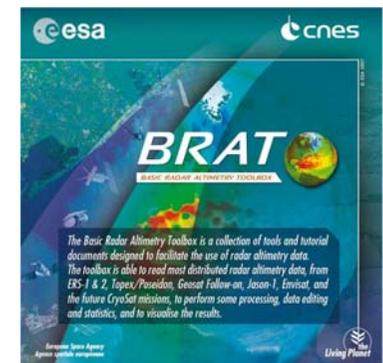
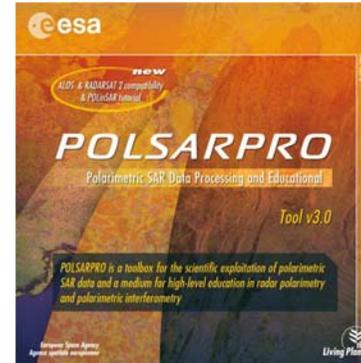
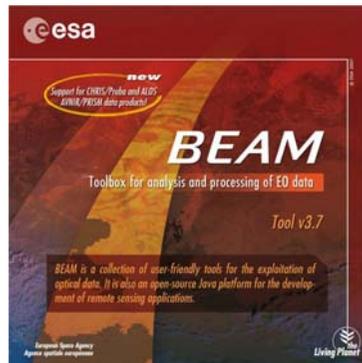
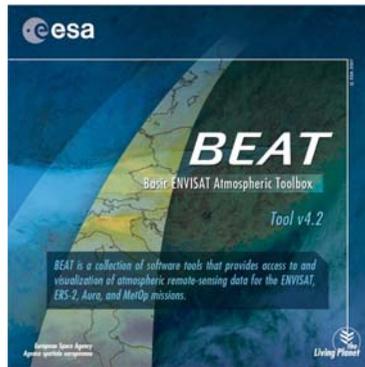




BEAM and BEST Software tools

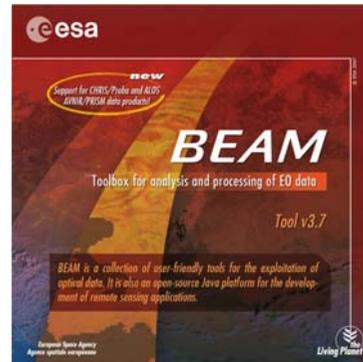
Muriel Simon

4 September 2007, Lecture D2L5-1



- <http://earth.esa.int/resources/softwaretools/>

Software	Purpose
Basic ERS & Envisat (AATSR and MERIS) Toolbox	The Basic ERS & Envisat (AATSR and MERIS) Toolbox (BEAM) is a collection of executable tools and an Application Programming Interface (API) which has been developed to facilitate the collection, viewing and processing of MERIS (AATSR) and ACAP data. BEAM now also supports CHRIS Probe and AATSR/PRISM A-DE data products. Now BEAM 4.0 is now available (download it free from here).



- **BEAM = Basic ERS & Envisat (A)ATSR and MERIS Toolbox**



BEAM

- BEAM = collection of executable tools + application programming interface (API) developed to facilitate the utilisation, viewing and processing of MERIS, (A)ATSR and ASAR data.

VISAT

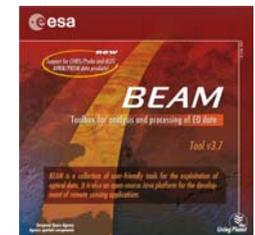
BEAM's **VIS**ualization and **Analysis Tool**

Scientific tools (Java):

format conversion, atmospheric corrections etc...

- BEAM = developed in Java, available for all common platforms (Windows, Linux, Mac OS X, Solaris...)
- Open source project

Brockmann Consult GmbH

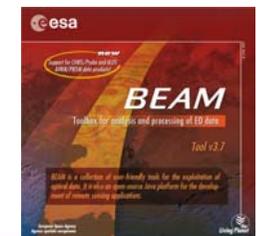
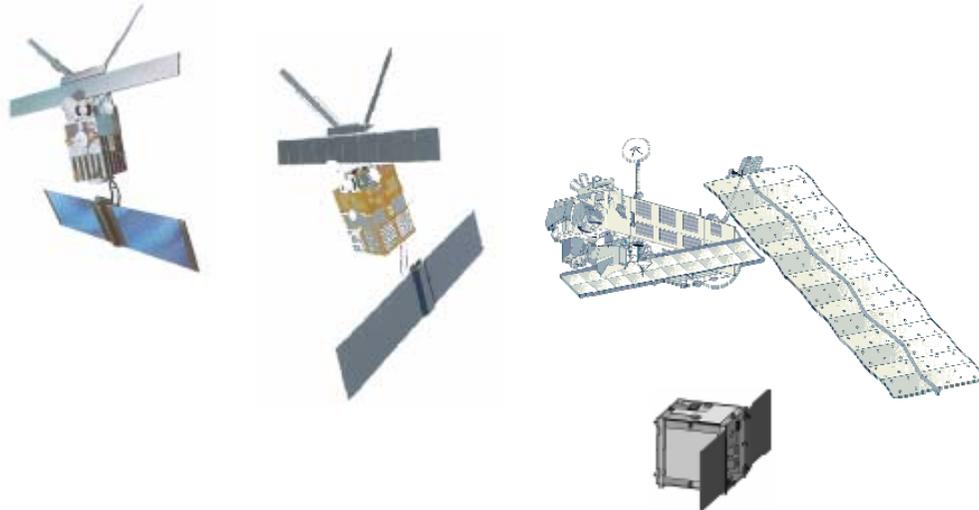




Instruments supported

- MERIS
- (A)ATSR
- (A)SAR
- CHRIS (Proba)

- AVNIR2, PRISM (ALOS)
- MODIS
- AVHRR
- Landsat TM





• **VISAT: Visualization and Analysis Tool**

Visualization

Import/Open Product
Colour Palette
Bitmask overlay
...

