

Introduction to PolSARpro Toolbox (Practical Session D2P2)

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University of Rennes 1



A Bit Of History



The initiative development of **PolSARpro Software** is a direct result of recommendations made during the **POLinSAR 2003 Workshop** held at ESA-ESRIN in January 2003.



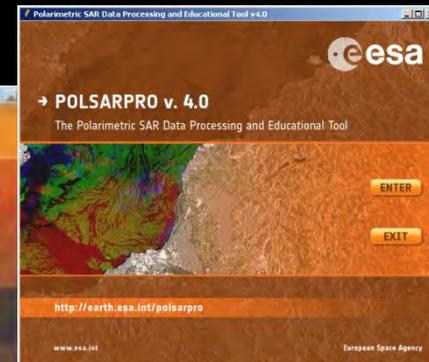
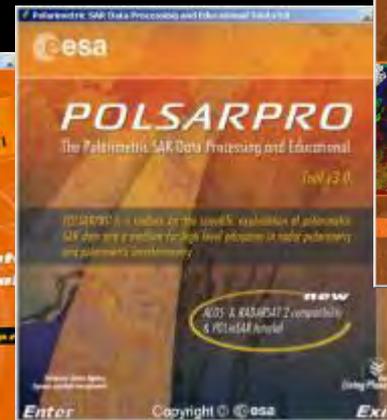
2003



2004



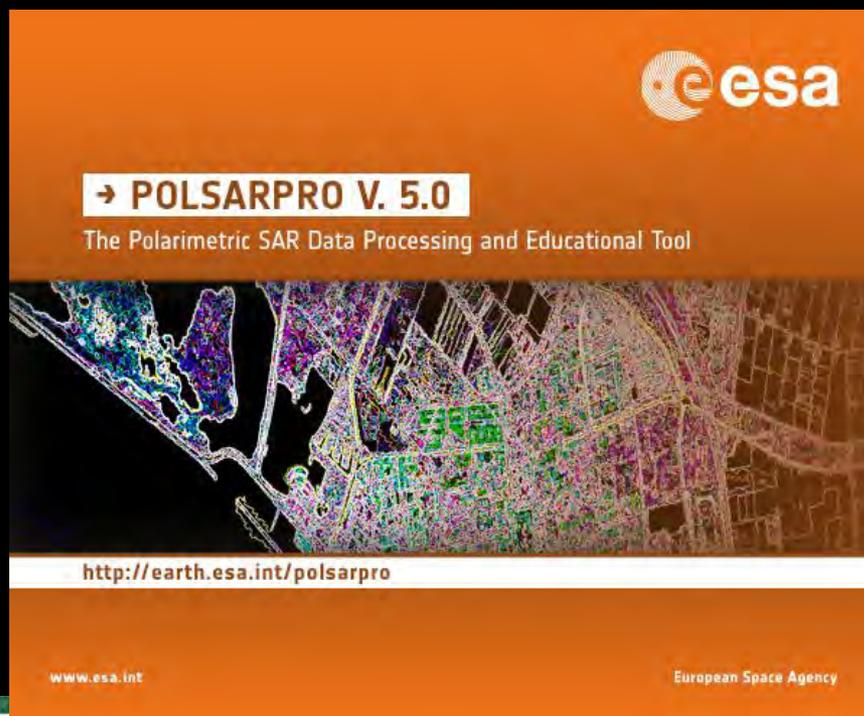
2007



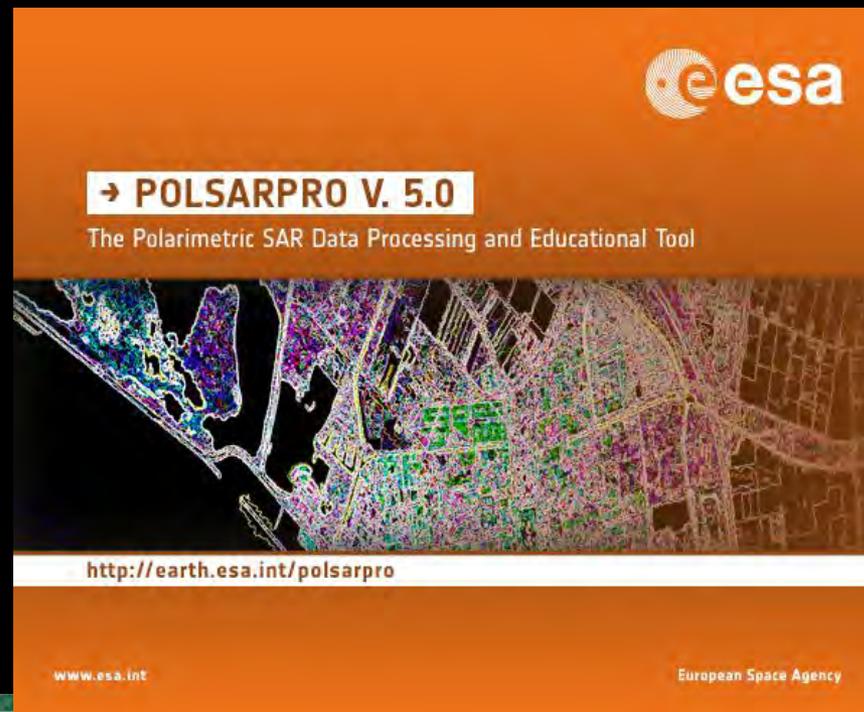
2009

→ 7th ADVANCED TRAINING COURSE ON LAND REMOTE SENSING 2006

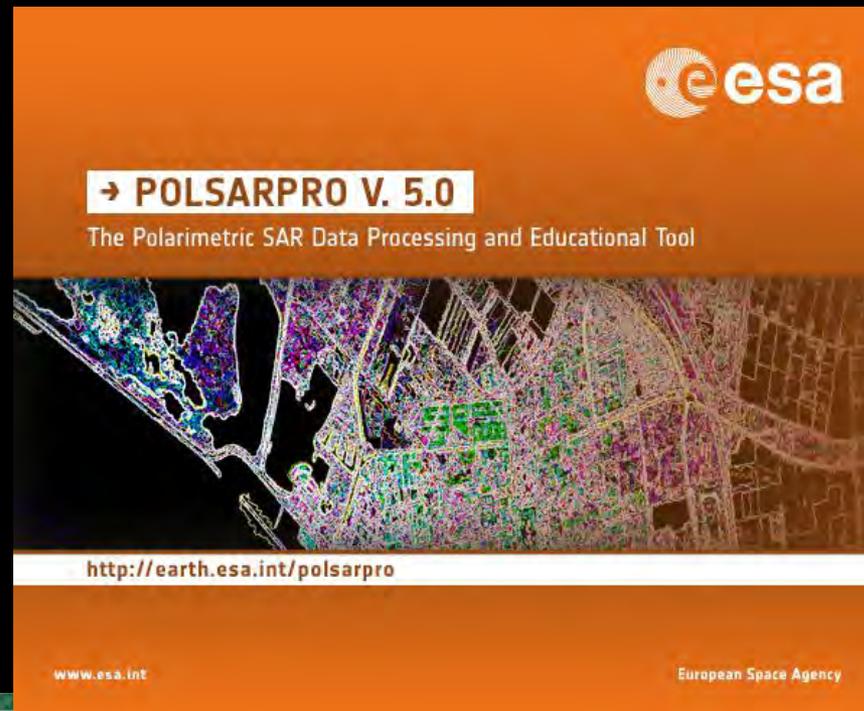
Tool specifically designed to handle :
Polarimetric data
and
Polarimetric Interferometric data.



Educational Software offering a tool for **self-education** in the field of **POLSAR** and **POL-InSAR** data processing and analysis.

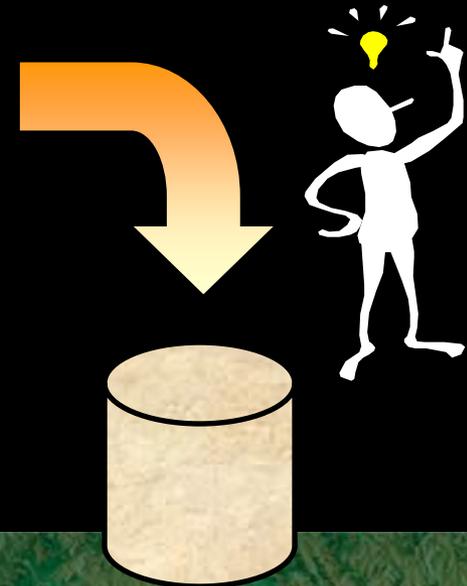
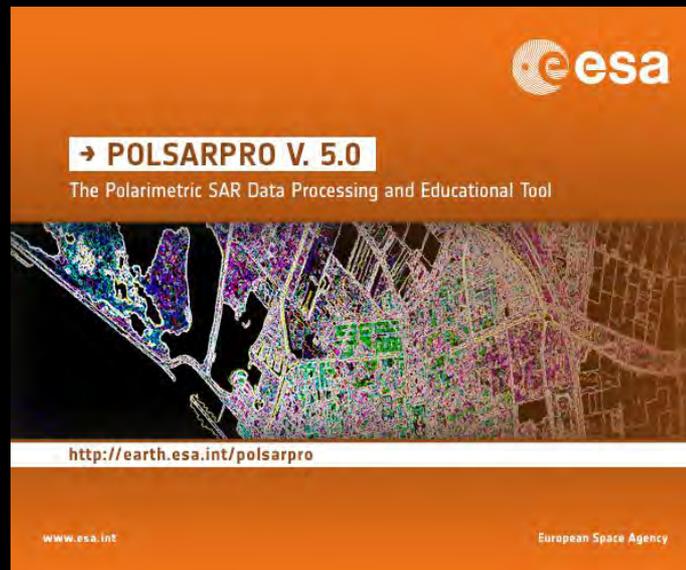
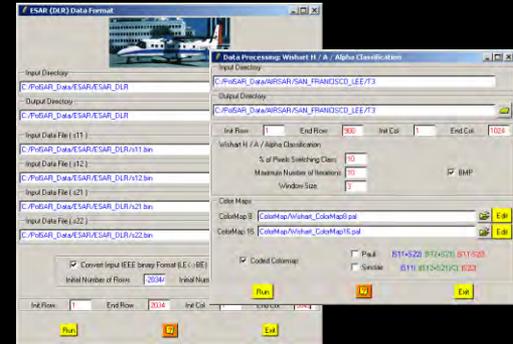


Developed to be **accessible** to :
a wide range of users
from **novices** to **experts**
in the field of **POLSAR** and **POL-InSAR**.



MODULAR STRUCTURE

Each element of the Software (a function) can be **extracted** and **incorporated** individually into **users'** own processing software.



OPEN SOURCE DEVELOPMENT

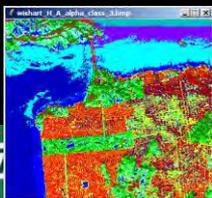
PoISARpro v5.1 Software is made available following the:

Open Source Software Development (OSSD)

approach, and follows the:

GNU General Public License v2 – June 1991.

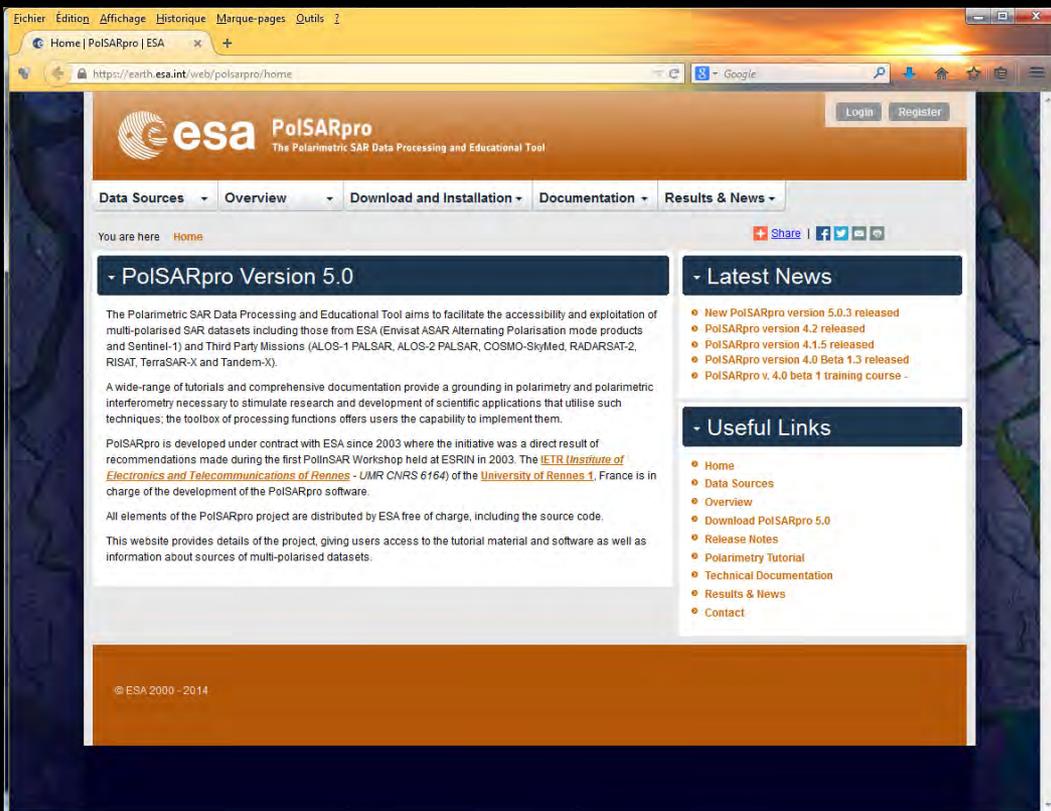
PoISARpro v5.1 Software runs today on Windows and Linux platforms



http://earth.esa.int/web/polsarpro/home

The Web Site provides

- **Details of the project**
- **Access to the tutorial and software**
- **Information about status of the development**
- **Demonstration Sample Datasets**



New!

v5.1 (January 2017)

International Collaborative Project

14 Universities

14 Research Centers

4 Space Agencies

PoISARpro v5.0 Contributors

Universities

-  Universitat Politecnica de Catalunya (SP) (C. Lopez Martinez)
-  University of Illinois at Chicago (US) (W.M. Boerner)
-  Niigata University (JP) (Y. Yamaguchi, S.G. Park)
-  Universidad de Alicante (SP) (J.M. Lopez Sanchez)
-  ETH Zurich (CH) (I. Hajnsek, A. Marino)
-  Indian Institute of Technologies, Bombay (Y.S. Rao)
-  Harbin Institute of Technology, Dept.I.E (L. Zhang)
-  University of Tor Vergata (IT) (M. Lavallo)
-  University of Pisa (IT) (R. Paladini)
-  University of Tohoku - Sendai (JP) (M. Sato)
-  Universite Paris Est - Marnes la Vallee (FR) (P.L. Frison)
-  University of Tsinghua (CN) (J. Yang, W. An, Y. Cui, J. Chen)
-  Polimi - Milan (IT) (S. Tebaldini)
-  Technische Universitat Berlin (DE) (D. D'Hondt, S. Guillaso)

Research Centers

-  Applied Electromagnetic Consultants (UK) (S.R. Cloude)
-  Institute of Electronics - CAS (CN) (W. Hong, Y. Li, M. Xiang)
-  Institute of Forest Resources Information Techniques - CAF (CN) (E. Chen, Z. Li)
-  Marc Williams Consultants (AU) (M. Williams)
-  GIPSA Lab - UMR 5216 (FR) (G. Vasile)
-  Center of Studies in Resources Engineering (IN) (Y.S. Rao)
-  Jet Propulsion Laboratory - NASA (US) (S. Hansley, J.J. Van Zyl)
-  Naval Research Laboratory (US) (T. Ainsworth, J.S. Lee)
-  National Resources Canada (CA) (R. Touzi)
-  Center for Earth Observation and Digital Earth - CAS (CN) (X. Li, C. Wang)
-  Remote Sensing Technology Center of Japan (JP)
-  Alaska SAR Facility (US) (R. Gens, D.K. Artwood)
-  SERTIT (FR) (H. Yesou)
-  Office National d'Etudes et de Recherche Aeronautiques (FR) (E. Colin)

Agencies

-  Japan Aerospace Exploration Agency (JP) (M. Shimada)
-  Deutschen Zentrums für Luft- und Raumfahrt (DE) (I. Hajnsek, K. Papathanassiou, A. Reigber)
-  Canadian Space Agency (CA) (S. Chalifoux, D. Delisle)
-  Centre National d'Etudes Spatiales (FR) (J.C. Souyris)

Version 5.0.3 (October 2014) Exit



**Tsinghua University
China**



**National Space Science Center,
CAS, China**



**University of Mining and
Technology, China**



Fudan University, China



Wuhan University, China



**Studies in Resources Engineering
Indian Institute of Technology**



**Satellite Surveying and Mapping
Application Center, China**



**Universidade Federal de Alagoas
Brazil**



Xidian University, China



**University of Science and
Technology, Poland**



**Harbin Institute of Technology
China**



**University of Tehran, School of
Surveying and Geospatial
Engineering, Iran**



**Key Lab of Microwave Remote
Sensing, CAS, China**



**Khajeh Nasir Toosi University of
Technology, Iran**



Hungarian
Space Office



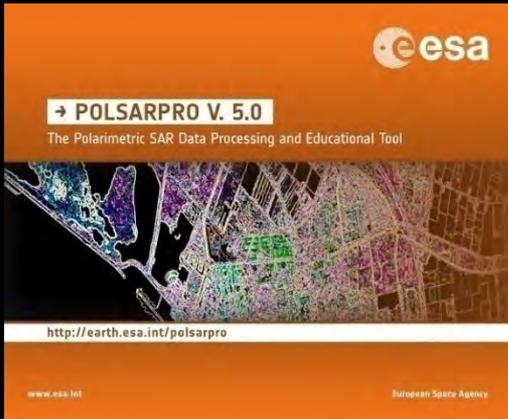
PoISARpro v5.1 SOFTWARE



Dual-Pol / Quad-Pol Sensors

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AIRSAR



SETHI



EMISAR



PISAR

NASDA
CRL

ESAR - FSAR



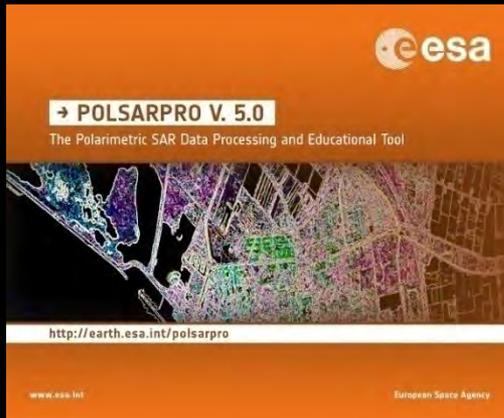
CONVAIR



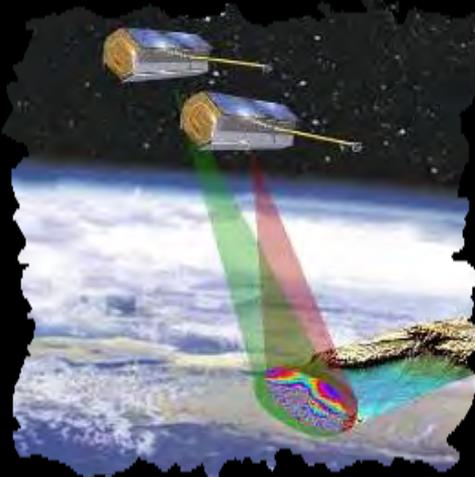
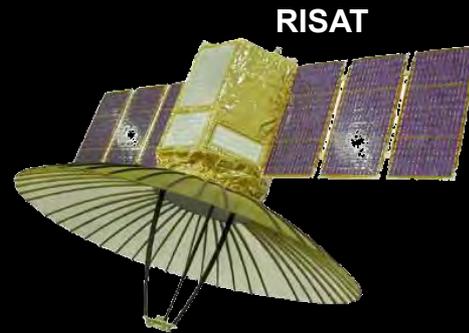
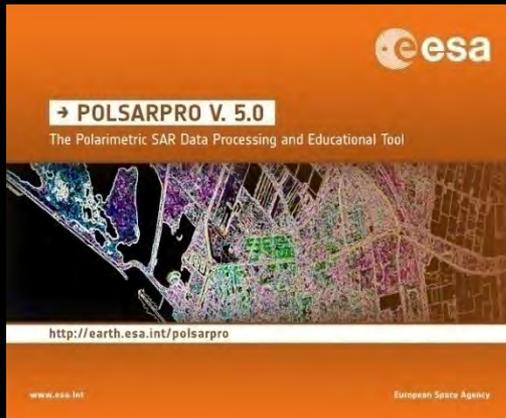
UAV-SAR

PoISARpro v5.1 Software offers the possibility to handle and convert polarimetric data from a range of well established **polarimetric airborne platforms.**

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PoISARpro v5.1 Software offers the possibility to handle and convert polarimetric data from a range of well established polarimetric spaceborne platforms.



