Royal Netherlands
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TROPOS

Freie Universität Berlin

Product Definition Document (PDD)

Product *A-TC*
Product format version *11.5*

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Reference ***A-PRO_A-TC_PDD***
Issue ***11***
Revision ***5***
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CHANGE LOG

Reason for change	Author	Issue	Revision	Date
Update for 11.5. Addition of met info. Removal of "*_no_error" variables.	D.D.	11	5	17-07-2025
Added Geoid_offset and new frame margin related config variables.	D.D.	11	3	29-03-2024
Updates to address product convention issues	D..D	11	2	06-12-2023
Update to address issues with AR-D	D.D.	11	1	20-11-2023
Update to V11	D.D.	11	0	13-10-2023
Fix to missed issues highlighted in re-opened [ECL2-1201] Jan 28, 2023	D.D.	10	2.2	30-01-2023
Fixed errors in product version in dumps and table	D.D.	10	2.1	27-01-2023
Fixes to finally address all issues raised in [ECL2-1201] and renamed data_quality_flag to extended_data_quality_index ➔product version 10.2	D.D.	10	2	18-01-2023
Med ➔ medium	D.D.	10	1	01-01-2023
V10.0 [ECL2-1177] fixed	D.D	10	0	17-05-2022
V9.1 -Fixed issues related to ECL2-1154, ECL2-1150	D.D.	9	1	12-11-2021
Update for V9.0 Common quality_status added to product	D.D.	9	0	07-09-2021
Addressed [ECAPRIL-336] Low and medium resolution averaging intervals added to the product.	D.D.	8	1	12-03-2021
Update for V8.0	D.D.	8	0	10-01-2021
Update for V7.1	D.D.	7	1	30-07-2020
Update for V7.0	D.D.	7	0	04-06-2020
Update for V6.1 (class attributes fixed)	D.D.	6	1	20-01-2020
Updates for AR6	D.D	6	0	20-06-2019
Updates for AR5	D.D	5	0	22-11-2018
Updates for AR4	D.D	4	**0**	25-11-2017
Updating PDD for software version 3	GJvZ	3	1	25-09-2017
Modification in preparation for TRR2	D.D.	2	9	17-07-2017
Modifications for AR2	D.Da.	2	0	21-02-2017
Modifications after introducing GMV libraries	D Da	1	9	02-12-2016
Incorporation of feedback from AR1	D Da	1	1	27-05-2016
Incorporation of feedback from PM3	GJvZ	0	4	29-10-2015
Incorporation of feedback from RR	DD	0	3	20-08-2015
	DD	0	2	17-03-2015
Version delivered at RR APRIL, based on ATLAS version	GJvZ	0	1	17-03-2015

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1 PURPOSE AND SCOPE

This document provides the format description for EarthCARE data product ATLID-Target classification (A-TC) containing the ATLID stand-alone target classification product at the joint standard grid resolution (horizontal approx. 1-km and vertical approx. 100 m).

2 APPLICABLE AND REFERENCE DOCUMENTS

2.1 Applicable documents

Applicable Documents	
[AD1]	ATLID-Profiles ATBD, A-PRO_ATBD issue 8.1, Mar. 2021

2.2 Reference documents

Keyword	Reference
[RD1]	Earth Observation Ground Segment File Format Standard, PE-TN-ESA-GS-0001, issue 2.0, 3 May 2012
[RD2]	Tailoring of the Earth Observation File Format Standard for the EarthCARE Ground Segment, EC-TN-ESA-GS-0218, issue 3, 20 Sep 2013
[RD3]	EarthCARE Product Definitions, Vol. 1: Common Product Definitions, EC.ICD.ASD.SY.00005, issue 8
[RD4]	EC.TN.ESA.SYS.0380_06.00_EarthCARE Production Model_02-03-2017
[RD5]	EC.ICD.ESA.SYS.0314_04.00_EarthCARE ESA Product List_02-03-2017
[RD6]	ATL L1 Product Definitions Volume A : Nominal Products (PDD), EC.ICD.GMV.ATL.0001_02.05, 26 Oct 2018.
[RD7]	X-MET L1d PDD, pdd-vol8-X-MET-issue-4-20150807 , issue 4, 07-08-2015
[RD8]	X-JSG L1d PDD EarthCARE product definitions. Volume 9: Joint Standard Grid (X-JSG) , issue 2, 07-08-2015
[RD9]	ATLID Featuremask Product Definition Document, A-FM_PDD issue 11, Oct. 2023
[RD10]	ATLID Extinction, backscatter and depolarization (A-EBD) Product Definition Document, A-EBD_PDD issue 11, Oct 2023.

3 PRODUCT OVERVIEW

This algorithm will produce the detection of targets and the classification of these targets into physically distinct classes (ice cloud, water cloud, aerosol type). The classification product is useful in its own right (for, i.e. model evaluation activities, radiative transfer application etc.) provides important inputs to other L2a and L2b algorithms such as the synergetic Lidar+Radar+MSI Target classification algorithm [ACM-TC-ATBD], the L2a High-Resolution Extinction algorithm [A-PRO-ATBD] and the L2b Lidar+Radar+MSI extinction and particle size algorithm [ACM-CAP]

The product will be defined on the JSG (i.e. horizontal resolution of approx. 1km and approx. 100 meters vertically) and is coupled directly to the A-EBD product. The target classification data associated with A-AER is provided within the A-AER product itself.

4 INPUT LIST

This product is created within the A-PRO processor using the following inputs:

- X-JSG [RD 8]
- The Ancillary datasets from X-MET: Temperature (ECMWF Field Code 130), Relative humidity (ECMWF Field Code 157), Height, Wet Bulb Temperature, Tropopause Height, Surface Altitude [RD 7].
- L1b A-NOM [RD 6]
- L2a A-FM [RD 9]

5 PRODUCT CHARACTERISTICS

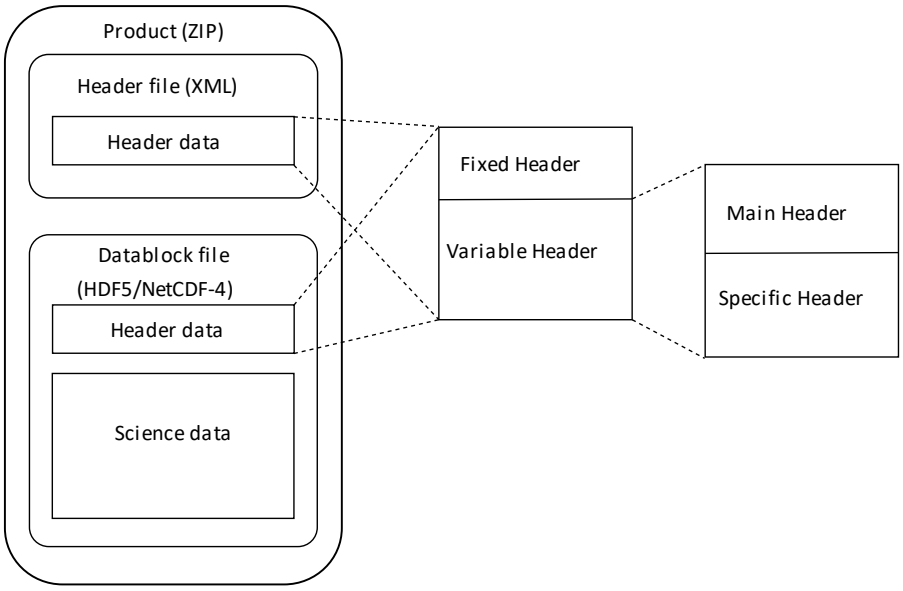
5.1 Overview

Identifier	***A-TC***	
Descriptive name	ATLID Target Classification	
Product level	2a	
File name pattern	ECA_EXAA_ATL_TC__2A_yyyymmddThhmmssZ_ yyyymmddThhmmssZ_ooooF	
Format version	11.5	
Software version	11.5	
Metaformat	NetCDF4/HDF5. Versions and use of internal compression TBC	
Granularity	1 frame (= 1/8 orbit) per file	
Frame margin	Variable (but on the order of 100km)	
File size	23 MB without compression	
	Horizontal 5000 profiles	vertical 241 samples
Spatial extent	N/A km across-track	0.1 km to 30 km
Spatial sampling	JSG native, (approx. 1 km)	JSG native, (approx. 100 m).
Spatial resolution	Variable (1-150km)	JSG native, (approx. 100 m).
Data volume per day	3.0 GB without compression	

6 PRODUCT FORMAT

6.1 Overview

The product format follows the conventions in [AD1], [AD2] and [AD3]. In particular, each product consists of two files, a NetCDF4/HDF5 data block file and an XML header file, packaged into a zip archive (zip without compression). For convenience, a copy of the header data is provided in the data block file as well. These header parameters are defined in [AD3] and in section 6.2.1 below. They should not be confused with headers internally generated by HDF5/NetCDF-4 for describing the file structure.



Below the overall structure of the data block file is shown. The hierarchical structure is reflected in the XML header file by nesting of XML tags (see [AD3]).

Element			**Format reference**
Header data	Fixed Header		[AD3]
	Variable Header	Main Product Header	[AD3]
		Specific Product Header	this doc, section 6.2.1
Science data			this doc, section 6.2.2

6.2 Detailed format

This shows the full product format in tabular form, listing groups and variables with their names, units, dimensions, data types, and descriptions. The table is preceded by a definition of the dimensions used.
Only the specific product header and science data are defined here. Refer to [AD3] for the definitions of fixed and main product header.

Dimensions:

Dimension	Description	Number of elements (exact/*typical*)
along_track	Horizontal grid points	*5000*
JSG_height	Vertical levels	241
class	Number of retrievable aerosol classification types	7
strlen	Maximum length of string variables	32

6.2.1 Specific Product Header

The variables contained in the specific product are defined by a verbatim copy of the xml configuration file used to generate the product. The configuration file parameters are described in detail within the A-PRO ATBD.

6.2.2 Science Data

Variable	Symbol	Description	Unit	Dim	type
time	t	seconds since 2000-1-1 00:00:00.0 0:00	s	along_track	double
joint_standard_grid_ index	i_{jsg}	X_JSG pixel	-	along_track	integer
medium_resolution _number_of_joint_ standard_pixels		Medium resolution data is boxcar smoothed over this horizontal resolution	JSG-pixels	Scalar	short-integer
low_resolution_number_of_joint_standard_grid_pixels		Low resolution data is boxcar smoothed over this horizontal resolution	JSG-Pixels	Scalar	short-integer
latitude	Lat	Latitude of co-located ATLID footprints at the JSG colocation altitude	degrees _east	along_track	double
longitude	Lon	Longitude of co-located ATLID footprints at the JSG co-location altitude	degress north	along_track	double
height	z	Altitude of pixel center in meters above WGS84 ellipsoid	m	along_track JSG_height	float
geoid_offset		Difference between geoid and ellipsoid	m	along_track	float
range	-	Range from lidar	m	along_track JSG_height	float
elevation	-	Terrain elevation for the pixel centre in meters above WGS84 ellipsoid	m	along_track	float
viewing_ elevation_ angle	-	Altitude of pixel centre in meters above WGS84 ellipsoid	degree	along_track	float
quality_status	QS	0: Good: Nominal 1: Likely Good, but possibly degraded or low SNR 2: Likely Bad 3. Bad or unusable retrieval (e.g. lidar signals effectively completely attenuated) 4: Missing of bad L1 data"	-	along_track JSG_height	byte
mie_detection_	-	-3: missing data	1	along_track	byte

status		-2: surface or below -1: attenuated region 0: clear sky 1: liquid cloud or aerosol targets		JSG_height	
rayleigh_ detection_ status	-	-3: missing data -2: surface or below -1: attenuated region 1: ray not attenuated	1	along_track JSG_height	byte
tropopause_ height		Tropopause height used in classification	m	along_track,	float
temperature	-	temperature	k	along_track, JSG_height	float
pressure		pressure	Pa	along_track, JSG_height	float
relative_humidity		Relative humidity	1	along_track, JSG_height	float
classification	-	-3: Missing Data -2: Surface or sub-surface -1: Noise in both Mie and Ray Channels 0: Clear 1: (Warm) Liquid Cloud 2: (Supercooled) Liquid Cloud 3: Ice Cloud 10 : Dust 11 : Sea_salt 12 :Continental_Pollution 13 : Smoke 14 : Dusty_smoke 15 : Dusty_mix 20 : STS 21 : NAT 22 : Stratospheric Ice 25 : Stratospheric_Ash 26 : Stratospheric_Sulfate 27 : Stratospheric_Smoke 101: Unknown: Aerosol Target has a very low probability (no class assigned) 102: Unknown: Aerosol classification outside of param space 104: Unknown: Strat. Aerosol Target has a very low probability (no class assigned) 105: Unknown: Strat.		along_track JSG_height	byte

