

ICOL+ Software User Manual

1.2

27 June 2012

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Chapter 1

Introduction

1.1 Scope

This document is the software user manual (SUM) for the ICOL+ processor.

1.2 Objectives

In images retrieved from spectrometers such as MERIS, an increase in the radiances, especially in the near infrared bands, can often be observed over water and in the vicinity of vegetated coasts. The affected area can extend over 10km or even more. This increase is not (always) related to an increase in the aerosol optical depth but is caused by the so-called adjacency effect. This effect results when photons are reflected and scattered towards the sensor and where a substantial contrast exists between the target and its surrounding. During processing of such measurements the correction schemes need to take this effect into account, otherwise the increased radiance is erroneously associated with other physical processes, and the derived geophysical quantities have an increased error.

Observations over waters near to land surfaces, both for coastal and inland waters, are affected because of the large contrast in the red and infrared part of the spectrum, where water is almost black and vegetated areas are very bright. The effect is easier to illustrate in coastal waters because it decreases from coastline to off-shore. This effect can best be studied in MERIS Full Resolution images, but even in reduced resolution the adjacency effect can also clearly be seen.

In order to build up a reliable tool for the correction of the adjacency effect, the ICOL (= Improve Contrast over Ocean and Land) prototype processor was developed as BEAM plugin. Although this prototype (ICOL1.0) has proven to retrieve results as expected from theory, it has some well-known limitations:

- Restricted to coastal areas over water (although the AE is known to exist as well over land)
- Restriction to case 1 waters
- No proper handling of clouds and sea ice
- Restricted to application on MERIS data only
- Slow processing

To overcome these limitations and to be able to apply the AE correction within operational processing chains, an improved BEAM plugin (ICOL+) has been developed. With this processor, the AE correction is applicable anywhere over ocean as well as over land and considers case 2 waters, clouds and sea ice. An improved convolution scheme (the core mathematical part of the AE correction) has been integrated to significantly speed up the processor. Moreover, it is possible with ICOL+ to apply the AE correction on Landsat TM data. This feature mainly serves as a demonstration for the general portability of the AE correction scheme to other instruments within future projects (e.g. related to the Sentinel missions). However, the full correction scheme has been implemented as for MERIS and has shown to provide results as expected ([RD-2]).

This manual basically describes and illustrates how to use the application. For a detailed description of the underlying algorithms see [RD-1], the technical realisation of the software package is outlined in [RD-3].

1.3 Reader Level

This specification is mainly written for the following audiences:

- MERIS QWG members
- Any other scientists interested in MERIS or Landsat TM image analysis

The ICOL user manual specifications assumes that the reader is familiar with basic concepts in using the BEAM software and its integrated processors.

1.4 Acronyms

- AE - Adjacency Effect
- AMORGOS - Accurate MERIS Ortho-Rectified Geo-location Operational Software
- AOT - Aerosol Optical Thickness
- ATBD - Algorithm Theoretical Basis Document
- BC - Brockmann Consult
- BEAM - Basic ERS & Envisat (A)ATSR and Meris Toolbox
- CTP - Cloud Top Pressure
- DEM - Digital Elevation Model
- ESA - European Space Agency
- ESTEC - European Space Technology and Research Centre
- FR - Full Resolution
- FRG - Full Resolution Geo/Ortho-corrected
- GPF - Graph Processing Framework
- GPU - Graphics Processing Unit
- ICOL - Improved Contrast over Ocean and Land
- MERIS - Medium Resolution Imaging Spectrometer
- NDSI - Normalized Difference Snow Index
- NDVI - Normalized Difference Vegetation Index
- QWG - Quality Working Group
- RR - Reduced Resolution
- RRG - Reduced Resolution Geo/Ortho-corrected
- SoW - Statement of Work
- SUM - Software User Manual
- TM - Thematic Mapper
- TOA - Top of Atmosphere
- TS - Technical Specification
- VVR - Verification and Validation Report

1.5 Applicable Documents

- [AD-1] Development of a multi-mission adjacency effect correction for an operational implementation. ESA Statement of Work GMES-CLVL-EOPG-SW-08-0003, Issue 1.4.
- [AD-2] MERIS Level 2 Detailed Processing Model, PO-TN-MEL-GS-0006, 15 July 2009, Issue i8r0.

1.6 Reference Documents

- [RD-1] ICOL+ ATBD. Version 1.0, ICOL+ project deliverable D4, 18 November 2010.
- [RD-2] ICOL+ VVR. Version 1.0, ICOL+ project deliverable D8, 18 November 2010.
- [RD-3] ICOL+ TS. Version 1.0, ICOL+ project deliverable D10, 18 November 2010.
- [RD-4] AMORGOS documentation: <http://earth.esa.int/services/amorgos/download/>
- [RD-5] Khronos Group OpenCL online documentation: <http://www.khronos.org/opencl/>
- [RD-6] USGS Earth Explorer data archive: <http://edcsns17.cr.usgs.gov/EarthExplorer/>

Chapter 2

Software Installation

2.1 ICOL+ as BEAM plugin

As a BEAM plugin, the ICOL+ processor needs the following software to be installed in advance:

- BEAM, version 4.10.x

The BEAM software can be obtained from the BEAM download page (www.brockmann-consult.de/beam).

The ICOL+ software main package consists of the jar file for the ICOL+ main module (version 2.9.2):

- beam-meris-icol-2.9.2.jar

The ICOL+ software package needs to be installed with the BEAM Module Manager in BEAM/Visat (see Figure 2.1 and the corresponding BEAM help documentation (<http://www.brockmann-consult.de/beam/doc/help/visat/ModuleManager.html>)).