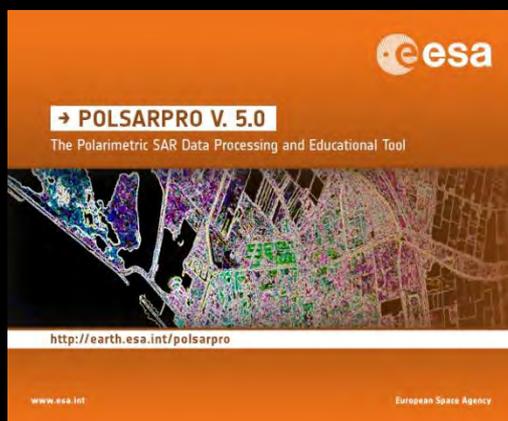
PoISARpro v5.1 Software offers the possibility to handle and convert polarimetric data from a range of well established **polarimetric spaceborne platforms.**

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External Softwares



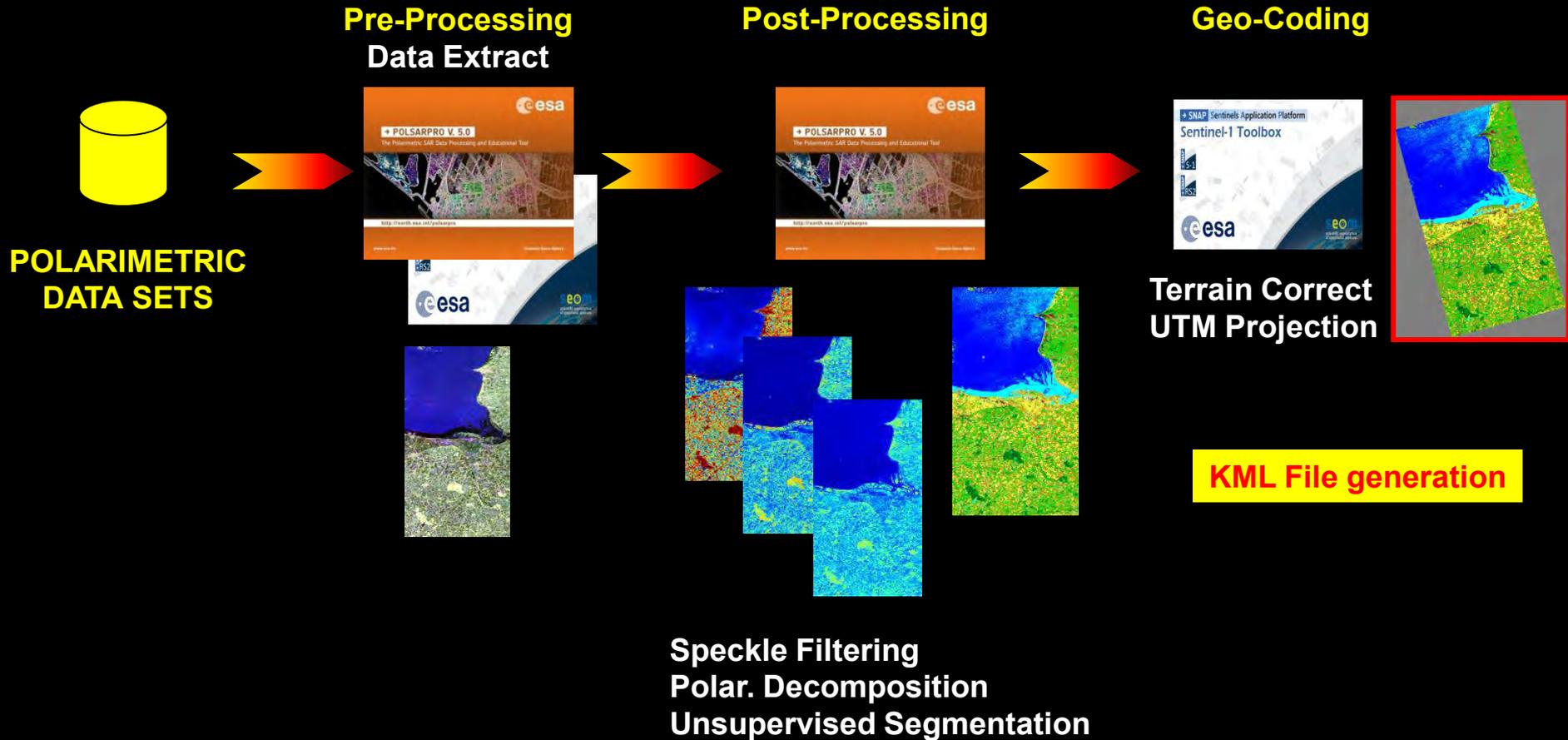


Polariametric Data Processing

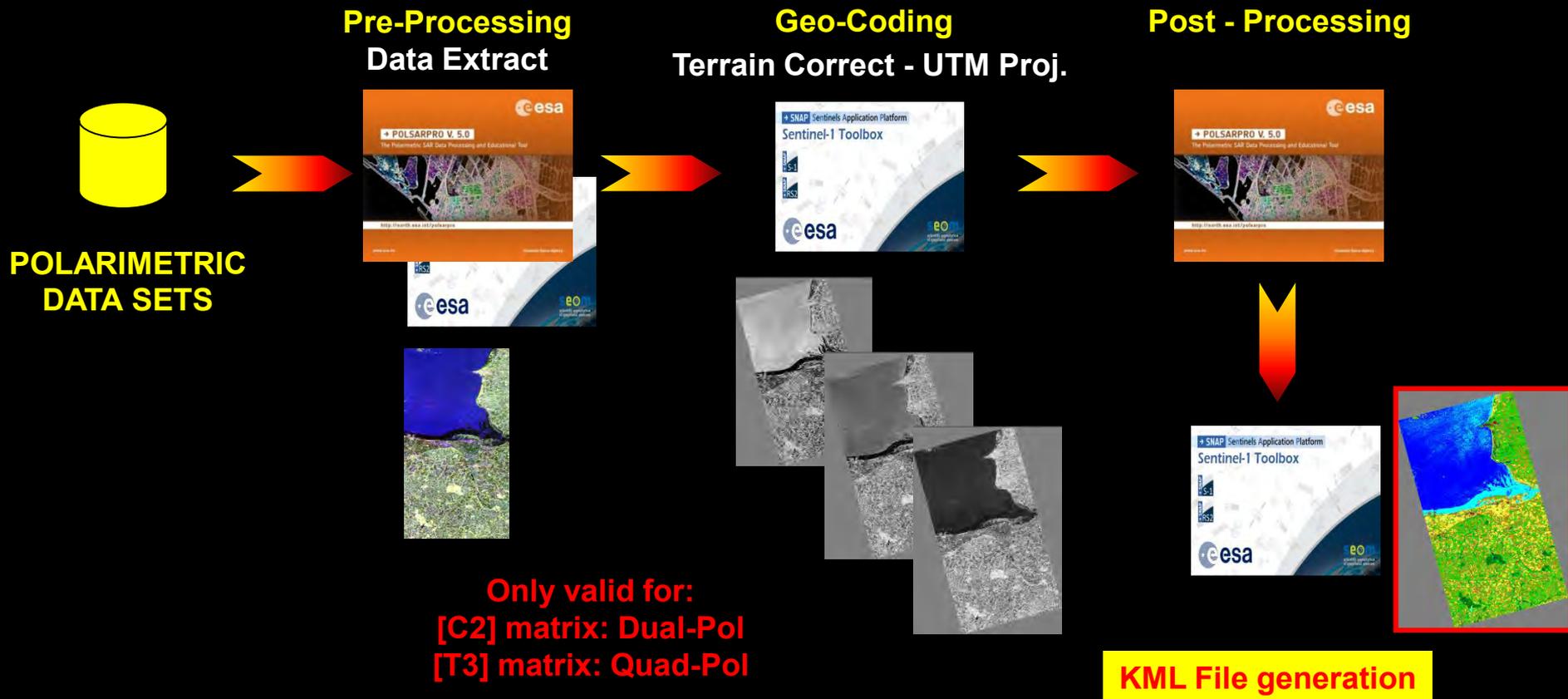


- S1 toolbox (split, deburst, merge ...)
- Geocoding toolbox
- Interferometric toolbox
(co-registration, flat Earth estimation ...)

ESA - SNAP



ESA - SNAP





Software – General Presentation



Hungarian
Space Office



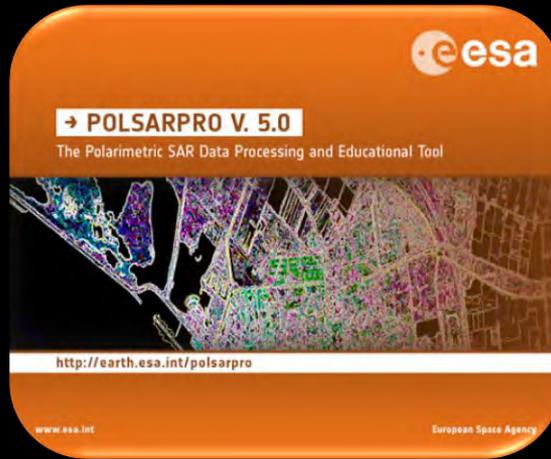
PolSARpro v5.1 SOFTWARE



WHAT IS NEW IN THE VERSION v5.1 ?

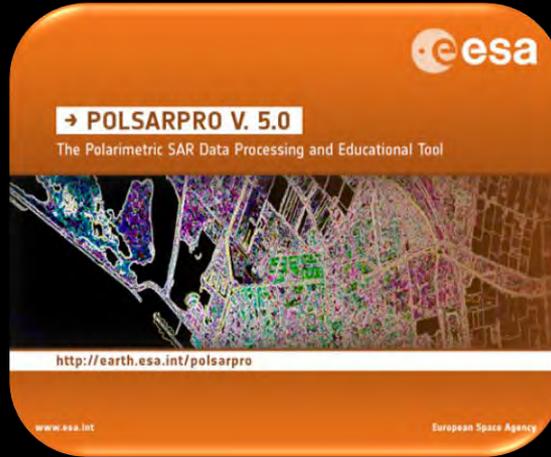
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A NEW ENGINE

A NEW DESIGN



A NEW ENGINE



Development of PolSARpro functionalities (ESA funded study)



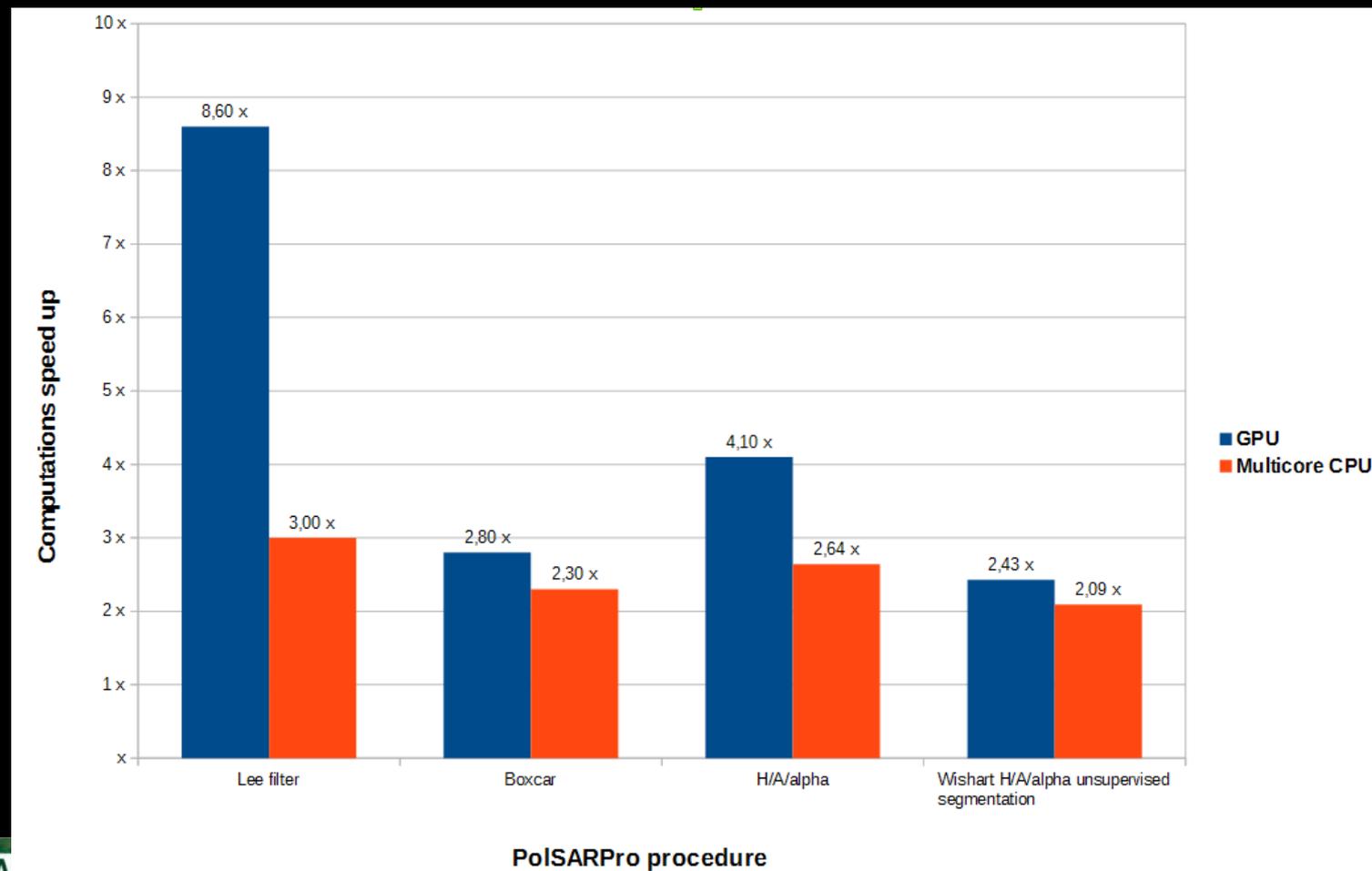
GPU

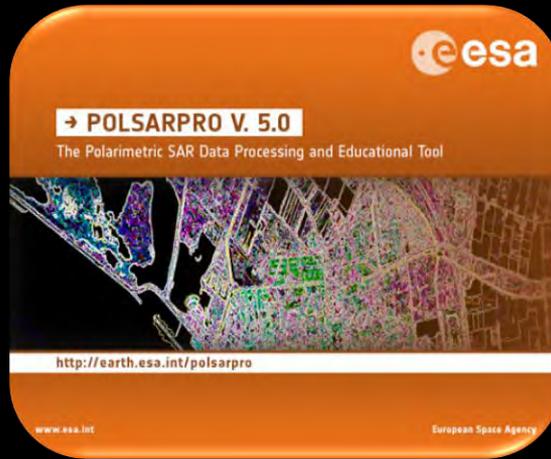


Multi-core CPU

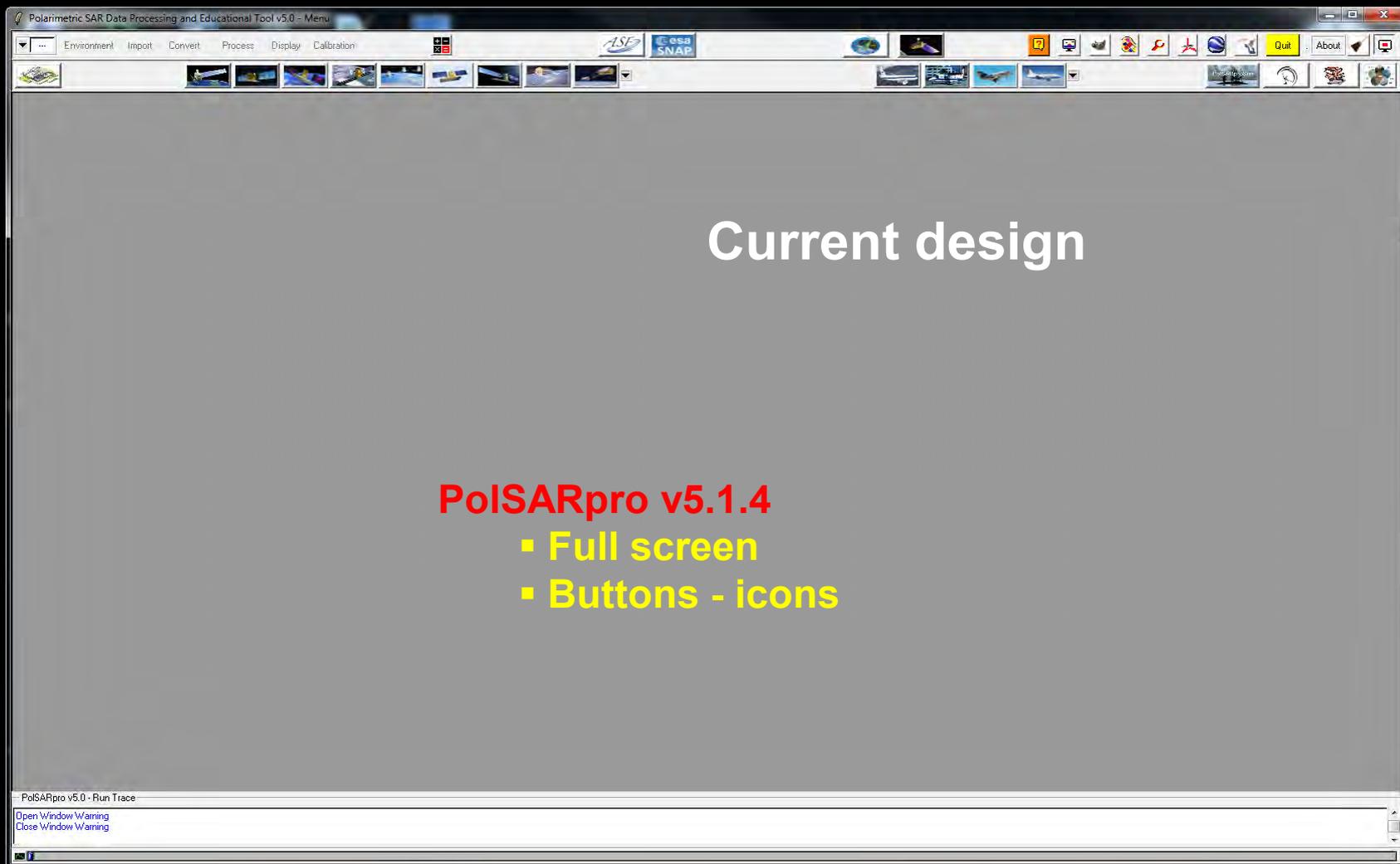


Speed-up PolSARpro computations by using multicore CPUs (parallelization) and Graphical Processing Unit (GPUs)

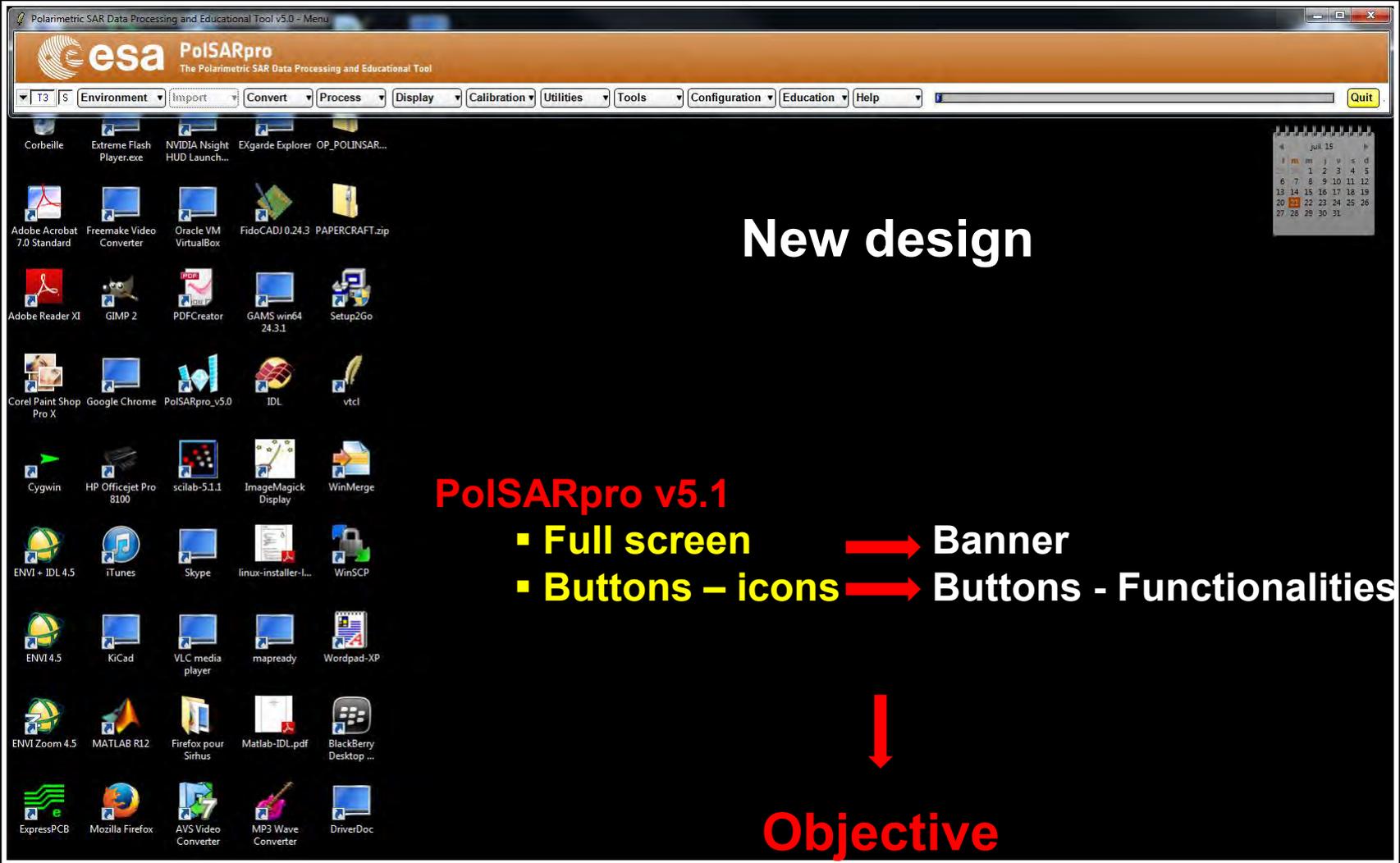




A NEW DESIGN







New design

- **Full screen** → Banner
- **Buttons – icons** → Buttons - Functionalities

↓

Objective

To minimize the data flow towards a

Data Processing: H / A / Alpha Decomposition Parameters

Input Directory: C:/ASF/T3

Output Directory: C:/ASF

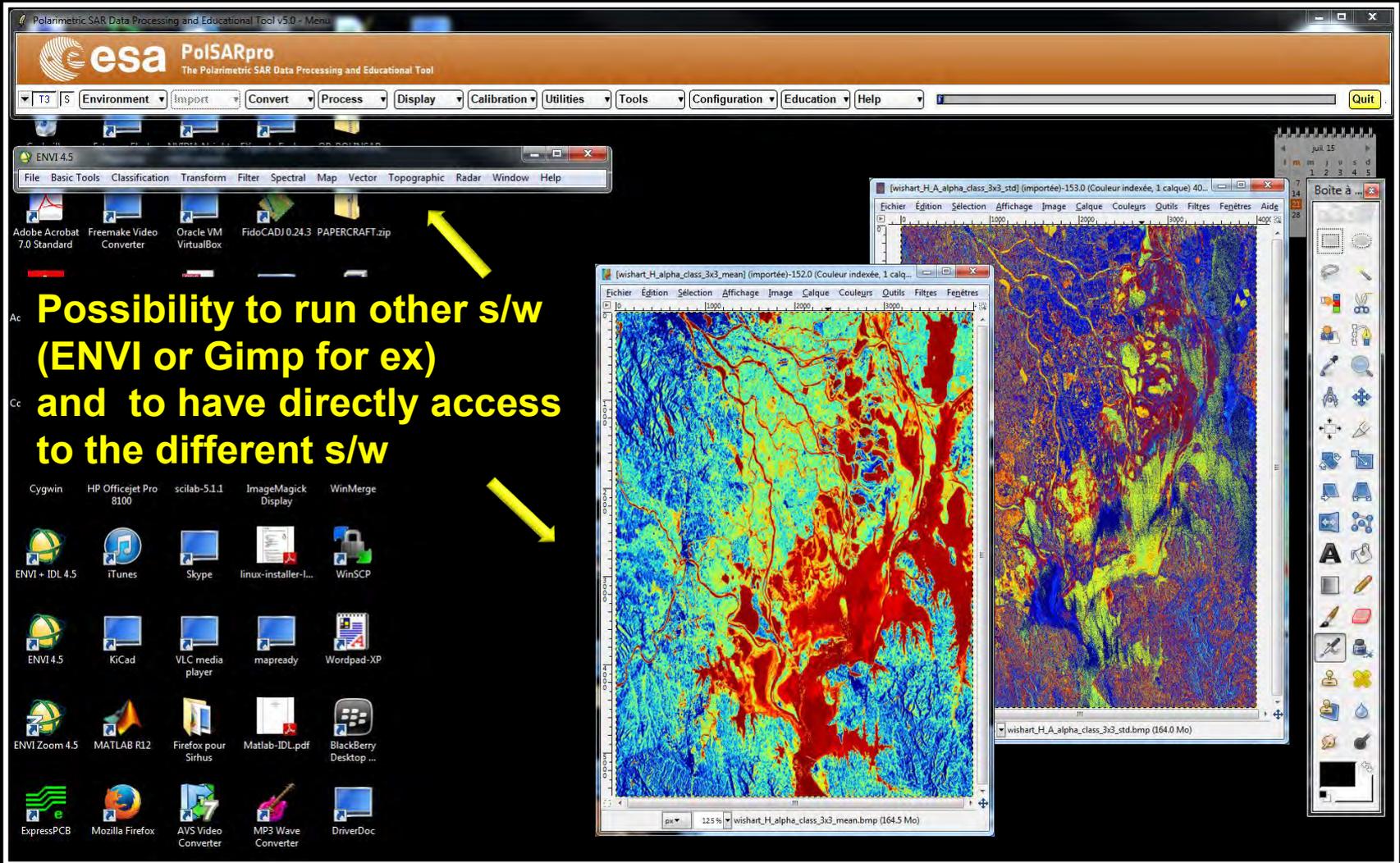
| Init Row | End Row | Init Col | End Col | Format |
|-------------------------------------|---------|---|--|-----------------------------------|
| 1 | 14416 | 1 | 2823 | BMP |
| <input checked="" type="checkbox"/> | | | | Alpha, Beta, Delta, Gamma, Lambda |
| <input checked="" type="checkbox"/> | | | | Lambda |
| <input checked="" type="checkbox"/> | | | | Alpha |
| <input checked="" type="checkbox"/> | | | | Entropy (H) |
| <input checked="" type="checkbox"/> | | | | Anisotropy (A) |
| <input checked="" type="checkbox"/> | | <input checked="" type="checkbox"/> H A | <input checked="" type="checkbox"/> (1-H)A | BMP |
| <input checked="" type="checkbox"/> | | <input checked="" type="checkbox"/> H (1-A) | <input checked="" type="checkbox"/> (1-H)(1-A) | BMP |

Window Size Row: ? Window Size Col: ?