		Aerosol classification outside of param space 106: Unknown: PSC Target has a very low probability (no class assigned) 107: Unknown: PSC classification outside of param space			
classification_medium_ resolution	-	Same as Classification	1	along_track JSG_height	byte
classification_low_ resolution	-	Same as Classification	1	along_track JSG_height	byte
simple_ classification	-	-3: Missing data -2: Surface -1: BOTH Mie and Ray Attenuated 0: Clear 1: liquid cloud 2: ice cloud 3: aerosol 4:Stratospheric cloud 5:Stratospheric aerosol	1	along_track JSG_height	byte
aerosol_classes		2-D character array of aerosol types. e.g. 1: Dust 2: Sea_salt 3: Continental_Pollution 4: Smoke 5: Dusty_smoke 6: Dusty_mix 7: Thin ice		strlen,class	char
aerosol_ classification_probs	-	Calculated probabilities accounting for error estimates in S and Depol 0: Not aerosol 1 : Dust 2 : Sea_salt 3 : Continental_Pollution 4 : Smoke 5 : Dusty_smoke 6 : Dusty_mix 7 : Ice	%	along_track JSG_height class	byte
aerosol_ classification_prob_medium_resolution	-	Same as above.	%	along_track JSG_height class	byte

aerosol_ classification_prob low_resolution	-	Same as above.	%	along_track JSG_height class	byte
extended_data_qua lity_status	-	0: Good: Nominal 1: Good: No layers detected 2: OE routine did not converge 100: Warning: Maximum number of layers reached 102: OE routine did not converge and Maximum number of layers reached 200: Level-1 data missing or bad	-	along_track JSG_height	byte

The "Symbol" refers to the symbol used in the algorithm mathematical description in the ATBD.

Note on horizontal resolution:

"Medium" resolution is usually on the order of 41 JSG horizontal pixels.
"Low" resolution is usually on the order of 151 JSG horizontal pixels.

The number of JSG pixels associated with the "Medium" and "Low" resolution are controlled by the **medium_resolution_number_of_joint_standard_grid_pixels** and **low_resolution_number_of_joint_standard_grid_pixels** configuration parameters [AD1]. The exact number of pixels used is reported in the **comment attribute** of each "Medium" and "Low" resolution data variable.

6.2.3 Note regarding the quality_status, gaps and fill values

This product is output in the JSG grid so "gaps" are mainly filled. Very uncommonly (due to e.g. numerical round-off issues or L1 data issues) there may be a JSG column defined but no lidar column assigned. In this case, the **quality_status** will report the data as missing and NetCDF fill values will be present. More information on the **quality_status** variable can be found in the in the A-EBD PDD [RD10].

In addition, if no valid lidar data is present in a given JSG column then both the **rayleigh_detection_status** and **mie_detection_status** variables are set to -3. If a retrieval has not been applied to a given column the **number_of_layers** for this column will be set to 0.

6.3 Datablock file example (CDL header)

This shows the structure (declarations of dimensions, variables, attributes, groups, and types) of the datablock file in network Common Data form Language (CDL) as produced by running the command `ncdump -h` on an example data product file.

```
netcdf ECA_EXAA_ATL_TC__2A_20250612T034848Z_20250717T120413Z_05900E {

// global attributes:
                        string :Conventions = "CF-1.6" ;
                        string :title = "" ;
                        string :history = "" ;

group: HeaderData {

 group: FixedProductHeader {
  variables:
            string File_Name ;
            string File_Description ;
            string Notes ;
            string Mission ;
            string File_Class ;
            string File_Type ;
            string File_Version ;

   group: Source {
    variables:
            string System ;
            string Creator ;
            string Creator_Version ;
            string Creation_Date ;
    } // group Source

   group: Validity_Period {
    variables:
            string Validity_Start ;
            string Validity_Stop ;
    } // group Validity_Period
  } // group FixedProductHeader

 group: VariableProductHeader {

   group: MainProductHeader {
    variables:
            string productName ;
            string originalProductName ;
            string missionID ;
            string fileClass ;
            string fileCategory ;
            string productType ;
            string productLevel ;
            string sensingStartTime ;
            string sensingStopTime ;
            byte degradedProductQualityFlag ;
            string description ;
            string processorName ;
            short processorMajorVersion ;
            short processorMinorVersion ;
            short executableMajorVersion ;
            short executableMinorVersion ;
            short formatMajorVersion ;
            short formatMinorVersion ;
```

```
            byte subsettedProduct ;
            string acquisitionStation ;
            string processingCentre ;
            string processingStartTime ;
            string processingStopTime ;
            uint orbitNumber ;
            string frameID ;
            string ANXTime ;
            double ANXLongitude ;
            string stateVectorSource ;
            string stateVectorTime ;
            double xPosition ;
            double yPosition ;
            double zPosition ;
            double xVelocity ;
            double yVelocity ;
            double zVelocity ;
            double orbitSemiMajorAxis ;
            double orbitEccentricity ;
            double orbitInclination ;
            double perigeeArgument ;
            double rightAscension ;
            double meanAnomaly ;
            string frameStartTime ;
            string frameStopTime ;
            double frameStartMargin ;
            double frameStopMargin ;

     group: frameStartCoordinates {
      variables:
            float geographicLatitude ;
            float geographicLongitude ;
      } // group frameStartCoordinates

     group: frameStopCoordinates {
      variables:
            float geographicLatitude ;
            float geographicLongitude ;
      } // group frameStopCoordinates
     } // group MainProductHeader

    group: SpecificProductHeader {
     variables:
            string InputFileList ;
            string ConfigurationParameters ;

     group: QualityStatistics {
      } // group QualityStatistics
     } // group SpecificProductHeader
    } // group VariableProductHeader
  } // group HeaderData

group: ScienceData {
  dimensions:
            along_track = 5063 ;
            JSG_height = 242 ;
            class = 7 ;
            strlen = 32 ;
  variables:
            short medium_resolution_number_of_joint_standard_grid_pixels ;
                  medium_resolution_number_of_joint_standard_grid_pixels:units = "1" ;
                  medium_resolution_number_of_joint_standard_grid_pixels:long_name                    =
"medium_resolution_number_of_joint_standard_grid_pixels" ;
```

medium_resolution_number_of_joint_standard_grid_pixels:comment = "Medium resolution data is boxcar smoothed over this horizontal resolution" ;
medium_resolution_number_of_joint_standard_grid_pixels:_FillValue = -32767s ;
short low_resolution_number_of_joint_standard_grid_pixels ;
low_resolution_number_of_joint_standard_grid_pixels:units = "1" ;
low_resolution_number_of_joint_standard_grid_pixels:long_name = "low_resolution_number_of_joint_standard_grid_pixels" ;
low_resolution_number_of_joint_standard_grid_pixels:comment = "Low resolution data is boxcar smoothed over this horizontal resolution" ;
low_resolution_number_of_joint_standard_grid_pixels:_FillValue = -32767s ;
int joint_standard_grid_index(along_track) ;
joint_standard_grid_index:units = "1" ;
joint_standard_grid_index:long_name = "Joint standard grid index" ;
joint_standard_grid_index:comment = "JSG Pixel Index" ;
joint_standard_grid_index:_FillValue = -2147483647 ;
double latitude(along_track) ;
latitude:units = "degree_north" ;
latitude:long_name = "Latitude" ;
latitude:comment = "Latitudes of the pixel centres [-90,90]" ;
latitude:_FillValue = 9.96920996838687e+36 ;
double longitude(along_track) ;
longitude:units = "degree_east" ;
longitude:long_name = "Longitude" ;
longitude:comment = "Longitudes of the pixel centres [-180,180]" ;
longitude:_FillValue = 9.96920996838687e+36 ;
double time(along_track) ;
time:units = "seconds since 2000-1-1 00:00:00.0 0:00" ;
time:long_name = "Time" ;
time:_FillValue = 9.96920996838687e+36 ;
float height(along_track, JSG_height) ;
height:units = "m" ;
height:long_name = "Height" ;
height:comment = "Altitude of pixel centre in meters above WGS84 ellipsoid" ;
height:_FillValue = 9.96921e+36f ;
float range(along_track, JSG_height) ;
range:units = "m" ;
range:long_name = "Range from lidar" ;
range:_FillValue = 9.96921e+36f ;
float viewing_elevation_angle(along_track) ;
viewing_elevation_angle:units = "degree" ;
viewing_elevation_angle:long_name = "Viewing elevation angle" ;
viewing_elevation_angle:_FillValue = 9.96921e+36f ;
float elevation(along_track) ;
elevation:units = "m" ;
elevation:long_name = "Terrain elevation" ;
elevation:comment = "Terrain elevation for the pixel centre in meters above WGS84 ellipsoid" ;
elevation:_FillValue = 9.96921e+36f ;
float tropopause_height(along_track) ;
tropopause_height:units = "m" ;
tropopause_height:long_name = "Tropopause height" ;
tropopause_height:comment = "The value is taken from the input X-met file" ;
tropopause_height:_FillValue = 9.96921e+36f ;
float geoid_offset(along_track) ;
geoid_offset:units = "m" ;
geoid_offset:long_name = "Geoid_offset" ;
geoid_offset:comment = "Height of the geoid above WGS84 ellipsoid" ;
geoid_offset:_FillValue = 9.96921e+36f ;
byte simple_classification(along_track, JSG_height) ;
simple_classification:units = "1" ;
simple_classification:long_name = "Simple Classification" ;
simple_classification:comment = "Simplified version for quick cloud/aerosol discrimination" ;