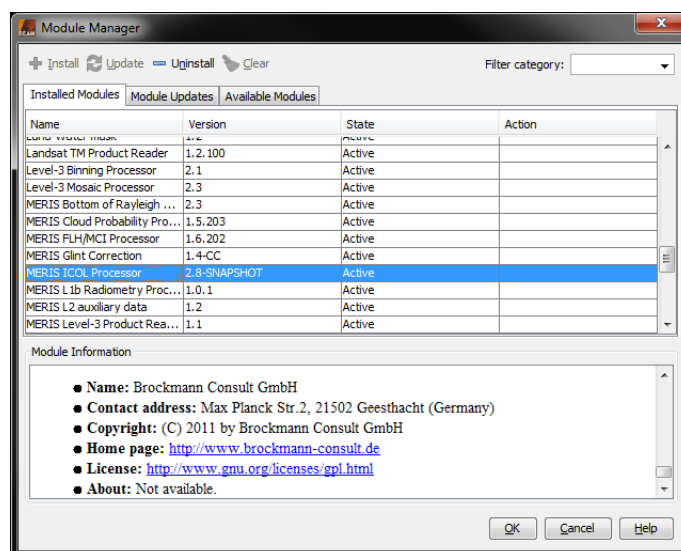


Figure 2.1: Installation of ICOL+ with the BEAM Module Manager

2.2 Additional Software

To be able to process all options properly, the ICOL+ processor needs the following add-ons to be installed in BEAM (if not already done):

- MERIS L2 Auxdata module
- MERIS Bottom of Rayleigh Reflectance (BRR) Processor
- MERIS Surface Directional Reflectance (SDR) Processor
- BEAM Watermask Operator
- GETASSE30 DEM reader (required for LANDSAT TM processing)
- GETASSE30 DEM (required for LANDSAT TM processing)

The MERIS L2 Auxdata, the BRR and SDR processor modules, the BEAM Watermask Operator, and the GETASSE30 DEM reader can also be installed with the BEAM module manager. See again BEAM help documentation for details.

The GETASSE30 DEM can be downloaded from the BEAM download page. See also BEAM help documentation:

<http://www.brockmann-consult.de/beam/doc/help/visat/GETASSE30ElevationModel.html>

2.3 Hardware and Memory Requirements

The ICOL+ processor is a rather complex tool and requires extensive memory resources to work properly:

- Usage of an up-to-date computer with at least 4GB RAM is strongly recommended. On less powerful machines, various kinds of failures may occur.
- The standard BEAM/Visat VM options are not sufficient for ICOL+: In the 'bin' folder of the BEAM 4.10.x installation, edit the file 'visat.voptions' and change the 'Xmx' parameter (maximum Java heap space) from 1024M to at least 3000M. Restart BEAM to enable these new settings.

Chapter 3

ICOL+ Products

3.1 Input Products

The input products which can be processed with the ICOL+ processor are:

- MERIS L1b radiance files (.N1 format or BEAM DIMAP format, product type 'MER_..._1P')
- MERIS L1b radiance files (BEAM DIMAP format, i.e. subsets of original .N1 files)
- MERIS L1 ortho-corrected radiance files (BEAM DIMAP format, product types 'MER_RRG_1P', 'MER_FRG_1P')
- MERIS L1 AMORGOS ([RD-4]) corrected radiance files (BEAM DIMAP format, product type 'MER_..._1N')
- MERIS L2 cloud product (BEAM DIMAP format): An optional input product which must contain a suitable cloud classification flag band which can then be used to define an alternative cloud mask expression for the AE correction algorithm.
- LANDSAT 5 TM L1 radiance files (GEOTIFF format)
- LANDSAT 7 ETM+ L1 radiance files (GEOTIFF format)

3.2 Output Products

3.2.1 MERIS

The MERIS L1c output products which can be derived using the ICOL+ processor are:

- MERIS L1c radiances: The MERIS radiances for bands 1-15 corrected for the adjacency effect. This product can be retrieved in either original .N1 format or BEAM DIMAP format (user option).

OR alternatively (user option):

- MERIS L1c TOA reflectances: AE corrected radiances for bands 1-15 converted to TOA reflectances. This product is provided in BEAM DIMAP format. Within this product, the following quantities are optionally provided (user option):
 - TOA reflectances (bands 1-15) corrected for AE (Rayleigh part of correction only)
 - TOA reflectances (bands 1-15) corrected for AE (Rayleigh and aerosol parts of correction)
 - AE Rayleigh correction term (bands 1-15)
 - AE aerosol correction term (bands 1-15)
 - Angstrom coefficient and aerosol optical thickness at 865nm.

- 'land_flag_ray_conv': Binary land-water mask smoothed onto interval [0,1] using Rayleigh weighting function.
- 'land_flag_aer_conv': Binary land-water mask smoothed onto interval [0,1] using aerosol weighting function.
- 'cloud_flag_ray_conv': Binary cloud mask smoothed onto interval [0,1] using Rayleigh weighting function.
- 'cloud_flag_aer_conv': Binary cloud mask smoothed onto interval [0,1] using aerosol weighting function.

Flag bands:

- MERIS L1 flag band

The coding of the MERIS L1 flags is listed in Table 3.1.

Name	Value	Description
COSMETIC	1	Pixel is cosmetic
DUPLICATED	2	Pixel has been duplicated (filled in)
GLINT_RISK	4	Pixel has glint risk
SUSPECT	8	Pixel is suspect
LAND_OCEAN	16	Pixel is over land, not ocean
BRIGHT	32	Pixel is bright
COASTLINE	64	Pixel is part of a coastline
INVALID	128	Pixel is invalid

Table 3.1: MERIS L1 flags

- ICOL aerosol retrieval flag band (not for patched N1 file, see Section 4.1)

The coding of the ICOL aerosol retrieval flags is listed in Table 3.2.

Name	Value	Description
bad_aerosol_model	1	No appropriate aerosol model could be applied for given pixel
bad_aot_model	2	No appropriate AOT model could be applied for given pixel
high_turbid_water	4	Turbidity was identified as high for this pixel
sunglint	8	Sun glint present in this pixel

Table 3.2: ICOL aerosol retrieval flags (MERIS)

- Adjacency effect flag band (only in case of TOA reflectances output)

The coding of the adjacency effect flags is listed in Table 3.3.

3.2.2 LANDSAT

The LANDSAT TM intermediate output products which can be derived using the ICOL+ processor are:

- Downscaled LANDSAT 5 TM L1 radiances: The LANDSAT 5 TM radiances for bands 1-5 and 7, downscaled to the AE correction grid. This product is provided in BEAM DIMAP format. It contains the same bands as the GEOTIFF input product.
- Downscaled LANDSAT 7 ETM+ L1 radiances: The LANDSAT 7 ETM+ radiances for bands 1-5, 7 and 8, downscaled to the AE correction grid. This product is provided in BEAM DIMAP format. It contains the same bands as the GEOTIFF input product.
- AE corrected LANDSAT 5 TM L1 radiances: The LANDSAT 5 TM radiances for bands 1-5 and 7, corrected for adjacency effect. This product is provided in BEAM DIMAP format on the AE correction grid. It contains the same bands as the GEOTIFF input product, plus cloud and land flag bands (see below).