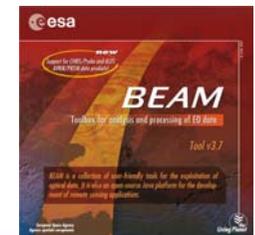
Analysis (basic)

Reflectance Spectrum
Pins
Profile
Export to Excel
ROI and Statistics

Real Band/Virtual Bands
Expression editor
Bitmasks
Band Arithmetic
...

More advanced

Co-registration of MERIS and
AATSR products
Ortho-rectification
Generation of Level 3 products
...





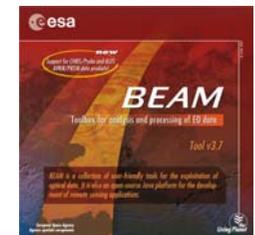
DIMAP format

- **DIMAP** (SPOT-Image) = simple data input/output format
- ⇒ easy to import ENVISAT data in other imaging applications

- **BEAM-DIMAP** = standard I/O product format for VISAT & Scientific Tools

- Data product composed of:
 - 1 single **product header** file with the suffix **.dim** (XML) containing the product meta-data
 - 1 **directory** with the same name plus the suffix **.data** containing plain binary raw image files for each band. Each geophysical band in the data product is represented by a single image.

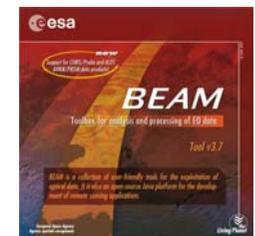
- + extra image header per band, **.hdr**
- + = ENVI header (⇒ compatible with ENVI)





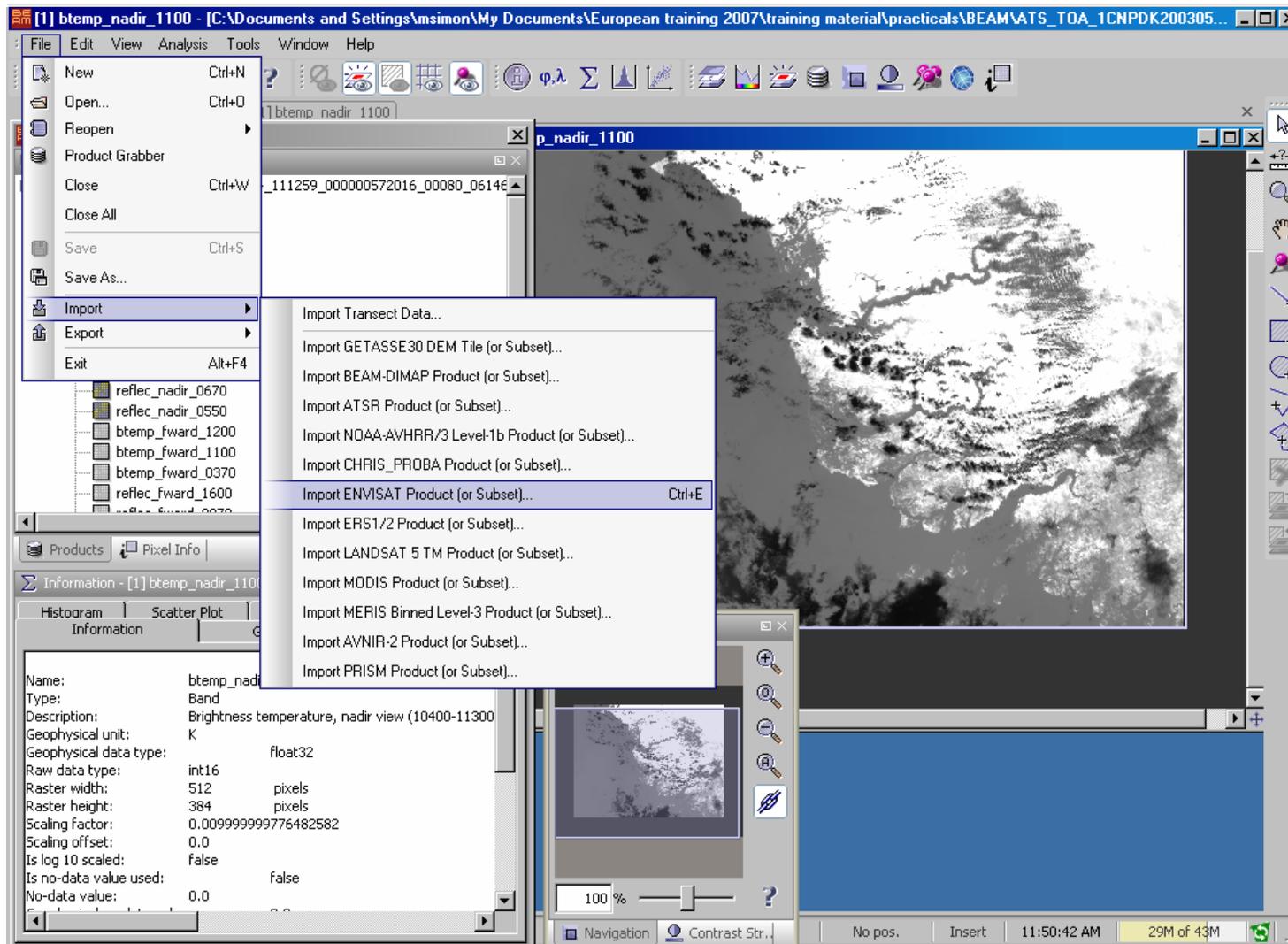
- **Version 4.0 (April 2007)**
 - High-Level Architecture Revision
 - Modernised VISAT User Interface
 - Module Manager (install, update and uninstall modules)
 - Help for Access to Data Sources
 - New Issue Tracking and Community Wiki