simple_classification:definition = "-3: Missing data \n\t-2: Surface \n\t-1: BOTH Mie and Ray Attenuated\n\t 0: Clear \n\t 1: liquid cloud \n\t 2: ice cloud \n\t 3: aerosol \n\t 4: stratospheric cloud \n\t 5: stratospheric aerosol \n" ;
simple_classification:_FillValue = -127b ;
byte mie_detection_status(along_track, JSG_height) ;
mie_detection_status:units = "1" ;
mie_detection_status:long_name = "Mie channel detection status" ;
mie_detection_status:definition = "-3: missing data \n\t-2: surface or below \n\t-1: attenuated region \n\t 0: clear sky \n\t 1: cloud or aerosol target present \n" ;
mie_detection_status:_FillValue = -127b ;
byte rayleigh_detection_status(along_track, JSG_height) ;
rayleigh_detection_status:units = "1" ;
rayleigh_detection_status:long_name = "Ray channel detection status" ;
rayleigh_detection_status:definition = "-3: missing data \n\t-2: surface or below \n\t-1: attenuated region \n\t 1: ray not attenuated \n" ;
rayleigh_detection_status:_FillValue = -127b ;
byte extended_data_quality_status(along_track, JSG_height) ;
extended_data_quality_status:units = "1" ;
extended_data_quality_status:long_name = "Extended Quality Status" ;
extended_data_quality_status:comment = "A-TC Extended Quality Status" ;
extended_data_quality_status:definition = "0: Good: Nominal \n\t1: Good: No layers detected \n\t2: OE routine did not converge\n\t100: Warning: Maximum number of layer reached\n\t102: OE routine did not converge and Maximum number of layer reached\n\t200: Level-1 data missing or bad\n" ;
extended_data_quality_status:_FillValue = -127b ;
byte quality_status(along_track, JSG_height) ;
quality_status:units = "1" ;
quality_status:long_name = "Quality Status" ;
quality_status:comment = "ATC Quality Status" ;
quality_status:definition = "0: Good: Nominal \n\t1: Likely Good, but possibly degraded or low SNR\n\t2: Likely Bad\n\t3: Bad or unusable retrieval (e.g. lidar signals effectively completely attenuated)\n\t4: Missing or bad L1 data" ;
quality_status:_FillValue = -127b ;
char aerosol_classes(class, strlen) ;
aerosol_classes:units = "1" ;
aerosol_classes:long_name = "Aerosol Classes" ;
aerosol_classes:comment = "Thin ice is included here as a special aerosol type" ;
aerosol_classes:definition = "Aerosol Classes" ;
byte aerosol_classification_prob(along_track, JSG_height, class) ;
aerosol_classification_prob:units = "10-2" ;
aerosol_classification_prob:long_name = "Aerosol classification probabilities" ;
aerosol_classification_prob:comment = "1 : Dust\n\t 2 : Sea_salt\n\t 3 : Continental_Pollution\n\t 4 : Smoke\n\t 5 : Dusty_smoke\n\t 6 : Dusty_mix\n\t 7 : Ice\n\t0: Not aerosol\n\t-1: Aerosol target has a very low probability (no class)\n\t-2: Aerosol classification outside of parameter space" ;
aerosol_classification_prob:definition = "Calculated probabilities derived taking error estimates into account" ;
aerosol_classification_prob:_FillValue = -127b ;
byte aerosol_classification_prob_medium_resolution(along_track, JSG_height, class) ;
aerosol_classification_prob_medium_resolution:units = "10-2" ;
aerosol_classification_prob_medium_resolution:long_name = "Aerosol classification probabilities (Medium hor. resolution)" ;
aerosol_classification_prob_medium_resolution:comment = "1 : Dust\n\t 2 : Sea_salt\n\t 3 : Continental_Pollution\n\t 4 : Smoke\n\t 5 : Dusty_smoke\n\t 6 : Dusty_mix\n\t 7 : Ice\n\t0: Not aerosol\n\t-1: Aerosol target has a very low probability (no class)\n\t-2: Aerosol classification outside of parameter space" ;
aerosol_classification_prob_medium_resolution:definition = "Calculated probabilities derived taking error estimates into account Medium resolution is 11 horizontal JSG pixels" ;
aerosol_classification_prob_medium_resolution:_FillValue = -127b ;
byte aerosol_classification_prob_low_resolution(along_track, JSG_height, class) ;
aerosol_classification_prob_low_resolution:units = "10-2" ;
aerosol_classification_prob_low_resolution:long_name = "Aerosol classification probabilities (Low hor. resolution)" ;
aerosol_classification_prob_low_resolution:comment = "1 : Dust\n\t 2 : Sea_salt\n\t 3 : Continental_Pollution\n\t 4 : Smoke\n\t 5 : Dusty_smoke\n\t 6 : Dusty_mix\n\t 7 : Ice\n\t0: Not aerosol\n\t-1: Aerosol target has a very low probability (no class)\n\t-2: Aerosol classification outside of parameter space" ;

aerosol_classification_prob_low_resolution:definition = "Calculated probabilities derived taking error estimates into account Low resolution is 101 horizontal JSG pixels" ;
aerosol_classification_prob_low_resolution:_FillValue = -127b ;
byte classification(along_track, JSG_height) ;
classification:units = "1" ;
classification:long_name = "Combined cloud/aerosol target classification" ;
classification:definition = "-3: Missing Data\n\t-2: Surface or sub-surface\n\t-1: Noise in both Mie and Ray Channels\n\t 0: Clear\n\t 1: (Warm) Liquid Cloud\n\t 2: (Supercooled) Liquid Cloud\n\t 3: Ice Cloud\n\t10 : Dust\n\t11 : Sea_salt\n\t12 : Continental_Pollution\n\t13 : Smoke\n\t14 : Dusty_smoke\n\t15 : Dusty_mix\n\t20 : STS\n\t21 : NAT\n\t22 : Stratospheric Ice\n\t25 : Stratospheric_Ash\n\t26 : Stratospheric_Sulfate\n\t27 : Stratospheric_Smoke\n\t101: Unknown: Aerosol Target has a very low probability (no class assigned)\n\t102:103: Unknown: Aerosol classification outside of param space\n\t104: Unknown: Strat. Aerosol Target has a very low probability (no class assigned)\n\t105: Unknown: Strat. Aerosol classification outside of param space\n\t106: Unknown: PSC Target has a very low probability (no class assigned)\n\t107: Unknown: PSC classification outside of param space" ;
classification:_FillValue = -127b ;
byte classification_medium_resolution(along_track, JSG_height) ;
classification_medium_resolution:units = "1" ;
classification_medium_resolution:long_name = "Medium horizontal resolution combined cloud/aerosol target classification" ;
classification_medium_resolution:comment = "Medium resolution is 11 horizontal JSG pixels" ;
classification_medium_resolution:definition = "-3: Missing Data\n\t-2: Surface or sub-surface\n\t-1: Noise in both Mie and Ray Channels\n\t 0: Clear\n\t 1: (Warm) Liquid Cloud\n\t 2: (Supercooled) Liquid Cloud\n\t 3: Ice Cloud\n\t10 : Dust\n\t11 : Sea_salt\n\t12 : Continental_Pollution\n\t13 : Smoke\n\t14 : Dusty_smoke\n\t15 : Dusty_mix\n\t20 : STS\n\t21 : NAT\n\t22 : Stratospheric Ice\n\t25 : Stratospheric_Ash\n\t26 : Stratospheric_Sulfate\n\t27 : Stratospheric_Smoke\n\t101: Unknown: Aerosol Target has a very low probability (no class assigned)\n\t102:103: Unknown: Aerosol classification outside of param space\n\t104: Unknown: Strat. Aerosol Target has a very low probability (no class assigned)\n\t105: Unknown: Strat. Aerosol classification outside of param space\n\t106: Unknown: PSC Target has a very low probability (no class assigned)\n\t107: Unknown: PSC classification outside of param space" ;
classification_medium_resolution:_FillValue = -127b ;
byte classification_low_resolution(along_track, JSG_height) ;
classification_low_resolution:units = "1" ;
classification_low_resolution:long_name = "Low horizontal resolution combined cloud/aerosol target classification" ;
classification_low_resolution:comment = "Low resolution is 101 horizontal JSG pixels" ;
classification_low_resolution:definition = "-3: Missing Data\n\t-2: Surface or sub-surface\n\t-1: Noise in both Mie and Ray Channels\n\t 0: Clear\n\t 1: (Warm) Liquid Cloud\n\t 2: (Supercooled) Liquid Cloud\n\t 3: Ice Cloud\n\t10 : Dust\n\t11 : Sea_salt\n\t12 : Continental_Pollution\n\t13 : Smoke\n\t14 : Dusty_smoke\n\t15 : Dusty_mix\n\t20 : STS\n\t21 : NAT\n\t22 : Stratospheric Ice\n\t25 : Stratospheric_Ash\n\t26 : Stratospheric_Sulfate\n\t27 : Stratospheric_Smoke\n\t101: Unknown: Aerosol Target has a very low probability (no class assigned)\n\t102:103: Unknown: Aerosol classification outside of param space\n\t104: Unknown: Strat. Aerosol Target has a very low probability (no class assigned)\n\t105: Unknown: Strat. Aerosol classification outside of param space\n\t106: Unknown: PSC Target has a very low probability (no class assigned)\n\t107: Unknown: PSC classification outside of param space" ;
classification_low_resolution:_FillValue = -127b ;
float temperature(along_track, JSG_height) ;
temperature:units = "K" ;
temperature:long_name = "" ;
temperature:comment = "From X-MET" ;
temperature:definition = "temperature" ;
temperature:_FillValue = 9.96921e+36f ;
float pressure(along_track, JSG_height) ;
pressure:units = "Pa" ;
pressure:long_name = "" ;
pressure:comment = "From X-MET" ;
pressure:definition = "pressure" ;
pressure:_FillValue = 9.96921e+36f ;
float relative_humidity(along_track, JSG_height) ;
relative_humidity:units = "1" ;
relative_humidity:long_name = "" ;
relative_humidity:comment = "FROM X-MET" ;
relative_humidity:definition = "Relative Humidity as value 0-1" ;
relative_humidity:_FillValue = 9.96921e+36f ;

```
 } // group ScienceData
}
```