Name	Value	Description
ae_mask_rayleigh	1	Pixel is inside Rayleigh AE correction mask
ae_mask_aerosol	2	Pixel is inside aerosol AE correction mask
landcons	4	Consolidated land pixel
cloud	8	Cloud pixel
ae_applied_rayleigh	16	Rayleigh AE correction was applied to this pixel
ae_applied_aerosol	32	Aerosol AE correction was applied to this pixel
alpha_out_of_range	64	Alpha value is out of range for this pixel
aot_out_of_range	128	AOT value is out of range for this pixel
high_turbid_water	256	Turbidity was identified as high for this pixel
sunglint	512	Sun glint present in this pixel

Table 3.3: Adjacency effect flags (MERIS)

- AE corrected LANDSAT 7 ETM+ L1 radiances: The LANDSAT 7 ETM+ radiances for bands 1-5 and 7, corrected for adjacency effect. This product is provided in BEAM DIMAP format on the AE correction grid. It contains the same bands as the GEOTIFF input product, plus cloud and land flag bands (see below).

The coding of the cloud classification flag is listed in Table 3.4.

Name	Value	Description
F_CLOUD	0	Pixel was finally specified as cloudy (if all flags below are set)
F_BRIGHT	1	Brightness flag (set if TM3 < BT)
F_NDVI	2	NDVI flag (set if NDVI < NDVIT_CLOUD, with $NDVI = (TM4 - TM3)/(TM4 + TM3)$)
F_NDSI	4	NDSI flag (set if NDSI < NDSIT, with $NDSI = (TM2 - TM5)/(TM2 + TM5)$)
F_TEMP	8	Temperature flag (set if TM6 < TM6T_CLOUD)

Table 3.4: Cloud classification flags (Landsat TM)

The coding of the land classification flag is listed in Table 3.5.

The LANDSAT TM final output products which can be derived using the ICOL+ processor are:

- LANDSAT 5 TM L1 radiances: The LANDSAT 5 TM radiances for bands 1-5 and 7 corrected for the adjacency effect. This product is provided in BEAM DIMAP format. It has the same dimensions and contains the same bands as the GEOTIFF input product.
- LANDSAT 7 ETM+ L1 radiances: The LANDSAT ETM+ radiances for bands 1-5, 7 and 8 corrected for the adjacency effect. This product is provided in BEAM DIMAP format. It has the same dimensions and contains the same bands as the GEOTIFF input product.

Name	Value	Description
F_LANDCONS	0	Pixel was classified as land
F_LOINLD	1	Pixel was classified as inland waters (currently no algorithm implemented and set to false)
F_NDVI	2	NDVI flag (set if $NDVI < NDVI_{T_LAND}$, with $NDVI = (TM4 - TM3)/(TM4 + TM3)$)
F_TEMP	8	Temperature flag (set if $TM6 > TM6_{T_LAND}$ (summer), $TM6 < TM6_{T_LAND}$ (winter))
F_ICE	16	Pixel was classified as ice (currently no algorithm implemented and set to false)

Table 3.5: Land classification flags (Landsat TM)

Chapter 4

ICOL+ User Interface

The ICOL+ processor graphical user interface is represented by one main dialog, which consists of the following components:

- 'I/O Parameters' Tab Pane
- 'General Settings' Tab Pane
- 'MERIS' Tab Pane
- 'LANDSAT TM' Tab Pane
- 'Run', 'Close' and 'Help' control buttons