Equivalence between [T] and [C] eigen-decompositions.

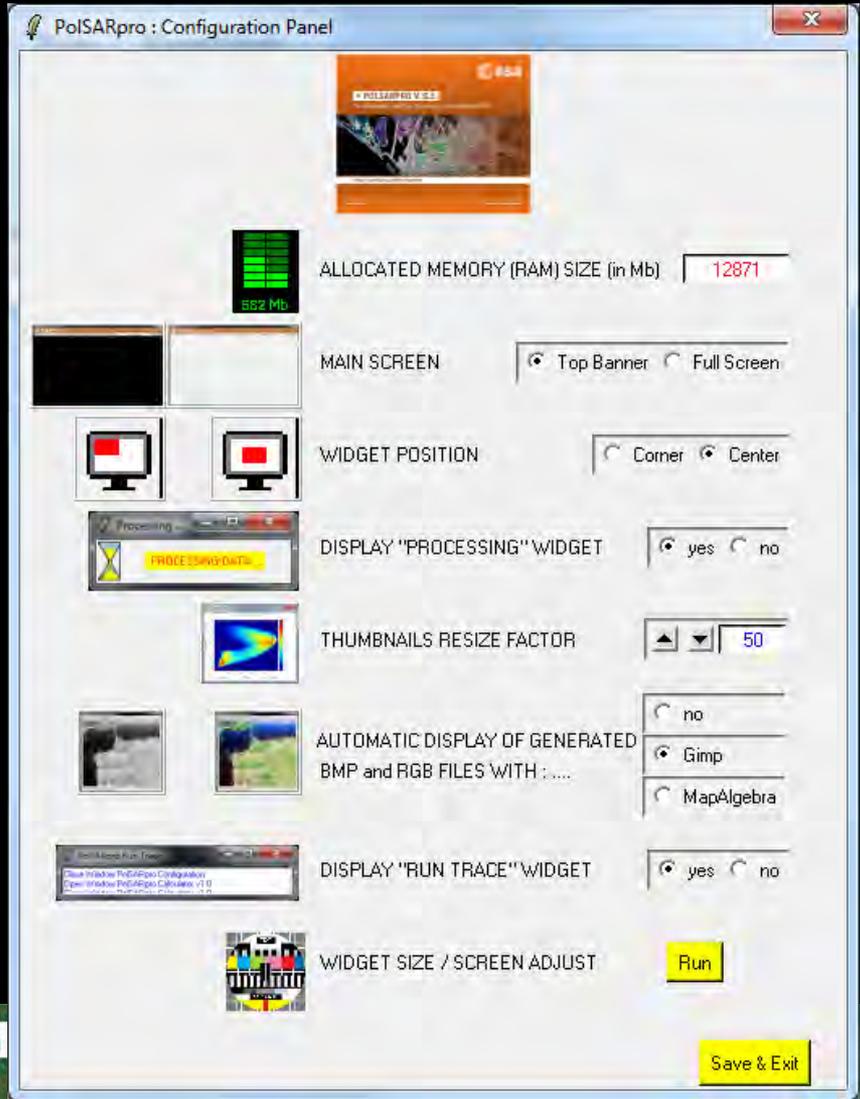
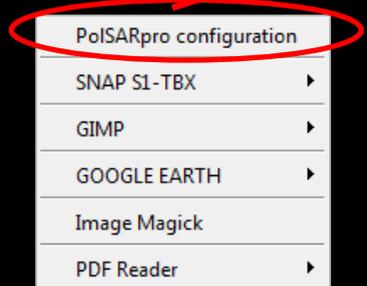
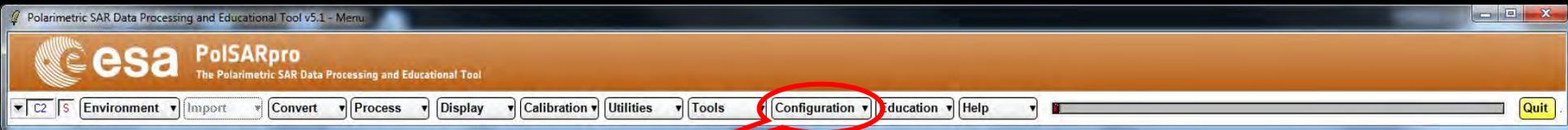
Run **Exit**

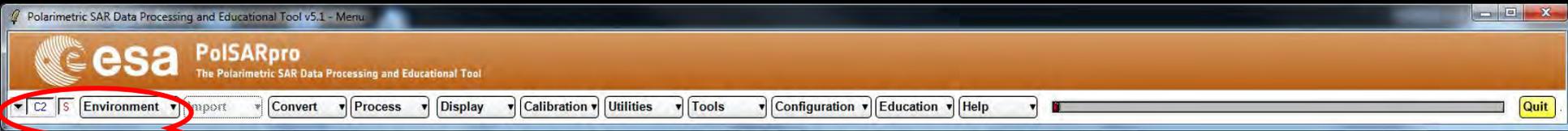
Widget on the desktop



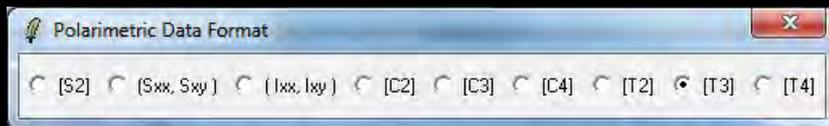
The screenshot displays the PoSARpro software interface, which is designed to run on a desktop environment. The main window shows a menu bar with options like File, Environment, Import, Convert, Process, Display, Calibration, Utilities, Tools, Configuration, Education, Help, and Quit. Below the menu bar, there is a desktop area with several application icons, including Adobe Acrobat, Freemake Video Converter, Oracle VM VirtualBox, FidoCADJ 0.24.3, PAPERCRAFT.zip, Cygwin, HP Officejet Pro 8100, scilab-5.1.1, ImageMagick Display, WinMerge, ENVI + IDL 4.5, iTunes, Skype, linux-installer-..., WinSCP, ENVI 4.5, KiCad, VLC media player, mapready, Wordpad-XP, ENVI Zoom 4.5, MATLAB R12, Firefox pour Sirius, Matlab-IDL.pdf, BlackBerry Desktop..., ExpressPCB, Mozilla Firefox, AVS Video Converter, MP3 Wave Converter, and DriverDoc. Two windows are open, showing SAR data processing results. One window displays a color-coded map of a landscape, and the other shows a similar map with a different color scheme. A yellow arrow points to the desktop area, highlighting the possibility of running other software like ENVI or Gimp. Another yellow arrow points to the application icons, highlighting the direct access to different software.

Possibility to run other s/w (ENVI or Gimp for ex) and to have directly access to the different s/w

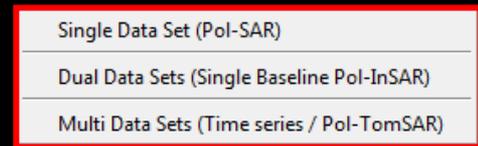




Polarimetric Data Format

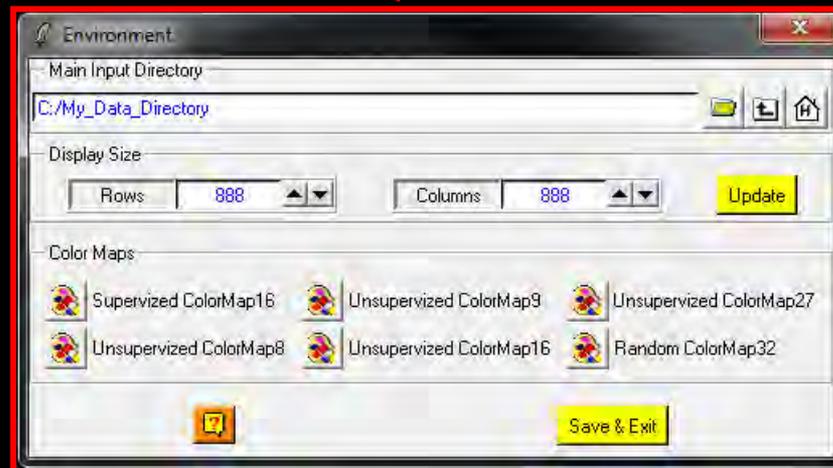
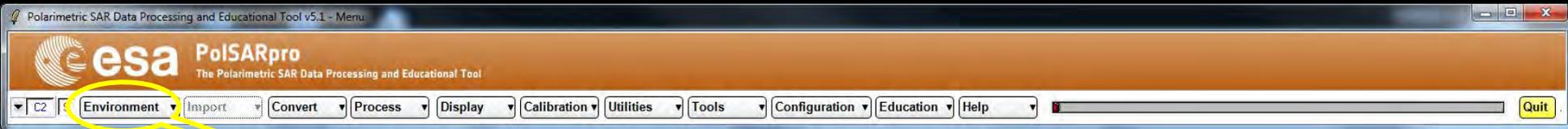


DataSet Type





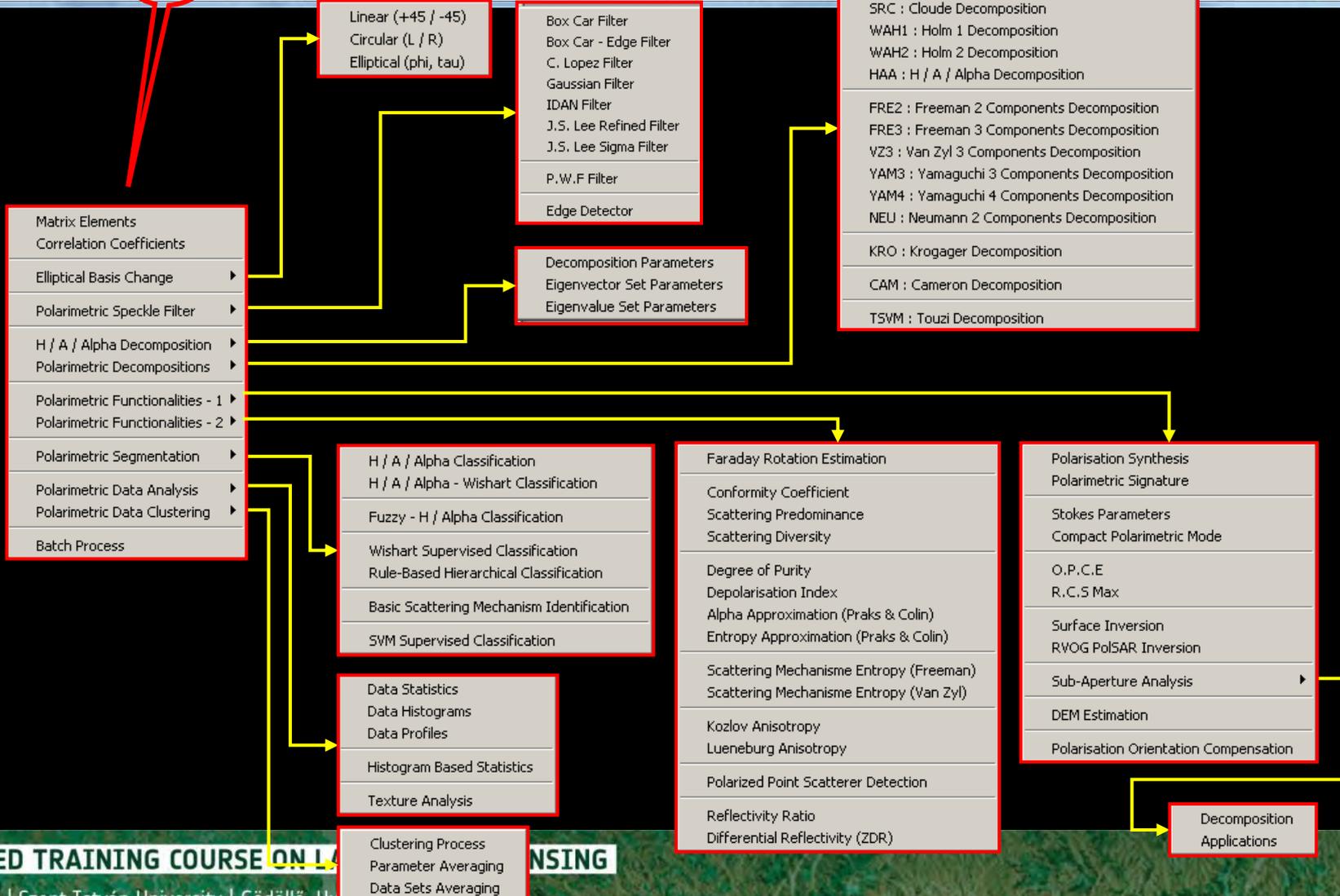
New Functionalities

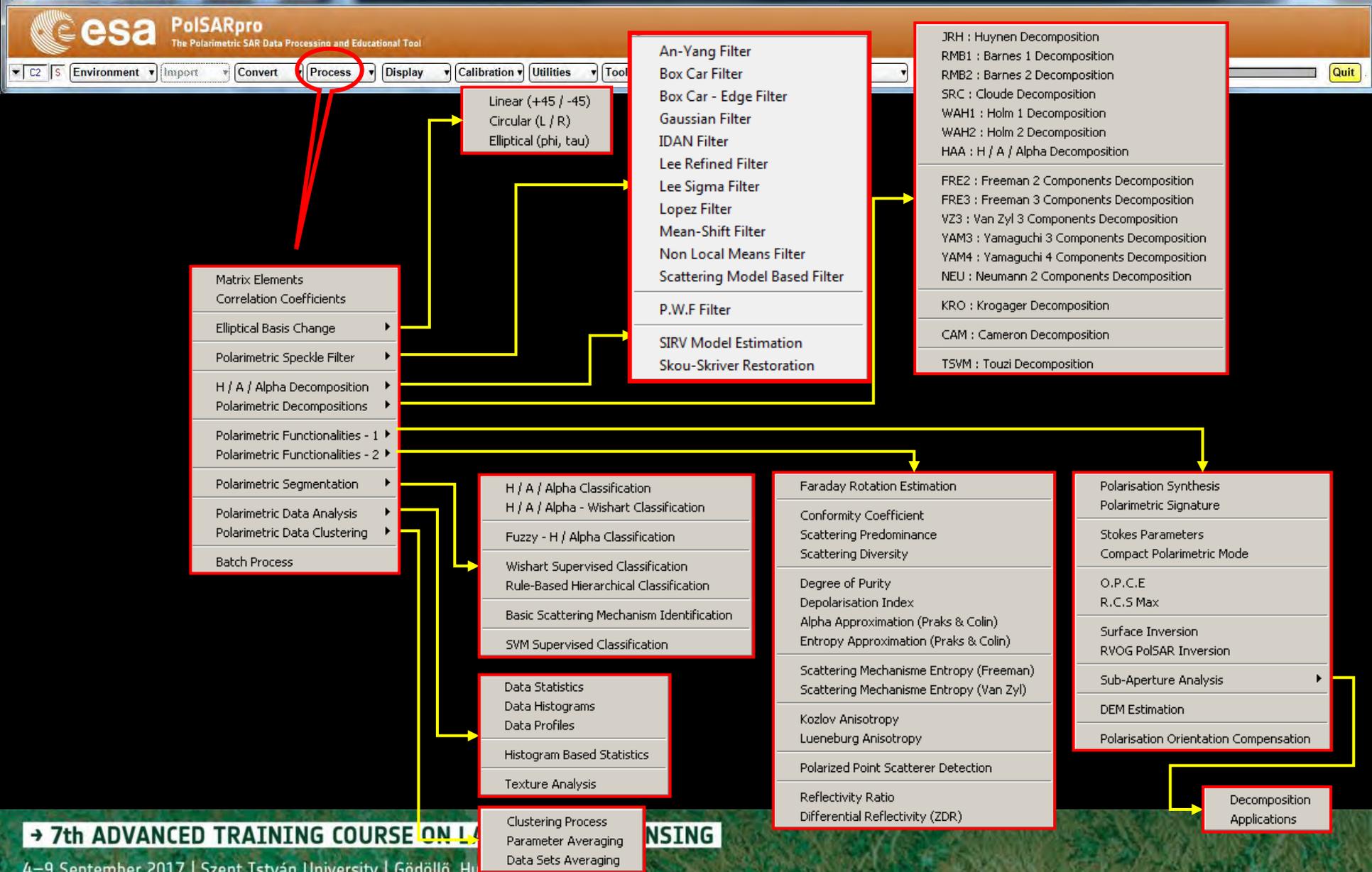


Polarimetric SAR Data Processing and Educational Tool v5.1 - Menu


PoISARpro
 The Polarimetric SAR Data Processing and Educational Tool

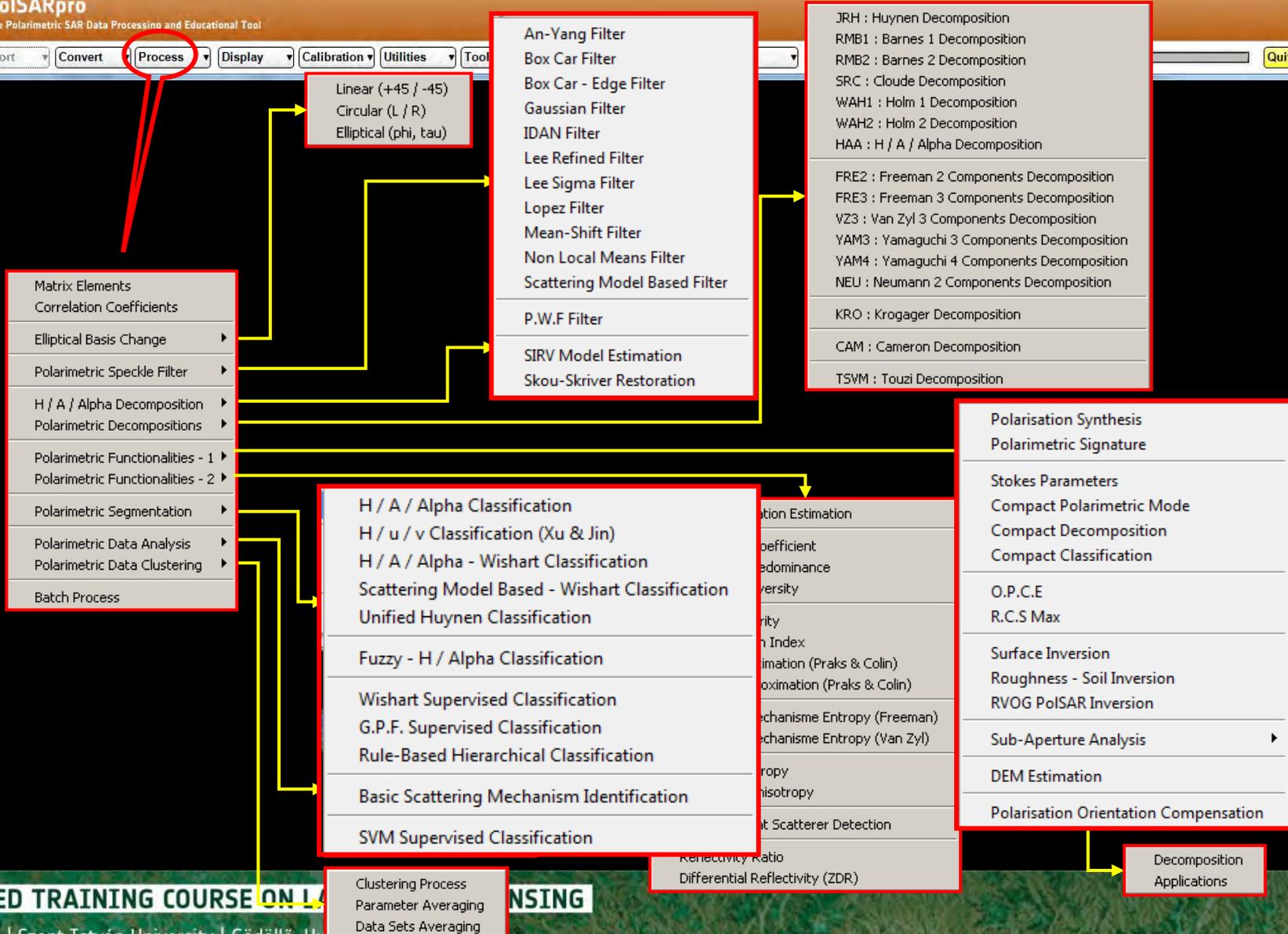
C2 | S | Environment | Import | Convert | **Process** | Display | Calibration | Utilities | Tools | Configuration | Education | Help






PoISARpro
 The Polarimetric SAR Data Processing and Educational Tool

C2 | S | Environment | Import | Convert | **Process** | Display | Calibration | Utilities | Tools



Polarimetric SAR Data Processing and Educational Tool v5.1 - Menu


PolSARpro
 The Polarimetric SAR Data Processing and Educational Tool

C2 | S | Environment | Import | Convert | **Process** | Display | Calibration | Utilities | Tools

Linear (+45 / -45)
Circular (L / R)
Elliptical (phi, tau)

An-Yang Filter
Box Car Filter
Box Car - Edge Filter
Gaussian Filter
IDAN Filter
Lee Refined Filter
Lee Sigma Filter
Lopez Filter
Mean-Shift Filter
Non Local Means Filter
Scattering Model Based Filter

P.W.F Filter

SIRV Model Estimation
Skou-Skriver Restoration

H / A / Alpha Classification
H / u / v Classification (Xu & Jin)
H / A / Alpha - Wishart Classification
Scattering Model Based - Wishart Classification
Unified Huynen Classification

Fuzzy - H / Alpha Classification

Wishart Supervised Classification
G.P.F. Supervised Classification
Rule-Based Hierarchical Classification

Basic Scattering Mechanism Identification

SVM Supervised Classification

KRO : Krogager Decomposition

CAM : Cameron Decomposition

HAA : H / A / Alpha Decomposition
JRH : Huynen Decomposition
RMB1 : Barnes 1 Decomposition
RMB2 : Barnes 2 Decomposition
SRC : Cloude Decomposition
UHDx : Unified Huynen Decomposition
WAH1 : Holm 1 Decomposition
WAH2 : Holm 2 Decomposition

AN3 : An & Yang 3 Component Decomposition
AN4 : An & Yang 4 Component Decomposition
BF4 : Bhattacharya & Frey 4 Component Decomposition
FRE2 : Freeman 2 Component Decomposition
FRE3 : Freeman 3 Component Decomposition
NEU : Neumann 2 Component Decomposition
NNED : Ariei 3 Component NNED Decomposition
ANNED : Ariei 3 Component ANNEDED Decomposition
VZ3 : Van Zyl (1992) 3 Component Decomposition
SIN4 : Singh 4 Component Decomposition
YAM3 : Yamaguchi 3 Component Decomposition
YAM4 : Yamaguchi 4 Component Decomposition
MCSM5 : L. Zhang 5 Component Decomposition

TSVM : Touzi Decomposition

Aghababae Decomposition

2KR : Raney Decomposition
CPD : Compact-Pol Decomposition

Sub-Aperture Analysis

DEM Estimation

Polarisation Orientation Compensation

Clustering Process
Parameter Averaging
Data Sets Averaging

Scattering Ratio
Differential Reflectivity (ZDR)

