Introduction to ESA EO User Toolboxes: BEAM and NEST

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Software ‘Toolboxes’ instigated by ESA contracts

Each Toolbox is a collection of OPEN SOURCE software tools to help the remote sensing community to exploit ESA-TPM data

New generation to contain scientific tutorials prepared with Universities and practical case studies using real EO data

Offered to the user community free-of-charge

http://earth.esa.int/resources/softwaretools/
**THE BEAM PROJECT**

**BEAM** (BASIC ERS&ENVISAT(A)ATSR AND MERIS TOOLBOXis) is an **open-source Java toolbox and development platform** for viewing, analysing and processing of optical remote sensing raster data.

Originally developed to facilitate the utilisation of image data from **Envisat**'s optical instruments, BEAM now supports a growing number of other EO sensors and generic data formats.

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<th>Instrument</th>
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<th>Formats</th>
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<td>MERIS L1b/L2</td>
<td>Envisat</td>
<td>Envisat N1</td>
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<td>MERIS L3</td>
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<td>AATSR L1b/L2</td>
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<td>ASAR</td>
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<td>ATSR L1b/L2</td>
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<td>SAR</td>
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<td>CHRIS L1</td>
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<td>AVNIR-2 L1/L2</td>
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<td>MODIS L2</td>
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<td>AVHRR/3 L1b</td>
<td>NOAA-KLM</td>
<td>NOAA, METOP</td>
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<tr>
<td>TM</td>
<td>Landsat 5</td>
<td>FAST</td>
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<table>
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<tr>
<th>Format</th>
<th>Support</th>
<th>Description</th>
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<tr>
<td>BEAM-DIMAP</td>
<td>read + write</td>
<td>The standard BEAM I/O format. It comprises an XML header based on the SpotImage/CNES DIMAP schema and ENVI images for the raster data.</td>
</tr>
<tr>
<td>GeoTIFF</td>
<td>read + write</td>
<td>A widely used EO data format, e.g. for Quickbird, LANDSAT, SPOT.</td>
</tr>
<tr>
<td>NetCDF</td>
<td>read</td>
<td>A widely used EO data format. BEAM supports NetCDF files conforming to the NetCDF CF Metadata Convention.</td>
</tr>
<tr>
<td>HDF-EOS</td>
<td>read</td>
<td>BEAM supports the HDF-EOS profile (HDF4) used by NASA Ocean Color data products of SeaWiFS, MODIS, OCTS, CZCS.</td>
</tr>
</tbody>
</table>

- **Supported Instruments**
- **Generic EO Data Formats**
• **VISAT** - An intuitive desktop application to be used for *visualization*, *analyzing* and *processing* of remote sensing raster data.

• A set of scientific tools (> 11 **Data Processors**) running either from the command line or invoked by VISAT, also entirely written in Java.

• A rich **Java API** for the development of new remote sensing applications and BEAM extension plug-ins.

• User support: Tutorials, Plug-Ins, Issue tracker, Community Wiki
• Very **fast image display and navigation** even of giga-pixel images

• Advanced **layer management** allows adding and manipulation of new overlays such as images of other bands, images from WMS servers or ESRI shapefiles

• Rich **region-of-interest** definitions for **statistics** and various **plots**

• Easy **bitmask** definition and overlay

• Flexible **band arithmetic** using arbitrary mathematical expressions

• Accurate **reprojection** and **ortho-rectification** to common map projections

• Geo-coding and rectification using **ground control points**

• Store and restore the current **session** including all opened files, views and layers
Manipulate colours to enhance visual representation
Display bands of multiple products in one view if they are in the same coordinate reference system.
Reproject data products
BAND ARITHMETIC

Definition of own expression for band combination
A standard set of **scientific data processors** which includes:

- Level 3 Binning and Mosaicing (all sensors)
- Collocation (all sensors)
- EM and K-Means Clustering, Linear Spectral Unmixing (all sensors)
- Radiance-to-Reflectance, Smile Effect Correction, Cloud Probability, SMAC Atmospheric Correction, Case 2 Water Constituents (MERIS)
- Sea Surface Temperature (AATSR)
- FLH/MCI, NDVI (all sensors)
CHRIS-PROBA Atmospheric Correction