4.1 I/O Parameters Tab Pane

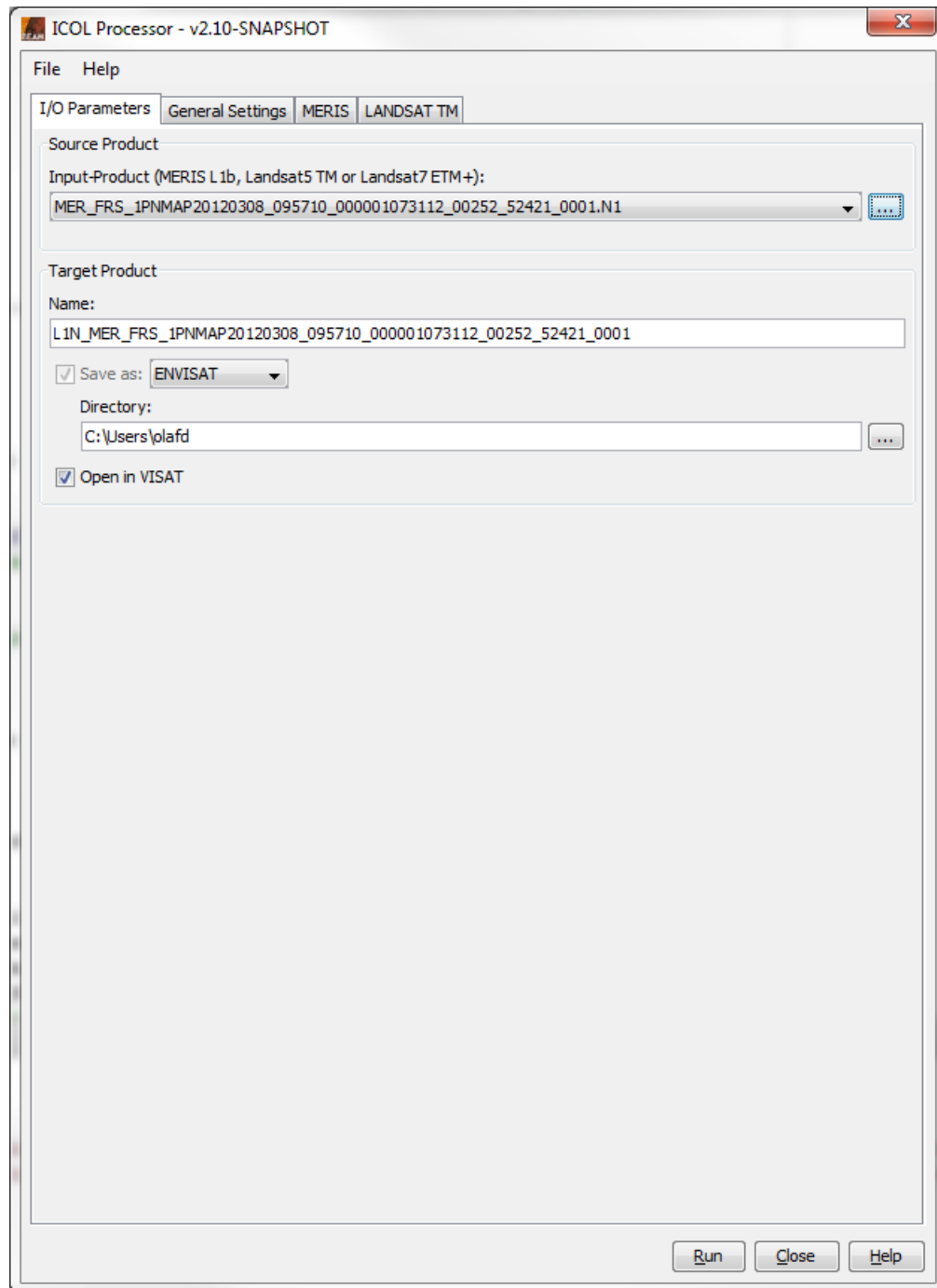


Figure 4.1: I/O Parameters Tab Pane

This tab pane (Figure 4.1) consists of the following components:

- Input product file: Select the input product file by pressing the file selection button to invoke a standard file dialog.
 - MERIS: Select a L1 product given in .N1 or BEAM-DIMAP format

- LANDSAT 5 TM or Landsat 7 ETM+: Select a L1 product given in GEOTIFF. A large number of Landsat TM products in GEOTIFF format can be found at the USGS Earth Explorer site ([RD-6]). To process TM GEOTIFF data in ICOL, do the following steps:

- * The data from [RD-6] usually come in gzipped format named like 'LT5...tar.gz'. If so, unpack this archive.
- * The unpacked product should consist of seven (TM) or eight (ETM+) single .tif files and two metafiles with suffixes '_MTL.txt' and '_GCP.txt'.
- * Select the file '..._MTL.txt' as input file.

After successful selection, the target product name field will be disabled and will show a name with suffix '_downscaled'. This name cannot be changed by the user. Also, the target directory text field will disappear, as this needs to be set on the LANDSAT TM tab pane (see below).

- Output product file: Select the output product file by typing the product filename into the text field.
 - Output product format and target directory:
 - 'Save as': If this checkbox is selected, the output product will be saved to disk.
 - Output product format: Select one of the available output product formats. For MERIS, these are:
 - * BEAM-DIMAP
 - * NETCDF
 - * ENVISAT (in case the input product is a .N1 file and the output product has been selected as 'Radiance Product' (see below). In this case, the output product contains the same bands as the input N1 product. This allows the AE corrected product to be re-used as input for many other BEAM processors (such as Case 2 Regional) within a processing chain.

For LANDSAT TM and ETM+, these are:

 - * BEAM-DIMAP
 - * NETCDF
 - * GeoTIFF - MERIS only: Select the output product directory by either typing the product path into the text field or by pressing the file selection button to invoke a standard file dialog.
- 'Open in Visat': If this checkbox is selected, the output product is opened in Visat after successful processing.

4.2 'General Settings' Tab Pane

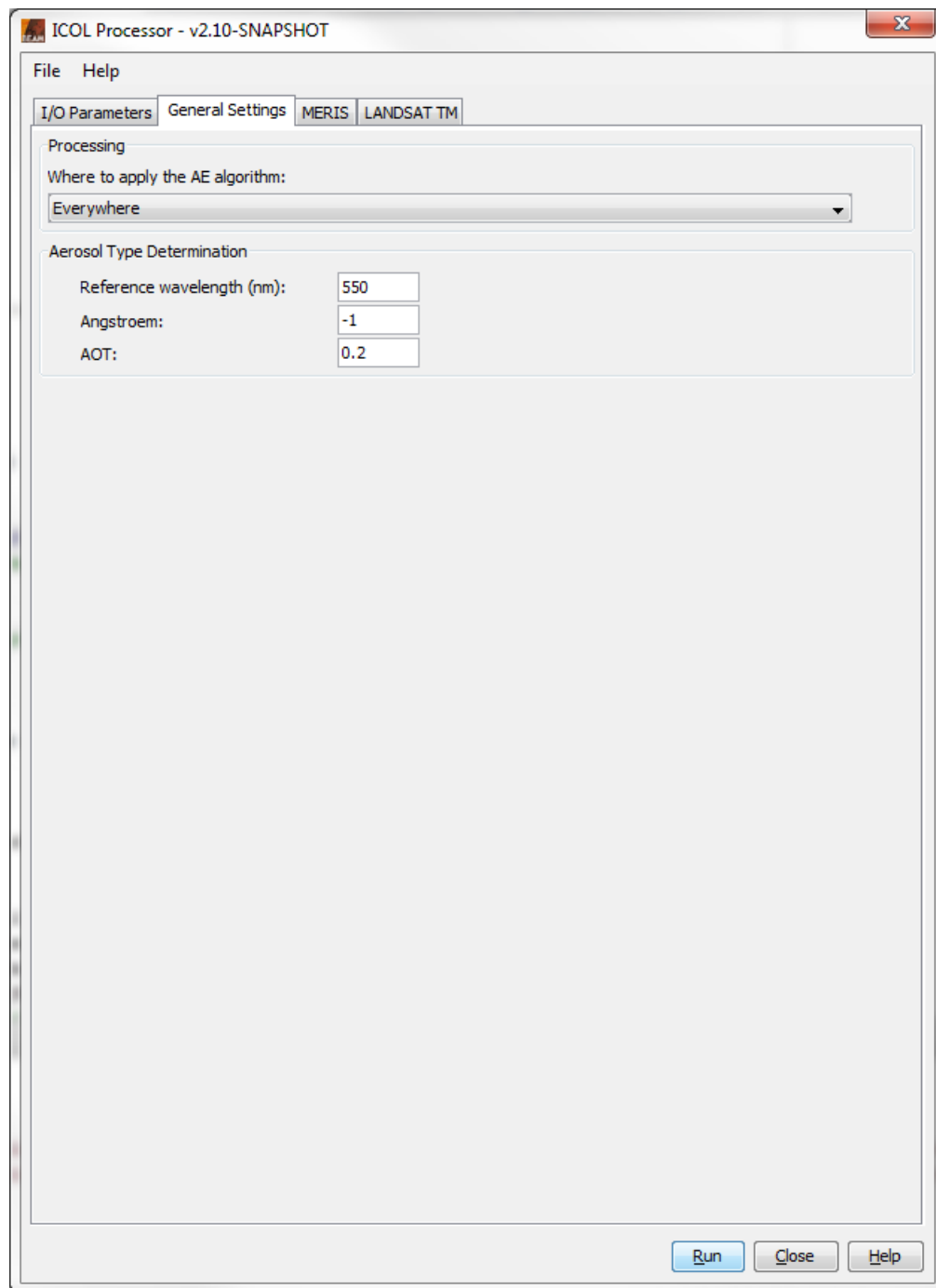


Figure 4.2: 'General Settings' Tab Pane

This tab pane (Figure 4.2) consists of three subpanels.