Decomposition Applications

Matrix Elements
Correlation Coefficients

Elliptical Basis Change

Polarimetric Speckle Filter

H / A / Alpha Decomposition
Polarimetric Decompositions

Polarimetric Functionalities - 1
Polarimetric Functionalities - 2

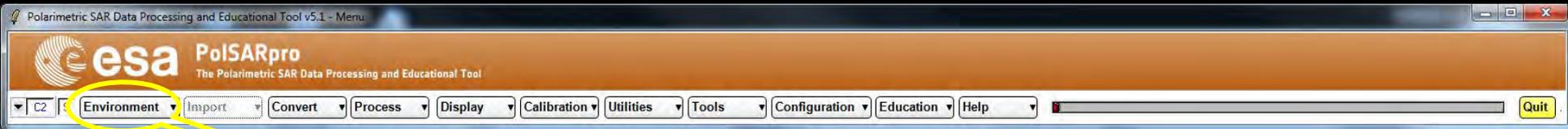
Polarimetric Segmentation

Polarimetric Data Analysis
Polarimetric Data Clustering

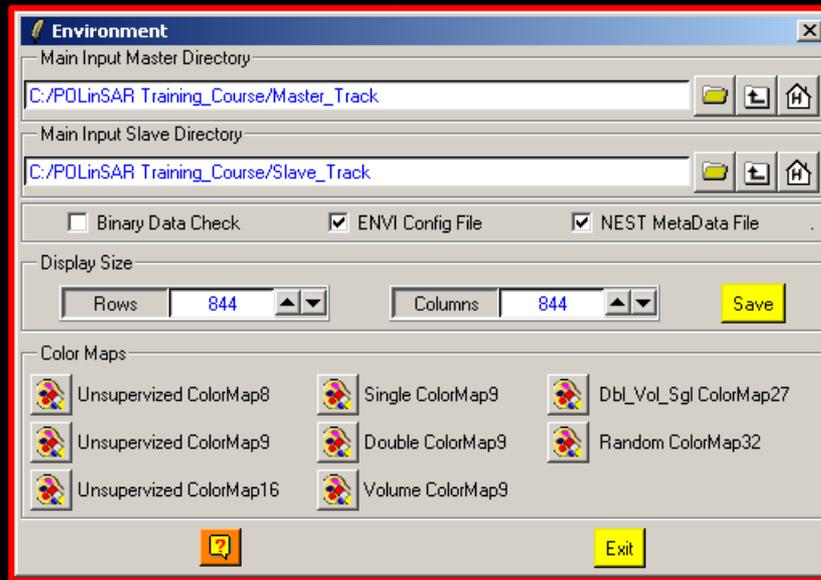
Batch Process

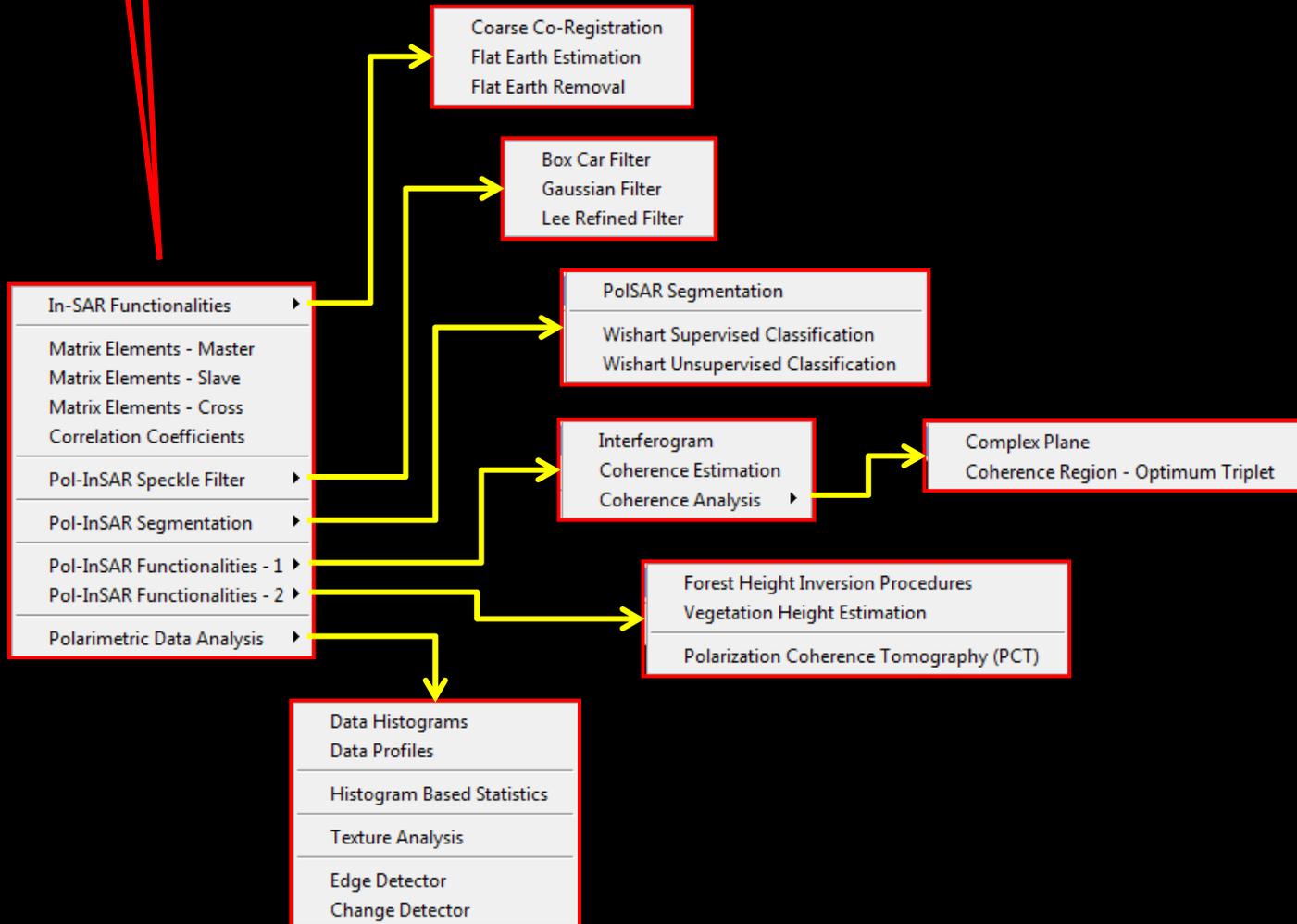
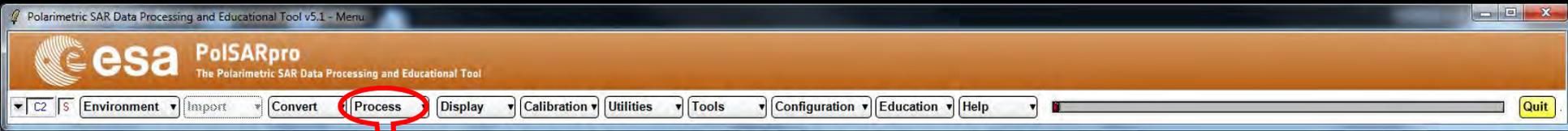
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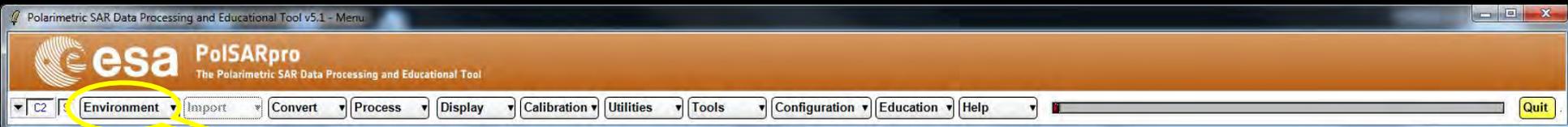
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- Single Data Set (Pol-SAR)
- Dual Data Sets (Single Baseline Pol-InSAR)
- Multi Data Sets (Time series / Pol-TomSAR)

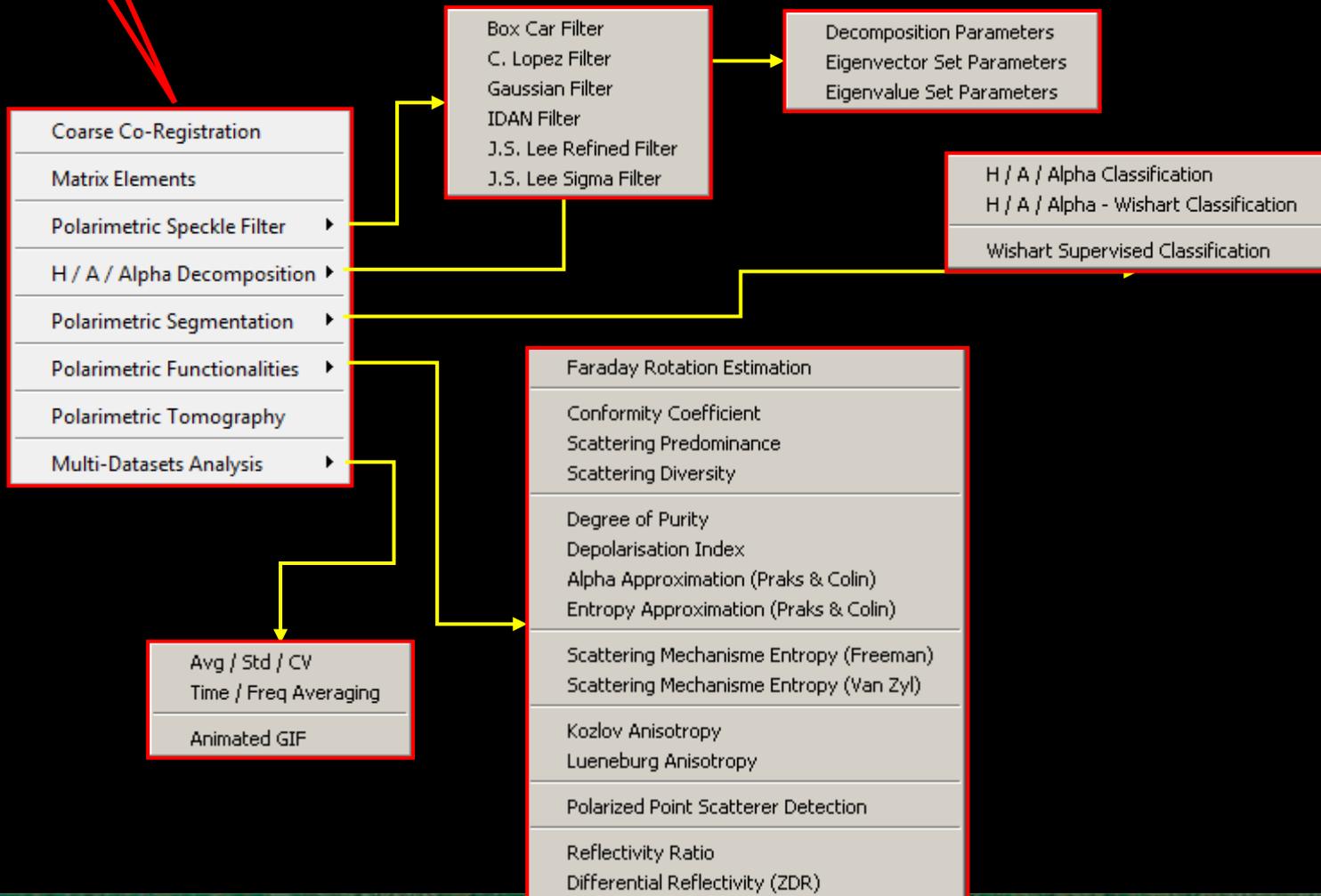
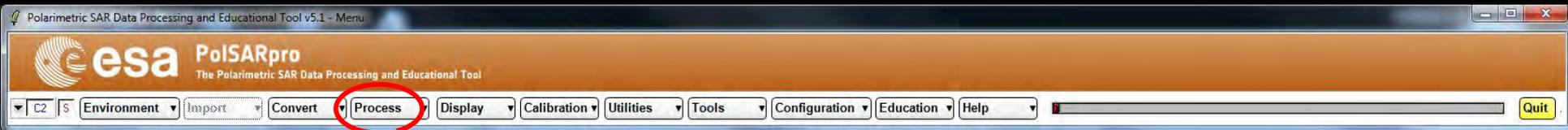


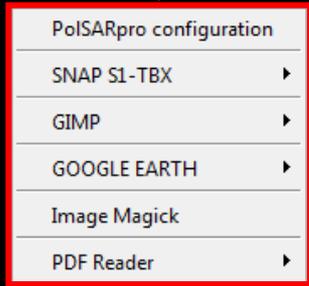
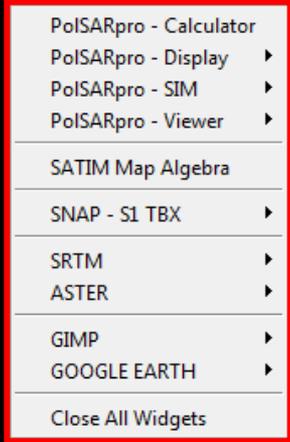
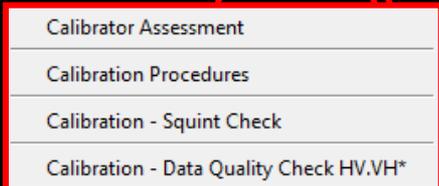
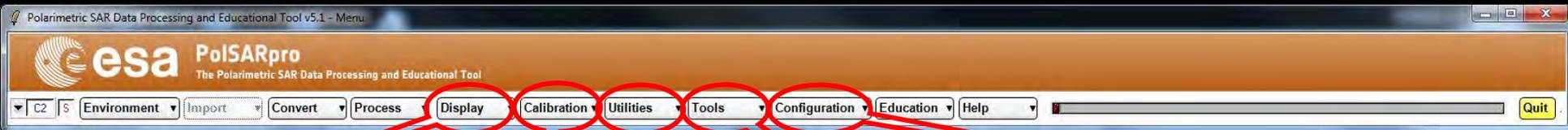


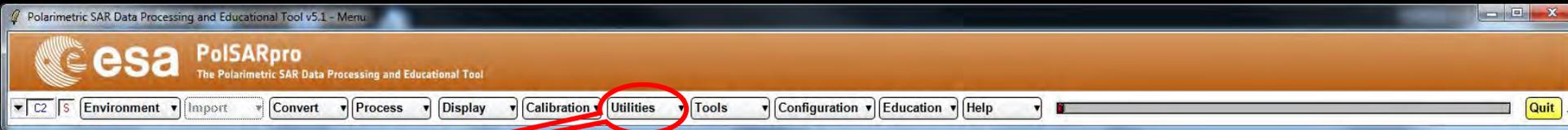


- Single Data Set (Pol-SAR)
- Dual Data Sets (Single Baseline Pol-InSAR)
- Multi Data Sets (Time series / Pol-TomSAR)









- PoISARpro - Calculator
- PoISARpro - Display ▶
- PoISARpro - SIM ▶
- PoISARpro - Viewer ▶
- SATIM Map Algebra
- SNAP - S1 TBX ▶
- SRTM ▶
- ASTER ▶
- GIMP ▶
- GOOGLE EARTH ▶
- Close All Widgets

PoISARpro Calculator v1.0

Op #1 (/Op#1) Operator (/Op#2) Op #2

Operand #1

File Mat S / M 2x2 mat 3x3 mat 4x4 mat

STO RCL MC AC

Input File

Input File Data Format Init Row End Row Init Col End Col

Input Matrix Directory

Input Matrix Data Format Init Row End Row Init Col End Col

Input Value Type Complex Value Float Value Integer Value Input Value +j

N x N Matrix

Complex Float Hermitian Special Unitary

| | | | | | | | | | | | | | | | |
|-----|----------------------|----|----------------------|-----|----------------------|----|----------------------|-----|----------------------|----|----------------------|-----|----------------------|----|----------------------|
| m11 | <input type="text"/> | +j | <input type="text"/> | m12 | <input type="text"/> | +j | <input type="text"/> | m13 | <input type="text"/> | +j | <input type="text"/> | m14 | <input type="text"/> | +j | <input type="text"/> |
| m21 | <input type="text"/> | +j | <input type="text"/> | m22 | <input type="text"/> | +j | <input type="text"/> | m23 | <input type="text"/> | +j | <input type="text"/> | m24 | <input type="text"/> | +j | <input type="text"/> |
| m31 | <input type="text"/> | +j | <input type="text"/> | m32 | <input type="text"/> | +j | <input type="text"/> | m33 | <input type="text"/> | +j | <input type="text"/> | m34 | <input type="text"/> | +j | <input type="text"/> |
| m41 | <input type="text"/> | +j | <input type="text"/> | m42 | <input type="text"/> | +j | <input type="text"/> | m43 | <input type="text"/> | +j | <input type="text"/> | m44 | <input type="text"/> | +j | <input type="text"/> |

Output Value +j

Operator : File

- (file) + value
- (file) - value
- (file) * value
- (file) / value
- (file) .+ (file)
- (file) .- (file)
- (file) .* (file)
- (file) ./ (file)
- .real (.)
- .imag (.)
- .arg (.)
- .abs (.)
- .cos (.)
- .sin (.)
- .tan (.)
- .conj (.)
- .acos (.)
- .asin (.)
- .atan (.)
- .boxcar (?x?)
- .sqrt (.)
- . (.) ^2
- . (.) ^3
- . (.) ^ (?)
- .log ([1.])
- .ln ([1.])
- .10^ (.)
- .exp (.)
- .10log ([1.])
- .20log ([1.])
- . (.) < { ? }
- . (.) > { ? }

Operator : Sinclair Matrix : S2

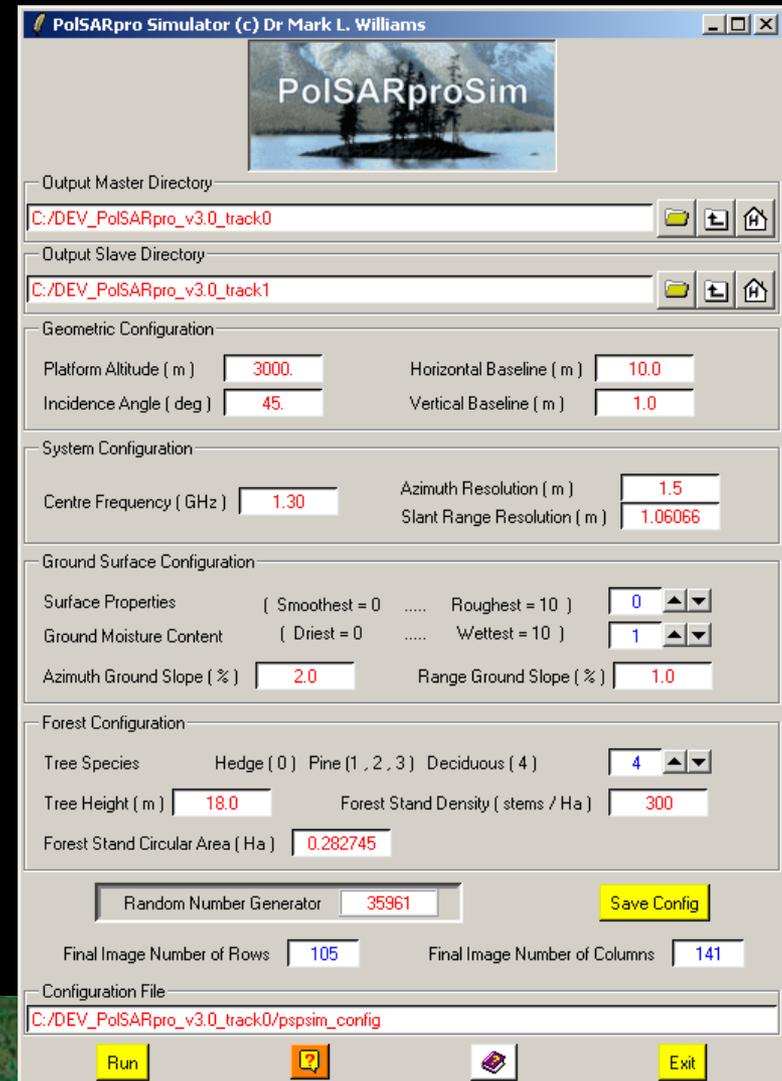
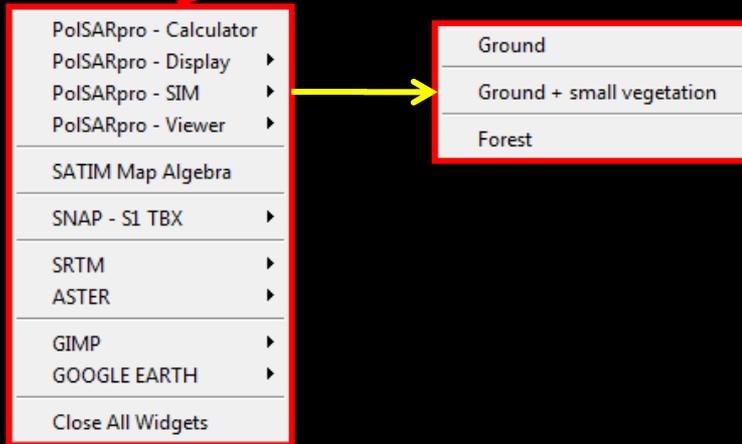
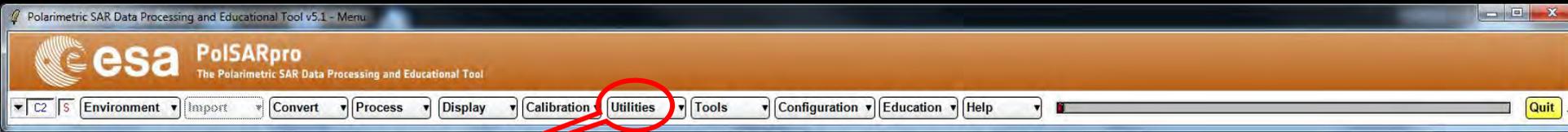
- [S] + value
- [S] - value
- [S] * value
- [S] / value
- [S] .+ (file)
- [S] .- (file)
- [S] .* (file)
- [S] ./ (file)
- [S] .+ [S]
- [S] .+ [mat]
- [S] .* [S]
- [S] .* [mat]
- [S] .* [S] *
- [U] .t.* [S] .* [U]
- .conj [S]
- .tr [S]
- .det [S]
- .inv [S]
- .eig1 [S]
- .eig2 [S]
- .eig1 [G]
- .eig2 [G]

Operator : Hermitian Matrix : C2, C3, C4, T2, T3, T4

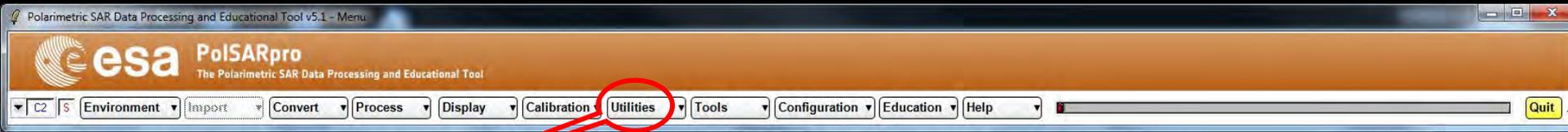
- [M] + value
- [M] - value
- [M] * value
- [M] / value
- [M] .+ (file)
- [M] .- (file)
- [M] .* (file)
- [M] ./ (file)
- [M] .+ [M]
- [M] .+ [mat]
- .inv [M]
- [U] .* [M] .* inv [U]
- .conj [M]
- .tr [M]
- .det [M]
- tr (inv [mat] .* [M])
- .eig1 [M]
- .eig2 [M]
- .eig3 [M]
- .eig4 [M]

Operator : Complex / Hermitian / Float / Special Unitary NxN Matrix

- [mat] + value
- [mat] - value
- [mat] * value
- [mat] / value
- [mat] .+ [mat]
- [mat] .- [mat]
- [mat] .* [mat]
- [mat] ./ [mat]
- .det [mat]
- .tr [mat]
- .conj [mat]
- .inv [mat]
- .eig1 [mat]
- .eig2 [mat]
- .eig3 [mat]
- .eig4 [mat]



PoISARproSim is a rapid, coherent, fully polarimetric and interferometric SAR simulation of forest.