6.4 Header file example (XML)

This example corresponds to the same example used in the last section.

```
<?xml version="1.0" encoding="UTF-8" standalone="no" ?>
<Earth_Explorer_Header xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">

 <Fixed_Header>
  <File_Name>ECA_EXAA_ATL_TC__2A_20250612T034848Z_20250717T120413Z_05900E</File_Name>
  <File_Description></File_Description>
  <Notes>Test Notes</Notes>
  <Mission>EarthCARE</Mission>
  <File_Class>EXAA</File_Class>
  <File_Type>ATL_TC__2A</File_Type>
  <Validity_Period>
   <Validity_Start>UTC=2025-06-12T03:48:48</Validity_Start>
   <Validity_Stop>UTC=2025-06-12T04:00:23</Validity_Stop>
  </Validity_Period>
  <File_Version>0001</File_Version>
  <Source>
   <System>KNMIxxxxxx</System>
   <Creator>A-PROxxxxx</Creator>
   <Creator_Version>1150</Creator_Version>
   <Creation_Date>UTC=2025-07-17T12:04:13</Creation_Date>
  </Source>
 </Fixed_Header>

 <Variable_Header>
  <MainProductHeader>
   <productName>ECA_EXAA_ATL_TC__2A_20250612T034848Z_20250717T120413Z_05900E</productName>
   <originalProductName></originalProductName>
   <missionID>ECA</missionID>
   <fileClass>EXAA</fileClass>
   <fileCategory>ATL_</fileCategory>
   <productType>TC__</productType>
   <productLevel>2A</productLevel>
   <sensingStartTime>UTC=2025-06-12T03:48:34</sensingStartTime>
   <sensingStopTime>UTC=2025-06-12T04:00:36</sensingStopTime>
   <degradedProductQualityFlag>1</degradedProductQualityFlag>
   <description></description>
   <processorName>A-PRO</processorName>
   <processorMajorVersion>11</processorMajorVersion>
   <processorMinorVersion>50</processorMinorVersion>
   <executableMajorVersion>11</executableMajorVersion>
   <executableMinorVersion>50</executableMinorVersion>
   <formatMajorVersion>5</formatMajorVersion>
   <formatMinorVersion>0</formatMinorVersion>
   <subsettedProduct>0</subsettedProduct>
   <acquisitionStation>CAIS</acquisitionStation>
   <processingCentre>KNMIxxxxxx</processingCentre>
   <processingStartTime>UTC=2025-07-17T12:04:13</processingStartTime>
   <processingStopTime>UTC=2025-07-17T12:05:45</processingStopTime>
   <orbitNumber>5900</orbitNumber>
   <frameID>E</frameID>
   <ANXTime>2025-06-12T03:08:23.594379</ANXTime>
   <ANXLongitude>-1.7908716615242383E+01</ANXLongitude>
   <stateVectorSource>ONBOARD_GPSxxxx</stateVectorSource>
```

```
    <stateVectorTime>2025-06-12T03:08:23.594379</stateVectorTime>
    <xPosition>6.4494239970000004E+06</xPosition>
    <yPosition>-2.0841889560000000E+06</yPosition>
    <zPosition>0.0000000000000000E+00</zPosition>
    <xVelocity>-4.4876324499999998E+02</xVelocity>
    <yVelocity>-1.3583785820000001E+03</yVelocity>
    <zVelocity>7.6131200360000003E+03</zVelocity>
    <orbitSemiMajorAxis>6.7712996371937208E+06</orbitSemiMajorAxis>
    <orbitEccentricity>1.2119053245827111E-03</orbitEccentricity>
    <orbitInclination>9.7014448909826712E+01</orbitInclination>
    <perigeeArgument>9.2728078680136733E+01</perigeeArgument>
    <rightAscension>2.9007819996939827E+02</rightAscension>
    <meanAnomaly>2.4485638906632397E+02</meanAnomaly>
    <frameStartCoordinates>
     <GeographicCoordinates>
      <geographicLatitude>22.5000000</geographicLatitude>
      <geographicLongitude>154.8938599</geographicLongitude>
     </GeographicCoordinates>
    </frameStartCoordinates>
    <frameStopCoordinates>
     <GeographicCoordinates>
      <geographicLatitude>-22.5000000</geographicLatitude>
      <geographicLongitude>146.1849060</geographicLongitude>
     </GeographicCoordinates>
    </frameStopCoordinates>
    <frameStartTime>UTC=2025-06-12T03:48:48</frameStartTime>
    <frameStopTime>UTC=2025-06-12T04:00:23</frameStopTime>
    <frameStartMargin>100.00</frameStartMargin>
    <frameStopMargin>100.00</frameStopMargin>
   </MainProductHeader>
   <SpecificProductHeader>
    <InputFileList>ECA_EXAE_ATL_NOM_1B_20250612T034848Z_20250612T064437Z_05900E
ECA_EXAA_ATL_FM__2A_20250612T034848Z_20250614T140611Z_05900E
ECA_EXAC_AUX_JSG_1D_20250612T034848Z_20250612T065451Z_05900E
ECA_EXAA_AUX_MET_1D_20250612T034847Z_20250612T063542Z_05900E
A-PRO_CFG_master
</InputFileList>
    <ConfigurationParameters><![CDATA[<?xml version="1.0" encoding="UTF-8"?>
<Earth_Explorer_File>
 <Earth_Explorer_Header>
  <Fixed_Header>
   <File_Name>conf_a_pro</File_Name>
   <File_Description>A-PRO_2A Configuration file</File_Description>
   <Notes></Notes>
   <Mission>EarthCARE</Mission>
   <File_Class>EXSA</File_Class>
   <File_Type>AUX_B_CF01</File_Type>
   <Validity_Period>
    <Validity_Start>UTC=2023-11-14T01:01:01</Validity_Start>
    <Validity_Stop>UTC=2030-01-01T01:01:01</Validity_Stop>
   </Validity_Period>
   <File_Version>1160</File_Version>
   <Source>
    <System>EarthCARE Level 2</System>
    <Creator>D.P. Donovan(KNMI)</Creator>
    <Creator_Version>1162</Creator_Version>
    <Creation_Date>UTC=2025-07-17T15:00:00</Creation_Date>
   </Source>
  </Fixed_Header>
  <Variable_Header></Variable_Header>
 </Earth_Explorer_Header>
 <Data_Block type="xml">
```

```
<Group name="logging_options" description="Logging file and logging level">
 <Parameter type="string" name="logging_output_file_aer" dims="1"
 description="file name for logging
 messages">./A-PRO_aer_logging.log</Parameter>

 <Parameter type="string" name="logging_output_file_ebd" dims="1"
 description="file name for logging
 messages">./A-PRO_ebd_logging.log</Parameter>

 <Parameter type="int" name="logging_level" dims="1"
 description="DEBUG = 0, INFO = 1, PROGRESS = 2, WARN = 3, ERROR
 = 4">0</Parameter>
</Group>

<Group name="output_frame_margins" description="Frame margins for processor outputs">
 <Parameter name="margin_before_frame_start" type="float" dims="1" units="km"
                description="Output product margin before frame start">100</Parameter>
 <Parameter
        name="margin_after_frame_stop" type="float"
        dims="1" units="km"
        description="Output product margin after frame stop">100</Parameter>
</Group>


<Group name="Compression" description="Parameters controlling internal compression in the NetCDF-4/HDF5
output products">

 <Parameter name="deflate_level" type="int" dims="1"
 description="The gzip compression level from 0 to 9. 0 indicates
 no compression. 9 is best compression/slowest">6</Parameter>

 <Parameter name="shuffle" type="int" dims="1" description="If
 non-zero (and deflate_level > 0), turn on the shuffle
 filter. This might improve compression ratios">1</Parameter>

</Group>


<Group name="general_options" description="General instrument related options/parameters used in A-PRO
processor">

 <Parameter name="laser_full_angle_divergence" type="float"
 dims="1" description="full-angle laser divergence"
 units="mrad">0.032</Parameter>

 <Parameter name="telescope_full_angle_field_of_view"
 type="float" dims="1" description="full-angle telescope fov"
 units="mrad">0.065</Parameter>

 <Parameter name="rayleigh_linear_depolarization"
 type="float" dims="1"
 description="Effective Rayleigh backscattering linear depolarization ratio (input a values less than zero to self
calibrate)"
 units="-">0.0041</Parameter>

 <Parameter name="upper_index_for_self_depol_cal"
 type="int" dims="1"
 description="upper range index (from toa) to use for depol self calibration"
 units="-">10</Parameter>

 <Parameter name="lower_index_for_self_depol_cal"
 type="int" dims="1"
```

```
 description="upper range index (from toa) to use for depol self calibration"
 units="-">100</Parameter>

 <Parameter name="sigma_C_lidar" type="float" dims="1"
 description="Assumed relative error in lidar calibration constant"
 units="1">0.005</Parameter>

</Group>

<Group name="Quality_status" description="Variables used to help common data quality status variables">

 <Parameter name="extinction_dq_relative_error_threshold"
 type="float" dims="1" description="Data will be marked as
 likely_bad if d_ext is greater than
 extinction_dq_relative_error_threshold*max(ext,minimum_extinction_dq_threshold)"
 units="-">5.0</Parameter>

 <Parameter name="minimum_extinction_dq_threshold" type="float"
 dims="1" description="Data will be marked as likely_bad if d_ext
 is greater than
 extinction_dq_relative_error_threshold*max(ext,minimum_extinction_dq_threshold)"
 units="m-1">1.0e-5</Parameter>

 <Parameter name="backscatter_dq_relative_error_threshold"
 type="float" dims="1" description="Data will be marked as
 likely_bad if d_beta is greater than
 backscatter_dq_relative_error_threshold*max(beta,minimum_backscatter_dq_threshold)"
 units="-">5.0</Parameter>

 <Parameter name="minimum_backscatter_dq_threshold" type="float"
 dims="1" description="Data will be marked as likely_bad if d_beta
 is greater than
 backscatter_dq_relative_error_threshold*max(beta,minimum_backscatter_dq_threshold)"
 units="m-1">1.0e-7</Parameter>

</Group>

<Group name="A_PRO_config_parameters"
        description="Algorithm configuration parameters used in A-PRO processor">

 <Parameter name="adjust_input_feature_mask" type="int" dims="1"
 description="Adjust the FM based on smoothed Mie and CRO
 signals 0==> False, 1==> True" units="-" >0</Parameter>

 <Parameter name="extend_feature_mask_standard_deviation_factor"
 type="float" dims="1" description="If the smoothed Mie signal in
 a_aer is greater than a factor of extend_fm_sd_fac than the
 estimated sd then force the internal feature mask to 1 [Only
 used if adjust_mask=1]" units="1">200.0</Parameter>

 <Parameter name="censor_feature_mask_standard_deviation_factor"
 type="float" dims="1" description="If smoothed Mie signal and
 CRO signal in a_aer is less than a factor of censor_fm_sd_fac
 than the estimated sd then force the internal feature mask to 0
 (or -1) [Only used if adjust_mask=1]" units="1">0.5</Parameter>

 <Parameter name="vertical_derivative_determination_window"
 type="float" dims="1" description="vertical window for
 determining S and Extinction" units="km">0.3</Parameter>

 <Parameter name="lidar_ratio_determination_method"
 type="int" dims="1" description="0 ==> Conventional method: 1 ==> Local OE fit method"
 units="-">0</Parameter>
```

<Parameter name="lidar_ratio_determination_window_factor"
type="float" dims="1" description="lidar ratio will be (post-determination) smoothed
to a resolution of this factor time the
vertical_derivative_determination_window
(- or zero to disable: only used if lidar_ratio_determination_method == 0)"
units="-">0.0</Parameter>

<Parameter name="maximum_horizontial_smoothing_window"
type="int" dims="1" description="sliding expanding horizontal
maximum window" units="km">100</Parameter>

<Parameter name="horizontial_smoothing_target_SNR" type="float"
dims="1" description="Target signal-to-noise ratio for the
horizontial smoothing window limits"
units="-">100.0</Parameter>

<Parameter name="smooth_R_cutoff_for_horizontial_smoothing"
type="float" dims="1" description="Discard points with
Scattering ratios greater than this when doing horizontial
averaging" units="1">4.0</Parameter>

<Parameter name="feature_mask_cutoff_for_horizontal_smoothing"
type="float" dims="1" description="Discard points with FM values
greater than this when doing horizontial averaging"
units="1">11.0</Parameter>

<Parameter name="feature_mask_difference_layer_threshold"
type="float" dims="1" description="If the FM changes by this
much or greater in one cell then start a new layer"
units="1">2.0</Parameter>

<Parameter name="dR2_difference_layer_threshold" type="float"
dims="1" description="If the absolute scattering ratio
difference changes by this much or greater in one cell then
start a new layer (0 or less to disable)"
units="1">1.0</Parameter>

<Parameter name="preliminary_smoothing_horizontial_window"
type="int" dims="1" description="Number of along_track pixels to
smooth for initial classification determination"
units="1">11</Parameter>

<Parameter name="preliminary_smoothing_vertical_window"
type="int" dims="1" description="Number of vertical pixels to
smooth for initial classification determination"
units="1">1</Parameter>

<Parameter name="layer_splitting_chisq_relative_step_stop"
type="float" dims="1" description="Stop layer splitting if chi2
decreases to less than this relative value for any one step"
units="1">0.1</Parameter>

<Parameter name="layer_splttting_chisq_relative_min_stop"
type="float" dims="1" description="Stop layer splitting if chi2
is within this factor of the minimum level reached"
units="1">2.0</Parameter>

<Parameter name="medium_resolution_number_of_jsg_pixels"
type="int" dims="1" description="Number of along_track pixels to
smooth for medium resolution classification determination"
units="1">11</Parameter>

<Parameter name="low_resolution_number_of_jsg_pixels" type="int"
dims="1" description="Number of along_track pixels to smooth for
low resolution classification determination"
units="1">101</Parameter>

<Parameter name="med_low_smooth_cutoff_class" type="int"
dims="1" description="If class is less than this
value then exclude these pixels from the smoothing used to
determine the low and medium resolution output fields (use
3(water clouds) or 4(ice+water))" units="1">4</Parameter>

<Parameter name="med_low_smooth_ext_cutoff" type="float"
dims="1" description="If the extinction is greater than or equal to
this value then we exclude these pixels from the smoothing used
to determine the low and medium resolution output fields (use
1.0e-3 or so, too low with bias the fields)" units="m-1">5.0e-3</Parameter>

<Parameter name="lidar_feature_mask_threshold" type="int"
dims="1" description="Threshold to apply to the target
mask...below this value no atmospheric targets are assumed
valid" units="1">6</Parameter>

<Parameter name="lidar_feature_mask_threshold_force_cloud"
type="int" dims="1" description="Threshold to apply to the
target mask..above this value targets are almost certainly
clouds" units="1">9</Parameter>

<Parameter name="minimum_cloud_R_threshold" type="float"
dims="1" description="Threshold on the backscatter-ratio (R) for
cld detection" units="1">1.15</Parameter>

<Parameter name="maximum_altitude_to_fill_with_aerosol"
type="float" dims="1" description="Below this altitude BL
aerosols exist" units="1">0.2</Parameter>

<Parameter name="ice_water_separation_temperature" type="float"
dims="1" description="Above this temperature [Celsius] clouds
will be classified as 'water-clouds', below as 'ice-clouds'"
units="C">0.0</Parameter>

<Parameter name="homogeneous_freezing_temperature" type="float"
dims="1" description="Below this temperature [Celsius] clouds
can only be ice'" units="C">-41.0</Parameter>

<Parameter
name="integrated_depolarization_to_integrated_beta_ratio_threshold"
type="float" dims="1" description="Ratio of int depol to int
beta used to distinguish ice from water" units="sr
m">1.0e+4</Parameter>

<Parameter name="force_class_to_water" type="int" dims="1"
description="Force high scattering ratio targets to water 1==>
yes" units="1">1</Parameter>

<Parameter name="water_cloud_R_threshold" type="float" dims="1"
description="Scattering ratio above which we assume only water
clouds" units="1">15.0</Parameter>

<Parameter name="maximum_allowed_layer_extent" type="int"
dims="1" description="Maximum allowed layer extent"
units="1">10</Parameter>

