pressure_levels | Retrieval_Level_Array | Float32 | Pascals | | | Pressure altitude corresponding to each atmospheric level |
| vector_pressure_levels_apriori | Retrieval_Level_Array | Float32 | Pascals | | | *a priori* pressure altitude corresponding to each atmospheric level |
| diverging_steps | Retrieval_Array | Int16 | | | | Number of iterations in which solution diverged |
| iterations | Retrieval_Array | Int16 | | | | Number of iterations |
| dof_co2_profile | Retrieval_Array | Float32 | | | | Degrees of freedom (XCO2 only) |
| dof_full_vector | Retrieval_Array | Float32 | | | | Degrees of freedom (Full state vector) |

| | | | | | | |
|---|---|---|---|---|---|---|
| xco2 | Retrieval_Array | Float32 | Moles Mole^{-1} | | | Column-averaged $CO_2$ dry air mole fraction |
| xco2_apriori | Retrieval_Array | Float32 | Moles Mole^{-1} | | | a priori of column-averaged CO2 dry air mole fraction |
| xco2_uncert | Retrieval_Array | Float32 | Moles Mole^{-1} | | | Uncertainty in column averaged $CO_2$ dry air mole fraction |
| xco2_correlation_interf | Retrieval_StateVectorElement_Array | Float32 | | | | Correlation between fluctuations in XCO2 and each element in the state vector |
| interference_smoothing_uncert | Retrieval_StateVectorElement_Array | Float32 | | | | Uncertainty in XCO2 attributable to each element in the state vector |
| xco2_uncert_noise | Retrieval_Array | Float32 | Moles Mole^{-1} | | | Variance of XCO2 due to noise |
| xco2_uncert_smooth | Retrieval_Array | Float32 | Moles Mole^{-1} | | | Variance of XCO2 due to smoothing |
| xco2_uncert_interf | Retrieval_Array | Float32 | Moles Mole^{-1} | | | Variance of XCO2 due to interference |
| co2_profile | Retrieval_Level_Array | Float32 | Moles Mole^{-1} | | | Vertical profile of $CO_2$ |
| co2_profile_apriori | Retrieval_Level_Array | Float32 | Moles Mole^{-1} | | | Vertical a priori profile of CO2 |
| co2_profile_uncert | Retrieval_Level_Array | Float32 | Moles Mole^{-1} | | | Vertical profile of $CO_2$ uncertainty |
| xco2_pressure_weighting_function | Retrieval_Level_Array | Float32 | | | | Pressure weighting function used to form XCO2 |
| xco2_avg_kernel | Retrieval_Level_Array | Float32 | | | | Column averaging kernel |
| xco2_avg_kernel_norm | Retrieval_Level_Array | Float32 | | | | Normalized column averaging kernel |
| co2_profile_averaging_kernel_matrix | Retrieval_Level_Level_Array | Float32 | | | | Averaging kernel for $CO_2$ profile |
| co2_profile_covariance_matrix | Retrieval_Level_Level_Array | Float32 | Moles^{2} Mole^{-2} | | | Covariance matrix for $CO_2$ profile |
| apriori_covariance_matrix | Retrieval_StateVectorElement_StateVectorElement_Array | Float32 | | | | a priori covariance matrix |
| aposteriori_covariance_matrix | Retrieval_StateVectorElement_StateVectorElement_Array | Float32 | | | | a posteriori covariance matrix |
| averaging_kernel_matrix | Retrieval_StateVectorElement_StateVectorElement_Array | Float32 | | | | a posteriori averaging kernel matrix |
| wind_speed | Retrieval_Array | Float32 | Meters Second^{-1} | | | Retrieved Cox-Munk wind speed |
| wind_speed_apriori | Retrieval_Array | Float32 | Meters Second^{-1} | | | a priori of retrieved Cox-Munk wind speed |
| wind_speed_uncert | Retrieval_Array | Float32 | Meters Second^{-1} | | | Uncertainty of retrieved Cox-Munk wind speed |
| h2o_scale_factor | Retrieval_Array | Float32 | | | | Retrieved scale factor for $H_2O$ profile |
| h2o_scale_factor_apriori | Retrieval_Array | Float32 | | | | a priori of retrieved scale factor for H2O profile |