- PolSARpro - Calculator
- PolSARpro - Display
- PolSARpro - SIM
- PolSARpro - Viewer
- SATIM Map Algebra
- SNAP - S1 TBX
- SRTM
- ASTER
- GIMP
- GOOGLE EARTH
- Close All Widgets

- Ground
- Ground + small vegetation
- Forest

PolSARpro Ground + Small vegetation simulator

Output Master Directory: C:/DEV_PolSARpro_v4.0/track_master

Output Slave Directory: C:/DEV_PolSARpro_v4.0/track_slave

Geometric Configuration

| | | | |
|-------------------------|-------|---------------------------|------|
| Platform Altitude (m) | 3000. | Horizontal Baseline (m) | 10.0 |
| Incidence Angle (deg) | 45. | Vertical Baseline (m) | 1.0 |

System Configuration

Centre Frequency (GHz)

Ground Surface Configuration

Surface Properties

Ground Moisture Content

Azimuth Ground Slope (%)

Ground Surface Square Area (Ha)

System Configuration

| | | | |
|--------------------------|------|------------------------------|---------|
| Centre Frequency (GHz) | 1.30 | Azimuth Resolution (m) | 1.5 |
| | | Slant Range Resolution (m) | 1.06066 |

Ground Surface Configuration

Surface Properties (Smoothest = 0 Roughest = 10)

Ground Moisture Content (Driest = 0 Wettest = 10)

Azimuth Ground Slope (%)

Range Ground Slope (%)

Ground Surface Square Area (Ha)

Small Vegetation Configuration

Mean Vegetation Height (m)

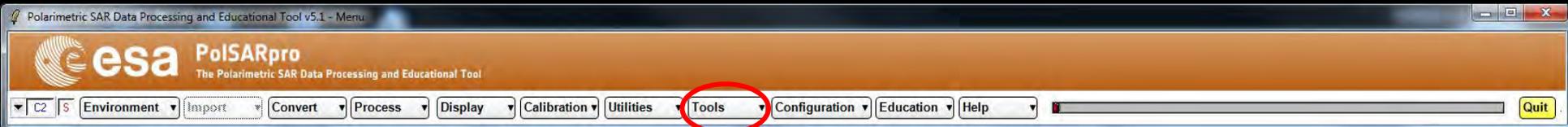
Random Number Generator: 34492

Save Config

Final Image Number of Rows: Final Image Number of Columns:

Configuration File:

File Exit

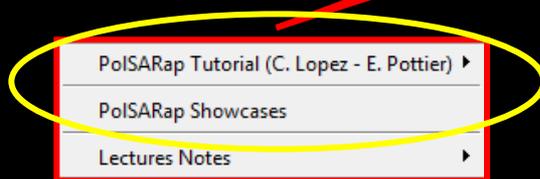
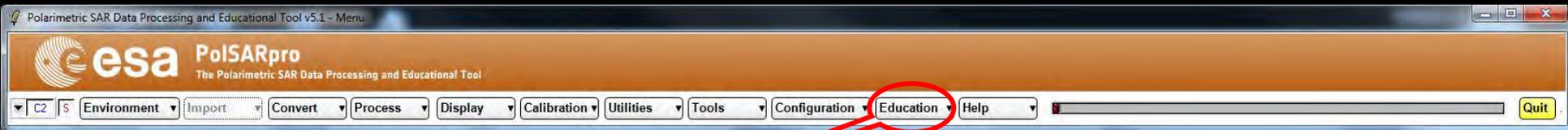


- Data Binary Check
- Compare Data Directory
- Create Mask Valid Pixels
- IEEE Format Convert
- Sub Data Extraction
- ROI Extraction
- Map Info Update
- Rotation 90 left
- Rotation 90 right
- Rotation 180
- Flip Up-Down
- Flip Left-Right
- Transpose
- Apply FFT
- Apply Mask



- Data Binary Check
- Compare Binary Files
- Read Binary Data Value
- Copy File
- Delete File
- Rename File
- IEEE Format Convert
- Sub Data Extraction
- Rotation 90 left
- Rotation 90 right
- Rotation 180
- Flip Up-Down
- Flip Left-Right
- Transpose
- Complex Data File
- Create MASK
- Create ENVI (.hdr) File

- Create Directory
- Copy Directory
- Delete Directory
- Rename Directory



Learning / Training Next P.I Generations



PoSAR-Ap Project



WP360 : Review and update of the Basic Principles and Applications
(E. Pottier, C. Lopez Martinez)



1 Basic Principles of SAR Polarimetry

C. Lopez Martinez¹, E. Pottier²

¹UPC Barcelona
²University of Rennes-1

1.1 Theory of radar polarimetry

1.1.1 Wave polarimetry

Polarimetry refers specifically to the vector nature of the electromagnetic waves, whereas radar polarimetry is the science of acquiring, processing and analyzing the polarization state of an electromagnetic wave in radar applications. This section summarizes the main theoretical aspects necessary for a correct processing and interpretation of the polarimetric information. As a result, the first part presents the so-called wave polarimetry that deals with the representation and the understanding of the polarization state of an electromagnetic wave. The second part introduces the concept of scattering polarimetry. This concept collects the topic of inferring the properties of a given target, from a polarimetric point of view, given the incident and the scattered polarized electromagnetic waves.

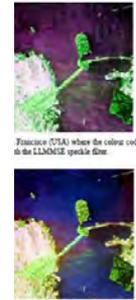
1.1.1.1 Electromagnetic waves and wave polarization descriptors

The generation, the propagation, as well as the interaction with matter of the electric and the magnetic waves are governed by the Maxwell's equations [1]. For an electromagnetic wave that is propagating in the z direction, the real electric wave can be decomposed into two orthogonal components: x and y , admitting the following vector formulation:

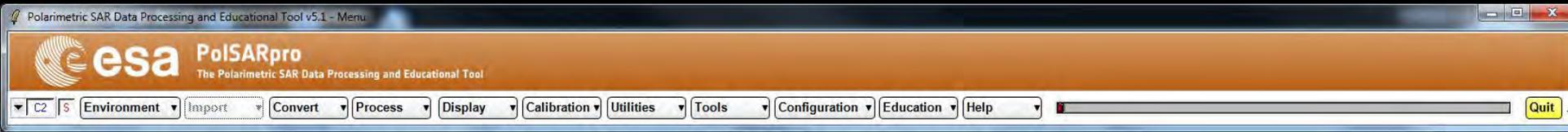
$$\vec{E}(t, z) = \begin{bmatrix} E_x \\ E_y \\ E_z \end{bmatrix} = \begin{bmatrix} E_{x0} \cos(\omega t - kz + \delta_x) \\ E_{y0} \cos(\omega t - kz + \delta_y) \\ 0 \end{bmatrix} \quad (1.1)$$

which may be also considered in a complex form

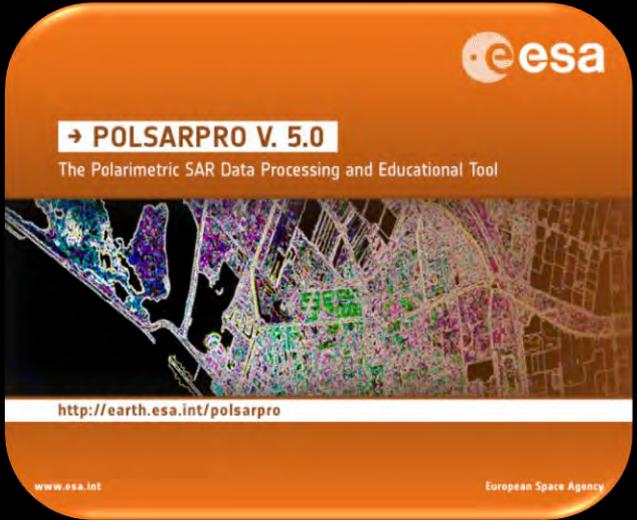
Using a better exploitation of the 3D, the Wishart distribution allows us model for all the elements of the data has been explained for PolSAR, so that if the filtering process is of speckle, depending on the chosen improved estimations of the different coherences or coherency matrices.



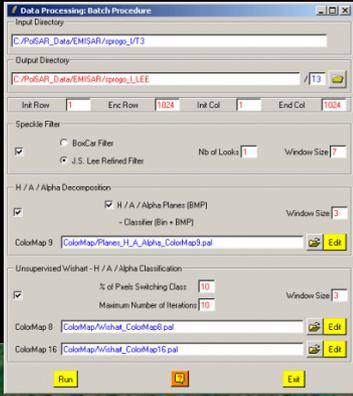
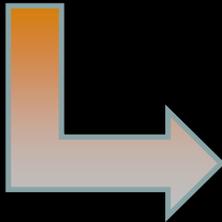
Beyond all the PolSAR data filtering techniques presented in this Section, there exist a wide variety of similar approaches in the related literature, where a con-

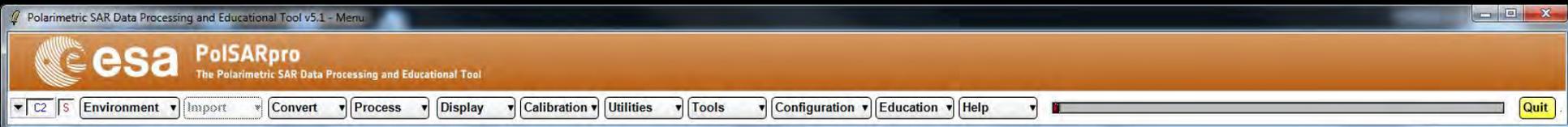


PolSAR-Ap Project



WP260 : Implementation of Selected Applications (E. Pottier)





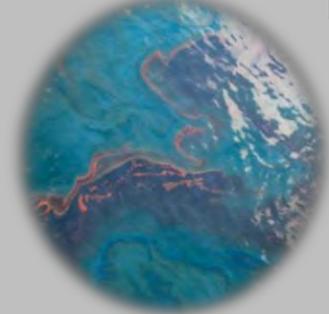
Agriculture



Forest



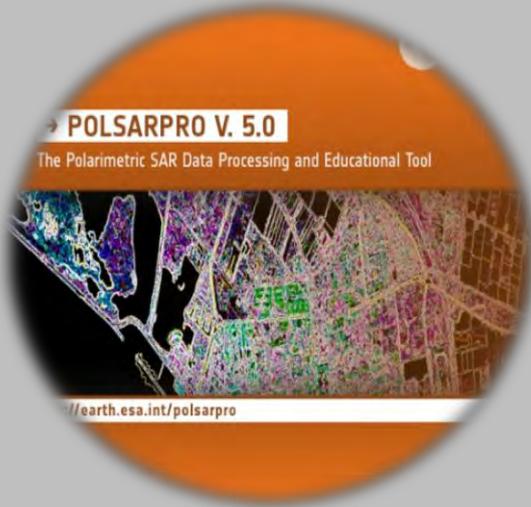
Ocean



ONERA



Urban



Cryosphere




PolSARpro
 The Polarimetric SAR Data Processing and Educational Tool

Environment | Configuration | Education | Help | Quit

PolSAR-ap Showcase : Agriculture

Input Directory:

Output Directory: / T3

Init Row: End Row: Init Col: End Col:

Decomposition: Window Size (Row) Window Size (Col)

Inc Ang Unit: Degrees Radians

Surface Soil Moisture Inversion: Soil Dielectric Constant Max: Increment Angle of the Incidence Angle LUT (deg):

Dihedral Soil Moisture Inversion: Soil Dielectric Constant Max: Trunk Dielectric Constant Max: Increment Angle of the Incidence Angle LUT (deg):

2D-Incidence Angle File:

2D Mask File:

Polarimetric Decomposition fs File:

Polarimetric Decomposition Beta File:

Vertical Roughness Indicator (ks) File (optional):

Output Soil Moisture File:

Output Soil Dielectric Constant File:

Output Trunk Dielectric Constant File:

Run Exit

PolSAR-ap Showcase : Ocean

Input Directory:

Output Directory: / T3

Init Row: End Row: Init Col: End Col:

Window Size - Train: Row Col

Window Size - Test: Row Col

Geometric Perturbation Filter: Threshold Reduction Ratio (RedR)

Output Coherence File:

Output Mask File:

Run Exit

PoISAR-ap Showcase : Cryosphere

Input Master - Slave Directory
D:/My_Data_Directory/Master_Dir_Slave_Dir

Output Master - Slave Directory
D:/My_Data_Directory/Master_Dir_Slave_Dir

Init Row: 1 End Row: 900 Init Col: 1 End Col: 1024

Decomposition
 Window Size (Row)
 Window Size (Col)

Inc Ang Unit
 Degrees
 Radians

Median Filter
 Window Size: 8
 Max Nb of Iterations: 3

Inversion
 Polarization Channel
 HH HV W

Ice Dielectric Constant: 2.8 Threshold: 40
 Range Pixel Spacing (optional): opt

2D Incidence Angle File
Enter 2D Incidence Angle file

2D Kz File
Enter 2D Kz file

Surface to Volume Ratio File
Enter [showcase_cryo_stv_ratio_HH.bin] file

Complex Coherence File
Enter [cmplx_coh_HH.bin] file

SNR Decorrelation File (optional)
Enter SNR Decorrelation file (Optional)

Output Extinction Coefficient File (kappa)
D:/My_Data_Directory/Master_Dir_Slave_Dir/showcase_cryo_kappa_HH.bin

Output Penetration Depth File
D:/My_Data_Directory/Master_Dir_Slave_Dir/showcase_cryo_depth_HH.bin

Run Exit

PoISAR-ap Showcase : Urban

Input Master - Slave Directory
D:/My_Data_Directory/Master_Slave_Dir/T6

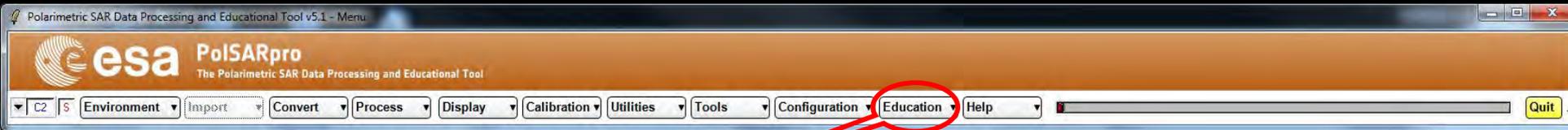
Output Master - Slave Directory
D:/My_Data_Directory/Master_Slave_Dir / T6

Init Row: 1 End Row: 900 Init Col: 1 End Col: 1024

Complex Coherence File

Output File

Run Exit



- PolSARap Tutorial (C. Lopez - E. Pottier) ▶
- PolSARap Showcases
- Lectures Notes ▶

- Recent Advances (W.M. Boerner)
- Basic Concepts (W.M. Boerner)
- Advanced Concepts (E. Pottier, J.S. Lee, L. Ferro-Famil)
- Polarimetric SAR Interferometry (S.R. Cloude, K. Papathanassiou) ▶
- Surface Parameter Retrieval (I. Hajnsek, K. Papathanassiou) ▶

- Single vs multi polarization interferometry
- Pol-InSAR (Training Course)
- Polarization Coherence Tomography (Training Course)

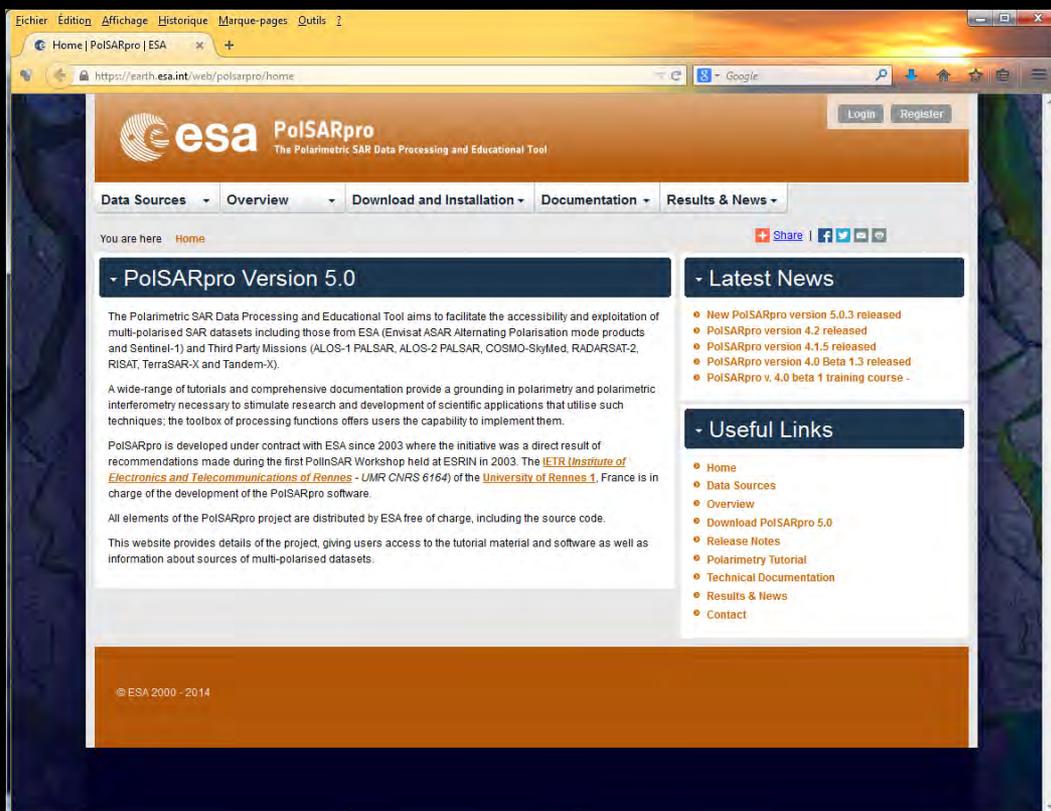


Learning / Training Next P.I Generations

http://earth.esa.int/web/polsarpro/home

The Web Site provides

- Details of the project
- Access to the tutorial and software
- Information about status of the development
- **Demonstration Sample Datasets**



<http://earth.esa.int/polsarpro/home>

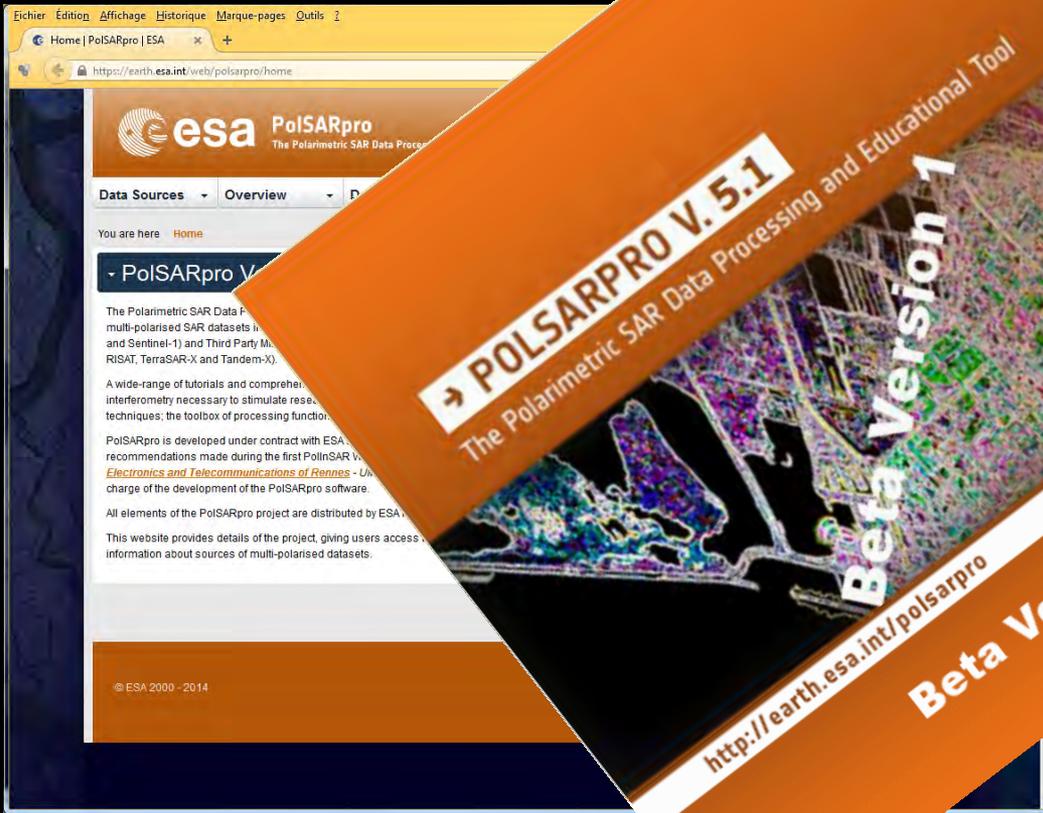
Web Site provides

of the project

the tutorial

information about status
of development

Demonstration Sample
Datasets



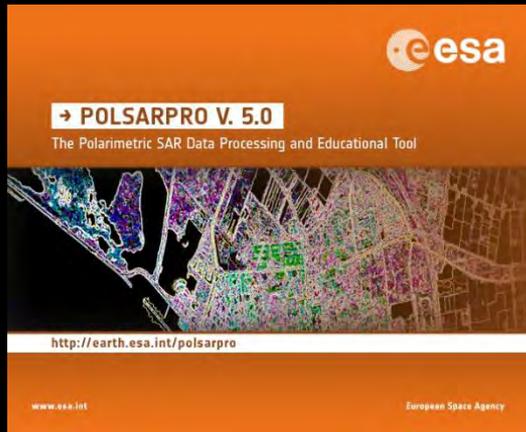
New!

v5.1 (January 2017)

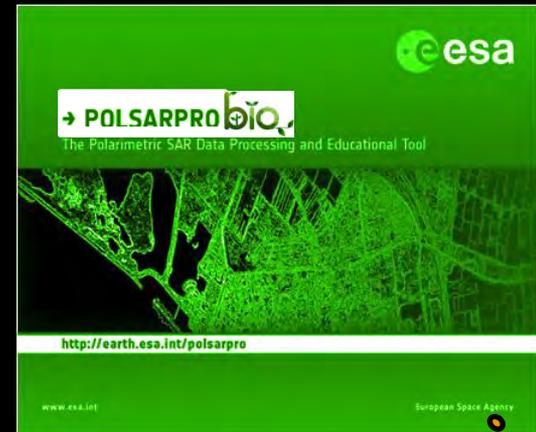
→ 7th ADVANCED TRAINING COURSE ON LAND REMOTE SENSING

4-9 September 2017 | Szent István University | Gödöllő, Hungary

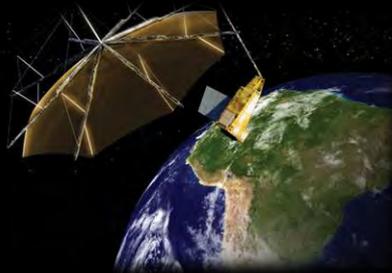
ESA & third party fully polarimetric SAR missions (**PoISARpro-Bio**)



ESA RFP - 2017



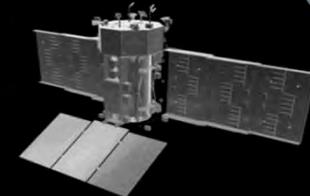
Future spaceborne sensors



BIOMASS



R.C.M



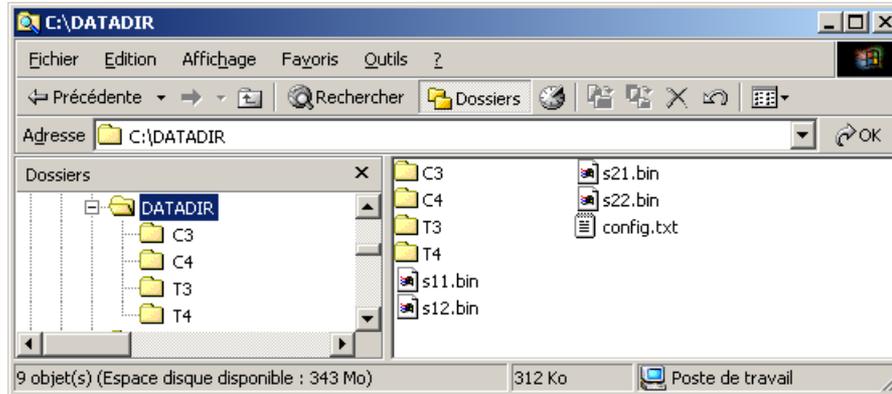
SAOCOM-CS

New functionalities : Pol-SAR, Pol-TomSAR and Pol-TimeSAR / Cloud-based infrastructure
SNAP / PoISARproSIM++ / QGIS Plug-in...