- **Version 4.1 (Autumn 2007)**
 - Geo-coding by ground control points incl. interactive tools in VISAT
 - Automatic and manual Co-Registration



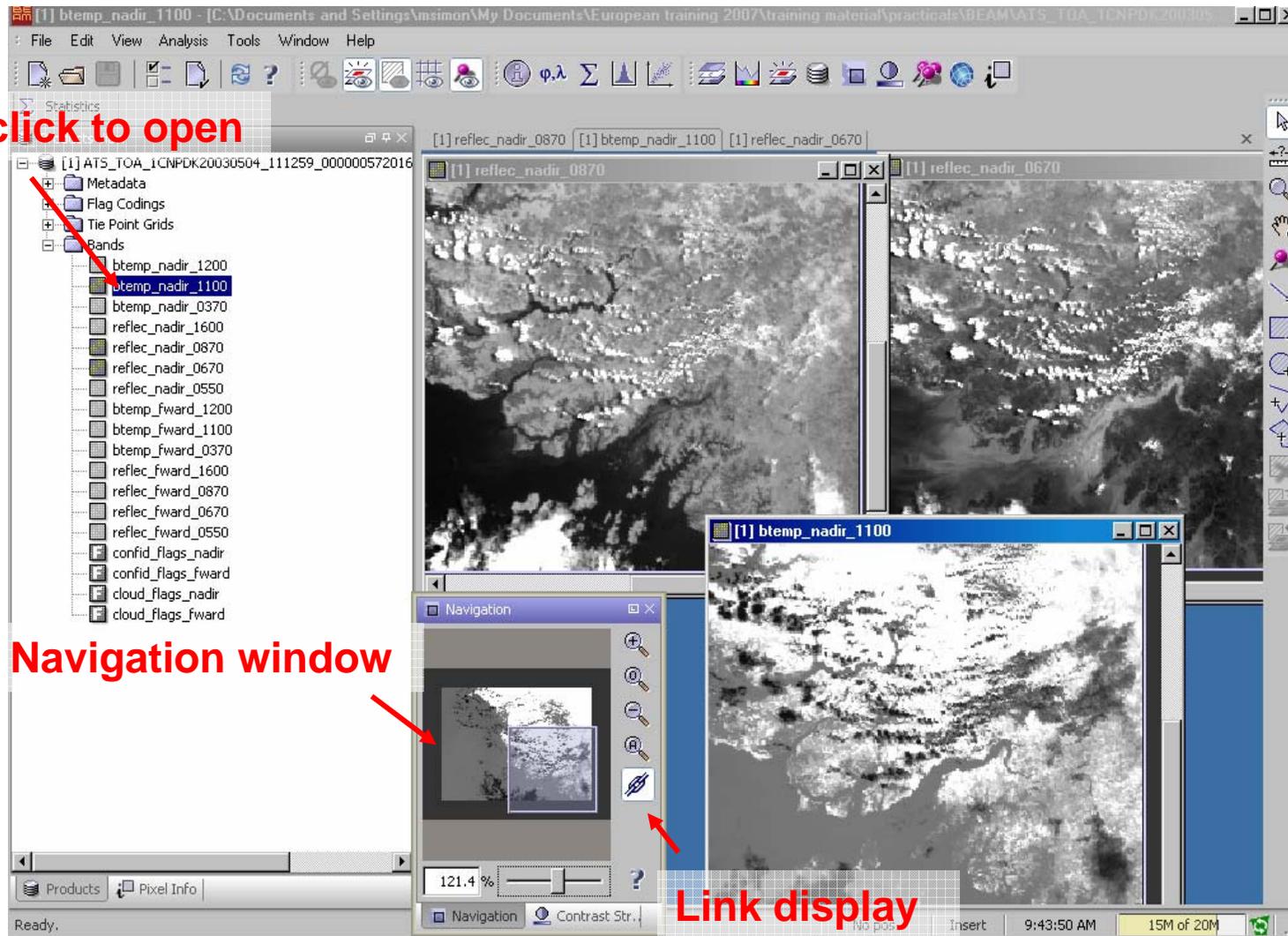


File: Import products



Visualize bands

Double-click to open



Navigation window

Link display



Product view – Pixel view

Double-click to display

Product view

Products View

- [1] ATS_TOA_1CNPKD20030504_111259_00000572016
 - Metadata
 - Flag Codings
 - Tie Point Grids
 - Bands
 - btemp_nadir_1200
 - btemp_nadir_1100**
 - btemp_nadir_0370
 - reflec_nadir_1600
 - reflec_nadir_0870
 - reflec_nadir_0670
 - reflec_nadir_0550
 - btemp_fward_1200
 - btemp_fward_1100
 - btemp_fward_0370
 - reflec_fward_1600
 - reflec_fward_0870
 - reflec_fward_0670
 - reflec_fward_0550
 - confid_flags_nadir
 - confid_flags_fward
 - cloud_flags_nadir
 - cloud_flags_fward

Navigation

121.4 %

Navigation Contrast Str.