| | | | | | | |
|---|---|---|---|---|---|---|
| h2o_scale_factor_uncert | Retrieval_Array | Float32 | | | | Uncertainty of retrieved scale factor for $H_2O$ profile |
| temperature_offset_fph | Retrieval_Array | Float32 | Kelvins | | | Retrieved offset of temperature profile |
| temperature_offset_apriori_fph | Retrieval_Array | Float32 | Kelvins | | | a priori of retrieved offset of temperature profile |
| temperature_offset_uncert_fph | Retrieval_Array | Float32 | Kelvins | | | Uncertainty of retrieved offset of temperature profile |
| fluorescence_at_reference | Retrieval_Array | Float32 | Ph sec^{-1} m^{-2} sr^{-1} um^{-1} | | | Retrieved fluorescence at 0.757 microns |
| fluorescence_at_reference_apriori | Retrieval_Array | Float32 | Ph sec^{-1} m^{-2} sr^{-1} um^{-1} | | | a priori of retrieved fluorescence at 0.757 microns |
| fluorescence_at_reference_uncert | Retrieval_Array | Float32 | Ph sec^{-1} m^{-2} sr^{-1} um^{-1} | | | Uncertainty of retrieved fluorescence at 0.757 microns |
| fluorescence_slope | Retrieval_Array | Float32 | Ph sec^{-1} m^{-2} sr^{-1} um^{-2} | | | Retrieved fluorescence slope at 0.757 microns |
| fluorescence_slope_apriori | Retrieval_Array | Float32 | Ph sec^{-1} m^{-2} sr^{-1} um^{-2} | | | a priori of retrieved fluorescence slope at 0.757 microns |
| fluorescence_slope_uncert | Retrieval_Array | Float32 | Ph sec^{-1} m^{-2} sr^{-1} um^{-2} | | | Uncertainty of retrieved fluorescence slope at 0.757 microns |
| eof_1_scale_o2 | Retrieval_Array | Float32 | | | | Retrieved scale factor of first empirical orthogonal residual function in ABO2 band |
| eof_1_scale_apriori_o2 | Retrieval_Array | Float32 | | | | a priori of retrieved scale factor of first empirical orthogonal residual function in ABO2 band |
| eof_1_scale_uncert_o2 | Retrieval_Array | Float32 | | | | Uncertainty of retrieved scale factor of first empirical orthogonal residual function in ABO2 band |
| eof_1_scale_weak_co2 | Retrieval_Array | Float32 | | | | Retrieved scale factor of first empirical orthogonal residual function in WCO2 band |
| eof_1_scale_apriori_weak_co2 | Retrieval_Array | Float32 | | | | a priori of retrieved scale factor of first empirical orthogonal residual function in WCO2 band |
| eof_1_scale_uncert_weak_co2 | Retrieval_Array | Float32 | | | | Uncertainty of retrieved scale factor of first empirical orthogonal residual function in WCO2 band |
| eof_1_scale_strong_co2 | Retrieval_Array | Float32 | | | | Retrieved scale factor of first empirical orthogonal residual function in SCO2 band |
| eof_1_scale_apriori_strong_co2 | Retrieval_Array | Float32 | | | | a priori of retrieved scale factor of first empirical orthogonal residual function in SCO2 band |
| eof_1_scale_uncert_strong_co2 | Retrieval_Array | Float32 | | | | Uncertainty of retrieved scale factor of first empirical orthogonal residual function in SCO2 band |
| eof_2_scale_o2 | Retrieval_Array | Float32 | | | | Retrieved scale factor of second empirical orthogonal residual function in ABO2 band |
| eof_2_scale_apriori_o2 | Retrieval_Array | Float32 | | | | a priori of retrieved scale factor of second empirical orthogonal residual function in ABO2 band |
| eof_2_scale_uncert_o2 | Retrieval_Array | Float32 | | | | Uncertainty of retrieved scale factor of second empirical orthogonal residual function in ABO2 band |
| eof_2_scale_weak_co2 | Retrieval_Array | Float32 | | | | Retrieved scale factor of second empirical orthogonal residual function in WCO2 band |

| | | | | | | |
|---|---|---|---|---|---|---|
| eof_2_scale_apriori_weak_co2 | Retrieval_Array | Float32 | | | | a priori of retrieved scale factor of second empirical orthogonal residual function in WCO2 band |
| eof_2_scale_uncert_weak_co2 | Retrieval_Array | Float32 | | | | Uncertainty of retrieved scale factor of second empirical orthogonal residual function in WCO2 band |
| eof_2_scale_strong_co2 | Retrieval_Array | Float32 | | | | Retrieved scale factor of second empirical orthogonal residual function in SCO2 band |
| eof_2_scale_apriori_strong_co2 | Retrieval_Array | Float32 | | | | a priori of retrieved scale factor of second empirical orthogonal residual function in SCO2 band |
| eof_2_scale_uncert_strong_co2 | Retrieval_Array | Float32 | | | | Uncertainty of retrieved scale factor of second empirical orthogonal residual function in SCO2 band |
| eof_3_scale_o2 | Retrieval_Array | Float32 | | | | Retrieved scale factor of third empirical orthogonal residual function in ABO2 band |
| eof_3_scale_apriori_o2 | Retrieval_Array | Float32 | | | | a priori of retrieved scale factor of third empirical orthogonal residual function in ABO2 band |
| eof_3_scale_uncert_o2 | Retrieval_Array | Float32 | | | | Uncertainty of retrieved scale factor of third empirical orthogonal residual function in ABO2 band |
| eof_3_scale_weak_co2 | Retrieval_Array | Float32 | | | | Retrieved scale factor of third empirical orthogonal residual function in WCO2 band |
| eof_3_scale_apriori_weak_co2 | Retrieval_Array | Float32 | | | | a priori of retrieved scale factor of third empirical orthogonal residual function in WCO2 band |
| eof_3_scale_uncert_weak_co2 | Retrieval_Array | Float32 | | | | Uncertainty of retrieved scale factor of third empirical orthogonal residual function in WCO2 band |
| eof_3_scale_strong_co2 | Retrieval_Array | Float32 | | | | Retrieved scale factor of third empirical orthogonal residual function in SCO2 band |
| eof_3_scale_apriori_strong_co2 | Retrieval_Array | Float32 | | | | a priori of retrieved scale factor of third empirical orthogonal residual function in SCO2 band |
| eof_3_scale_uncert_strong_co2 | Retrieval_Array | Float32 | | | | Uncertainty of retrieved scale factor of third empirical orthogonal residual function in SCO2 band |
| co2_vertical_gradient_delta | Retrieval_Array | Float32 | Moles Mole^{-1} | | | The difference between the retrieved value of the vertical gradient in the CO2 profile and its *a priori* |
| retrieved_dry_air_column_layer_thickness | Retrieval_Layer_Array | Float32 | Molecules Meters^{-2} | | | Retrieved vertical column of dry air per atmospheric layer |
| retrieved_wet_air_column_layer_thickness | Retrieval_Layer_Array | Float32 | Molecules Meters^{-2} | | | Retrieved vertical column of wet air per atmospheric layer |
| retrieved_h2o_column_layer_thickness | Retrieval_Layer_Array | Float32 | Molecules Meters^{-2} | | | Retrieved vertical column of $H_2O$ per atmospheric layer |
| apriori_o2_column | Retrieval_Array | Float32 | Molecules Meters^{-2} | | | a priori vertical column of O2 |
| retrieved_co2_column | Retrieval_Array | Float32 | Molecules Meters^{-2} | | | Retrieved vertical column of $CO_2$ |
| retrieved_h2o_column | Retrieval_Array | Float32 | Molecules Meters^{-2} | | | Retrieved vertical column of $H_2O$ |
| retrieved_o2_column | Retrieval_Array | Float32 | Molecules Meters^{-2} | | | Retrieved vertical column of $O_2$ |
| xco2_gain_vector | Retrieval_RetrievalColor_Array | Float32 | Moles Mole^{-1} Ph^{-1} sec m^{2} sr um | | | Partial derivative of retrieved XCO2 with respect to the measured radiance |