General Presentation of PolSARpro v5.1 Software

Compatible Raw Binary Data

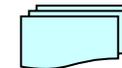


2x2 Complex Sinclair Matrix [S2]

DATADIR



config.txt



s11.bin, s12.bin
s21.bin, s22.bin

PolarCase

- Monostatic s12.bin == s21.bin
- Bistatic s12.bin <> s21.bin
- Intensities lxy.bin

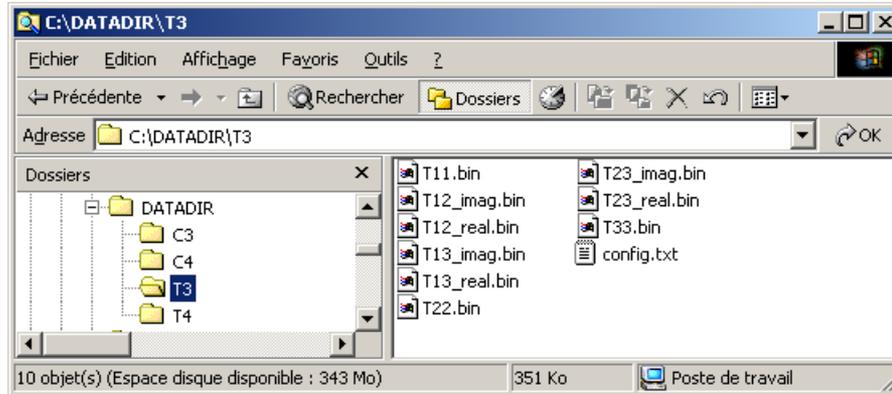
PolarType

- Full s11.bin, s12.bin, s21.bin, s22.bin
- pp1 s11.bin, s21.bin
- pp2 s12.bin, s22.bin
- pp3 s11.bin, s22.bin
- pp4 l11.bin, l12.bin, l22.bin
- pp5 l11.bin, l21.bin
- pp6 l12.bin, l22.bin
- pp7 l11.bin, l22.bin

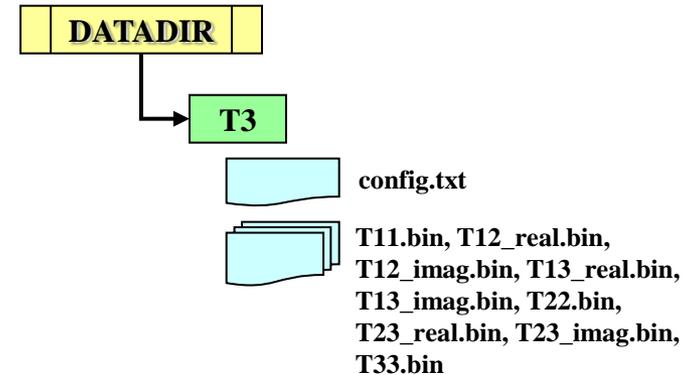
```

Nrow
1234
-----
Ncol
4789
-----
PolarCase
Monostatic/Bistatic/Intensities
-----
PolarType
Full/pp1/pp2/pp3/pp4/pp5/pp6/pp7
    
```

Compatible Raw Binary Data



3x3 Complex Coherency Matrix [T3]



$$\underline{k}_{3P} = \frac{1}{\sqrt{2}} \begin{bmatrix} S_{11} + S_{22} & S_{11} - S_{22} & S_{12} + S_{21} \end{bmatrix}$$

$$\Rightarrow [T_3] = \langle \underline{k}_{3P} \cdot \underline{k}_{3P}^\dagger \rangle$$

$$[T_3] = \begin{bmatrix} T_{11} & T_{12} & T_{13} \\ T_{12}^* & T_{22} & T_{23} \\ T_{13}^* & T_{23}^* & T_{33} \end{bmatrix}$$

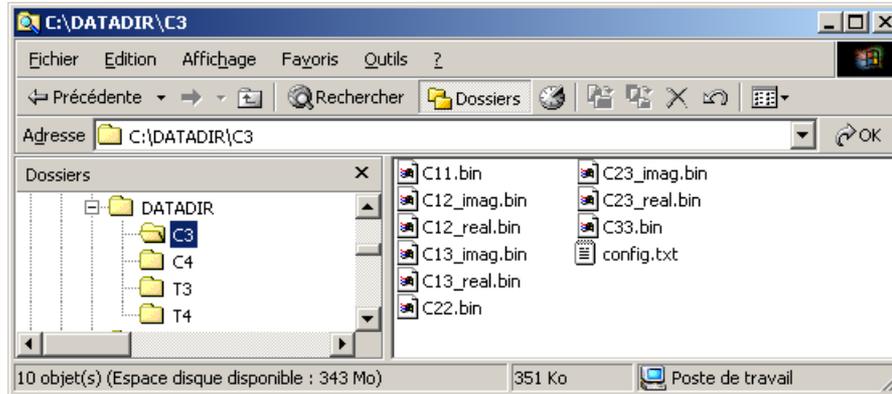
Nrow
1234

Ncol
4789

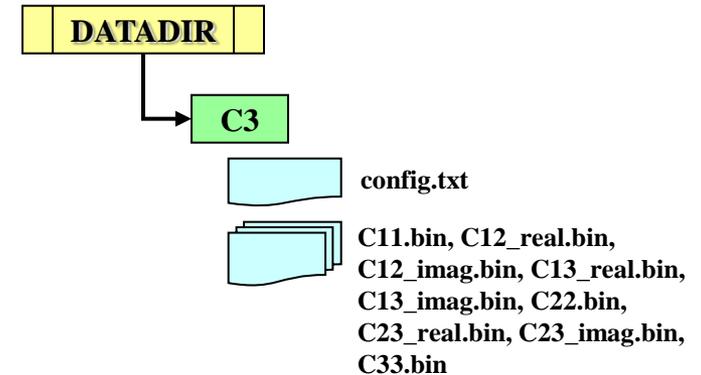
PolarCase
Monostatic/Bistatic

PolarType
Full

Compatible Raw Binary Data



3x3 Complex Covariance Matrix [C3]



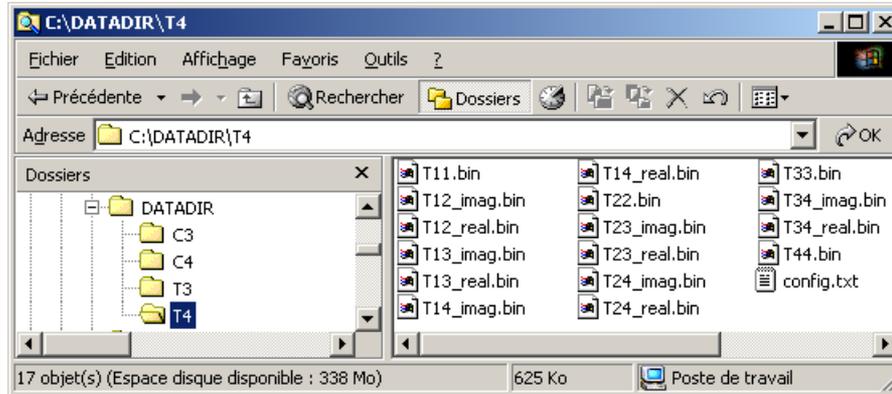
$$\underline{k}_{3L} = [S_{11} \quad S_{12} \cdot \sqrt{2} \quad S_{22}]$$

$$\Rightarrow [C_3] = \langle \underline{k}_{3L} \cdot \underline{k}_{3L}^\dagger \rangle$$

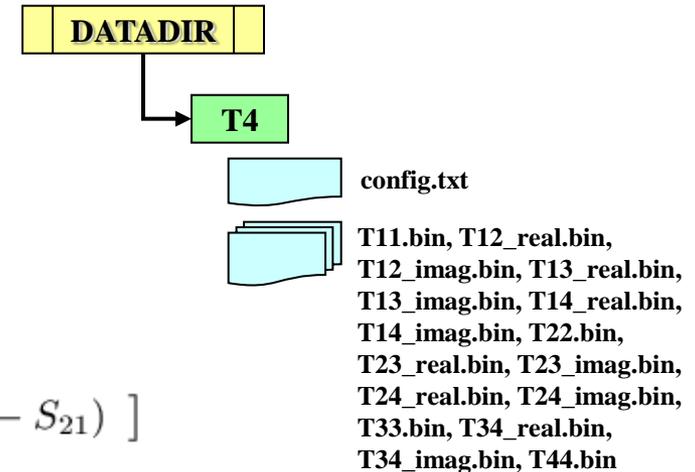
$$[C_3] = \begin{bmatrix} C_{11} & C_{12} & C_{13} \\ C_{12}^* & C_{22} & C_{23} \\ C_{13}^* & C_{23}^* & C_{33} \end{bmatrix}$$

| | |
|------------------|---------------------|
| Nrow | 1234 |
| ----- | |
| Ncol | 4789 |
| ----- | |
| PolarCase | Monostatic/Bistatic |
| ----- | |
| PolarType | Full |

Compatible Raw Binary Data



4x4 Complex Coherency Matrix [T4]



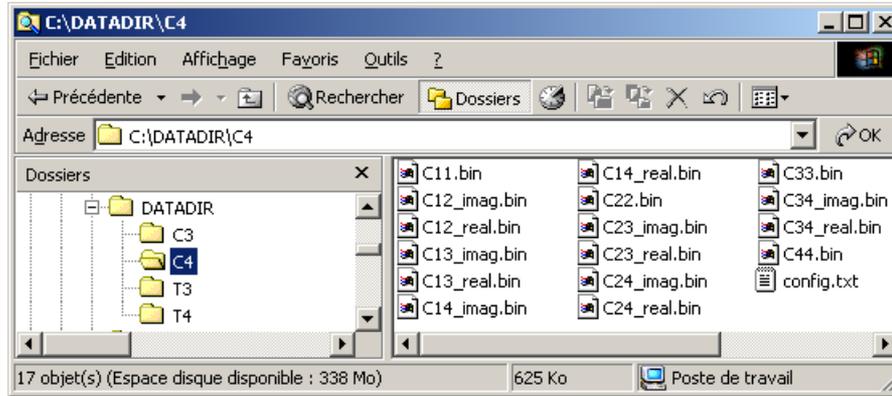
$$\underline{k}_{4P} = \frac{1}{\sqrt{2}} \begin{bmatrix} S_{11} + S_{22} & S_{11} - S_{22} & S_{12} + S_{21} & j(S_{12} - S_{21}) \end{bmatrix}$$

$$\Rightarrow [T_4] = \langle \underline{k}_{4P} \cdot \underline{k}_{4P}^\dagger \rangle$$

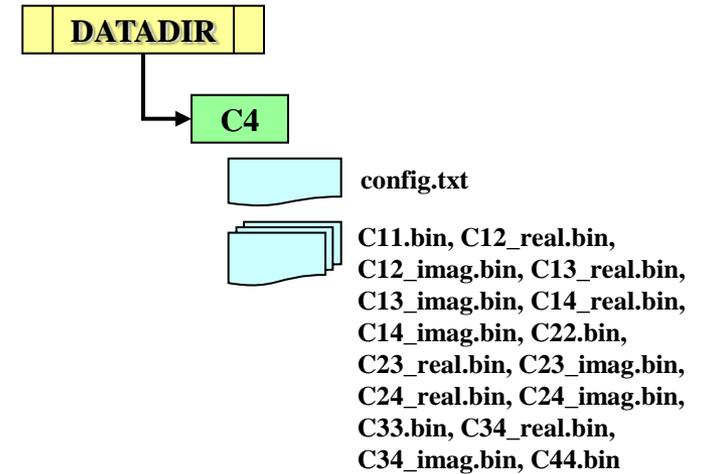
$$[T_4] = \begin{bmatrix} T_{11} & T_{12} & T_{13} & T_{14} \\ T_{12}^* & T_{22} & T_{23} & T_{24} \\ T_{13}^* & T_{23}^* & T_{33} & T_{34} \\ T_{14}^* & T_{24}^* & T_{34}^* & T_{44} \end{bmatrix}$$

| | |
|------------------|----------|
| Nrow | 1234 |
| ----- | |
| Ncol | 4789 |
| ----- | |
| PolarCase | Bistatic |
| ----- | |
| PolarType | Full |

Compatible Raw Binary Data



4x4 Complex Covariance Matrix [C4]



$$\underline{k}_{AL} = [S_{11} \quad S_{12} \quad S_{21} \quad S_{22}]$$

$$\Rightarrow [C_4] = \langle \underline{k}_{AL} \cdot \underline{k}_{AL}^\dagger \rangle$$

$$[C_4] = \begin{bmatrix} C_{11} & C_{12} & C_{13} & C_{14} \\ C_{12}^* & C_{22} & C_{23} & C_{24} \\ C_{13}^* & C_{23}^* & C_{33} & C_{34} \\ C_{14}^* & C_{24}^* & C_{34}^* & C_{44} \end{bmatrix}$$

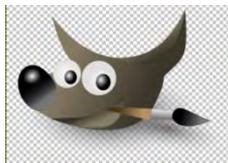
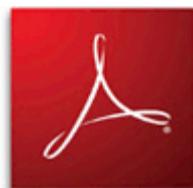
Nrow
 1234

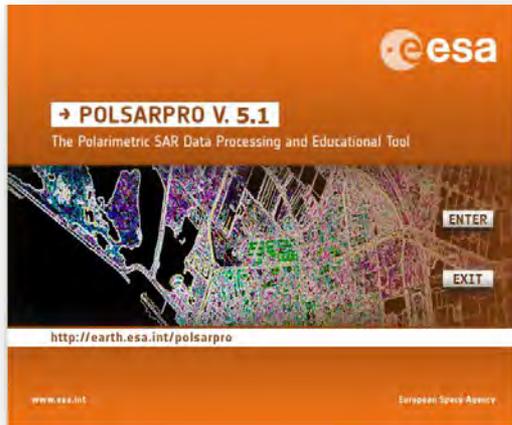
Ncol
 4789

PolarCase
 Bistatic

PolarType
 Full

CONFIGURATION

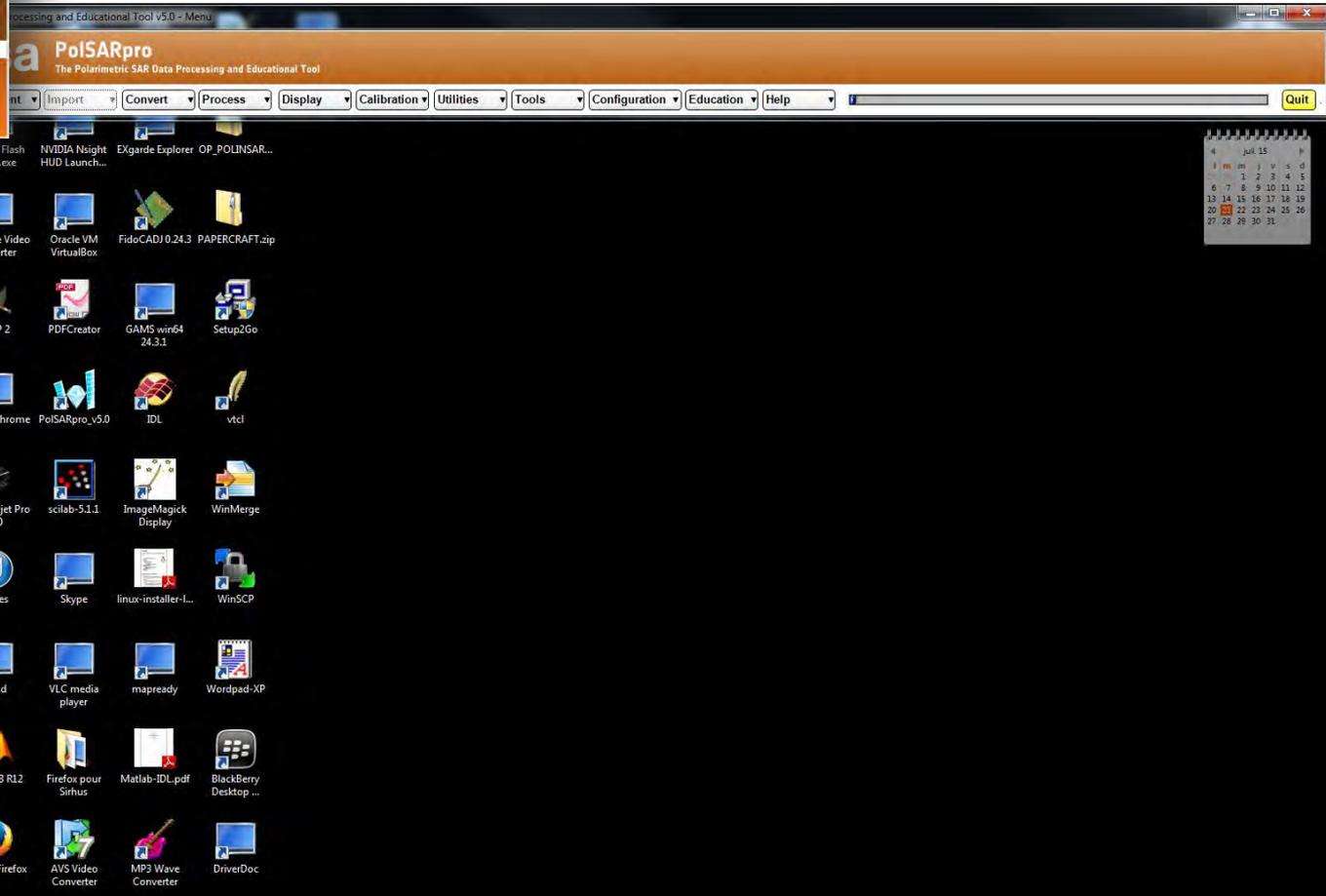




ENTRY SCREEN



MAIN WINDOW





PolSARpro v5.1 MAIN WINDOW

CONFIGURATION - 1st INSTALLATION

PolSAR Data Processing and Educational Tool v5.1 - Menu

esa PolSARpro
The Polarimetric SAR Data Processing and Educational Tool

Environment Import Convert Process Display Calibration Utilities Tools Configuration Education Help Quit

PolSARpro : Widget Size Adjust

Block 1

Porrigitur porrigitur quaerente feracium quos fructus magnitudo cuncta virtute per **Top**

Porrigitur porrigitur quaerente feracium quos fructus magnitudo cuncta virtute per

Porrigitur porrigitur quaerente feracium quos fructus magnitudo cuncta virtute per

Porrigitur porrigitur quaerente feracium quos fructus magnitudo cuncta virtute per

Porrigitur porrigitur quaerente feracium quos fructus magnitudo cuncta virtute per

Block 2

Porrigitur porrigitur quaerente feracium quos fructus magnitudo cuncta virtute per

Porrigitur porrigitur quaerente feracium quos fructus magnitudo cuncta virtute per

Porrigitur porrigitur quaerente feracium quos fructus magnitudo cuncta virtute per

Porrigitur porrigitur quaerente feracium quos fructus magnitudo cuncta virtute per

Block 3

Porrigitur porrigitur quaerente feracium quos fructus magnitudo cuncta virtute per

Porrigitur porrigitur quaerente feracium quos fructus magnitudo cuncta virtute per

Porrigitur porrigitur quaerente feracium quos fructus magnitudo cuncta virtute per

Porrigitur porrigitur quaerente feracium quos fructus magnitudo cuncta virtute per

Block 4

Porrigitur porrigitur quaerente feracium quos fructus magnitudo cuncta virtute per

Porrigitur porrigitur quaerente feracium quos fructus magnitudo cuncta virtute per

Porrigitur porrigitur quaerente feracium quos fructus magnitudo cuncta virtute per

Porrigitur porrigitur quaerente feracium quos fructus magnitudo cuncta virtute per **Down**

Left **Center** **Right**

PolSARpro : Widget Size Adjust Cmd

Widget Width Size
Initial Size (pix) 520 Current Size (pix) 520

Widget Height Size
Initial Size (pix) 740 Current Size (pix) 740

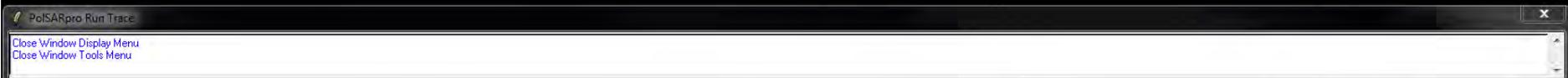
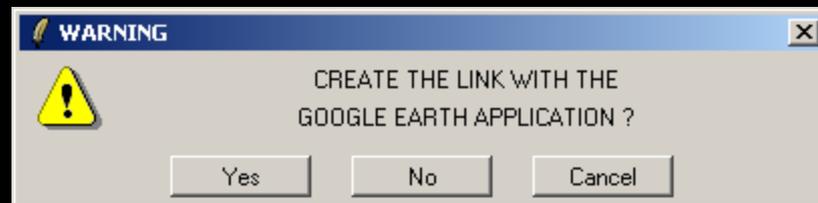
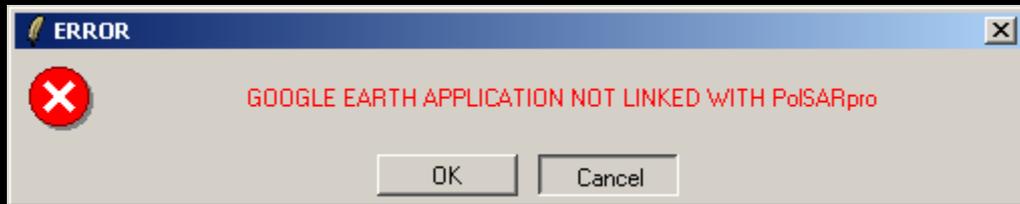
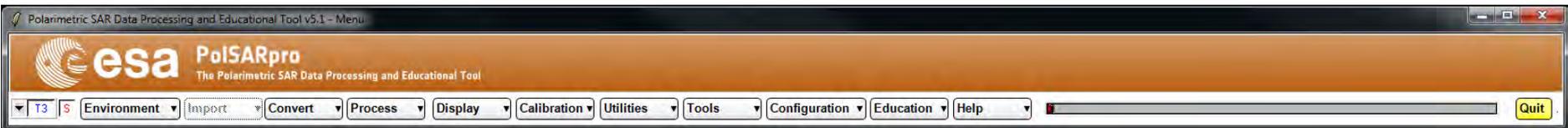
Widget Size Ratio
Width Ratio 1.0 Height Ratio 1.0

Refresh Reset Save and Exit

WIDGET SIZE ADJUST

The screenshot displays the PolSARpro v5.1 software interface. At the top, the title bar reads "PolSARpro The Polarimetric SAR Data Processing and Educational Tool". Below the title bar is a menu bar with options: Environment, Import, Convert, Process, Display, Calibration, Utilities, Tools, Configuration, Education, and Help. A "Quit" button is located on the right side of the menu bar. In the center, an "ERROR" dialog box is open, displaying a red "X" icon and the message "PDF READER APPLICATION NOT LINKED WITH PolSARpro". Below the message are "OK" and "Cancel" buttons. To the right of the error dialog is a red Adobe PDF icon. A large red arrow points from the error dialog down to a "WARNING" dialog box. The warning dialog features a yellow warning triangle icon and the text "CREATE THE LINK WITH THE PDF READER APPLICATION ?". It includes "Yes", "No", and "Cancel" buttons. At the bottom of the interface, a "PolSARpro Run Trace" window is visible, containing the text "Close Window Display Menu" and "Close Window Tools Menu".

The screenshot shows the PolSARpro v5.1 software interface. At the top, there is a menu bar with options: Environment, Import, Convert, Process, Display, Calibration, Utilities, Tools, Configuration, Education, and Help. A 'Quit' button is located on the right side of the menu bar. In the center, a 'WARNING' dialog box is displayed with a yellow warning icon and the text: 'CREATE THE LINK WITH THE PDF READER APPLICATION ?'. Below the text are three buttons: 'Yes', 'No', and 'Cancel'. To the right of the warning dialog is a red Adobe Acrobat icon. A large red arrow points from the warning dialog down to a 'Configuration' dialog box. The 'Configuration' dialog box has a title bar with 'Configuration' and a close button. It contains a section for 'PDF READER' with a small Adobe Acrobat icon. Below this, there is a text box with the text: 'Research one of the following exe files' and a list of file names: 'acroread acord32 acrobat xpdf kghostview ghostview gv'. Below the list is a 'Path Name' field with the text: 'C:/Program Files/Adobe/Acrobat 7.0/Acrobat/Acrobat.exe' and a folder icon. At the bottom of the configuration dialog are two buttons: 'Save & Exit' and 'Exit (without Saving)'. At the bottom of the screenshot, there is a 'PolSARpro Run Trace' window with the text: 'Close Window Display Menu' and 'Close Window Tools Menu'.