<Parameter name="apply_class_mode_filter" type="int" dims="1"

```
    description="Apply class filtering to aer classes within A-EBD
    1==> yes" units="1">1</Parameter>

    <Parameter name="apply_class_mode_filter_to_ebd_input"
    type="int" dims="1" description="Apply class filtering to output
    of A_AER (input to A_EBD) types 1==> yes"
    units="1">1</Parameter>

    <Parameter name="class_mode_filter_window" type="int" dims="1"
    description="Width of hybrid mode filter to apply when class
    filtering" units="jsg pixels">11</Parameter>

    <Parameter name="class_mode_SNR_minimum_threshold" type="float"
    dims="1" description="When class filtering remove points whose
    ext SNR is below this threshold" units="1">1.0</Parameter>

    <Parameter name='minimum_relative_error_in_cost_func_mie'
    type="float" dims="1" description="Minimum allowed relative
    error in Mie_para when calculating inversion cost-function"
    units="1">0.05</Parameter>

    <Parameter name='minimum_relative_error_in_cost_func_ray'
    type="float" dims="1" description="Minimum allowed relative
    error in Ray_para when calculating inversion cost-function"
    units="1">0.05</Parameter>

    <Parameter name='minimum_absolute_error_in_cost_func_mie'
    type="float" dims="1" description="Minimum allowed absolute
    error to Mie_para when calculating inversion cost-function"
    units="m-1 sr-1">1.0e-7</Parameter>

    <Parameter name='minimum_absolute_error_in_cost_func_ray'
    type="float" dims="1" description="Minimum allowed absolute
    error to Ray_para when calculating inversion cost-function"
    units="m-1 sr-1">1.0e-7</Parameter>

    <Parameter name="gradient_convergence_tolerance" type="float"
    dims="1" description="Convergence tolarence in dfpmin
    (gradient)" units="1">1.0e-5</Parameter>

    <Parameter name="step_convergence_tolerance" type="float"
    dims="1" description="Convergence tolerance in dfpmin (deltaD)"
    units="1">1.0e-5</Parameter>

    <Parameter name="maximum_number_of_iterations" type="int"
    dims="1" description="Max # of iterations"
    units="1">100</Parameter>

    <Parameter name="step_factor_used_in_line_search" type="float"
    dims="1" description="Maximum step factor in dfpmin"
    units="1">0.2</Parameter>

    <Parameter name="SSE_limit" type="float" dims="1"
    description="If initial guess sse is above this limit then do
    not attept an inversion (- to disable check)"
    units="1">-1.0e+8</Parameter>

<!--
    <Parameter name="a_priori_water_mie_ms_f_factor" type="float" dims="1"
    description="A priori Factor to account for less MS backscatter
    for Mie vs Ray" units="1">0.7</Parameter>

    <Parameter name="a_priori_ice_mie_ms_f_factor" type="float" dims="1"
```

```
    description="A priori Factor to account for less MS backscatter
    for Mie vs Ray" units="1">0.6</Parameter>

    <Parameter name="a_priori_aerosol_mie_ms_f_factor" type="float" dims="1"
    description="A priori Factor to account for less MS backscatter
    for Mie vs Ray" units="1">0.95</Parameter>

    <Parameter name="a_priori_water_eta_o" type="float" dims="1"
    description="A priori eta_o multiple-scattering parameter"
    units="1">0.5</Parameter>
-->

    <Parameter name="a_priori_water_mie_ms_f_factor" type="float" dims="1"
    description="A priori Factor to account for less MS backscatter
    for Mie vs Ray" units="1">0.8</Parameter>

    <Parameter name="a_priori_ice_mie_ms_f_factor" type="float" dims="1"
    description="A priori Factor to account for less MS backscatter
    for Mie vs Ray" units="1">0.75</Parameter>

    <Parameter name="a_priori_aerosol_mie_ms_f_factor" type="float" dims="1"
    description="A priori Factor to account for less MS backscatter
    for Mie vs Ray" units="1">0.85</Parameter>

    <Parameter name="a_priori_water_eta_o" type="float" dims="1"
    description="A priori eta_o multiple-scattering parameter"
    units="1">0.45</Parameter>

    <Parameter name="a_priori_ice_eta_o" type="float" dims="1"
    description="A priori eta_o multiple-scattering parameter"
    units="1">0.45</Parameter>

    <Parameter name="a_priori_aerosol_eta_o" type="float" dims="1"
    description="A priori eta_o multiple-scattering parameter"
    units="1">0.1</Parameter>

    <Parameter name="a_priori_water_S_ratio" type="float" dims="1"
    description="A priori S_ratio for Water"
    units="sr">20.0</Parameter>

    <Parameter name="starting_value_water_S_ratio" type="float"
    dims="1" description="starting S_ratio for Water"
    units="sr">20.0</Parameter>

    <Parameter name="sigma_a_priori_water_S_ratio" type="float"
    dims="1" description="The A priori fractional sd S ratio for
    Water" units="1">0.2</Parameter>

    <Parameter name="a_priori_water_ra_eff" type="float" dims="1"
    description="A priori effective area radius for water"
    units="microns">4.0</Parameter>

    <Parameter name="starting_value_water_ra_eff" type="float"
    dims="1" description="Starting value effective area radius for
    water" units="microns">4.0</Parameter>

    <Parameter name="sigma_a_priori_water_ra_eff" type="float"
    dims="1" description="SD effective area radius for water"
    units="microns">2.0</Parameter>

    <Parameter name="a_priori_ice_S_ratio" type="float" dims="1"
    description="A priori S_ratio for Ice (a negative value will
    trigger the use of A-AER results when possible)"
```

```
units="sr">25.0</Parameter>

<Parameter name="starting_value_ice_S_ratio" type="float"
dims="1" description="starting S_ratio for ice"
units="sr">25.0</Parameter>

<Parameter name="sigma_a_priori_ice_S_ratio" type="float"
dims="1" description="The A priori fractional sd S ratio for
ice" units="1">0.25</Parameter>

<Parameter name="a_priori_ice_ra_eff" type="float" dims="1"
description="A priori effective area radius for ice (enter a
negative value to parameterize by temperature instead)"
units="microns">-20.0</Parameter>

<Parameter name="starting_value_ice_ra_eff" type="float"
dims="1" description="Starting value effective area radius for
ice" units="microns">20.0</Parameter>

<Parameter name="sigma_a_priori_ice_ra_eff" type="float"
dims="1" description="SD effective area radius for ice"
units="microns">10.0</Parameter>

<Parameter name="a_priori_aerosol_S_ratio" type="float" dims="1"
description="A priori S_ratio for aerosol (a negative ivalue will
trigger the use of A-AER results when possible..otherwise abs(S)
will be used" units="sr">-50.0</Parameter>

<Parameter name="starting_value_aerosol_S_ratio" type="float"
dims="1" description="starting S_ratio for aerosol"
units="sr">50.0</Parameter>

<Parameter name="sigma_a_priori_aerosol_S_ratio" type="float"
dims="1" description="The A priori fractional sd S ratio for
aerosol" units="1">0.1</Parameter>

<Parameter name="a_priori_aerosol_ra_eff" type="float" dims="1"
description="A priori effective area radius for aerosol"
units="microns">0.2</Parameter>

<Parameter name="starting_value_aerosol_ra_eff" type="float"
dims="1" description="Starting value effective area radius for
aerosol" units="microns">0.2</Parameter>

<Parameter name="sigma_a_priori_aerosol_ra_eff" type="float"
dims="1" description="SD effective area radius for aerosol"
units="microns">0.20</Parameter>

<!-- X-talk related variabiles For future work <Parameter
    name="Ax_factor" type="float" dims="1" description="A
    priori Ax X-talk adjust factor" units="sr">1.0</Parameter>
    <Parameter name="sigma_Ax_factor" type="float" dims="1"
    description="The a priori fractional sd for Ax factor"
    units="1">0.05</Parameter> <Parameter name="Bx_factor"
    type="float" dims="1" description="A priori Bx X-talk
    adjust factor" units="sr">1.0</Parameter> <Parameter
    name="sigma_Bx_factor" type="float" dims="1"
    description="The a priori fractional sd for Bx factor"
    units="1">0.05</Parameter> <Parameter name="Cx_factor"
    type="float" dims="1" description="A priori Cx X-talk
    adjust factor" units="sr">1.0</Parameter> <Parameter
    name="sigma_Cx_factor" type="float" dims="1"
    description="The a priori fractional sd for Cx factor"
```

```
    units="1">0.05</Parameter> <Parameter name="Dx_factor"
    type="float" dims="1" description="A priori Dx X-talk
    adjust factor" units="sr">1.0</Parameter> <Parameter
    name="sigma_Dx_factor" type="float" dims="1"
    description="The a priori fractional sd for Dx factor"
    units="1">0.05</Parameter>
 -->

</Group>

<Group name="A_TC_config_parameters"
          description="A-TC algorithm configuration parameters used in A-PRO processor">

 <Group name="troposphere_stratosphere_separation"
           description="Separation of Tropospheric and Stratospheric">

        <Parameter name="tropopause_definition" description="wmo or
        calipso" type="string" dims="1">calipso</Parameter>

        <Parameter name="min_height_above_tropopause" type="float"
        dims="1" description="layers within this distance from the
        tropopause can be classified as either tropospheric or
        stratospheric if they are connected with lower(higher)
        extended features" units="m">2.0e2</Parameter>

        <Parameter name="max_temp_psc" type="float" dims="1"
        description="Maximum temperature for which PSCs are allowed"
        units="Celsius">-78.0</Parameter>

        <!---Note max_temp_psa is NOT used in this version -->
        <Parameter name="max_temp_psa" type="float" dims="1"
        description="Below this temperature PSC precursor aerosols are
                    expected" units="Celsius">-70.0</Parameter>

 </Group>

 <Group name="aerosol_cloud_separation"
           description="Aerosol cloud Separation parameters">

        <!--
        <Parameter name="beta_cloud_layer_threshold" type="float" dims="1"
        description="Default layers are seen as aerosols when average
        backscatter smaller than beta cld def" units="m-1 sr-1">
        0.1e-5</Parameter>

        <Parameter name="beta_cloud_layer_threshold_in_boundary_layer"
        type="float" dims="1" description="Boundary layers are seen as
        aerosols when average backscatter smaller than beta cld bl"
        units="m-1 sr-1">1.0e-5</Parameter>

        <Parameter name="beta_cloud_threshold_above_270K" type="float"
        dims="1" description="Layers at temperatures above 270 K are
        seen as aerosols when average backscatter smaller than beta
        cld temp" units="m-1 sr-1">1.0e-5</Parameter>
        -->

        <Parameter name="beta_cloud_layer_threshold" type="float" dims="1"
        description="Default layers are seen as aerosols when average
        backscatter smaller than beta cld def" units="m-1 sr-1">
        1.0e-6</Parameter>

        <Parameter name="beta_cloud_layer_threshold_in_boundary_layer"
        type="float" dims="1" description="Targets in Boundary layer
```

```
        are seen as aerosols when average backscatter smaller than
        beta cld bl" units="m-1 sr-1">1.0e-5</Parameter>

        <Parameter name="beta_cloud_threshold_above_270K" type="float"
        dims="1" description="Layers at temperatures above 270 K are
        seen as aerosols when average backscatter smaller than beta
        cld temp" units="m-1 sr-1">5.0e-5</Parameter>

        <Parameter name="beta_cloud_threshold_in_stratosphere"
        type="float" dims="1" description="Stratospheric layers are
        seen as aerosols when average backscatter smaller than beta
        cld strat" units="m-1 sr-1">0.1e-6</Parameter>

        <Parameter name="minimum_PSC_height" type="float" dims="1"
        description="minimum height for which layers can be seen as
        Polar Stratospheric cloud" units="m">5.5e+3</Parameter>

        <Parameter
        name="number_of_temperature_aerosol_ice_separation_points"
        type="int" dims="1" description="number of temperatures for
        ice/aerosol separation thresholds" units="1">5</Parameter>

        <Parameter
        name="number_of_height_aerosol_ice_separation_points"
        type="int" dims="1" description="number of altitudes points
        for " units="1">2</Parameter>

        <Parameter name="temperature_aerosol_ice_separation_points"
                type="float" dims="5"
                description="min. temperature for which the respective
                        threshold extinction holds" units="K">
    <row>200.0</row>
    <row>240.0</row>
    <row>250.0</row>
    <row>260.0</row>
    <row>270.0</row>
        </Parameter>

        <Parameter name="height_aerosol_ice_separation_points" type="float"
                dims="2"
                description="height ratio (with respect to tropopause)
                        for which the extinction threshold holds" units="1">
         <row>0.3</row>
         <row>1.0</row>
        </Parameter>

        <Parameter name="extinction_thresholds_for_aerosol_ice_separation"
                type="float" dims="2 5"
                description="threshold extinction for ice-aerosol
                        separation as a function of the above
                        height-temperature points" units="m-1">
    <row> <col>5.0e-07</col> <col>5.0e-07</col> <col>1.0e-05</col> <col>1.e-03</col> <col>1.e3</col></row> --
>
          <row>       <col>5.0e-07</col>       <col>5.0e-07</col>       <col>1.0e-05</col>       <col>1.e-03</col>
<col>1.e3</col></row> -->
<!--      <row> <col>0.0</col> <col>0.0</col> <col>0.0</col> <col>0.0</col> <col>0.0</col></row> -->
<!--       <row> <col>0.0</col> <col>0.0</col> <col>0.0</col> <col>0.0</col> <col>0.0</col></row> -->
        </Parameter>
    </Group>

    <Group name="cloud_phase_separation" description="Cloud Separation parameters">

     <Parameter name="a_depolarization_beta_coefficient"
```

```
 type="float" dims="1" description="A(dep,beta) value of the
 depolarization parameterization (Eq. 5.5.44)"
 units="%sr">325.0</Parameter>

 <Parameter name="b_depolarization_beta_coefficient"
 type="float" dims="1" description="B(dep,beta) value of the
 depolarization parameterization (Eq. 5.5.44)"
 units="%">2.5</Parameter>

      <Parameter name="minimum_probability_for_ice_test"
      type="float" dims="1" description="Min prob value to test for
      ice (Eq. 5.5.47)" units="1">0.0</Parameter>

      <Parameter name="supercooled_water_lower_temperature_limit"
      type="float" dims="1" description="Liquid layers with
      temperature lower than supercool_low are set to inconsistent
      liquid" units="C">-40.0</Parameter>

      <Parameter name="supercooled_water_upper_temperature_limit"
      type="float" dims="1" description="Liquid layers with
      temperature lower than supercool_up are set to supercool"
      units="C">-2.0</Parameter>

      <Parameter name="ice_wet_bulb_upper_temperature_threshold"
      type="float" dims="1" description="If the wet-bulb temperature
      of an ice layer is larger than wet_bulb_up ice is set to
      inconsistent ice" units="1">-2.0</Parameter>
</Group>

<Group name="aerosol_types" description="Aerosols different mixtures">
 <Parameter name="number_of_aerosol_classes" type="int"
 dims="1" description="number of aerosol types"
 units="1">7</Parameter>

      <Parameter name="number_of_strat_aerosol_classes" type="int"
      dims="1" description="number of stratospheric aerosol types"
      units="1">3</Parameter>

      <Parameter name="minimum_aerosol_probability_threshold"
      type="float" dims="1" description="Minimum aerosol probability
      to be used in classification (exp(-9./2.)"
      units="1">0.0011109</Parameter>

      <Parameter
      name="minimum_aerosol_probability_single_type_threshold"
      type="float" dims="1" description="The minimum prob value for
      a cell to be defined as a single aerosol type (0.55)"
      units="1">0.0005</Parameter>

      <Parameter name="minimum_aerosol_probability_three_type_limit"
      type="float" dims="1" description="There can only be three
      aerosol types when P1 lt min_P1 and P2 lt min_P2 (0.3)"
      units="1">0.000025</Parameter>
</Group>

<Group name="aerosol_parameters1" description="Aerosols mixture 1 parameters">
      <Parameter name="name" type="string" dims="1"
      description="Coarse mode dust" units="1">Dust</Parameter>

      <Parameter name="shape" type="string" dims="1"
      description="Assumed shape distribution used "
      units="1">Gasteigers spheroid distribution</Parameter>
```

```
        <Parameter name="effective_area_radius" type="float" dims="1"
        description="assummed effective area radius"
        units="um">1.5</Parameter>

        <Parameter name="eta_0" type="float" dims="1"
        description="assummed ms eta parameter"
        units="1">0.375</Parameter>

        <Parameter name="mie_ms_f_fac" type="float" dims="1"
        description="assummed mie_ms_f_fac parameter"
        units="1">0.8</Parameter>

        <Parameter name="lambda" type="float" dims="1"
        description="Wavelength for which the aerosol parameters are
        valid" units="microns">0.355</Parameter>

        <Parameter name="linear_depolarization_ratio" type="float"
        dims="1" description="Central depolarization value"
        units="%">25.0</Parameter>

        <Parameter name="lidar_ratio" type="float" dims="1"
        description="Central lidar ratio value"
        units="Sr">55.</Parameter>

        <Parameter name="lidar_ratio_ms_adjust_factor" type="float" dims="1"
        description="Central lidar ratio value ms adjust factor"
        units="Sr">1.0</Parameter>

        <Parameter
        name="standard_deviation_linear_depolarization_ratio"
        type="float" dims="1" description="Std deviation in the depol"
        units="%">5.0</Parameter>

        <Parameter name="standard_deviation_lidar_ratio" type="float"
        dims="1" description="Std deviation in the lidar ratio"
        units="Sr">10.0</Parameter>

        <Parameter name="standard_deviation_lidar_ratio_ms_adjust_factor" type="float"
        dims="1" description="Std deviation in the lidar ratio ms adjust factor"
        units="Sr">1.0</Parameter>

        <Parameter name="angle" type="float" dims="1"
        description="Orientation of the 2D gaussian distribution with
        respect to depol axis (righthanded)"
        units="degrees">0.0</Parameter>

        <Parameter name="backscatter_ratio" type="float" dims="1"
        description="expected backscatter ratio"
        units="%">1.1</Parameter>

        <Parameter name="d_backscatter_ratio" type="float" dims="1"
        description="sd expected backscatter ratio"
        units="%">100.</Parameter>


    </Group>

    <Group name="aerosol_parameters2" description="Aerosols mixture 2 parameters">

        <Parameter name="name" type="string" dims="1"
        description="Coarse Sea Salt" units="1">Sea_salt</Parameter>

        <Parameter name="shape" type="string" dims="1"
```

```
        description="Assumed shape distribution used "
        units="1">Spheres</Parameter>

        <Parameter name="effective_area_radius" type="float" dims="1"
        description="assummed effective area radius"
        units="um">1.0</Parameter>

        <Parameter name="eta_0" type="float" dims="1"
        description="assummed ms eta parameter"
        units="1">0.375</Parameter>

        <Parameter name="mie_ms_f_fac" type="float" dims="1"
        description="assummed mie_ms_f_fac parameter"
        units="1">0.8</Parameter>

        <Parameter name="lambda" type="float" dims="1"
        description="Wavelength for which the aerosol parameters are
        valid" units="microns">0.355</Parameter>

        <Parameter name="linear_depolarization_ratio" type="float"
        dims="1" description="Central depolarization value"
        units="%">3.0</Parameter>

        <Parameter name="lidar_ratio" type="float" dims="1"
        description="Central lidar ratio value"
        units="Sr">25.0</Parameter>

        <Parameter name="lidar_ratio_ms_adjust_factor" type="float" dims="1"
        description="Central lidar ratio value ms adjust factor"
        units="Sr">0.75</Parameter>

        <Parameter
        name="standard_deviation_linear_depolarization_ratio"
        type="float" dims="1" description="Std deviation in the depol"
        units="%">4.0</Parameter>

        <Parameter name="standard_deviation_lidar_ratio" type="float"
        dims="1" description="Std deviation in the lidar ratio"
        units="Sr">12.0</Parameter>

        <Parameter name="standard_deviation_lidar_ratio_ms_adjust_factor" type="float"
        dims="1" description="Std deviation in the lidar ratio ms adjust factor"
        units="Sr">1.0</Parameter>

        <Parameter name="angle" type="float" dims="1"
        description="Orientation of the 2D gaussian distribution with
        respect to linear_depolarization_ratio axis (righthanded)"
        units="degrees">20.0</Parameter>

        <Parameter name="backscatter_ratio" type="float" dims="1"
        description="expected backscatter ratio"
        units="%">1.05</Parameter>

        <Parameter name="d_backscatter_ratio" type="float" dims="1"
        description="sd expected backscatter ratio"
        units="%">2.5</Parameter>

    </Group>

    <Group name="aerosol_parameters3" description="Aerosols mixture 3 parameters">

        <Parameter name="name" type="string" dims="1"
        description="Fine mode pollution"
```

```
        units="1">Continental_Pollution</Parameter>

        <Parameter name="shape" type="string" dims="1"
        description="Assumed shape distribution used "
        units="1">Spheres</Parameter>

        <Parameter name="effective_area_radius" type="float" dims="1"
        description="assummed effective area radius"
        units="um">0.17</Parameter>

        <Parameter name="eta_0" type="float" dims="1"
        description="assummed ms eta parameter"
        units="1">0.1</Parameter>

        <Parameter name="mie_ms_f_fac" type="float" dims="1"
        description="assummed mie_ms_f_fac parameter"
        units="1">0.95</Parameter>

        <Parameter name="lambda" type="float" dims="1"
        description="Wavelength for which the aerosol parameters are
        valid" units="microns">0.355</Parameter>

        <Parameter name="linear_depolarization_ratio" type="float"
        dims="1" description="Central depolarization value"
        units="%">3.0</Parameter>

        <Parameter name="lidar_ratio" type="float" dims="1"
        description="Central lidar ratio value"
        units="Sr">57.0</Parameter>

        <Parameter name="lidar_ratio_ms_adjust_factor" type="float" dims="1"
        description="Central lidar ratio value ms adjust factor factor"
        units="Sr">1.0</Parameter>

        <Parameter
        name="standard_deviation_linear_depolarization_ratio"
        type="float" dims="1" description="Std deviation in the depol"
        units="%">9.0</Parameter>

        <Parameter name="standard_deviation_lidar_ratio" type="float"
        dims="1" description="Std deviation in the lidar ratio"
        units="Sr">18.0</Parameter>

        <Parameter name="standard_deviation_lidar_ratio_ms_adjust_factor" type="float"
        dims="1" description="Std deviation in the lidar ratio adjust factor"
        units="Sr">1.0</Parameter>

        <Parameter name="angle" type="float" dims="1"
        description="Orientation of the 2D gaussian distribution with
        respect to depol axis (righthanded)"
        units="degrees">-3.0</Parameter>

        <Parameter name="backscatter_ratio" type="float" dims="1"
        description="expected backscatter ratio"
        units="%">1.1</Parameter>

        <Parameter name="d_backscatter_ratio" type="float" dims="1"
        description="sd expected backscatter ratio"
        units="%">2.5</Parameter>

    </Group>

    <Group name="aerosol_parameters4" description="Aerosols mixture 4 parameters">
```