4.2.1 'Processing' Subpanel

- 'Where to apply the AE algorithm': This drop-down menu provides the following options where the AE algorithm shall be applied (see also Figure 4.3):
 - Everywhere
 - Coastal regions over ocean and land
 - Coastal regions over the ocean
 - Everywhere over the ocean

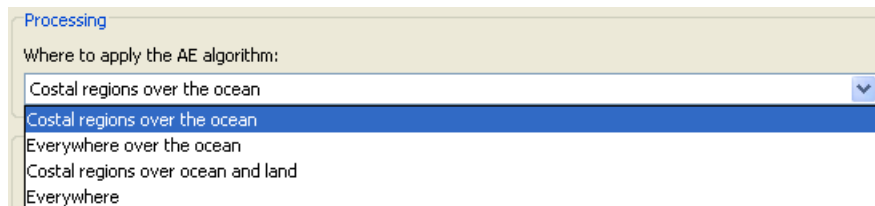


Figure 4.3: Drop-down menu for the selection of the area to apply the AE correction

4.2.2 'Aerosol Type Determination' Subpanel

- 'Reference wavelength (nm)': A text field to enter the reference wavelength for Angstrom and AOT values below. The default is 550nm..
- 'Angstrom': A text field to enter the Angstrom coefficient. The default is -1, the valid interval is [-2.1, -0.4].
- 'AOT': A text field to enter the aerosol optical thickness. The default is 0.2, the valid interval is [0.0, 1.5].

4.3 'MERIS' Tab Pane

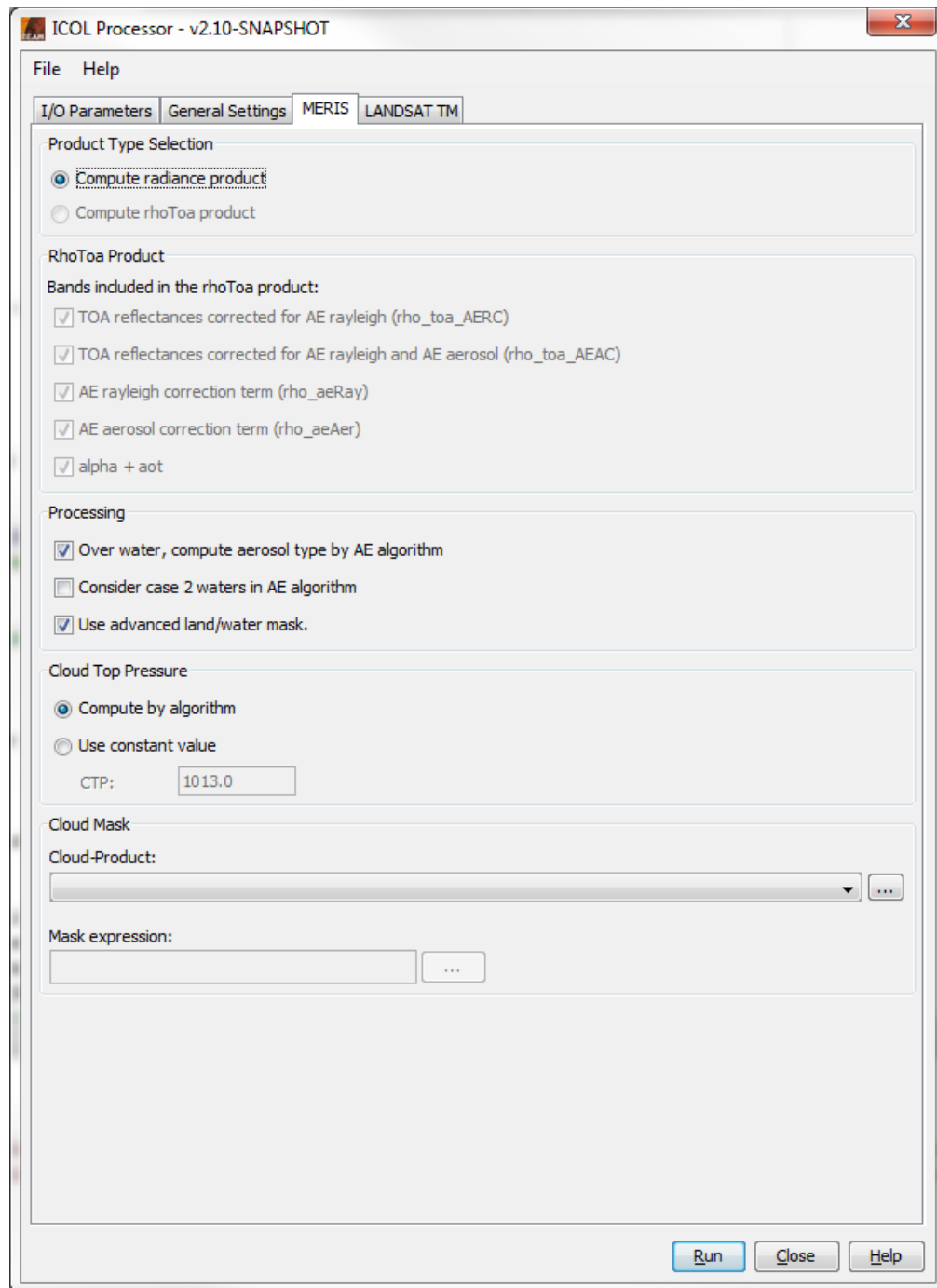


Figure 4.4: 'MERIS' Tab Pane

This tab pane (Figure 4.4) consists of five subpanels.