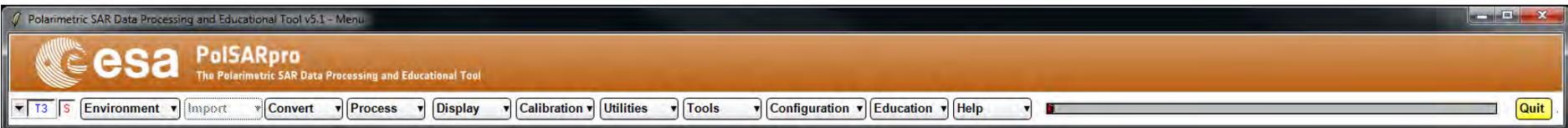
The screenshot displays the PolSARpro v5.1 software interface. At the top, the title bar reads "PolSARpro The Polarimetric SAR Data Processing and Educational Tool". Below the title bar is a menu bar with options: Environment, Import, Convert, Process, Display, Calibration, Utilities, Tools, Configuration, Education, and Help. A "Quit" button is located on the right side of the menu bar. In the center, a "WARNING" dialog box is open, asking "CREATE THE LINK WITH THE GOOGLE EARTH APPLICATION ?" with "Yes", "No", and "Cancel" buttons. To the right of this dialog is a "Google Earth" logo. A large red arrow points from the warning dialog down to a "Configuration" dialog box. The "Configuration" dialog is titled "GOOGLE EARTH" and contains a text field with the search results "googleearth gEarth gearth google-earth GE arth". Below this is a "Path Name" field containing "C:/Program Files/Google/Google Earth/client/googleearth.exe" and a folder icon. At the bottom of the configuration dialog are "Save & Exit" and "Exit (without Saving)" buttons. At the bottom of the main window, a "PolSARpro Run Trace" window is visible, showing "Close Window Display Menu" and "Close Window Tools Menu".

The screenshot shows the PolSARpro v5.1 software interface. At the top, there is a menu bar with options: Environment, Import, Convert, Process, Display, Calibration, Utilities, Tools, Configuration, Education, and Help. A red error dialog box is displayed in the center, titled "ERROR" with a red 'X' icon. The message reads: "GIMP VIEWER APPLICATION NOT LINKED WITH PolSARpro". Below the message are "OK" and "Cancel" buttons. To the right of the error dialog is a small cartoon dog icon. A large red arrow points downwards from the error dialog to a warning dialog box. The warning dialog is titled "WARNING" with a yellow warning icon. The message reads: "CREATE THE LINK WITH THE GIMP VIEWER APPLICATION ?". Below the message are "Yes", "No", and "Cancel" buttons. At the bottom of the screenshot, a "PolSARpro Run Trace" window is visible, showing the text: "Close Window Display Menu" and "Close Window Tools Menu".

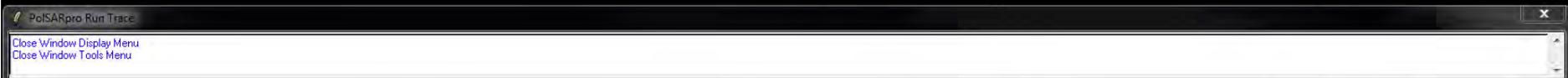
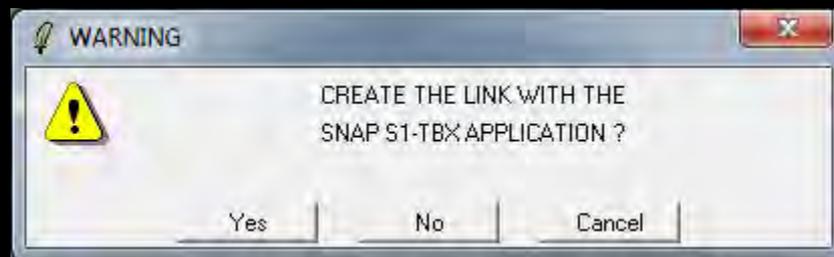
The screenshot shows the PolSARpro v5.1 software interface. At the top, there is a menu bar with options: Environment, Import, Convert, Process, Display, Calibration, Utilities, Tools, Configuration, Education, and Help. A 'Quit' button is located on the right side of the menu bar. In the center, a 'WARNING' dialog box is displayed with a yellow warning icon and the text: 'CREATE THE LINK WITH THE GIMP VIEWER APPLICATION?'. Below the text are three buttons: 'Yes', 'No', and 'Cancel'. To the right of the warning dialog is a small cartoon dog icon. A large red arrow points from the warning dialog down to a 'Configuration' dialog box. The 'Configuration' dialog box has a title bar with a GIMP icon and the text 'GIMP'. It contains a text field with 'gimp-2.6' and a 'Path Name' field with 'C:/Program Files/GIMP-2.0/bin/gimp-2.6.exe'. At the bottom of the configuration dialog are two buttons: 'Save & Exit' and 'Exit (without Saving)'. At the bottom of the main window, there is a 'PolSARpro Run Trace' window with a list of actions: 'Close Window Display Menu' and 'Close Window Tools Menu'.

The screenshot shows the PoSARpro v5.1 software interface. At the top, there is a menu bar with options: Environment, Import, Convert, Process, Display, Calibration, Utilities, Tools, Configuration, Education, and Help. A red error dialog box is displayed in the center, titled "ERROR" with a red 'X' icon. The message reads: "IMAGE-MAGICK APPLICATION NOT LINKED WITH PoSARpro". Below the message are "OK" and "Cancel" buttons. To the right of the error dialog is a small cartoon illustration of a wizard with a blue robe and a pointed hat, holding a wand, with the text "Image Magick" above him. A large red arrow points from the error dialog down to a warning dialog box. The warning dialog box is titled "WARNING" with a yellow warning icon. The message reads: "CREATE THE LINK WITH THE IMAGE-MAGICK APPLICATION ?". Below the message are "Yes", "No", and "Cancel" buttons. At the bottom of the screenshot, a "PoSARpro Run Trace" window is visible, containing the text: "Close Window Display Menu" and "Close Window Tools Menu".

The screenshot shows the PoSARpro v5.1 software interface. At the top, there is a menu bar with options: Environment, Import, Convert, Process, Display, Calibration, Utilities, Tools, Configuration, Education, and Help. A 'Quit' button is located on the right side of the menu bar. Below the menu bar, a 'WARNING' dialog box is displayed with a yellow warning icon and the text: 'CREATE THE LINK WITH THE IMAGE-MAGICK APPLICATION?'. Below the warning dialog, a red arrow points down to a 'Configuration' dialog box. The 'Configuration' dialog box has a title bar 'Configuration' and a sub-title 'IMAGE MAGICK'. It contains a text field with the value 'convert' and a 'Path Name' field with the value 'C:/Program Files/ImageMagick-6.5.1-Q8/convert.exe'. At the bottom of the configuration dialog, there are two buttons: 'Save & Exit' and 'Exit (without Saving)'. In the bottom right corner of the main window, there is a small cartoon wizard icon with the text 'Image Magick'.



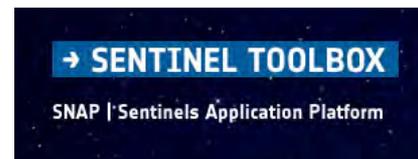
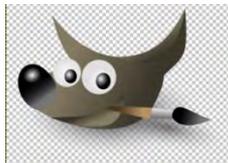
→ **SENTINEL TOOLBOX**
SNAP | Sentinels Application Platform

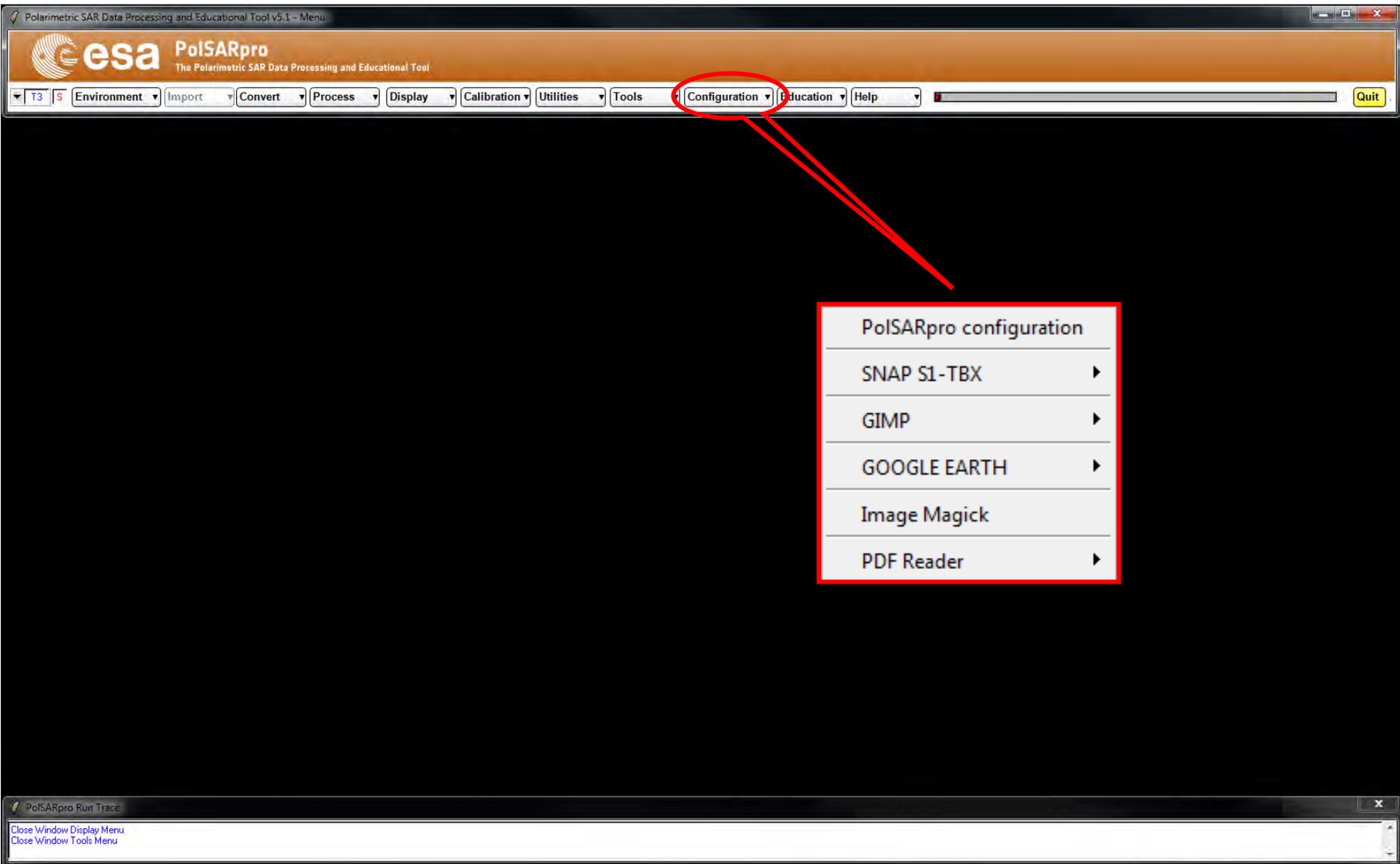


The screenshot displays the PoISARpro v5.1 software interface. At the top, there is a menu bar with options: Environment, Import, Convert, Process, Display, Calibration, Utilities, Tools, Configuration, Education, and Help. A 'Quit' button is located on the right side of the menu bar. Below the menu bar, a 'WARNING' dialog box is open, asking 'CREATE THE LINK WITH THE SNAP S1-TBX APPLICATION ?' with 'Yes', 'No', and 'Cancel' buttons. A red arrow points from this dialog to a 'Configuration' dialog box. The 'Configuration' dialog box is titled 'Configuration' and contains a section for 'SNAP S1-TBX'. It has a text field for 'Research one of the following exe files:' with the value 's1tbx' entered. Below this is a 'Path Name' field with the value 'C:/Program Files/S1TBX/s1tbx.exe' and a folder icon button. At the bottom of the dialog are 'Save & Exit' and 'Exit (without Saving)' buttons. At the bottom of the main window, there is a 'PoISARpro Run Trace' window with the text 'Close Window Display Menu' and 'Close Window Tools Menu'.

→ **SENTINEL TOOLBOX**
SNAP | Sentinels Application Platform

TEST THE CONFIGURATION





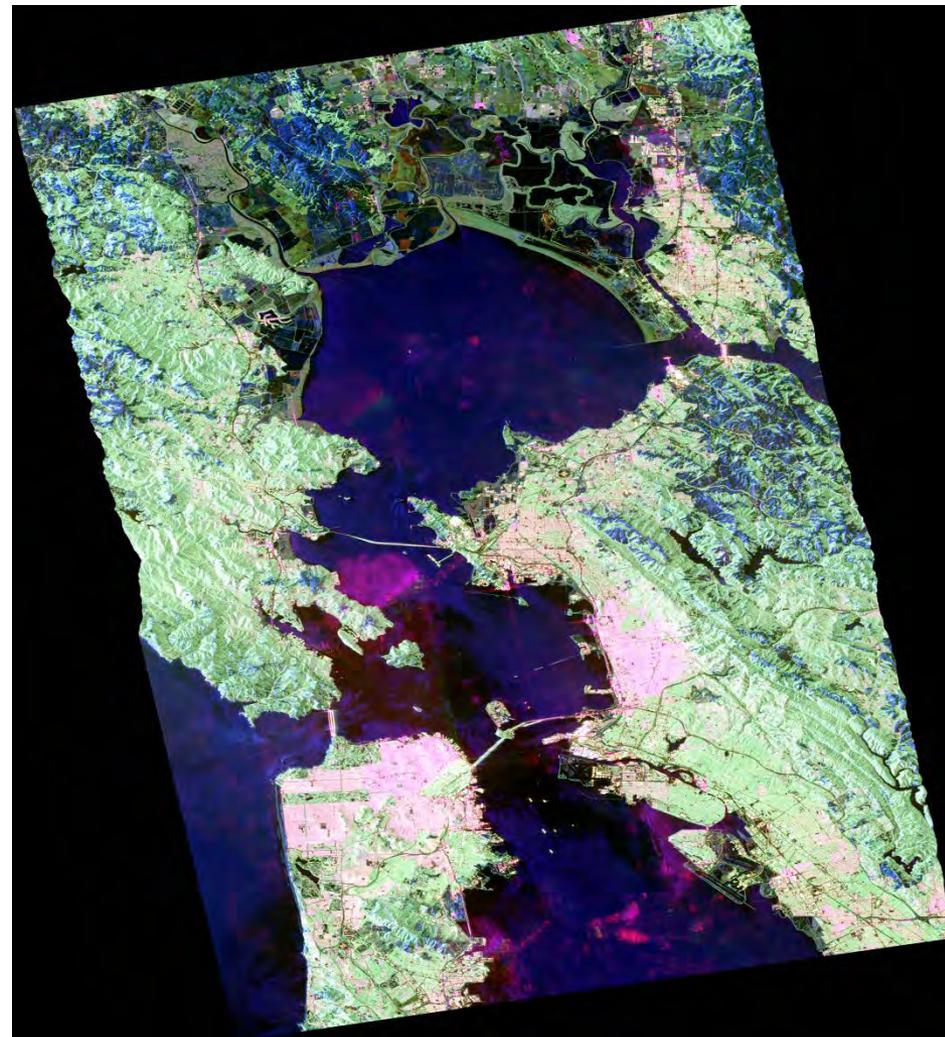
Questions ?



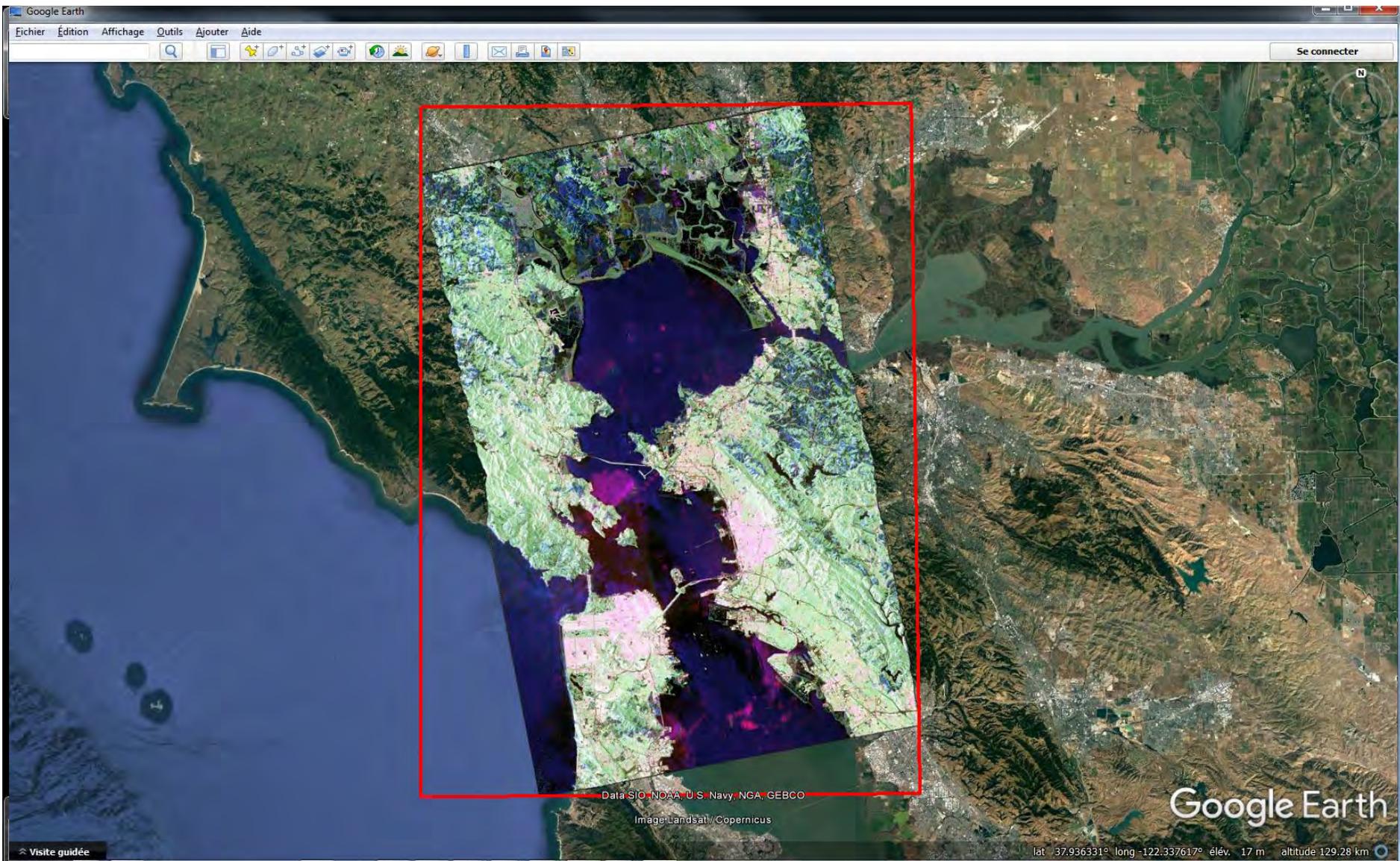
KODÁK LÁSZLÓ INTÉZMÉNYE 854008 L.



PolSARpro v5.1 Software Practical basic session



ALOS : Advanced Land Observing Satellite
PALSAR : Phase Array L-Band SAR



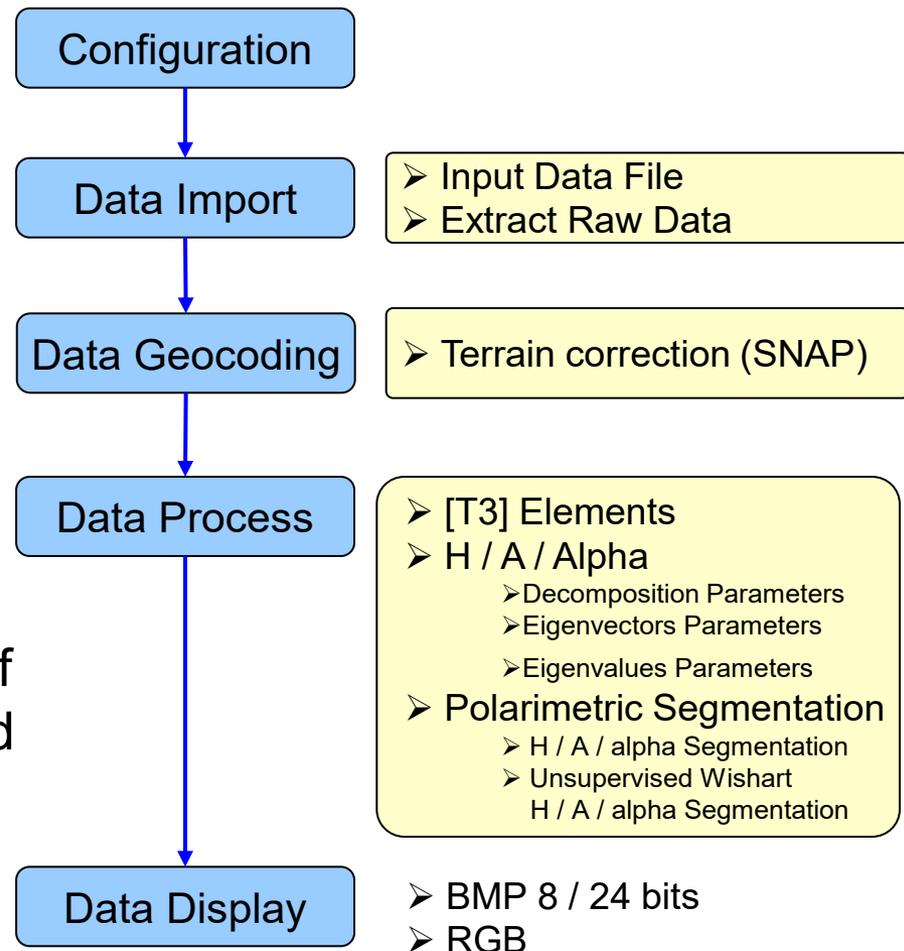
→ 7th ADVANCED TRAINING COURSE ON LAND REMOTE SENSING

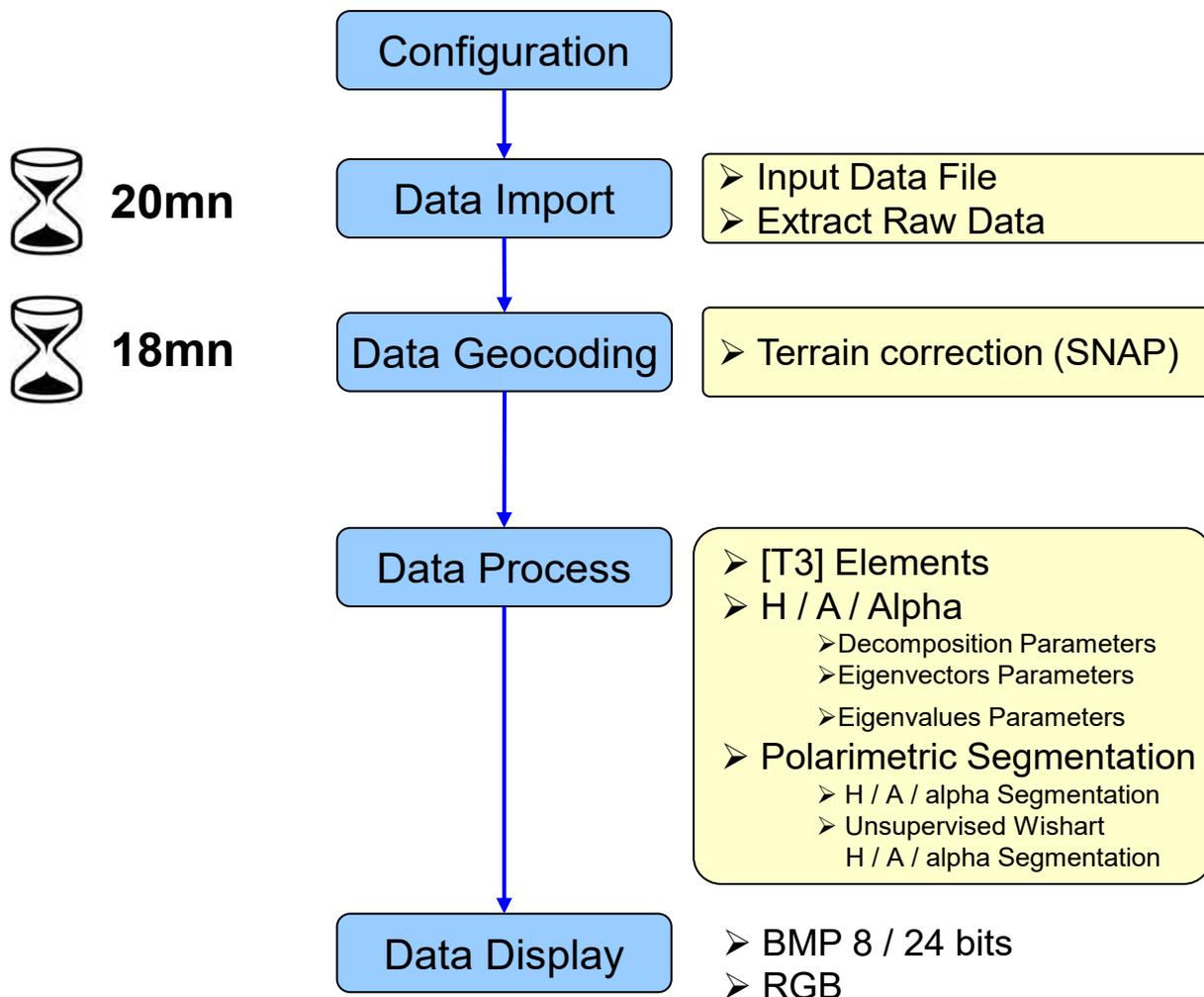
4–9 September 2017 | Szent István University | Gödöllő, Hungary