Ready. No pos. Insert 9:43:50 AM 15M of 20M



Product view – Pixel view

The screenshot shows the ENVI software interface with the 'Pixel Info View' window open. The 'Pixel Info View' window contains several sections:

- Geo-location:**

Coordinate	Value	Unit
Image-X	372	pixel
Image-Y	192	pixel
Longitude	15°20'14" W	degree
Latitude	12°42'09" N	degree
- Flags:**

Flag	Value
confid_flags_forward.NOT_D...	Not loaded
confid_flags_forward.NO_ST...	Not loaded
confid_flags_forward.SATUR...	Not loaded
confid_flags_forward.OUT_D...	Not loaded
- Time Info:**

Time	Value	Unit
Date	2003-05-04	YYYY-MM-DD
Time (UTC)	11:13:28:180 AM	HH:MM:SS:mm [A...
- Tie Point Grids:**

Tie Point Grid	Value	Unit
latitude	12.702406	deg
longitude	-15.337131	deg
- Bands:**

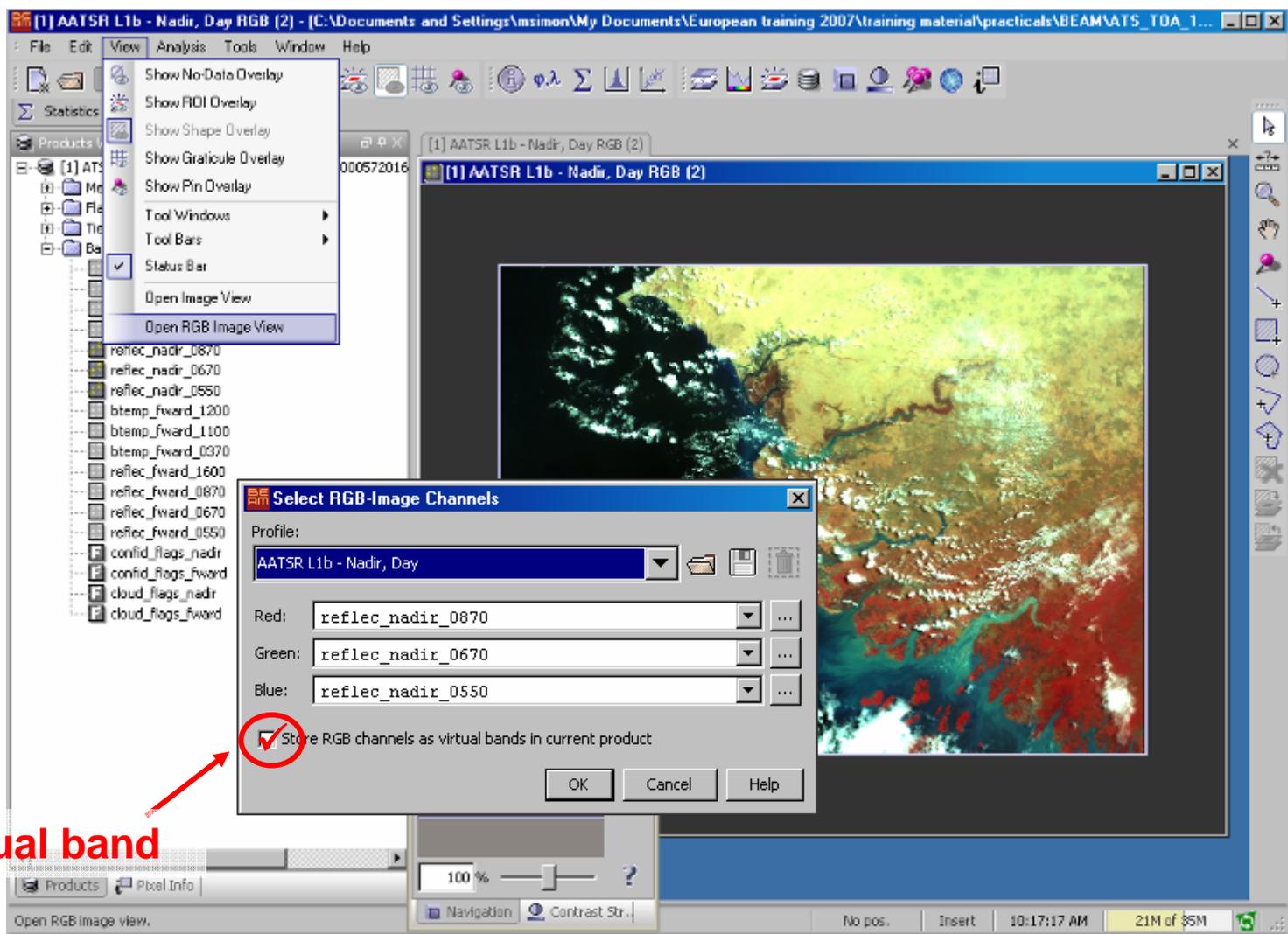
Band	Value	Unit
btemp_nadir_1100	307.91	K
reflec_nadir_0870	21.51	%
reflec_nadir_0670	14.73	%

A red arrow points to the 'Pixel Info' button in the bottom left corner of the 'Pixel Info View' window. The main image area shows three satellite images: 'reflec_nadir_0870', 'reflec_nadir_1100', and 'reflec_nadir_0670'. The 'reflec_nadir_0870' image is selected and zoomed in to 121.4%.

Pixel view



Visualization tool: RGB image



Virtual band



Visualization tool: World map

The screenshot shows the ENVI software interface. The main window displays a satellite image of a coastal region. A 'View' menu is open, showing options like 'Show No-Data Overlay', 'Show ROI Overlay', 'Show Shape Overlay', 'Show Graticule Overlay', and 'Show Pin Overlay'. The 'World Map' option is selected, which opens a smaller window showing a world map. A red arrow points to a specific location on the world map, labeled 'Geographic location of the product'. The world map window also shows zoom levels (1x, 2x, 4x, 8x, 16x, 32x) and a 'Center' button. The main window's status bar shows 'Ready'.