4.3.1 'Product Type Selection' Subpanel

- 'Compute radiance product', 'Compute rhoToa product': With this radio button group (toggle button), the user can determine whether he wants to write AE corrected radiances or TOA reflectances to the output product.

4.3.2 'RhoToa Product' Subpanel

- Bands included in the rhoToa product: With the checkboxes in this subpanel, the user can select additional quantities (as listed in Section 3.2.1) to be written to the output product. Note that the checkboxes are enabled only if 'Compute rhoToa product' was selected above.

4.3.3 'Processing' Subpanel

- 'Over water, compute aerosol type by AE algorithm': If this checkbox is selected, the aerosol type over water used for the AE correction will be determined by the algorithm itself. Otherwise, it will be taken from the Angstrom/AOT combination as set by the user above (same as over land).
- 'Consider case 2 waters in AE algorithm': With this checkbox the user can select that case 2 waters are considered in the AE correction algorithm.
- 'Use advanced land/water mask': With this checkbox the user can select that, instead of the MERIS L1b land flag, a more accurate land mask based on a set of shape files is used.

4.3.4 'Cloud Top Pressure' Subpanel

- 'Compute by algorithm', 'Use constant value': With this radio button group (toggle button), the user can determine whether he wants to use a cloud top pressure computed by the algorithm or to use a constant value.
- 'CTP': A text field to enter the constant cloud top pressure value. The default is 1013 hPa, the valid interval is [0.0, 1013.0]. Note that this textfield is enabled only if 'Use constant value' was selected above.

4.3.5 'Cloud Mask' Subpanel

- Cloud product file: Select the cloud product file by pressing the file selection button to invoke a standard file dialog.
- Mask expression: Define a cloud mask expression by either typing in the text field or by pressing selection button to invoke a standard BEAM expression editor (Figure 4.5). A detailed description how to use this component can be found in the BEAM help (search keyword 'Band Maths Expression Editor'). An expression validity check is performed before the ICOL processing is being started. E.g., if 'xxx' is typed into the text field, an error message as shown in Figure 4.6 will be displayed.

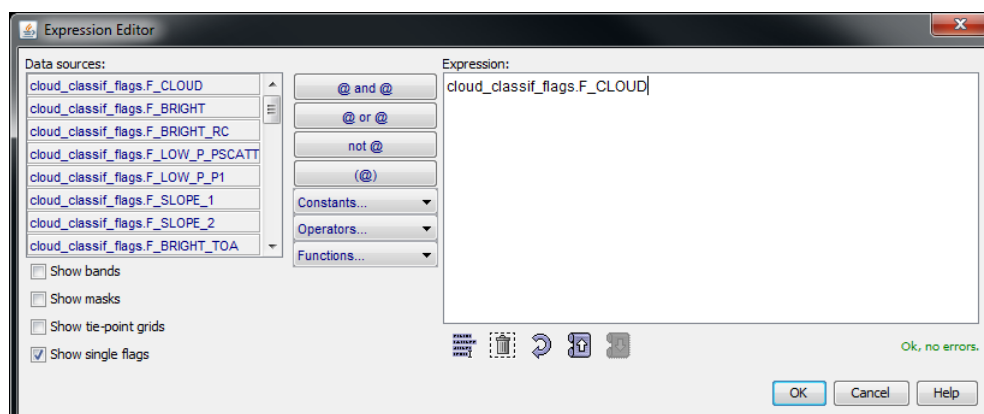


Figure 4.5: BEAM Band Maths Expression Editor

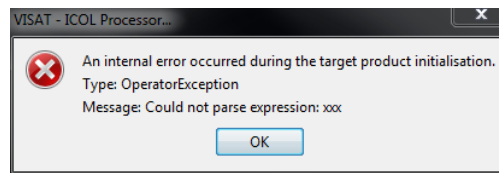


Figure 4.6: Cloud mask expression validation: expression invalid.

4.4 'LANDSAT TM' Tab Pane

ICOL Processor - v2.10-SNAPSHOT

File Help

I/O Parameters General Settings MERIS **LANDSAT TM**

Processing

Output Products Directory : C:\Users\olafd

Output product type:

- ☒ Downscale source product to AE correction grid
- ☐ Compute AE corrected product on AE correction grid
- ☐ Upscale AE corrected product to original grid

AE correction grid resolution:

- ☐ 300 m
- ☒ 1200 m

Atmospheric Parameters

Ozone content (cm atm): 0.32

Surface pressure (hPa): 1013.25

Surface TM apparent temperature (K): 300.0

Cloud Flag Settings

- ☒ Brightness flag (set if TM3 > BT)

Brightness threshold BT: 0.3
- ☒ NDVI flag (set if NDVI < NDVIT, with $NDVI = (TM4 - TM3)/(TM4 + TM3)$)

NDVI threshold NDVIT: 0.2
- ☒ NDSI flag (set if NDSI < NDSIT, with $NDSI = (TM2 - TM5)/(TM2 + TM5)$)

NDSI threshold NDSIT: 3.0
- ☒ Temperature flag (set if TM6 < TM6T)

Temperature threshold TM6T (K): 300.0

Land Flag Settings

- ☒ NDVI flag (set if NDVI < NDVIT, with $NDVI = (TM4 - TM3)/(TM4 + TM3)$)

NDVI threshold: 0.1
- ☒ Temperature flag (set if TM6 > TM6T (summer), TM6 < TM6T (winter))

Temperature threshold TM6T (K): 300.0

Season:

 - ☒ Summer
 - ☐ Winter

Run Close Help

Figure 4.7: 'LANDSAT TM' Tab Pane

This tab pane (Figure 4.7) consists of four subpanels.

4.4.1 'Processing' Subpanel

- 'Output products directory': In this text field, the user shall specify the directory where both the intermediate (after downscaling and after AE correction) and the final product will be written.
- 'Output product type': With this radio button group (toggle button), the user can specify what kind of output he wants to write into the target product:
 - 'Downscale source product to AE correction grid': The input L1 radiance product will be downscaled to the AE correction grid.
 - 'Compute AE corrected product on AE correction grid': The AE correction will be done on the AE correction grid.
 - 'Upscale AE corrected product to original grid': The AE corrected product will be upscaled to the original resolution of the input product.
- 'AE correction grid resolution': With this radio button group (toggle button), the user can specify if the LANDSAT TM AE correction shall be performed with a 300m (MERIS FR) or a 1200m (MERIS RR) resolution.