| | | | | | | |
|---|---|---|---|---|---|---|
| last_step_levenberg_marquardt_ parameter | Retrieval_Array | Float32 | | | | Levenberg Marquardt parameter corresponding to last iteration |
| | | | | | | |
| **Group** | **AlbedoResults** | | | | | |
| **Group description** | Albedo output from L2 Full-physics retrievals | | | | | |
| **Data Element** | **Shape** | **Type** | **Units** | **Minimum value** | **Maximum value** | **Comments** |
| albedo_o2_fph | Retrieval_Array | Float32 | | | | Retrieved Lambertian component of albedo at 0.77 microns |
| albedo_weak_co2_fph | Retrieval_Array | Float32 | | | | Retrieved Lambertian component of albedo at 1.615 microns |
| albedo_strong_co2_fph | Retrieval_Array | Float32 | | | | Retrieved Lambertian component of albedo at 2.06 microns |
| albedo_apriori_o2_fph | Retrieval_Array | Float32 | | | | a priori of retrieved Lambertian component of albedo at 0.77 microns |
| albedo_apriori_weak_co2_fph | Retrieval_Array | Float32 | | | | a priori of retrieved Lambertian component of albedo at 1.615 microns |
| albedo_apriori_strong_co2_fph | Retrieval_Array | Float32 | | | | a priori of retrieved Lambertian component of albedo at 2.06 microns |
| albedo_uncert_o2_fph | Retrieval_Array | Float32 | | | | Uncertainty of retrieved Lambertian component of albedo 0.77 microns |
| albedo_uncert_weak_co2_fph | Retrieval_Array | Float32 | | | | Uncertainty of retrieved Lambertian componet of albedo at 1.615 microns |
| albedo_uncert_strong_co2_fph | Retrieval_Array | Float32 | | | | Uncertainty of retrieved Lambertian component of albedo at 2.06 microns |
| albedo_slope_o2 | Retrieval_Array | Float32 | Centimeters | | | Retrieved spectral dependence of Lambertian component of albedo within ABO2 band |
| albedo_slope_weak_co2 | Retrieval_Array | Float32 | Centimeters | | | Retrieved spectral dependence of Lambertian component of albedo within WCO2 band |
| albedo_slope_strong_co2 | Retrieval_Array | Float32 | Centimeters | | | Retrieved spectral dependence of Lambertian component of albedo within SCO2 band |
| albedo_slope_apriori_o2 | Retrieval_Array | Float32 | Centimeters | | | a priori of retrieved spectral dependence of Lambertian component of albedo within ABO2 band |
| albedo_slope_apriori_weak_co2 | Retrieval_Array | Float32 | Centimeters | | | a priori of retrieved spectral dependence of Lambertian component of albedo within WCO2 band |
| albedo_slope_apriori_strong_co2 | Retrieval_Array | Float32 | Centimeters | | | a priori of spectral dependence of Lambertian component of albedo within SCO2 band |
| albedo_slope_uncert_o2 | Retrieval_Array | Float32 | Centimeters | | | Uncertainty of retrieved spectral dependence of Lambertian component of albedo within ABO2 band |
| albedo_slope_uncert_weak_co2 | Retrieval_Array | Float32 | Centimeters | | | Uncertainty of retrieved spectral dependence of Lambertian component of albedo within WCO2 band |
| albedo_slope_uncert_strong_co2 | Retrieval_Array | Float32 | Centimeters | | | Uncertainty of spectral dependence of Lambertian component of albedo within SCO2 band |
| | | | | | | |
| **Group** | **DispersionResults** | | | | | |
| **Group description** | Dispersion output from L2 Full-physics retrievals | | | | | |
| **Data Element** | **Shape** | **Type** | **Units** | **Minimum value** | **Maximum value** | **Comments** |
| dispersion_offset_o2 | Retrieval_Array | Float64 | Microns | | | Retrieved dispersion offset term in ABO2 band |