Visualization tool: Bitmap overlay

The screenshot shows a software interface for processing satellite data. The main window displays a satellite image with a pink overlay representing cloud test results. A 'Bitmap Overlay' dialog box is open, showing a list of overlays with their names, colors, and transparency values. The 'ch_cloudy_dmus...' entry is selected and circled in red. A red arrow points from the 'Cloud test results' text box to this entry. The interface also includes a 'Pixel Info View' panel on the left with tables for Geo-location and Bands, and a 'Navigation' panel with a zoom slider.

Coordinate	Value	Unit
Image-X	Invalid pos.	pixel
Image-Y	Invalid pos.	pixel

Band	Value	Unit
reflec_nadir_0870	Invalid pos.	%
reflec_nadir_0670	Invalid pos.	%
reflec_nadir_0550	Invalid pos.	%

Name	Color	Trsr
ch_cloudy	Cyan	0.5
ch_sun_glint	Yellow	0.5
ch_cloudy_refl_hist	Yellow	0.5
ch_cloudy_spat_c...	Red	0.5
ch_cloudy_spat_c...	Red	0.5
ch_cloudy_gross_1	Magenta	0
ch_cloudy_dmus...	Magenta	0
ch_cloudy_med_hi...	Yellow	0.5
ch_cloudy_fog_lo...	Yellow	0.5
ch_cloudy_vw_diff...	Red	0.5

Visualization tool: Pin Manager

Pins in selected locations

Spectral bands selection

X,Y	Lon,Lat	Name/Description	reflec_1	reflec_2	reflec_3
723.5 518.....	-3.2349708 37.110153	pin_1	0.62032497	0.6276493	0.6315129
577.5 474.....	-5.22173 37.708904	pin_2	0.053440135	0.061002508	0.070286095
447.5 529.....	-6.9907627 36.96047	pin_4	0.024444857	0.0090683397	0.009896992

Values in the bands



Analysis tools: information, statistics

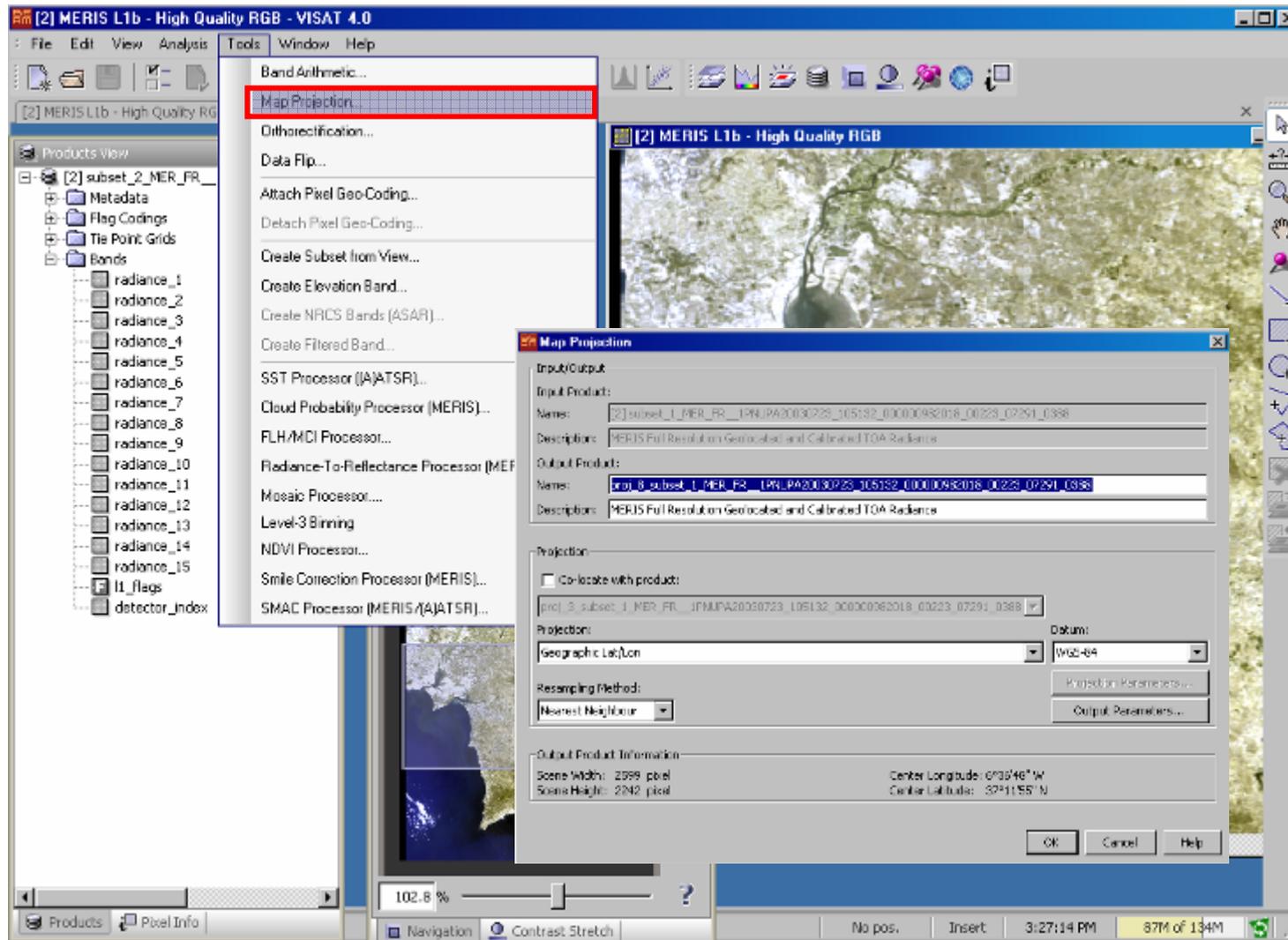
The screenshot shows the ENVI software interface. The 'Analysis' menu is open, listing various tools. The 'Information...' option is selected, opening a dialog box for the 'reflec_nadir_0870' band. The dialog box has tabs for 'Histogram', 'Scatter Plot', 'Profile Plot', 'Co-ordinate List', and 'Statistics'. The 'Statistics' tab is active, displaying the following data:

Information		Geo-Coding	
Only ROI pixels considered:	No		
Number of pixels total:	196608		
Number of considered pixels:	196608		
Ratio of considered pixels:	100.0	%	
Minimum:	-0.01999999952965164	%	
Maximum:	92.13999794051051	%	
Mean:	19.106775441664002	%	
Std-Dev:	12.38528428635837	%	
Variance:	153.3952668539156	% ^ 2	
Sum:	3756544.9660346764	%	

Buttons at the bottom of the dialog box include 'Compute for scene' and 'Compute for ROI'.

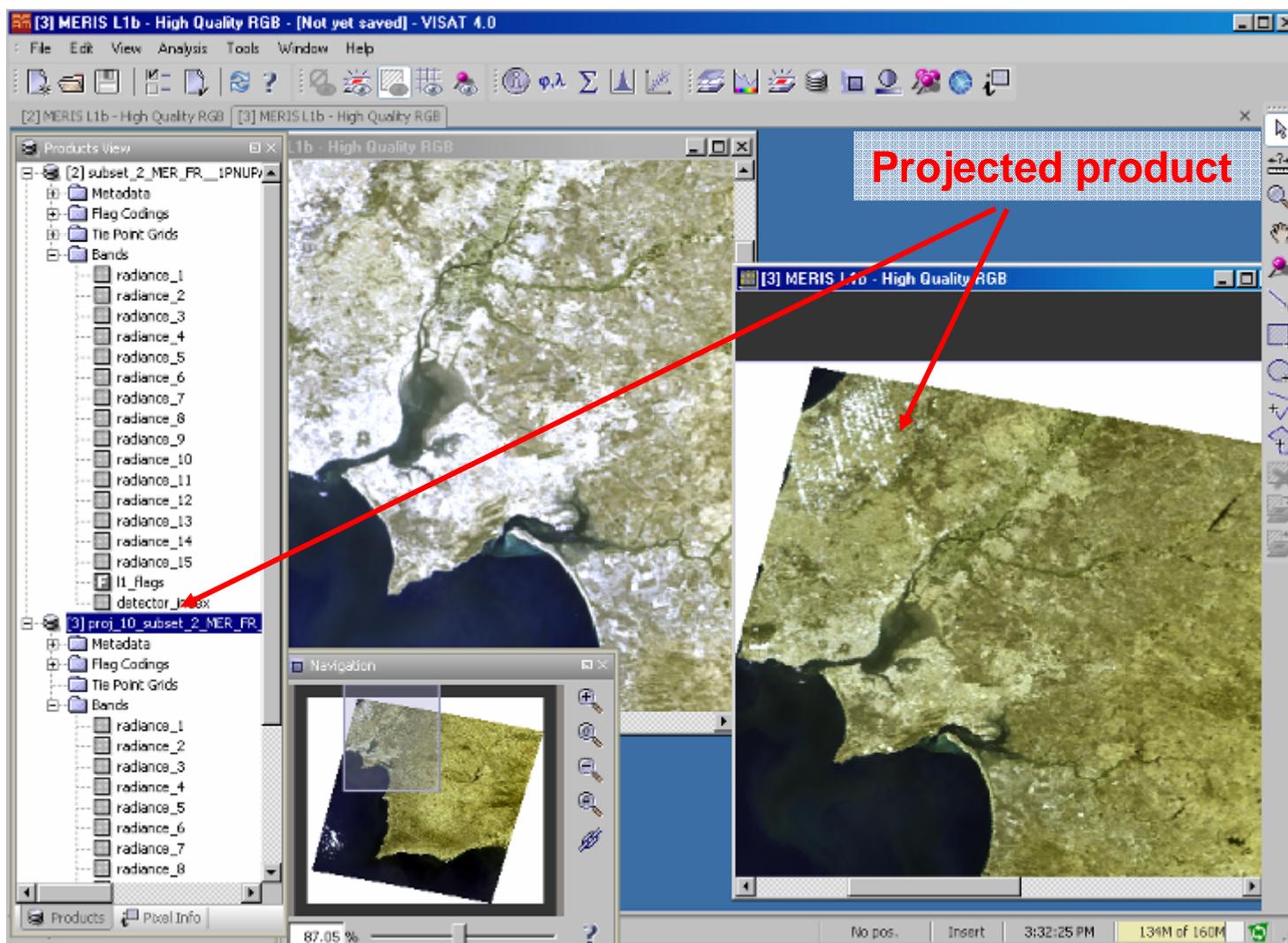


Processing tools





Processing tool: Map projection





And also:

- **Band Arithmetic,**
- **Data fusion between two products...**

More this afternoon!



VISAT Help

General help menu

The screenshot displays the VISAT 4.0 interface with several windows open:

- Map Projection Dialog Box:** Shows input/output product names and descriptions, projection settings (Geographic Lat/Lon, WGS-84), and resampling method (Nearest Neighbour). A red circle highlights the **Help** button at the bottom right.
- BEAM Help Window:** A tree view on the left lists help topics under categories like General, VISAT, and Tools. The **Map Projection** topic is selected and expanded. A red arrow points from the text 'Specific help topic' to this selected item.
- Main Help Content:** The right pane shows the text for the 'Map Projection' help topic, including an introduction and instructions on how to use the tool and view the results.