<Parameter name="name" type="string" dims="1"
description="Fine mode Smoke" units="1">Smoke</Parameter>

<Parameter name="shape" type="string" dims="1"
description="Assumed shape distribution used "
units="1">Spheres</Parameter>

<Parameter name="effective_area_radius" type="float" dims="1"
description="assummed effective area radius"
units="um">0.16</Parameter>

<Parameter name="eta_0" type="float" dims="1"
description="assummed ms eta parameter"
units="1">0.1</Parameter>

<Parameter name="mie_ms_f_fac" type="float" dims="1"
description="assummed mie_ms_f_fac parameter"
units="1">0.95</Parameter>

<Parameter name="lambda" type="float" dims="1"
description="Wavelength for which the aerosol parameters are
valid" units="microns">0.355</Parameter>

<Parameter name="linear_depolarization_ratio" type="float"
dims="1" description="Central depolarization value"
units="%">5.0</Parameter>

<Parameter name="lidar_ratio" type="float" dims="1"
description="Central lidar ratio value"
units="Sr">80.0</Parameter>

<Parameter name="lidar_ratio_ms_adjust_factor" type="float" dims="1"
description="Central lidar ratio value adjust factor"
units="Sr">1.0</Parameter>

<Parameter
name="standard_deviation_linear_depolarization_ratio"
type="float" dims="1" description="Std deviation in the depol"
units="%">12.0</Parameter>

<Parameter name="standard_deviation_lidar_ratio" type="float"
dims="1" description="Std deviation in the lidar ratio"
units="%">30.0</Parameter>