| | | | | | | |
|---|---|---|---|---|---|---|
| dispersion_offset_weak_co2 | Retrieval_Array | Float64 | Microns | | | Retrieved dispersion offset term in WCO2 band |
| dispersion_offset_strong_co2 | Retrieval_Array | Float64 | Microns | | | Retrieved dispersion offset term in SCO2 band |
| dispersion_offset_apriori_o2 | Retrieval_Array | Float64 | Microns | | | a priori of retrieved dispersion offset term in ABO2 band |
| dispersion_offset_apriori_weak_co2 | Retrieval_Array | Float64 | Microns | | | a priori of retrieved dispersion offset term in WCO2 band |
| dispersion_offset_apriori_strong_co2 | Retrieval_Array | Float64 | Microns | | | a priori of retrieved dispersion offset term in SCO2 band |
| dispersion_offset_uncert_o2 | Retrieval_Array | Float32 | Microns | | | Uncertainty of retrieved dispersion offset term in ABO2 band |
| dispersion_offset_uncert_weak_co2 | Retrieval_Array | Float32 | Microns | | | Uncertainty of retrieved dispersion offset term in WCO2 band |
| dispersion_offset_uncert_strong_co2 | Retrieval_Array | Float32 | Microns | | | Uncertainty of retrieved dispersion offset term in SCO2 band |
| dispersion_spacing_o2 | Retrieval_Array | Float32 | Microns | | | Retrieved dispersion spacing in ABO2 band |
| dispersion_spacing_weak_co2 | Retrieval_Array | Float32 | Microns | | | Retrieved dispersion spacing in WCO2 band |
| dispersion_spacing_strong_co2 | Retrieval_Array | Float32 | Microns | | | Retrieved dispersion spacing in SCO2 band |
| dispersion_spacing_apriori_o2 | Retrieval_Array | Float32 | Microns | | | a priori of retrieved dispersion spacing in ABO2 band |
| dispersion_spacing_apriori_weak_co2 | Retrieval_Array | Float32 | Microns | | | a priori of retrieved dispersion spacing in WCO2 band |
| dispersion_spacing_apriori_strong_co2 | Retrieval_Array | Float32 | Microns | | | a priori of retrieved dispersion spacing in SCO2 band |
| dispersion_spacing_uncert_o2 | Retrieval_Array | Float32 | Microns | | | Uncertainty of retrieved dispersion spacing in ABO2 band |
| dispersion_spacing_uncert_weak_co2 | Retrieval_Array | Float32 | Microns | | | Uncertainty of retrieved dispersion spacing in WCO2 band |
| dispersion_spacing_uncert_strong_co2 | Retrieval_Array | Float32 | Microns | | | Uncertainty of retrieved dispersion spacing in SCO2 band |
| | | | | | | |
| **Group** | **AerosolResults** | | | | | |
| **Group description** | | | | | | |
| **Data Element** | **Shape** | **Type** | **Units** | **Minimum value** | **Maximum value** | **Comments** |
| aerosol_1_gaussian_log_param | Retrieval_AerosolGaussianLogParam_Array | Float32 | | | | Retrieved gaussian log parameters for aerosol type 1 [total log aod, center pressure/surf-pressure, pressure sigma/surf-pressure] |
| aerosol_1_gaussian_log_param_apriori | Retrieval_AerosolGaussianLogParam_Array | Float32 | | | | a priori of retrieved gaussian log parameters for aerosol type 1 |
| aerosol_1_gaussian_log_param_uncert | Retrieval_AerosolGaussianLogParam_Array | Float32 | | | | Uncertainty of retrieved gaussian log parameters for aerosol type 1 |
| aerosol_2_gaussian_log_param | Retrieval_AerosolGaussianLogParam_Array | Float32 | | | | Retrieved gaussian log parameters of aerosol type 2 [total log aod, center pressure/surf-pressure, pressure sigma/surf-pressure] |
| aerosol_2_gaussian_log_param_apriori | Retrieval_AerosolGaussianLogParam_Array | Float32 | | | | a priori of retrieved gaussian log parameters for aerosol type 2 |
| aerosol_2_gaussian_log_param_uncert | Retrieval_AerosolGaussianLogParam_Array | Float32 | | | | Uncertainty of retrieved gaussian log parameters for aerosol type 2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| aerosol_3_gaussian_log_param | Retrieval_AerosolGaussianLogParam_Array | Float32 | | | | Retrieved gaussian log parameters for aerosol type 3 [total log aod, center pressure/surf-pressure, pressure sigma/surf-pressure] |
| aerosol_3_gaussian_log_param_apriori | Retrieval_AerosolGaussianLogParam_Array | Float32 | | | | a priori of retrieved gaussian log parameters for aerosol type 3 |
| aerosol_3_gaussian_log_param_uncert | Retrieval_AerosolGaussianLogParam_Array | Float32 | | | | Uncertainty of retrieved gaussian log parameters of aerosol type 3 |
| aerosol_4_gaussian_log_param | Retrieval_AerosolGaussianLogParam_Array | Float32 | | | | Retrieved gaussian log parameters for aerosol type 4 [total log aod, center pressure/surf-pressure, pressure sigma/surf-pressure] |
| aerosol_4_gaussian_log_param_apriori | Retrieval_AerosolGaussianLogParam_Array | Float32 | | | | a priori of retrieved gaussian log parameters for aerosol type 4 |
| aerosol_4_gaussian_log_param_uncert | Retrieval_AerosolGaussianLogParam_Array | Float32 | | | | Uncertainty of retrieved gaussian log parameters for aerosol type 4 |
| aerosol_1_aod | Retrieval_Array | Float32 | | | | Retrieved total column-integrated aerosol optical depth for aerosol type 1 |
| aerosol_1_aod_low | Retrieval_Array | Float32 | | | | Retrieved column-integrated aerosol optical depth of aerosol type 1 for pressure levels greater than 80000 Pa |
| aerosol_1_aod_mid | Retrieval_Array | Float32 | | | | Retrieved column-integrated aerosol optical depth of aerosol type 1 for pressure levels between 50,000 and 80,000 Pa |
| aerosol_1_aod_high | Retrieval_Array | Float32 | | | | Retrieved column-integrated aerosol optical depth of aerosol type 1 for pressure levels less than 50,000 Pa |
| aerosol_2_aod | Retrieval_Array | Float32 | | | | Retrieved total column-integrated aerosol optical depth for aerosol type 2 |
| aerosol_2_aod_low | Retrieval_Array | Float32 | | | | Retrieved column-integrated aerosol optical depth of aerosol type 2 for pressure levels greater than 80,000 Pa |
| aerosol_2_aod_mid | Retrieval_Array | Float32 | | | | Retrieved column-integrated aerosol optical depth of aerosol type 2 for pressure levels between 50,000 and 80,000 Pa |
| aerosol_2_aod_high | Retrieval_Array | Float32 | | | | Retrieved column-integrated aerosol optical depth of aerosol type 2 for pressure levels less than 50,000 Pa |
| aerosol_3_aod | Retrieval_Array | Float32 | | | | Retrieved total column-integrated aerosol optical depth for aerosol type 3 |
| aerosol_3_aod_low | Retrieval_Array | Float32 | | | | Retrieved column-integrated aerosol optical depth of aerosol type 3 for pressure levels greater than 80,000 Pa |
| aerosol_3_aod_mid | Retrieval_Array | Float32 | | | | Retrieved column-integrated aerosol optical depth of aerosol type 3 for pressure levels between 50,000 and 80,000 Pa |
| aerosol_3_aod_high | Retrieval_Array | Float32 | | | | Retrieved column-integrated aerosol optical depth of aerosol type 3 for pressure levels less than 50,000 Pa |
| aerosol_4_aod | Retrieval_Array | Float32 | | | | Retrieved total column-integrated aerosol optical depth for aerosol type 4 |
| aerosol_4_aod_low | Retrieval_Array | Float32 | | | | Retrieved column-integrated aerosol optical depth of aerosol type 4 for pressure levels greater than 80,000 Pa |
| aerosol_4_aod_mid | Retrieval_Array | Float32 | | | | Retrieved column-integrated aerosol optical depth of aerosol type 4 for pressure levels between 50,000 and 80,000 Pa |
| aerosol_4_aod_high | Retrieval_Array | Float32 | | | | Retrieved column-integrated aerosol optical depth of aerosol type 4 for pressure levels less than 50,000 Pa |
| aerosol_types | Retrieval_AerosolType_Array | String | | | | Retrieved aerosol type |