After setting the output products directory and cloud/land flag parameters (see below), the AE correction process of a Landsat TM or ETM+ product MUST be carried out in three subsequent steps:

- Select 'Downscale source product to AE correction grid', click 'Run': The downscaling subprocess will be done, an intermediate product with prefix 'LIN_' and suffix '_downscaled' will be written.
- Select 'Compute AE corrected product on AE correction grid', click 'Run': The AE correction subprocess will be done, an intermediate product with prefix 'LIN_' and suffix '_downscaled_corrected' will be written.
- Select 'Upscale AE corrected product to original grid', then select the name of the output product on the I/O parameters pane, then click 'Run': The upscaling subprocess will be done, the final product will be written.

4.4.2 'Atmospheric Parameters' Subpanel

- 'Ozone content (cm atm):' : A text field to enter the ozone content value to be used by the AE correction algorithm. The default is 0.32 cm atm, the valid interval is [0.01, 1.0].
- 'Surface pressure (hPa):' : A text field to enter the surface pressure value to be used by the AE correction algorithm. The default is 1013.0 hPa, the valid interval is [300.0, 1060.0].
- 'Surface TM apparent temperature (K):' : A text field to enter the ozone content value to be used by the AE correction algorithm. The default is 300 K, the valid interval is [200.0, 320.0].

4.4.3 'Cloud Flag Settings' Subpanel

- With the checkboxes in this subpanel, the user can select subsequent tests (see also [Section 3.2.2](#)) to finally define a cloud flag:
 - Brightness test ('passed' if $TM3 < BT$)
 - NDVI test ('passed' if $NDVI < NDVIT_CLOUD$, with $NDVI = (TM4 - TM3)/(TM4 + TM3)$)
 - NDSI test ('passed' if $NDSI < NDSIT$, with $NDSI = (TM2 - TM5)/(TM2 + TM5)$)
 - Temperature test ('passed' if $TM6 < TM6T_CLOUD$)

If all selected tests are passed, the given pixel is considered and flagged as 'cloudy'.
- With the textfields in this subpanel, the user can specify distinct thresholds for the tests above:
 - Brightness threshold BT: The default is 0.3, the valid interval is [0.0, 1.0]
 - NDVI threshold NDVIT_CLOUD: The default is 0.2, the valid interval is [0.0, 1.0]
 - NDSI threshold NDSIT: The default is 3.0, the valid interval is [0.0, 10.0]
 - Temperature threshold TM6T_CLOUD: The default is 300.0, the valid interval is [200.0, 320.0]

4.4.4 'Land Flag Settings' Subpanel

- With the checkboxes in this subpanel, the user can select subsequent tests (see also Section 3.2.2) to finally define a land flag:
 - NDVI test ('passed' if $NDVI < NDVIT_LAND$, with $NDVI = (TM4 - TM3)/(TM4 + TM3)$)
 - Temperature test ('passed' if $TM6 > TM6T$ (summer), $TM6 < TM6T$ (winter))

If all selected tests are passed, the given pixel is considered and flagged as 'land'.
- With the textfields in this subpanel, the user can specify distinct thresholds for the tests above:
 - NDVI threshold $NDVIT_LAND$: The default is 0.2, the valid interval is [0.0, 1.0]
 - Temperature threshold $TM6T_LAND$: The default is 300.0, the valid interval is [200.0, 320.0]
- 'Season': With this radio button group (toggle button), the user can specify if he wants to apply the 'winter' or the 'summer' criterion in the temperature test above.

4.5 Control Buttons

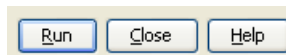


Figure 4.8: ICOL+ control buttons

From all ICOL+ tab panes, the following control buttons can be accessed:

- 'Run': If this button is clicked, the processor will start the computations.
- 'Close': If this button is clicked, the ICOL+ dialog is closed.
- 'Help': If this button is clicked, this manual is displayed as BEAM help.

4.6 Processing from command line

Since the ICOL+ processor makes use of the BEAM graph processing framework, it can be used also as a command line tool outside BEAM-VISAT. The graph processing is invoked by the command

- `${BEAM-INSTALL-DIR}/bin/gpt`

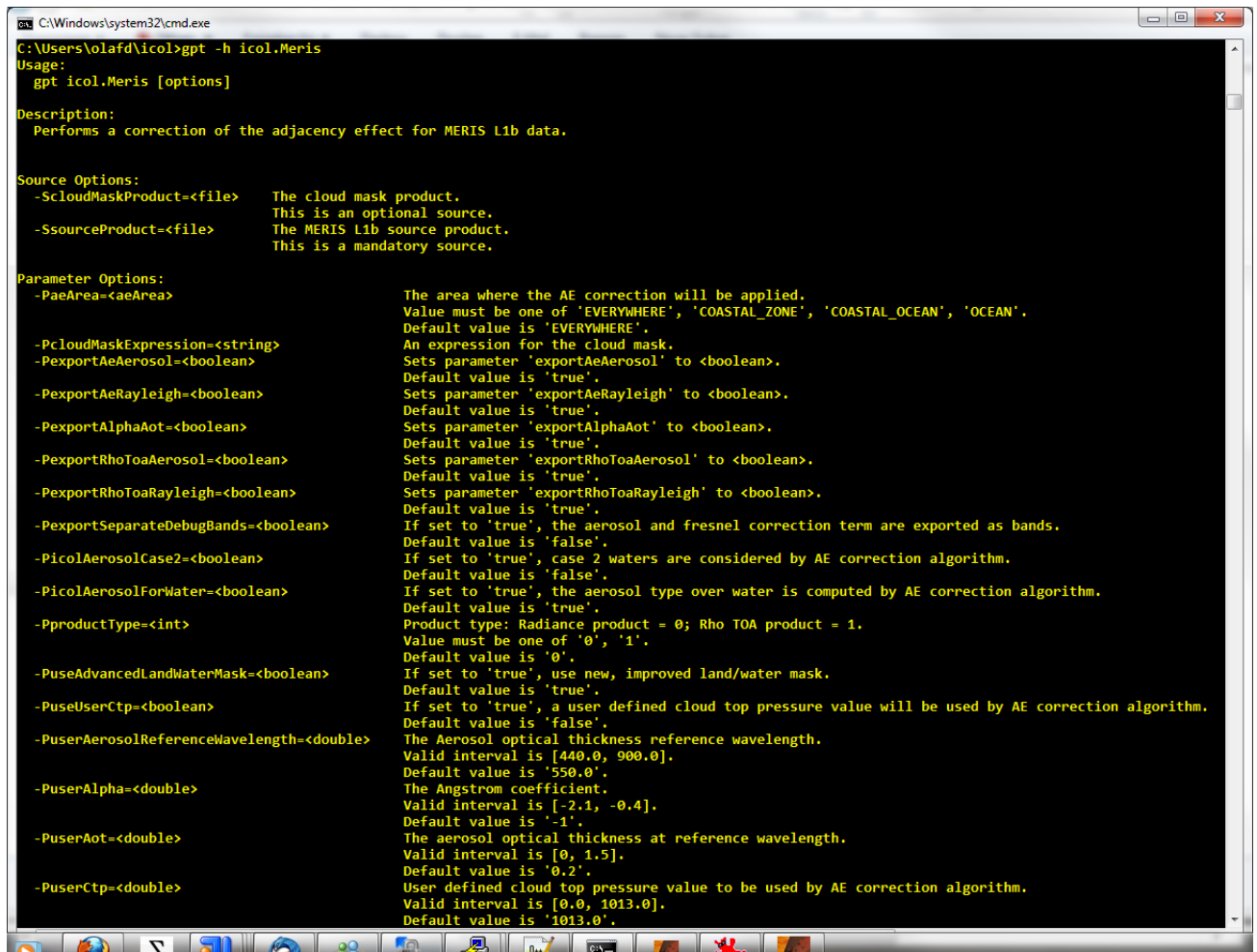
To obtain general help on the graph processing, use the command