<Parameter name="standard_deviation_lidar_ratio_ms_adjust_factor" type="float"
dims="1" description="Std deviation in the lidar ratio ms adjust factor"
units="Sr">1.0</Parameter>

<Parameter name="angle" type="float" dims="1"
description="Orientation of the 2D gaussian distribution with
respect to linear_depolarization_ratio axis (righthanded)"
units="degrees">-5.0</Parameter>

<Parameter name="backscatter_ratio" type="float" dims="1"
description="expected backscatter ratio"
units="%">1.1</Parameter>

<Parameter name="d_backscatter_ratio" type="float" dims="1"
description="sd expected backscatter ratio"
units="%">100.</Parameter>

```
</Group>

 <Group name="aerosol_parameters5" description="Aerosols mixture 5 parameters">
        <Parameter name="name" type="string" dims="1"
        description="Aerosol mixture"
        units="1">Dusty_smoke</Parameter>

        <Parameter name="shape" type="string" dims="1"
        description="Assumed shape distribution used "
        units="1">Spheres</Parameter>

        <Parameter name="effective_area_radius" type="float" dims="1"
        description="assummed effective area radius"
        units="um">0.25</Parameter>

        <Parameter name="eta_0" type="float" dims="1"
        description="assummed ms eta parameter"
        units="1">0.375</Parameter>

        <Parameter name="mie_ms_f_fac" type="float" dims="1"
        description="assummed mie_ms_f_fac parameter"
        units="1">0.9</Parameter>

        <Parameter name="lambda" type="float" dims="1"
        description="Wavelength for which the aerosol parameters are
        valid" units="microns">0.355</Parameter>

        <Parameter name="linear_depolarization_ratio" type="float"
        dims="1" description="Central
        linear_depolarization_ratio  value"
        units="%">16.0</Parameter>

        <Parameter name="lidar_ratio" type="float" dims="1"
        description="Central lidar ratio value"
        units="Sr">73.0</Parameter>

        <Parameter name="lidar_ratio_ms_adjust_factor" type="float" dims="1"
        description="Central lidar ratio value ms adjust factor"
        units="Sr">1.0</Parameter>

        <Parameter
        name="standard_deviation_linear_depolarization_ratio"
        type="float" dims="1" description="Std deviation in the depol"
        units="%">10.0</Parameter>

        <Parameter name="standard_deviation_lidar_ratio" type="float"
        dims="1" description="Std deviation in the lidar ratio"
        units="Sr">15.0</Parameter>

        <Parameter name="standard_deviation_lidar_ratio_ms_adjust_factor" type="float"
        dims="1" description="Std deviation in the lidar ratio ms adjust factor"
        units="Sr">1.0</Parameter>

        <Parameter name="angle" type="float" dims="1"
        description="Orientation of the 2D gaussian distribution with
        respect to depol axis (righthanded)"
        units="degrees">-15.0</Parameter>


        <Parameter name="backscatter_ratio" type="float" dims="1"
        description="expected backscatter ratio"
        units="%">1.1</Parameter>
```

```
        <Parameter name="d_backscatter_ratio" type="float" dims="1"
        description="sd expected backscatter ratio"
        units="%">100.</Parameter>

    </Group>

    <Group name="aerosol_parameters6" description="Aerosols mixture 6
                                                    parameters">

        <Parameter name="name" type="string" dims="1"
        description="Aeorsol mixture" units="1">Dusty_mix</Parameter>

        <Parameter name="shape" type="string" dims="1"
        description="Assumed shape distribution used "
        units="1">Spheres</Parameter>

        <Parameter name="effective_area_radius" type="float" dims="1"
        description="assummed effective area radius"
        units="um">0.3</Parameter>

        <Parameter name="eta_0" type="float" dims="1"
        description="assummed ms eta parameter"
        units="1">0.375</Parameter>

        <Parameter name="mie_ms_f_fac" type="float" dims="1"
        description="assummed mie_ms_f_fac parameter"
        units="1">0.9</Parameter>

        <Parameter name="lambda" type="float" dims="1"
        description="Wavelength for which the aerosol parameters are
        valid" units="microns">0.355</Parameter>

        <Parameter name="linear_depolarization_ratio" type="float"
        dims="1" description="Central depolarization value"
        units="%">14.0</Parameter>

        <Parameter name="lidar_ratio" type="float" dims="1"
        description="Central lidar ratio value"
        units="Sr">43.0</Parameter>

        <Parameter name="lidar_ratio_ms_adjust_factor" type="float" dims="1"
        description="Central lidar ratio value adjust factor"
        units="Sr">1.0</Parameter>

        <Parameter
        name="standard_deviation_linear_depolarization_ratio"
        type="float" dims="1" description="Std deviation in the depol"
        units="%">5.0</Parameter>

        <Parameter name="standard_deviation_lidar_ratio" type="float"
        dims="1" description="Std deviation in the lidar ratio"
        units="Sr">15.0</Parameter>

        <Parameter name="standard_deviation_lidar_ratio_ms_adjust_factor" type="float"
        dims="1" description="Std deviation in the lidar ratio ms adjust factor"
        units="Sr">1.0</Parameter>

        <Parameter name="angle" type="float" dims="1"
        description="Orientation of the 2D gaussian distribution with
        respect to depol axis (righthanded)"
        units="degrees">15.0</Parameter>
```

```
        <Parameter name="backscatter_ratio" type="float" dims="1"
        description="expected backscatter ratio"
        units="%">1.1</Parameter>

        <Parameter name="d_backscatter_ratio" type="float" dims="1"
        description="sd expected backscatter ratio"
        units="%">100.</Parameter>


</Group>

<Group name="aerosol_parameters7" description="Ice parameters">
        <Parameter name="name" type="string" dims="1"
        description="Optically thin Ice" units="1">Ice</Parameter>

        <Parameter name="shape" type="string" dims="1"
        description="Assumed shape distribution used "
        units="1">Ice</Parameter>

        <Parameter name="effective_area_radius" type="float" dims="1"
        description="assummed effective area radius"
        units="um">5.0</Parameter>

        <Parameter name="eta_0" type="float" dims="1"
        description="assummed ms eta parameter"
        units="1">0.375</Parameter>

        <Parameter name="mie_ms_f_fac" type="float" dims="1"
        description="assummed mie_ms_f_fac parameter"
        units="1">0.8</Parameter>

        <Parameter name="lambda" type="float" dims="1"
        description="Wavelength for which the aerosol parameters are
        valid" units="microns">0.355</Parameter>

        <Parameter name="linear_depolarization_ratio" type="float"
        dims="1" description="Central depolarization value"
        units="%">37.0</Parameter>

        <Parameter name="lidar_ratio" type="float" dims="1"
        description="Central effective lidar ratio value"
        units="Sr">20.</Parameter>

        <Parameter name="lidar_ratio_ms_adjust_factor" type="float" dims="1"
        description="Central lidar ratio value ms adjust factor"
        units="Sr">0.75</Parameter>

        <Parameter
        name="standard_deviation_linear_depolarization_ratio"
        type="float" dims="1" description="Std deviation in the depol"
        units="%">7.0</Parameter>

        <Parameter name="standard_deviation_lidar_ratio" type="float"
        dims="1" description="Std deviation in the lidar ratio"
        units="Sr">7.0</Parameter>

        <Parameter name="standard_deviation_lidar_ratio_ms_adjust_factor" type="float"
        dims="1" description="Std deviation in the lidar ratio ms adjust factor"
        units="Sr">1.0</Parameter>

        <Parameter name="angle" type="float" dims="1"
        description="Orientation of the 2D gaussian distribution with
        respect to depol axis (righthanded)"
```

```
        units="degrees">0.0</Parameter>

        <Parameter name="backscatter_ratio" type="float" dims="1"
        description="expected backscatter ratio"
        units="%">1.1</Parameter>

        <Parameter name="d_backscatter_ratio" type="float" dims="1"
        description="sd expected backscatter ratio"
        units="%">100.</Parameter>


</Group>

<Group name="strat_aerosol_parameters1"
            description="Stratospheric Aerosols mixture 1 parameters">

        <Parameter name="name" type="string" dims="1" description="Ash
        Coarse mode dust" units="1">Stratospheric_Ash</Parameter>

        <Parameter name="shape" type="string" dims="1"
        description="Assumed shape distribution used "
        units="1">Gasteigers spheroid distribution</Parameter>

        <Parameter name="effective_area_radius" type="float" dims="1"
        description="assummed effective area radius"
        units="um">1.5</Parameter>

        <Parameter name="eta_0" type="float" dims="1"
        description="assummed ms eta parameter"
        units="1">0.375</Parameter>

        <Parameter name="mie_ms_f_fac" type="float" dims="1"
        description="assummed mie_ms_f_fac parameter"
        units="1">0.8</Parameter>

        <Parameter name="lambda" type="float" dims="1"
        description="Wavelength for which the aerosol parameters are
        valid" units="microns">0.355</Parameter>

        <Parameter name="linear_depolarization_ratio" type="float"
        dims="1" description="Central depolarization value"
        units="%">35.0</Parameter>

        <Parameter name="lidar_ratio" type="float" dims="1"
        description="Central lidar ratio value"
        units="Sr">55.</Parameter>

        <Parameter name="lidar_ratio_ms_adjust_factor" type="float" dims="1"
        description="Central lidar ratio value ms adjust factor"
        units="Sr">1.0</Parameter>

        <Parameter
        name="standard_deviation_linear_depolarization_ratio"
        type="float" dims="1" description="Std deviation in the depol"
        units="%">5.0</Parameter>

        <Parameter name="standard_deviation_lidar_ratio" type="float"
        dims="1" description="Std deviation in the lidar ratio"
        units="Sr">10.0</Parameter>

        <Parameter name="standard_deviation_lidar_ratio_ms_adjust_factor" type="float"
        dims="1" description="Std deviation in the lidar ratio ms adjust factor"
        units="Sr">1.0</Parameter>
```

```
        <Parameter name="angle" type="float" dims="1"
        description="Orientation of the 2D gaussian distribution with
        respect to depol axis (righthanded)"
        units="degrees">0.0</Parameter>

        <Parameter name="backscatter_ratio" type="float" dims="1"
        description="expected backscatter ratio"
        units="%">1.5</Parameter>

        <Parameter name="d_backscatter_ratio" type="float" dims="1"
        description="sd expected backscatter ratio"
        units="%">10.</Parameter>


    </Group>

    <Group name="strat_aerosol_parameters2" description="Strat Aerosols
                                                         mixture 2
                                                         parameters">

        <Parameter name="name" type="string" dims="1" description="Sulphate"
units="1">Stratospheric_Sulfate</Parameter>

        <Parameter name="shape" type="string" dims="1"
        description="Assumed shape distribution used "
        units="1">Spheres</Parameter>

        <Parameter name="effective_area_radius" type="float" dims="1"
        description="assummed effective area radius"
        units="um">0.16</Parameter>

        <Parameter name="eta_0" type="float" dims="1"
        description="assummed ms eta parameter"
        units="1">0.375</Parameter>

        <Parameter name="mie_ms_f_fac" type="float" dims="1"
        description="assummed mie_ms_f_fac parameter"
        units="1">0.95</Parameter>

        <Parameter name="lambda" type="float" dims="1"
        description="Wavelength for which the aerosol parameters are
        valid" units="microns">0.355</Parameter>

        <Parameter name="linear_depolarization_ratio" type="float"
        dims="1" description="Central depolarization value"
        units="%">5.0</Parameter>

        <Parameter name="lidar_ratio" type="float" dims="1"
        description="Central lidar ratio value"
        units="Sr">60.</Parameter>

        <Parameter name="lidar_ratio_ms_adjust_factor" type="float" dims="1"
        description="Central lidar ratio value ms adjust factor"
        units="Sr">0.75</Parameter>

        <Parameter
        name="standard_deviation_linear_depolarization_ratio"
        type="float" dims="1" description="Std deviation in the depol"
        units="%">5.0</Parameter>

        <Parameter name="standard_deviation_lidar_ratio" type="float"
        dims="1" description="Std deviation in the lidar ratio"
```

```
        units="Sr">30.0</Parameter>

        <Parameter name="standard_deviation_lidar_ratio_ms_adjust_factor" type="float"
        dims="1" description="Std deviation in the lidar ratio ms adjust factor"
        units="Sr">1.0</Parameter>