| | | | | | | |
|---|---|---|---|---|---|---|
| aerosol_total_aod | Retrieval_Array | Float32 | | | | Retrieved total column-integrated aerosol optical depth for all aerosol types |
| aerosol_total_aod_low | Retrieval_Array | Float32 | | | | Retrieved column-integrated aerosol optical depth for all aerosol types for pressure levels greater than 80,000 Pa |
| aerosol_total_aod_mid | Retrieval_Array | Float32 | | | | Retrieved column-integrated aerosol optical depth for all aerosol types for pressure levels between 50,000 and 80,000 Pa |
| aerosol_total_aod_high | Retrieval_Array | Float32 | | | | Retrieved column-integrated aerosol optical depth for all aerosol types for pressure levels less than 50,000 Pa |
| | | | | | | |
| **Group** | **RetrievedStateVector** | | | | | |
| **Group description** | State vectors generated by L2 Full-physics retrievals | | | | | |
| **Data Element** | **Shape** | **Type** | **Units** | **Minimum value** | **Maximum value** | **Comments** |
| state_vector_names | Retrieval_StateVectorElement_Array | String | | | | Names of elements in retrieved state vector |
| state_vector_result | Retrieval_StateVectorElement_Array | Float32 | | | | Final values of elements in retrieved state vector |
| state_vector_aposteriori_uncert | Retrieval_StateVectorElement_Array | Float32 | | | | Uncertainty of elements in retrieved state vector |
| state_vector_apriori | Retrieval_StateVectorElement_Array | Float32 | | | | a priori values for elements of retrieved state vector |
| state_vector_apriori_uncert | Retrieval_StateVectorElement_Array | Float32 | | | | Uncertainty of elements of a priori state vector |
| | | | | | | |
| **Group** | **SpectralParameters** | | | | | |
| **Group description** | Statistics on the spectral fit | | | | | |
| **Data Element** | **Shape** | **Type** | **Units** | **Minimum value** | **Maximum value** | **Comments** |
| residual_mean_square_o2 | Retrieval_Array | Float32 | Ph sec^{-1} m^{-2} sr^{-1} um^{-1} | | | Mean of the squares of the residuals for the ABO2 band |
| residual_mean_square_weak_co2 | Retrieval_Array | Float32 | Ph sec^{-1} m^{-2} sr^{-1} um^{-1} | | | Mean of the squares of the residuals for the WCO2 band |
| residual_mean_square_strong_co2 | Retrieval_Array | Float32 | Ph sec^{-1} m^{-2} sr^{-1} um^{-1} | | | Mean of the squares of the residuals for the SCO2 band |
| signal_o2_fph | Retrieval_Array | Float32 | Ph sec^{-1} m^{-2} sr^{-1} um^{-1} | | | Aggregate signal in the ABO2 band |
| signal_weak_co2_fph | Retrieval_Array | Float32 | Ph sec^{-1} m^{-2} sr^{-1} um^{-1} | | | Aggregate signal in the WCO2 band |
| signal_strong_co2_fph | Retrieval_Array | Float32 | Ph sec^{-1} m^{-2} sr^{-1} um^{-1} | | | Aggregate signal in the SCO2 band |