- `${BEAM-INSTALL-DIR}/bin/gpt -h`

Specific help on the ICOL+ processor (MERIS or LANDSAT TM), can be obtained with

- `${BEAM-INSTALL-DIR}/bin/gpt -h icol.Meris`
- `${BEAM-INSTALL-DIR}/bin/gpt -h icol.ThematicMapper`
- `${BEAM-INSTALL-DIR}/bin/gpt -h icol.EnhancedThematicMapper`

In this case, information on the usage and a list of all available parameters are given. (see Figure 4.9).



```

C:\Windows\system32\cmd.exe
C:\Users\olaf\icol>gpt -h icol.Meris
Usage:
  gpt icol.Meris [options]

Description:
  Performs a correction of the adjacency effect for MERIS L1b data.

Source Options:
  -ScldMaskProduct=<file>    The cloud mask product.
                             This is an optional source.
  -SsourceProduct=<file>    The MERIS L1b source product.
                             This is a mandatory source.

Parameter Options:
  -PaeArea=<aeArea>          The area where the AE correction will be applied.
                             Value must be one of 'EVERYWHERE', 'COASTAL_ZONE', 'COASTAL_OCEAN', 'OCEAN'.
                             Default value is 'EVERYWHERE'.
  -PcloudMaskExpression=<string> An expression for the cloud mask.
  -PexportAeAerosol=<boolean>    Sets parameter 'exportAeAerosol' to <boolean>.
                             Default value is 'true'.
  -PexportAeRayleigh=<boolean>   Sets parameter 'exportAeRayleigh' to <boolean>.
                             Default value is 'true'.
  -PexportAlphaAot=<boolean>     Sets parameter 'exportAlphaAot' to <boolean>.
                             Default value is 'true'.
  -PexportRhoToaAerosol=<boolean> Sets parameter 'exportRhoToaAerosol' to <boolean>.
                             Default value is 'true'.
  -PexportRhoToaRayleigh=<boolean> Sets parameter 'exportRhoToaRayleigh' to <boolean>.
                             Default value is 'true'.
  -PexportSeparateDebugBands=<boolean> If set to 'true', the aerosol and fresnel correction term are exported as bands.
                             Default value is 'false'.
  -PicolAerosolCase2=<boolean>    If set to 'true', case 2 waters are considered by AE correction algorithm.
                             Default value is 'false'.
  -PicolAerosolForWater=<boolean> If set to 'true', the aerosol type over water is computed by AE correction algorithm.
                             Default value is 'true'.
  -PproductType=<int>            Product type: Radiance product = 0; Rho TOA product = 1.
                             Value must be one of '0', '1'.
                             Default value is '0'.
  -PuseAdvancedLandWaterMask=<boolean> If set to 'true', use new, improved land/water mask.
                             Default value is 'true'.
  -PuseUserCtp=<boolean>         If set to 'true', a user defined cloud top pressure value will be used by AE correction algorithm.
                             Default value is 'false'.
  -PuserAerosolReferenceWavelength=<double> The Aerosol optical thickness reference wavelength.
                             Valid interval is [440.0, 900.0].
                             Default value is '550.0'.
  -PuserAlpha=<double>          The Angstrom coefficient.
                             Valid interval is [-2.1, -0.4].
                             Default value is '-1'.
  -PuserAot=<double>            The aerosol optical thickness at reference wavelength.
                             Valid interval is [0, 1.5].
                             Default value is '0.2'.
  -PuserCtp=<double>            User defined cloud top pressure value to be used by AE correction algorithm.
                             Valid interval is [0.0, 1013.0].
                             Default value is '1013.0'.

```

Figure 4.9: ICOL+ command line processing

If MERIS N1 products shall be written as output result a graph xml file has to be created. This xml file should concatenate the icol.Meris operator and the Meris.N1Patcher operator. A possible graph xml file would look like the following. For demonstration purpose only the necessary parameter have been set.

```

<graph id="N1Icol">
  <version>1.0</version>
  <node id="merisIcol">
    <operator>icol.Meris</operator>
    <sources>
      <sourceProduct>${n1Product}</sourceProduct>
    </sources>
  </node>
  <node id="n1Writer">
    <operator>Meris.N1Patcher</operator>
    <sources>
      <n1>${n1Product}</n1>
      <input>merisIcol</input>
    </sources>
  </node>
</graph>

```

```
        <patchedFile>${n1TargetFile}</patchedFile>
      </parameters>
    </node>
  </graph>
```

This graph can be invoked by the following call on the command line:

```
gpt <graph-file.xml> -Pn1TargetFile=<path-to-target-file> -Sn1Product=<path- ↵
    to-source-file>
```