I/O Parameters
- Source Product
  - Name: 1 CHRIS_SO_041001_472A_31_NR
- Target Product
  - Name: CHRIS_SO_041001_472A_31_NR_AC
  - Save as: BEAM-DIMAP
  - Directory:
    - Dokumente und Einstellungen\Ralf\Desktop
  - Open in VISAT

Processing Parameters
- Aerosol optical thickness at 550 nm: 0.0
- Initial water vapour column (g cm⁻²): 1.0
- Cloud product threshold: 0.05
  - Perform adjacency correction
  - Perform spectral polishing (If 'true' an adjacency correction is performed.)
  - Generate water vapour map

Run Close Help
The project **SMOS Toolbox for BEAM** (SMOS-Box) has been brought into life in order to support users of data acquired by ESA's Soil Moisture and Ocean Salinity (SMOS) mission.

- Version 1.0 of the SMOS-Box is now available

- Information about how to retrieve test data and the source code of the SMOS Toolbox can found at the SMOS Wiki

  https://www.brockmann-consult.de/beam-wiki/display/SBOX/SMOS+Toolbox+for+BEAM

BEAM is being developed by Brockmann-Consult of Geesthacht Germany under ESA Contract

http://www.brockmann-consult.de/cms/web/beam/
NEST (Next ESA SAR Toolbox) is a new ESA software for visualizing, analyzing and post-processing ESA and 3rd party SAR data processed from Level-1 or higher

- Provides both basic and advanced tools for SAR user community

- *Shares the core architecture with the ESA BEAM toolbox*

- Fully portable to multiple hardware platforms and operating systems thanks to a 100% pure Java implementation.

- Modular design for easy modifications and upgrades

- An API enables users to easily add their own modules and extend the capabilities of NEST

- Fully open source under the GNU GPL licence
**Project Time scale**

First Release 1C – November 2008

**Second release 2C – June 2009**

Third release 3C is expected in December 2009

**Currently supported products**

- ESA SAR missions: ERS1 & 2 (CEOS & Envisat format from PGS and VMP), ENVISAT
- Third party SAR-data: ALOS PALSAR, JERS SAR, TerraSAR-X (except SSC), Radarsat-2

- An integrated Display and Analysis Tool (**DAT**) for SAR data visualisation, analysis and processing

- A Graph Processing Tool (**GPT**) for command line execution of user-defined batch processing chains

- A rich collection of **readers** and **writers** to allow easy and efficient access to SAR data and transfer of data between different software packages (DIMAP, GeoTIFF, HDF 4 & HDF 5, NetCDF, ENVI, Generic Binary)
Envisat ASAR, ERS 1&2 and ALOS calibration

Coregistration of detected and complex products.

Multilooking & speckle filtering

Debursting of ASAR WSS products

Ingestion and utilisation of external orbit files - DORIS VOR, POR and DELFT Precise Orbits

Orthorectification for Envisat ASAR, ERS, and Radarsat2 products

Radiometric terrain correction for Envisat ASAR products

ASAR Wave Product Support

PolsarPro Reader
NEST 2C HIGHLIGHTS [3]

• Slant Range to Ground Range conversion
• Band arithmetic & filtering
• Data type conversion
• Automatic import of 90m SRTM DEM
• Principle Component Analysis
• Layer Management
• Vector Shape Layers
• Web Map Service (WMS) layers
• NASA WorldWind Integration
Release 3 (late 2009)

- Interferometry [InSAR, (DinSAR,PS later)]
- Mosaicking
- Multitemporal Speckle Filtering
- Render data on a 3D DEM
- object detection, ocean tools
- Supported Product Formats: Radarsat 1, JPEG2000, Sentinel-1, Cosmo-Skymed
For software upgrades, documentation and more information regarding the NEST project, please visit the website at

http://earth.esa.int/nest

NEST is being developed by Array Systems Computing Inc. of Toronto Canada under ESA Contract number 20698/07/I-LG.

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We look forward to receive your feedback....
1 h introduction to NEST 2C and PolSARpro v. 4 beta 1.3

Tomorrow
8:30 – 10:30
InSAR Principles: Guidelines for SAR Interferometry Processing and Interpretation (ESA TM-19)

Synthetic Aperture Radar (SAR) is a microwave imaging system. It
Polarimetric Radar Imaging: From Basics to Applications

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THANK YOU

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