| | | | | | | |
|---|---|---|---|---|---|---|
| noise_o2_fph | Retrieval_Array | Float32 | Ph sec^{-1} m^{-2} sr^{-1} um^{-1} | | | Aggregate noise in the ABO2 band |
| noise_weak_co2_fph | Retrieval_Array | Float32 | Ph sec^{-1} m^{-2} sr^{-1} um^{-1} | | | Aggregate noise in the WCO2 band |
| noise_strong_co2_fph | Retrieval_Array | Float32 | Ph sec^{-1} m^{-2} sr^{-1} um^{-1} | | | Aggregate noise in the SCO2 band |
| relative_residual_mean_square_o2 | Retrieval_Array | Float32 | | | | Mean square of the residuals divided by the signal for the ABO2 band |
| relative_residual_mean_square_weak_co2 | Retrieval_Array | Float32 | | | | Mean square of the residuals divided by the signal for the WCO2 band |
| relative_residual_mean_square_strong_co2 | Retrieval_Array | Float32 | | | | Mean square of the residuals divided by the signal for the SCO2 band |
| reduced_chi_squared_o2_fph | Retrieval_Array | Float32 | | | | Reduced chi squared of spectral fit of the ABO2 band |
| reduced_chi_squared_weak_co2_fph | Retrieval_Array | Float32 | | | | Reduced chi squared of spectral fit of the WCO2 band |
| reduced_chi_squared_strong_co2_fph | Retrieval_Array | Float32 | | | | Reduced chi squared of spectral fit of the SCO2 band |
| num_colors | Retrieval_Array | Int32 | | | | The number of spectral colors contributing to the retrieval result |
| num_colors_per_band | Retrieval_Spectrum_Array | Int32 | | | | The number of spectral colors contributing to the retrieval result per spectral region |
| measured_radiance | Retrieval_RetrievalColor_Array | Float32 | Ph sec^{-1} m^{-2} sr^{-1} um^{-1} | | | The measured spectra mapped into the retrieval color grid |
| measured_radiance_uncert | Retrieval_RetrievalColor_Array | Float32 | Ph sec^{-1} m^{-2} sr^{-1} um^{-1} | | | Uncertainty of the measured spectra mapped into the retrieval color grid |
| modeled_radiance | Retrieval_RetrievalColor_Array | Float32 | Ph sec^{-1} m^{-2} sr^{-1} um^{-1} | | | The modeled spectra mapped into the retrieval color grid |
| sample_indexes | Retrieval_RetrievalColor_Array | Int32 | | 1 | 1016 | The 1-based index of the detector sample associated with the radiance |
| wavelength | Retrieval_RetrievalColor_Array | Float32 | Microns | | | The wavelength represented by each point in the retrieval color grid |

## Product Quality Flags

| co2_weak_band_processing_flag_idp<br>co2_strong_band_processing_flag_idp | | cloud_flag | | fluorescence_qual_flag | | outcome_flag | |
|---|---|---|---|---|---|---|---|
| **Value** | **Meaning** | **Value** | **Meaning** | **Value** | **Meaning** | **Value** | **Meaning** |
| 0 | Processing succeeded | -2 | Measurements unusable | 0 | Good | -1 | Packaging failure |
| 1 | Processing failed | -1 | Did not converge | 1 | Bad | -2 | Bad Fill |
| 2 | Processing skipped | 0 | Definitely cloudy | | | 1 | Passed internal quality check |
| | | 1 | Probably cloudy | | | 2 | Failed internal quality check |
| | | 2 | Probably clear | | | 3 | Reached maximum allowed iterations |
| | | 3 | Very clear | | | 4 | Reached maximum allowed divergences |

| packaging_qual_flag | |
|---|---|
| **Value** | |
| 0 | Spare |
| 1 | Spare |
| 2 | 1 = Sounding excluded during sounding selection |
| 3 | 1 = Packaging skipped due to missing L2 Full-physics Algorithm output |
| 4 | 1 = Packaging skipped due to failed validation of L2 Full-physics Algorithm output |
| 5 | 1 = Packaging failed due to error while reading L2 Full-physics Algorithm output |
| 6 | Spare |
| 7 | 1 = Packaging failed due to miscellaneous error in PGE |

| sounding_qual_flag | |
|---|---|
| **Bit** | **Meaning** |
| 0 | 0 = The PGE successfully calculated the sounding position. |
| 1 | 0 = Reported sounding time valid |
| 2 | 0 = Ephemeris data associated with sounding invalid |
| 3 | 0 = Attitude data associated with sounding invalid |
| 4 | 1=Aperture blocked by Cal Door while in Science mode |
| 5-15 | Spare |
| 16 | 0 = The PGE successfully calculated the ABO2 sample radiances for the current sounding. |
| 17 | 0 = The PGE successfully calculated the WCO2 sample radiances for the current sounding. |

| sounding_qual_flag | |
|---|---|
| 18 | 0 = The PGE successfully calculated the SCO2 sample radiances for the current sounding. |
| 19 | 0 = Frame-level engineering data valid |
| 20 | 0 = ABO2 engineering data valid |
| 21 | 0 = WCO2 engineering data valid |
| 22 | 0 = SCO2 engineering data valid |
| 23 | 0 = ABO2 summed offset and multiplier valid |
| 24 | 0 = WCO2 summed offset and multiplier valid |
| 25 | 0 = SCO2 summed offset and multiplier valid |
| 26 | 0 = ABO2 footprint position valid |
| 27 | 0 = WCO2 footprint position valid |
| 28 | 0 = SCO2 footprint position valid |
| 29 | 0 = Radiance for all colors is less than or equal to measureable_signal_max_observed for ABO2 |
| 30 | 0 = Radiance for all colors is less than or equal to measureable_signal_max_observed for WCO2 |
| 31 | 0 = Radiance for all colors is less than or equal to measureable_signal_max_observed for SCO2 |
| 32-63 | Spare |