Specific help topic



BEAM community

Set of communication tools provided by the BEAM development team to the user community through the BEAM Website.

- Includes:
 - FAQs
 - Plug-Ins provided by users / developed as technology studies (e.g. *SEBS plug-in, D1La6, Bob Su*)
 - wish-list: proposals for new improvements/developments for next BEAM releases.



- **More on BEAM this week:**
- Hands-on introduction this afternoon (D3PA & D3PB)
- Land Use Land Cover (D3PA, Mário Caetano)
- Water resources (D5PA, Bob Su and Jose Moreno)
- ...

- **And further:**
- <http://earth.esa.int/beam>
- info@brockman-consult.de



BEST = Basic ERS & Envisat SAR Toolbox



BEST

- **BEST** = collection of software tools developed to facilitate the use of ESA SAR data.

- **BEST** = pre-processing tool only, no advanced SAR processing

- **Input data:**

ASAR (Advanced Synthetic Aperture Radar) onboard Envisat
AMIs (Active Microwave Instrument) onboard ERS 1&2

- **Output data:**

TIFF, GeoTIFF, BIL...

- **Platforms:**

Windows™ 98/2000/ME/NT/XP, Linux, Solaris2™.





- **Toolbox Functionalities**
- Data Import and Quick Look
- Data Export
- Data Conversion
- Statistics
- Resampling
- Co-registration and Coherence Generation
- Radiometric Resolution Enhancement
- Calibration





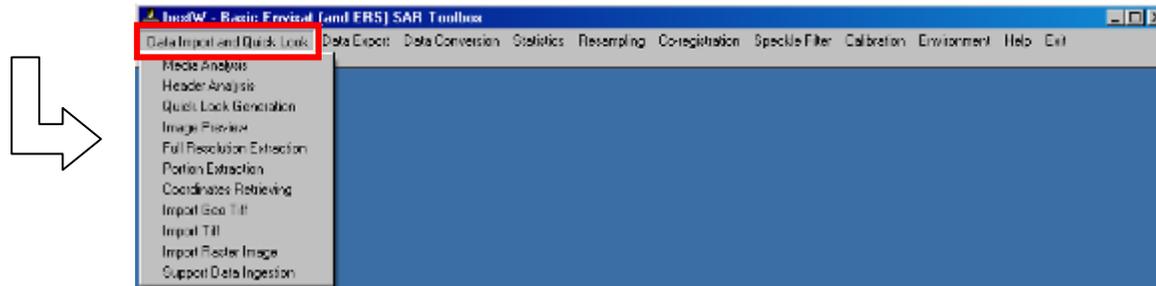
Toolbox Functionalities

Data Import and Quick Look

Extract data from Envisat ASAR and ERS SAR products held on any media (CD-ROM/DVD/EXABYTE/hard disk) in a standard ESA format

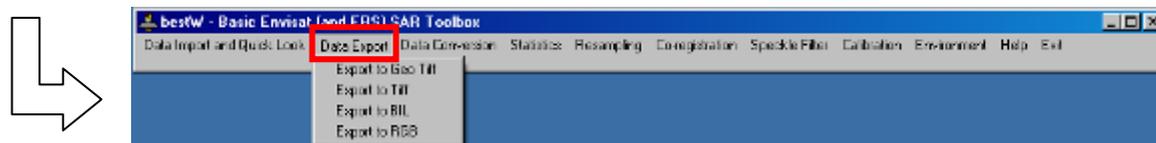
Import TIFF and GeoTIFF images, generic raster data and ancillary data

Quick Look tool for generating reduced-size TIFF images of datasets directly from original products or from files created by BEST in internal format.



Data Export

Converting data from the Toolbox's internal format to the common image formats TIFF, GeoTIFF or BIL, to allow visualisation of processing results. Data may be exported as a single channel, as a RGB false-colour composite or in multi-channel binary files.





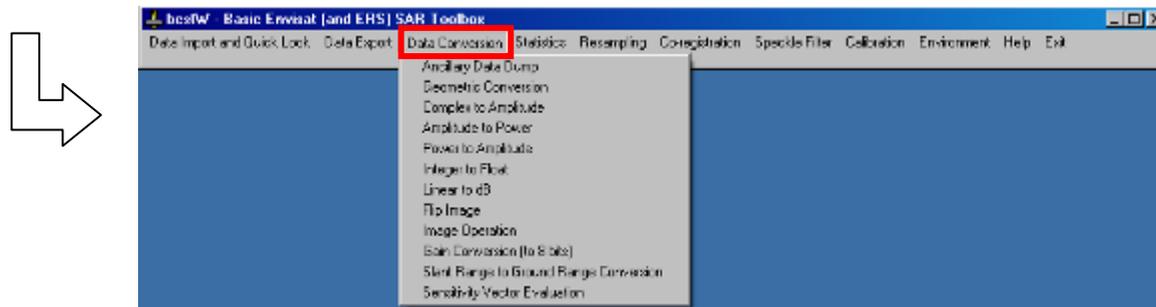
Toolbox Functionalities

Data Conversion

Convert between different image formats (e.g. Complex to amplitude, amplitude to power etc.) and perform basic mathematical operations on images.

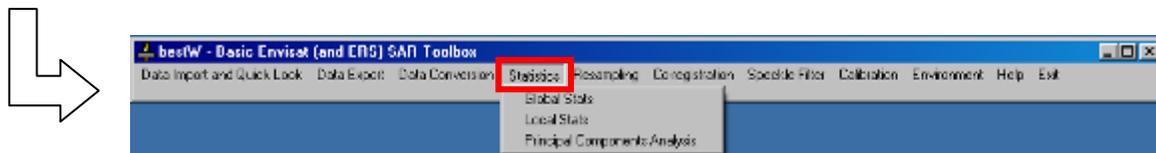
Also for altering image orientation (flipping) and transforming data from slant range to ground range.