        <Parameter name="angle" type="float" dims="1"
        description="Orientation of the 2D gaussian distribution with
        respect to depol axis (righthanded)"
        units="degrees">0.0</Parameter>

        <Parameter name="backscatter_ratio" type="float" dims="1"
        description="expected backscatter ratio"
        units="%">1.1</Parameter>

        <Parameter name="d_backscatter_ratio" type="float" dims="1"
        description="sd expected backscatter ratio"
        units="%">2.</Parameter>


    </Group>

    <Group name="strat_aerosol_parameters3"
            description="Aerosols mixture 3 parameters">

        <Parameter name="name" type="string" dims="1" description="Smoke"
units="1">Stratospheric_Smoke</Parameter>

        <Parameter name="shape" type="string" dims="1"
        description="Assumed shape distribution used "
        units="1">Spheres</Parameter>

        <Parameter name="effective_area_radius" type="float" dims="1"
        description="assummed effective area radius"
        units="um">0.16</Parameter>

        <Parameter name="eta_0" type="float" dims="1"
        description="assummed ms eta parameter"
        units="1">0.375</Parameter>

        <Parameter name="mie_ms_f_fac" type="float" dims="1"
        description="assummed mie_ms_f_fac parameter"
        units="1">0.95</Parameter>

        <Parameter name="lambda" type="float" dims="1"
        description="Wavelength for which the aerosol parameters are
        valid" units="microns">0.355</Parameter>

        <Parameter name="linear_depolarization_ratio" type="float"
        dims="1" description="Central depolarization value"
        units="%">40.0</Parameter>

        <Parameter name="lidar_ratio" type="float" dims="1"
        description="Central lidar ratio value"
        units="Sr">75.0</Parameter>

        <Parameter name="lidar_ratio_ms_adjust_factor" type="float" dims="1"
        description="Central lidar ratio value ms adjust factor"
        units="Sr">1.0</Parameter>

        <Parameter
        name="standard_deviation_linear_depolarization_ratio"
        type="float" dims="1" description="Std deviation in the depol"
```

```
        units="%">10.0</Parameter>

        <Parameter name="standard_deviation_lidar_ratio" type="float"
        dims="1" description="Std deviation in the lidar ratio"
        units="Sr">35.0</Parameter>

        <Parameter name="standard_deviation_lidar_ratio_ms_adjust_factor" type="float"
        dims="1" description="Std deviation in the lidar ratio ms adjust factor"
        units="Sr">1.0</Parameter>

        <Parameter name="angle" type="float" dims="1"
        description="Orientation of the 2D gaussian distribution with
        respect to depol axis (righthanded)"
        units="degrees">-5.0</Parameter>


        <Parameter name="backscatter_ratio" type="float" dims="1"
        description="expected backscatter ratio"
        units="%">1.1</Parameter>

        <Parameter name="d_backscatter_ratio" type="float" dims="1"
        description="sd expected backscatter ratio"
        units="%">100.</Parameter>


</Group>

<Group name="strat_cloud_types" description="Stratospheric cloud types">
        <Parameter name="number_of_strat_cloud_classes" type="int"
        dims="1" description="number of stratospheric cloud types"
        units="1">3</Parameter>
</Group>

<Group name="strat_cloud_parameters1"
            description="Stratospheric Supercooled Ternary droplets (STS)">

        <Parameter name="name" type="string" dims="1" description="STS
        (H2SO4 mixture)" units="1">STS</Parameter>

        <Parameter name="effective_area_radius" type="float" dims="1"
        description="assummed effective area radius"
        units="um">1.00</Parameter>

        <Parameter name="eta_0" type="float" dims="1"
        description="assummed ms eta parameter"
        units="1">0.375</Parameter>

        <Parameter name="mie_ms_f_fac" type="float" dims="1"
        description="assummed mie_ms_f_fac parameter"
        units="1">0.8</Parameter>

        <Parameter name="shape" type="string" dims="1"
        description="Assumed shape distribution used "
        units="1">single-mode lognormal PSD</Parameter>

        <Parameter name="lambda" type="float" dims="1"
        description="Wavelength for which the aerosol parameters are
        valid" units="microns">0.355</Parameter>

        <Parameter name="linear_depolarization_ratio" type="float"
        dims="1" description="Central depolarization value"
        units="%">1.0</Parameter>
```

```
        <Parameter name="lidar_ratio" type="float" dims="1"
        description="Central lidar ratio value"
        units="Sr">30.</Parameter>

        <Parameter name="lidar_ratio_ms_adjust_factor" type="float" dims="1"
        description="Central lidar ratio value ms adjust factor"
        units="Sr">1.0</Parameter>

        <Parameter
        name="standard_deviation_linear_depolarization_ratio"
        type="float" dims="1" description="Std deviation in the depol"
        units="%">2.0</Parameter>

        <Parameter name="standard_deviation_lidar_ratio" type="float"
        dims="1" description="Std deviation in the lidar ratio"
        units="Sr">20.0</Parameter>

        <Parameter name="standard_deviation_lidar_ratio_ms_adjust_factor" type="float"
        dims="1" description="Std deviation in the lidar ratio ms adjust factor"
        units="Sr">1.0</Parameter>

        <Parameter name="angle" type="float" dims="1"
        description="Orientation of the 2D gaussian distribution with
        respect to depol axis (righthanded)"
        units="degrees">0.0</Parameter>

        <Parameter name="backscatter_ratio" type="float" dims="1"
        description="Minimum backscatter ratio"
        units="%">0.</Parameter>

        <Parameter name="d_backscatter_ratio" type="float" dims="1"
        description="sd expected backscatter ratio"
        units="%">100.</Parameter>


    </Group>

    <Group name="strat_cloud_parameters2" description="Stratospheric (Nitric
                                                        Acid Trihydrate)
                                                        mixtures (NAT)">

        <Parameter name="name" type="string" dims="1" description="NAT" units="1">NAT</Parameter>

        <Parameter name="shape" type="string" dims="1"
        description="Assumed shape distribution used "
        units="1">"Irregular snmall crystals"</Parameter>

        <Parameter name="effective_area_radius" type="float" dims="1"
        description="assummed effective area radius"
        units="um">2.0</Parameter>

        <Parameter name="eta_0" type="float" dims="1"
        description="assummed ms eta parameter"
        units="1">0.375</Parameter>

        <Parameter name="mie_ms_f_fac" type="float" dims="1"
        description="assummed mie_ms_f_fac parameter"
        units="1">0.95</Parameter>

        <Parameter name="lambda" type="float" dims="1"
        description="Wavelength for which the aerosol parameters are
        valid" units="microns">0.355</Parameter>
```

```
        <Parameter name="linear_depolarization_ratio" type="float"
        dims="1" description="Central depolarization value"
        units="%">15.0</Parameter>

        <Parameter name="lidar_ratio" type="float" dims="1"
        description="Central lidar ratio value"
        units="Sr">80.</Parameter>

        <Parameter name="lidar_ratio_ms_adjust_factor" type="float" dims="1"
        description="Central lidar ratio value ms adjust factor"
        units="Sr">0.75</Parameter>

        <Parameter
        name="standard_deviation_linear_depolarization_ratio"
        type="float" dims="1" description="Std deviation in the depol"
        units="%">10.0</Parameter>

        <Parameter name="standard_deviation_lidar_ratio" type="float"
        dims="1" description="Std deviation in the lidar ratio"
        units="Sr">40.0</Parameter>

        <Parameter name="standard_deviation_lidar_ratio_ms_adjust_factor" type="float"
        dims="1" description="Std deviation in the lidar ratio ms adjust factor"
        units="Sr">1.0</Parameter>

        <Parameter name="angle" type="float" dims="1"
        description="Orientation of the 2D gaussian distribution with
        respect to depol axis (righthanded)"
        units="degrees">0.0</Parameter>

        <Parameter name="backscatter_ratio" type="float" dims="1"
        description="Minimum backscatter ratio"
        units="%">2.0</Parameter>

        <Parameter name="d_backscatter_ratio" type="float" dims="1"
        description="sd expected backscatter ratio"
        units="%">100.</Parameter>

</Group>

<Group name="strat_cloud_parameters3" description="Stratospheric Ice">
        <Parameter name="name" type="string" dims="1"
        description="Stratospheric Ice particles "
        units="1">Stratospheric Ice</Parameter>

        <Parameter name="shape" type="string" dims="1"
        description="Assumed shape distribution used "
        units="1">small_crystals</Parameter>

        <Parameter name="effective_area_radius" type="float" dims="1"
        description="assummed effective area radius"
        units="um">1.00</Parameter>

        <Parameter name="eta_0" type="float" dims="1"
        description="assummed ms eta parameter"
        units="1">0.375</Parameter>

        <Parameter name="mie_ms_f_fac" type="float" dims="1"
        description="assummed mie_ms_f_fac parameter"
        units="1">0.8</Parameter>

        <Parameter name="lambda" type="float" dims="1"
        description="Wavelength for which the aerosol parameters are
```

```
        valid" units="microns">0.355</Parameter>

        <Parameter name="linear_depolarization_ratio" type="float"
        dims="1" description="Central depolarization value"
        units="%">30.0</Parameter>

        <Parameter name="lidar_ratio" type="float" dims="1"
        description="Central lidar ratio value"
        units="Sr">25.0</Parameter>

        <Parameter name="lidar_ratio_ms_adjust_factor" type="float" dims="1"
        description="Central lidar ratio value ms adjust factor"
        units="Sr">0.75</Parameter>

        <Parameter
        name="standard_deviation_linear_depolarization_ratio"
        type="float" dims="1" description="Std deviation in the depol"
        units="%">20.0</Parameter>

        <Parameter name="standard_deviation_lidar_ratio" type="float"
        dims="1" description="Std deviation in the lidar ratio"
        units="Sr">20.0</Parameter>

        <Parameter name="standard_deviation_lidar_ratio_ms_adjust_factor" type="float"
        dims="1" description="Std deviation in the lidar ratio ms adjust factor"
        units="Sr">1.0</Parameter>

        <Parameter name="angle" type="float" dims="1"
        description="Orientation of the 2D gaussian distribution with
        respect to depol axis (righthanded)"
        units="degrees">-5.0</Parameter>

        <Parameter name="backscatter_ratio" type="float" dims="1"
        description="Minimum backscatter ratio"
        units="%">10.0</Parameter>

        <Parameter name="d_backscatter_ratio" type="float" dims="1"
        description="sd expected backscatter ratio"
        units="%">100.</Parameter>

  </Group>
</Group>

<Group name="A_ICE_config_parameters"
          description="A-ICE algorithm
                              configuration parameters used in A-PRO processor">

  <Parameter name="fractional_size_error" type="float" dims="1"
  description="Estimated relative error in parameterised ice particle
  effective radius" units="-">0.5</Parameter>


  <Parameter name="temperature_intervals"
                    type="float" dims="3"
                    description="Temperature intervals used to define the
                                  Reff,IWC, vs T parmaterization used" units="C">
        <row>-71.0</row>
        <row>-56.0</row>
        <row>0.0</row>
  </Parameter>

  <Parameter name="alpha_parameters"
                    type="float" dims="3"
```

```
                    description="Alpha parameter" units="-">

     <row>83.3</row>
          <row>9.1744e+4</row>
          <row>308.4</row>

          <!--
            These values are from the Heymsfield paper. The values below have been tuned to the Gem scenes.
            Likely the paper values should be used for real data. Will need post-launch investigation
          -->

          <!--
          <row>40.0</row>
          <row>4.5e+4</row>
          <row>150.0</row>
          -->

    </Parameter>


    <Parameter name="beta_parameters"
                    type="float" dims="3"
                    description="Beta Parameter" units="-">
          <row>0.0184</row> <row>0.117</row> <row>0.0152</row>
    </Parameter>
   </Group>

   <Group name="LARISSA" description="Options for LARISSA processing">
    <Parameter name="larissa_correction_factor" type="float" dims="1" description="larissa_correction_factor"
units="1">1.0</Parameter>
    <Parameter name="wind_slope_type" type="string" dims="1"  description="water surface reflection model
(coxmunk,'hu08,wu90)"
                    units="1">hu08</Parameter>
   </Group>

  </Data_Block>
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