# OCO-2 Standard Metadata

| Group | Metadata | | | | | |
|---|---|---|---|---|---|---|
| Group description | This table describes the metadata contained in all OCO-2 HDF products. These metadata fields appear in the Metadata group in each of these products. Each product may also contain product-specific fields in that group. | | | | | |
| **Data Element** | **Shape** | **Type** | **Units** | **Minimum value** | **Maximum value** | **Comments** |
| AncillaryDataDescriptors | AncFile_Array | String | | | | The file names of the ancillary data files that were used to generate this product (ancillary data sets include all input files except for the primary input files) |
| BuildId | Scalar | String | | | | The ID of build in which included the software that created this product |
| CollectionLabel | Scalar | String | | | | Label of the data collection containing this product |
| DataFormatType | Scalar | String | | | | 'NCSA HDF' - A character string that describes the internal format of the data product. |
| GapStartTime | Gap_Array | String | | | | The timestamp after which a nonexistent, unnecessary, spurious, questionable, or erroneous data segment begins. Set to 1993-01-01T00:00:00.000Z if no bad segment exists. |
| GapStopTime | Gap_Array | String | | | | The timestamp before which a nonexistent, unnecessary, spurious, questionable, or erroneous data segment ends. Set to 1993-01-01T00:00:00.000Z if no bad segment exists. |
| GranulePointer | Scalar | String | | | | The filename of this product |
| HDFVersionId | Scalar | String | | | | '5.x' - A character string that identifies the version of the HDF (Hierarchical Data Format) software that was used to generate this data file |
| InputPointer | InputPtr_Array | String | | | | A pointer to one or more data granules that provide the major input that was used to generate this product. |
| InstrumentShortName | Scalar | String | | | | 'OCO-2' - The name of the instrument that collected the telemetry data |
| LongName | Scalar | String | | | | A complete descriptive name for the data type of this product |
| PlatformLongName | Scalar | String | | | | 'Orbiting Carbon Observatory 2' |
| PlatformShortName | Scalar | String | | | | 'OCO-2' |
| PlatformType | Scalar | String | | | | 'spacecraft' - The type of platform associated with the instrument which acquires the accompanying data |
| ProcessingLevel | Scalar | String | | | | Indicates data level (Level 0, Level 1A, Level 1B, Level 2) in this product |
| ProducerAgency | Scalar | String | | | | 'NASA' - Identification of the agency that provides the project funding |
| ProducerInstitution | Scalar | String | | | | 'JPL' - Identification of the institution that provides project management. |
| ProductionDateTime | Scalar | String | | | | The date and time at which the product was created (yyyy-mm-ddThh:mm:ss.mmmZ) |
| ProductionLocation | Scalar | String | | | | Facility in which this file was produced, typically: 'Operations Pipeline', 'Operations Pipeline 2', 'Science Computing Facility', 'Test Pipeline', Test Pipeline 2' |
| ProductionLocationCode | Scalar | String | | | | One-letter code indicating the ProductionLocation, typically: ' ' - Operations Pipelines (1) or 2, 's' - Science Computing Facility, 't' - Test Pipelines (1) or 2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| ProjectId | Scalar | String | | | | 'OCO-2' - The project identification string |
| QAGranulePointer | Scalar | String | | | | A pointer to the quality assessment product that was generated with this product |
| RangeBeginningDate | Scalar | String | | | | The date on which the earliest data contained in the product were acquired (yyyy-mm-dd) |
| RangeBeginningTime | Scalar | String | | | | The time at which the earliest data contained in the product were acquired (hh:mm:ss.mmmZ) |
| RangeEndingDate | Scalar | String | | | | The date on which the latest data contained in the product were acquired (yyyy-mm-dd) |
| RangeEndingTime | Scalar | String | | | | The time at which the latest data contained in the product were acquired (hh:mm:ss.mmmZ) |
| ShortName | Scalar | String | | | | The short name identifying the data type of this product |
| SISName | Scalar | String | | | | The name of the document describing the contents of the product |
| SISVersion | Scalar | String | | | | The version of the document describing the contents of the product |
| SizeMBECSDataGranule | Scalar | Float32 | Megabytes | | | The size of this data granule in Megabytes |
| StartOrbitNumber | Scalar | Int32 | | 1 | 99999 | The first orbit on which data contained in the product were acquired |
| StartPathNumber | Scalar | Int32 | | 1 | 233 | The first WRS path on which data contained in the product was collected |
| StopOrbitNumber | Scalar | Int32 | | 1 | 99999 | The last orbit on which data contained in the product were acquired |
| StopPathNumber | Scalar | Int32 | | 1 | 233 | The last WRS path on which data contained in the product was collected |

# 6 Appendix 1: Shape Descriptions

The shape name of a data element is a descriptive label that describes the rank and dimensions of that element.