Additional tool for calculating the sensitivity vectors for points in an image.



Statistics

Calculate global or local statistical parameters from real image data and compute the principal components of multi-dimensional datasets.

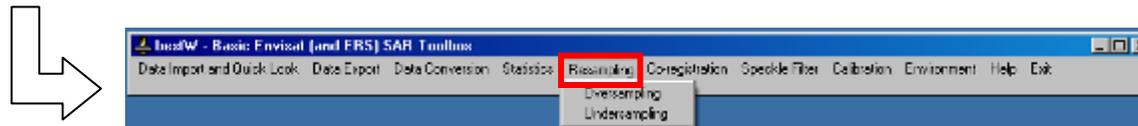




Toolbox Functionalities

Resampling

Over- and under-sampling (both spatial and spectral)

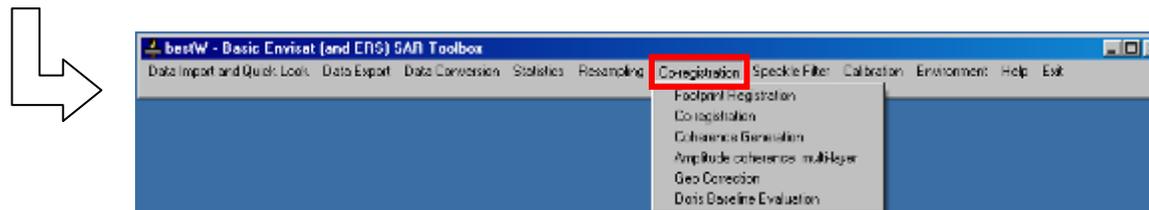


Co-registration and Support for Interferometry

Automatic co-registration of both real and complex images and evaluation of associated residuals, quality and coherence values.

Also for generating an optimised coherence image and computing the interferometric altitude of ambiguity.

Additional tools for deriving orbital baselines from pairs of DORIS files and geometrically correcting ASAR medium resolution products.

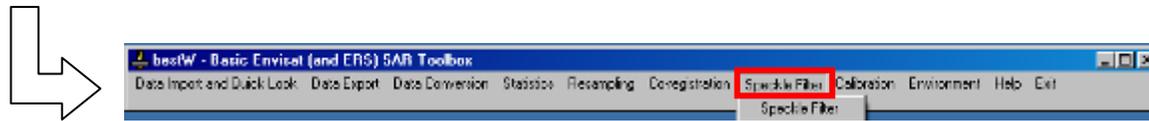




Toolbox Functionalities

Radiometric Resolution Enhancement

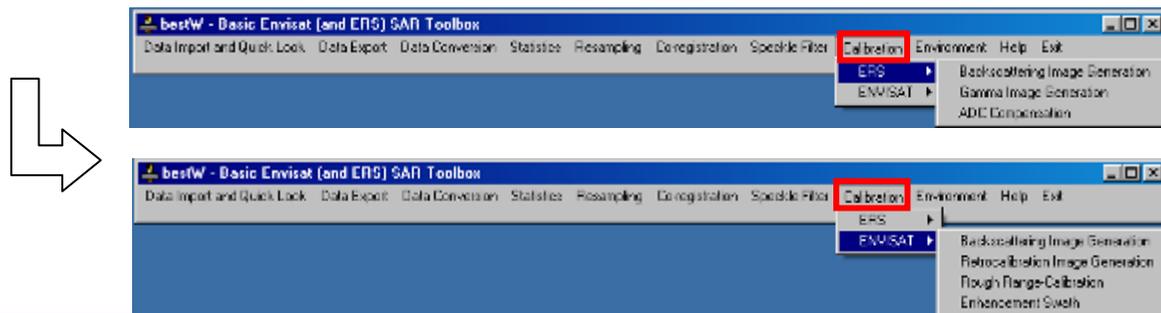
A Gamma MAP speckle filtering tool for increasing the radiometric resolution of the backscatter image. The filter can be used with real or complex images and has a range of parameters configurable by the user.



Calibration

Algorithms for performing various levels of radiometric correction to an input image, including the generation of an image in which the pixel values represent the backscattering coefficient. The calibration tool is based for ERS on the document "Derivation of backscattering coefficient in ERS SAR PRI images (version 2.c)", for ENVISAT on the document "Absolute Calibration of ASAR level 1 products generated with PF-ASAR".

Also for replacing the antenna pattern used to calibrate an ASAR product (retro-calibration) and enhancing ASAR Wide-swath images by correcting incidence angle effects in range and smoothing the steps between ScanSAR sub-swaths.





More on BEST this week

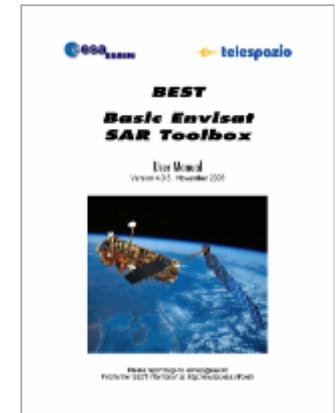
- Forest-Agriculture (D3PB, Part 1, Andrea Minchella)
- Forest-Agriculture (D3PB, Part 4, Thuy Le Toan)
- ...

- Questions? Andrea Minchella



And further:

- User guide: overview, detailed functionality descriptions, examples
- <http://earth.esa.int/best>





Thank you