Rules for creating shapes:

1. Shape names do not include any context information, such as what mode the instrument is in when it takes data with that shape. Any context information needed to distinguish between similarly named dimensions is appended as a label, just before the "_Array" suffix.
2. Any "temporal" dimension, e.g. Frame, is always outermost.
3. If Frame and Sounding are both present, they occur in direct sequence, i.e. Frame_Sounding_.
4. Shapes that include Frame, Sounding, and Spectrum cannot have any additional dimensions.
5. Spectrum precedes all other physical instrument dimensions, except when this rule contradicts any of the above rules.
6. If Spectrum and Sounding are present in the absence of Frame, they occur in direct sequence, i.e., Spectrum_Sounding.
7. Color comes after SinglePixel.
8. SinglePixel comes after Slice.

| Shape | Rank | Max dimension sizes (Units) | Dimensions |
|---|---|---|---|
| AncFile_Array | 1 | 20 (Number of ancillary input files) | AncFile |
| Frame_Sounding_Array | 2 | 10512 (Frames) x 8 (Soundings) | Frame, Sounding |
| Gap_Array | 1 | 10 (Number of gaps) | Gap |
| InputPtr_Array | 1 | 20 (Number of primary input files) | InputFile |
| L2FullPhysicsInputPtr_Array | 1 | 20 (Number of primary input files) | L2FullPhysicsInputPtr |
| OrbitParamPtr_Array | 1 | 16 (Attitude and ephemeris files) | OrbitFile |
| Retrieval_AerosolGaussianLogParam_Array | 2 | 37008 (Retrievals) x 3 (Parameters) | Retrieval, AerosolGaussianLogParam |
| Retrieval_AerosolType_Array | 2 | 37008 (Retrievals) x 4 (Types) | Retrieval, AerosolType |
| Retrieval_AlbedoWavelength_Array | 2 | 37008 (Retrievals) x 2 (Wavelengths) | Retrieval, AlbedoWavelength |
| Retrieval_Array | 1 | 37008 (Retrievals) | Retrieval |
| Retrieval_ECMWFLevel_Array | 2 | 37008 (Retrievals) x 137 (Atmospheric Levels) | Retrieval, ECMWFLevel |
| Retrieval_Layer_Array | 2 | 37008 (Retrievals) x 20 (Layers) | Retrieval, Layer |
| Retrieval_Level_Array | 2 | 37008 (Retrievals) x 12 (Atmospheric levels) | Retrieval, Level |
| Retrieval_Level_Level_Array | 3 | 37008 (Retrievals) x 12 (Atmospheric levels) x 12 (Atmospheric levels) | Retrieval, Level, Level |
| Retrieval_RetrievalColor_Array | 2 | 37008 (Retrievals) x 3048 (Spectral Pixels) | Retrieval, RetrievalColor |
| Retrieval_Spectrum_Array | 2 | 37008 (Retrievals) x 3 (Spectrometers) | Retrieval, Spectrum |
| Retrieval_Spectrum_Vertex_Array | 4 | 37008 (Retrievals) x 3 (Spectrometers) x 4 (Vertices) | Retrieval, Spectrum, Vertex |
| Retrieval_StateVectorElement_Array | 2 | 37008 (Retrievals) x 100 (State vector elements) | Retrieval, StateVectorElement |
| Retrieval_StateVectorElement_StateVectorElement_Array | 3 | 37008 (Retrievals) x 100 (State vector elements) x 100 (State vector elements) | Retrieval, StateVectorElement, StateVectorElement |
| SoundingPosition_Array | 1 | 8 (Maximum number of footprints) | SoundingPosition |
| Spectrum_Array | 1 | 3 (Spectrometers) | Spectrum |

# 7 Appendix 2: Acronyms

| | |
|---|---|
| AOD | Aerosol Optical Depth |
| APID | Application Process Identifier |
| ASCII | American Standard Code for Information Interchange |
| ASD | Algorithm Specification Document |
| ATBD | Algorithm Theoretical Basis Document |
| $CO_2$ | Carbon Dioxide |
| DAAC | Distributed Active Archive Center |
| DOORS | Dynamic Object Oriented Requirements |
| ECHO | Earth observing system Clearing HOuse - The NASA-developed spatial and temporal metadata registry |
| ECMWF | European Center for Medium-range Weather Forecast |
| EDOS | EOS Data and Operations System |
| EOS | Earth Observing System |
| GES DISC | Goddard Earth Sciences Data and Information Services Center |
| HDF | Hierarchical Data Format |
| HECC | High-end Computing Capability |
| ICD | Interface Control Document |
| IMAP-DOAS | Iterative Maximum *A Posteriori* Differential Optical Absorption Spectroscopy |
| IOC | In-Orbit Checkout |
| ITAR | International Traffic in Arms Regulations |
| MOS | Mission Operations System |
| MOU | Memorandum of Understanding |
| NAS | NASA Advanced Supercomputing |
| NASA | National Aeronautics and Space Administration |
| $O_2$ | Oxygen |
| OCO | Orbiting Carbon Observatory |
| PGE | Product Generation Executable |
| SCF | Science Computing Facility |
| SDOS | Science Data Operations System |
| SIS | Software Interface Specification |
| SP4A | Simple, Scalable Script-based Science Processor Archive |
| TBD | To Be Determined |
| TCCON | Total Carbon Column Observing Network |
| UTC | Coordinated Universal Time |
| $X_{CO2}$ | Column-averaged dry air mole fraction of atmospheric $CO_2$ |