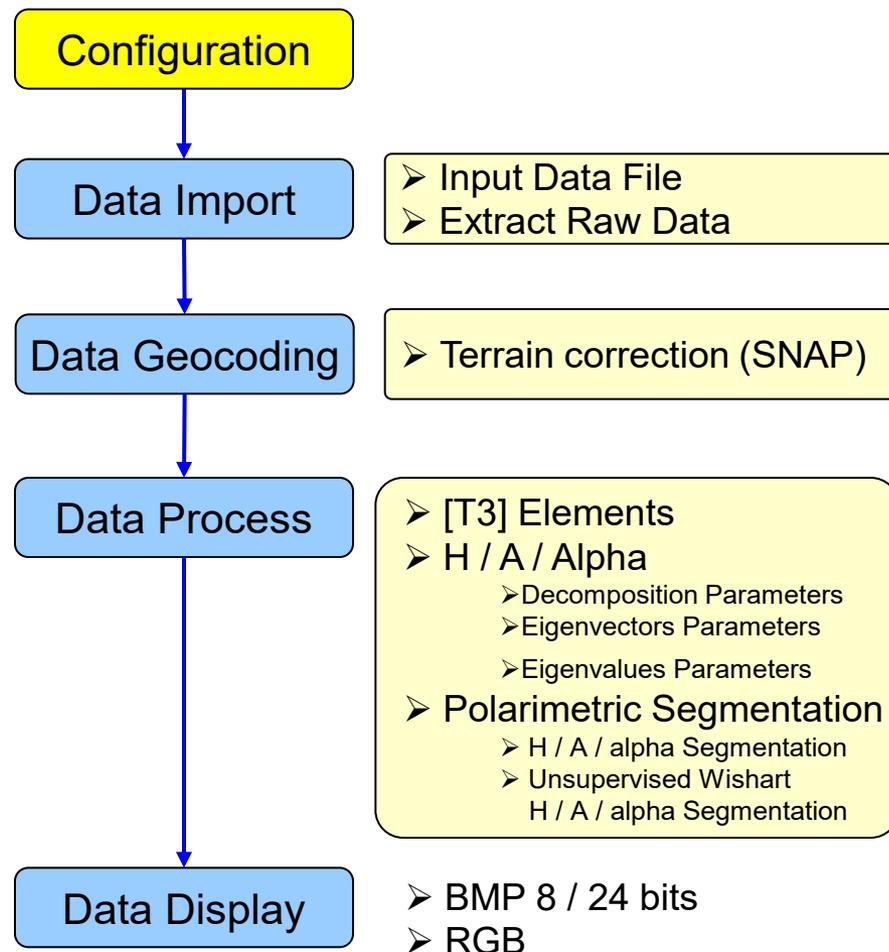
PolSARpro v5.1 Software
 performs complete **end-to-end processing** without the need for
 any other software.

Data Processing Approach
 along a '**recommended**'
 and easy processing chain

Provide a **First Qualitative Analysis** of
 the fully polarimetric data set processed







The screenshot displays the PolSARpro v5.1 software interface. The main menu bar includes: C2, Environment, Import, Convert, Process, Display, Calibration, Utilities, Tools, Configuration, Education, Help, and Quit. The 'Environment' menu is highlighted with a red circle, and a red arrow points to a callout box containing the following options:

- Single Data Set (Pol-SAR)
- Dual Data Sets (Single Baseline Pol-InSAR)
- Multi Data Sets (Time series / Pol-TomSAR)

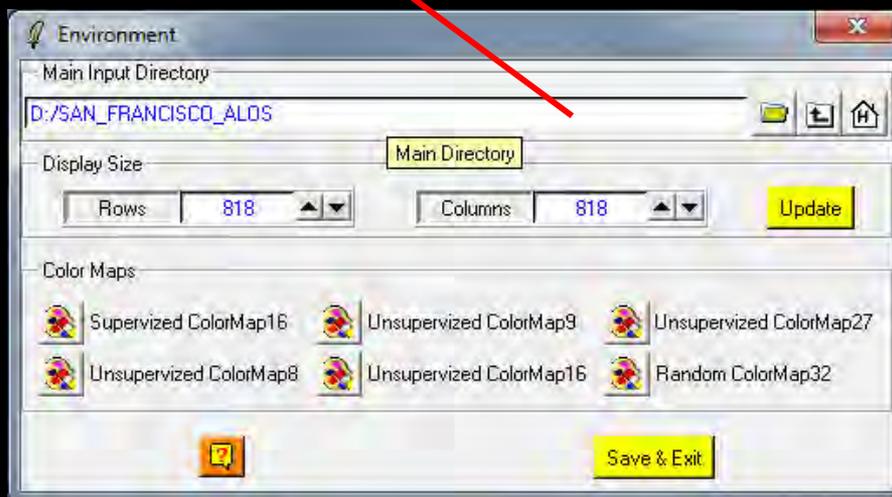
The 'Environment' dialog box is open, showing the following settings:

- Main Input Directory: C:/My_Data_Directory
- Display Size: Rows 888, Columns 888 (with an Update button)
- Color Maps: Supervized ColorMap16, Unsupervized ColorMap9, Unsupervized ColorMap27, Unsupervized ColorMap8, Unsupervized ColorMap16, Random ColorMap32 (with a Save & Exit button)

At the bottom, a 'PolSARpro Run Trace' window is visible with the text: Close Window Display Menu, Close Window Tools Menu.

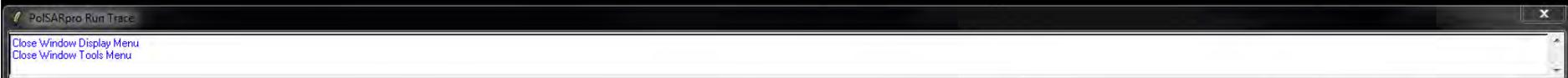


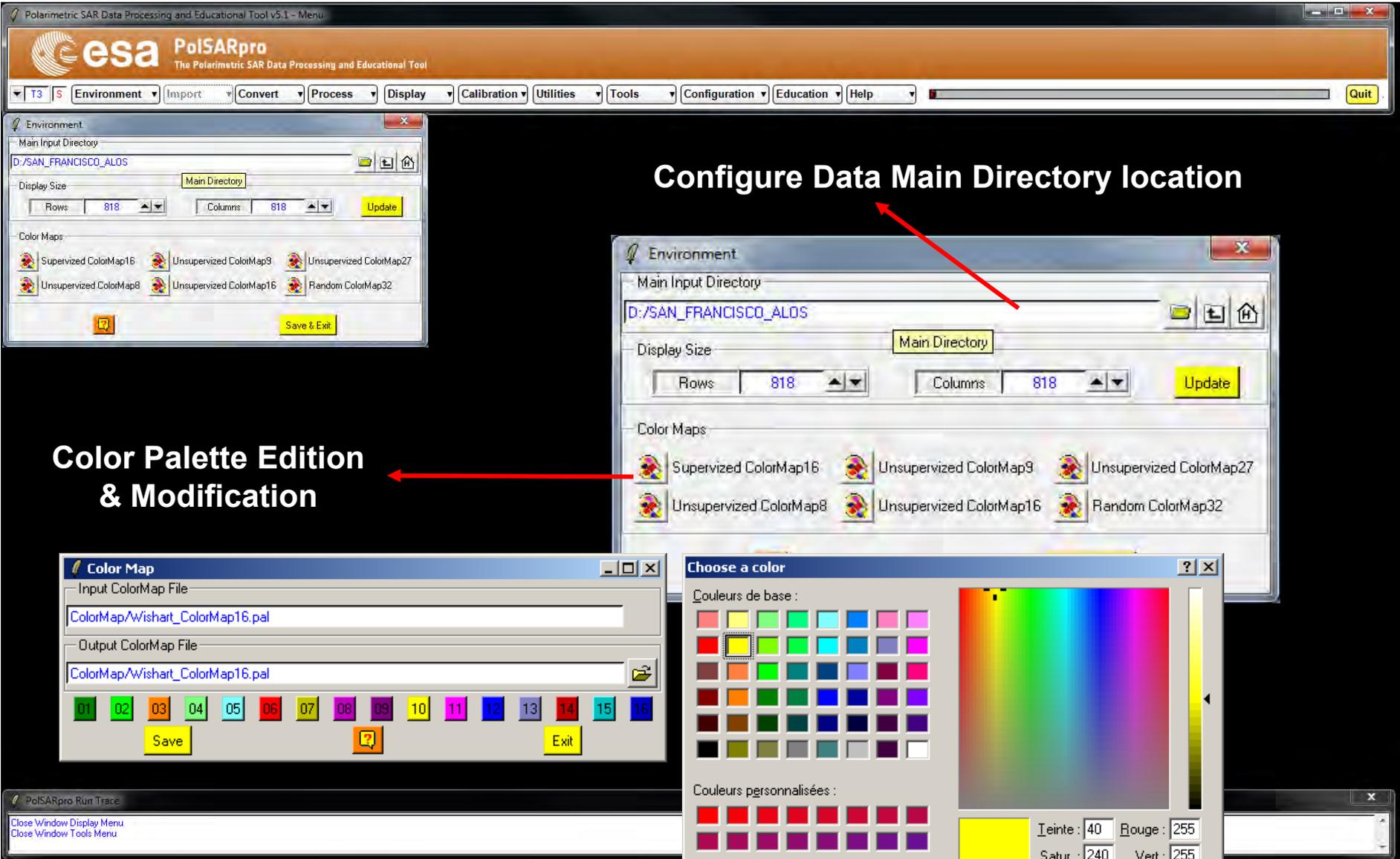
Configure Data Main Directory location



Input Data Directory :

SAN_FRANCISCO_ALOS2



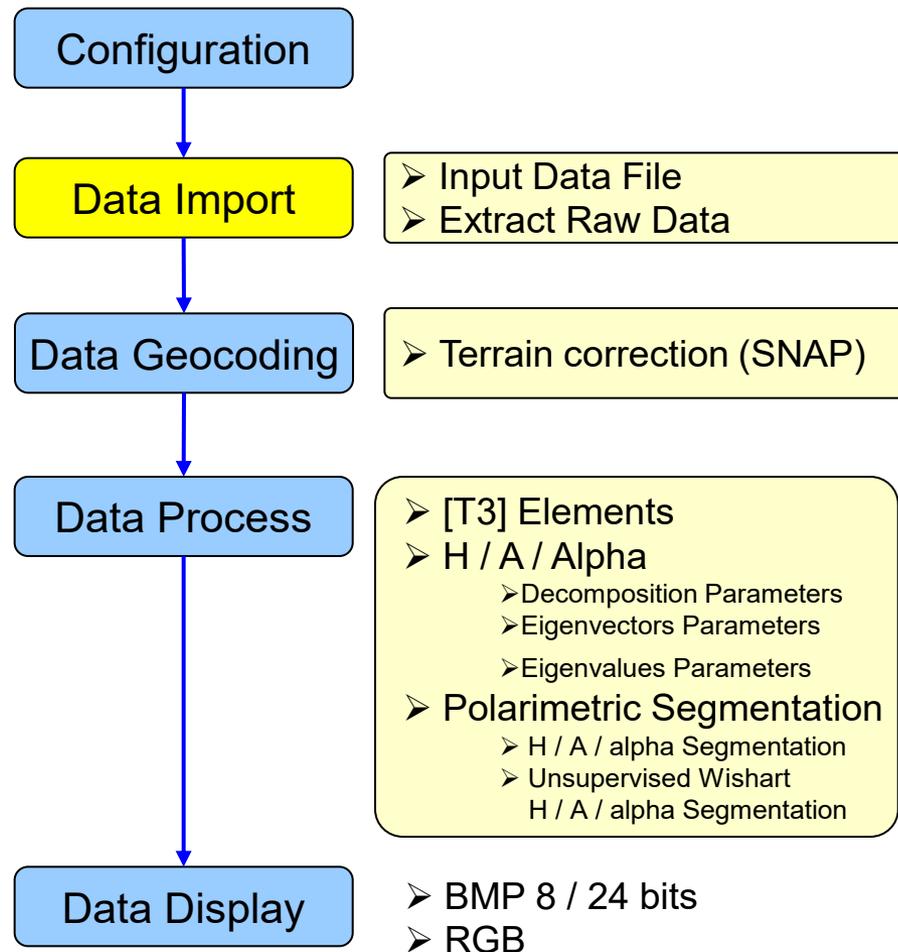


The screenshot displays the PolSARpro software interface. At the top, the title bar reads "Polarimetric SAR Data Processing and Educational Tool v5.1 - Menu". The main menu includes "Environment", "Import", "Convert", "Process", "Display", "Calibration", "Utilities", "Tools", "Configuration", "Education", "Help", and "Quit".

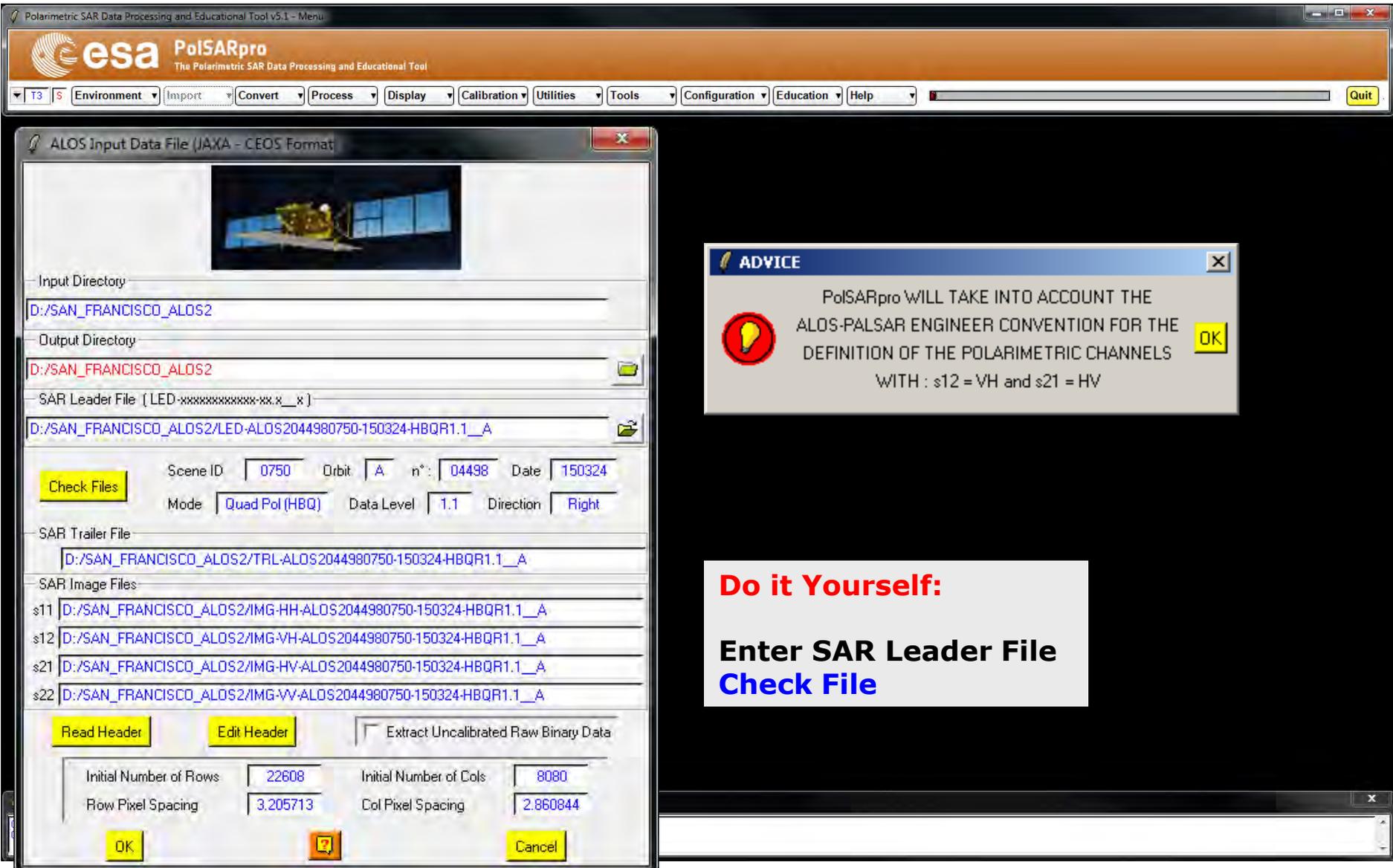
The "Environment" dialog box is open, showing the "Main Input Directory" set to "D:/SAN_FRANCISCO_ALDS". It also features "Display Size" controls (Rows: 818, Columns: 818) and a "Color Maps" section with several color map options like "Supervised ColorMap16", "Unsupervised ColorMap9", etc. A red arrow points to the "Main Input Directory" field with the text "Configure Data Main Directory location".

The "Color Map" dialog box is also open, showing the "Input ColorMap File" and "Output ColorMap File" both set to "ColorMap/Wishart_ColorMap16.pal". It includes a color palette with 16 numbered color swatches and "Save" and "Exit" buttons. A red arrow points to this dialog with the text "Color Palette Edition & Modification".

The "Choose a color" dialog box is open, showing a "Couleurs de base" (base colors) grid and a "Couleurs personnalisées" (custom colors) grid. It includes a color selection tool and numerical input fields for "Teinte" (40), "Rouge" (255), "Satur." (240), "Vert" (255), "Lum." (120), and "Bleu" (0). A red arrow points to the "Couleurs personnalisées" grid.



The screenshot shows the PolSARpro software interface. The title bar reads "PolSARpro The Polarimetric SAR Data Processing and Educational Tool". The menu bar includes: Environment, Import, Convert, Process, Display, Calibration, Utilities, Tools, Configuration, Education, Help, and Quit. The "Import" menu is open, showing options: Raw Binary Data, Airborne Sensors, Spaceborne Sensors, Extract PolSAR images, and Edit Config File. The "Spaceborne Sensors" sub-menu is open, listing: Alos-1 - Palsar, Alos-2 - Palsar, Cosmo - Skymed, Envisat - Asar, Radarsat2, Risat, Sentinel-1, SIR-C, TerraSAR X, and Tandem X. The "Alos-2 - Palsar" sub-menu is open, showing "Dual - Pol" and "Quad - Pol". Red boxes highlight the "Import" menu, the "Spaceborne Sensors" sub-menu, the "Alos-2 - Palsar" sub-menu, and the "Quad - Pol" option. Yellow arrows indicate the navigation path from "Spaceborne Sensors" to "Alos-2 - Palsar" and then to "Quad - Pol". A "PolSARpro Run Trace" window is visible at the bottom, containing the text: "Close Window Display Menu" and "Close Window Tools Menu".



PolSARpro
The Polarimetric SAR Data Processing and Educational Tool

Environment | Import | Convert | Process | Display | Calibration | Utilities | Tools | Configuration | Education | Help

ALOS Input Data File (JAXA - CEOS Format)

Input Directory: D:/SAN_FRANCISCO_ALOS2

Output Directory: D:/SAN_FRANCISCO_ALOS2

SAR Leader File [LED-xxxxxxxxxx.x_x]: D:/SAN_FRANCISCO_ALOS2/LED-ALOS2044980750-150324-HBQR1.1__A

Scene ID: 0750 | Orbit: A | n*: 04498 | Date: 150324

Mode: Quad Pol (HBQ) | Data Level: 1.1 | Direction: Right

SAR Trailer File: D:/SAN_FRANCISCO_ALOS2/TRL-ALOS2044980750-150324-HBQR1.1__A

SAR Image Files:

- s11: D:/SAN_FRANCISCO_ALOS2/IMG-HH-ALOS2044980750-150324-HBQR1.1__A
- s12: D:/SAN_FRANCISCO_ALOS2/IMG-VH-ALOS2044980750-150324-HBQR1.1__A
- s21: D:/SAN_FRANCISCO_ALOS2/IMG-HV-ALOS2044980750-150324-HBQR1.1__A
- s22: D:/SAN_FRANCISCO_ALOS2/IMG-VV-ALOS2044980750-150324-HBQR1.1__A

Initial Number of Rows: 22608 | Initial Number of Cols: 8080

Row Pixel Spacing: 3.205713 | Col Pixel Spacing: 2.860844

Buttons: Check Files, Read Header, Edit Header, Extract Uncalibrated Raw Binary Data, OK, Cancel

ADVICE

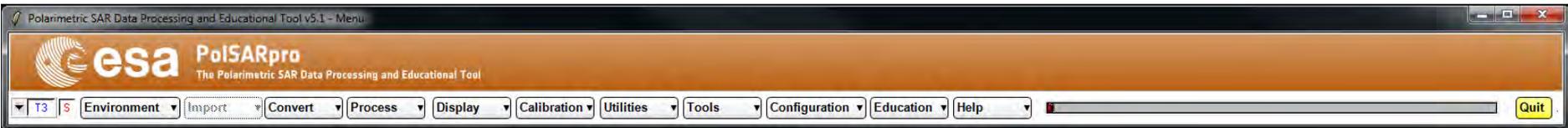
PolSARpro WILL TAKE INTO ACCOUNT THE ALOS-PALSAR ENGINEER CONVENTION FOR THE DEFINITION OF THE POLARIMETRIC CHANNELS WITH : s12 = VH and s21 = HV

OK

Do it Yourself:

Enter SAR Leader File

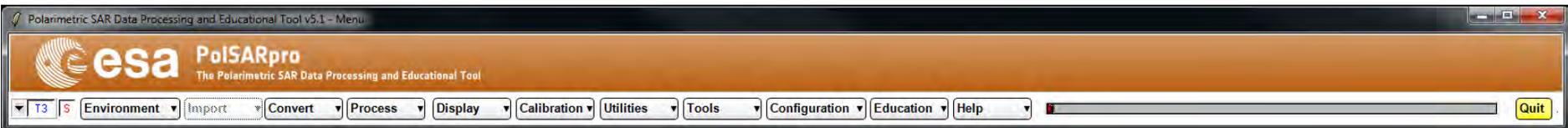
Check File



Do it Yourself:

Enter SAR Leader File
Read Header
OK

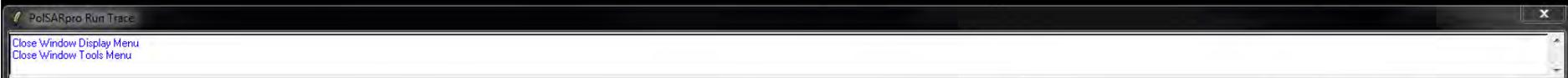
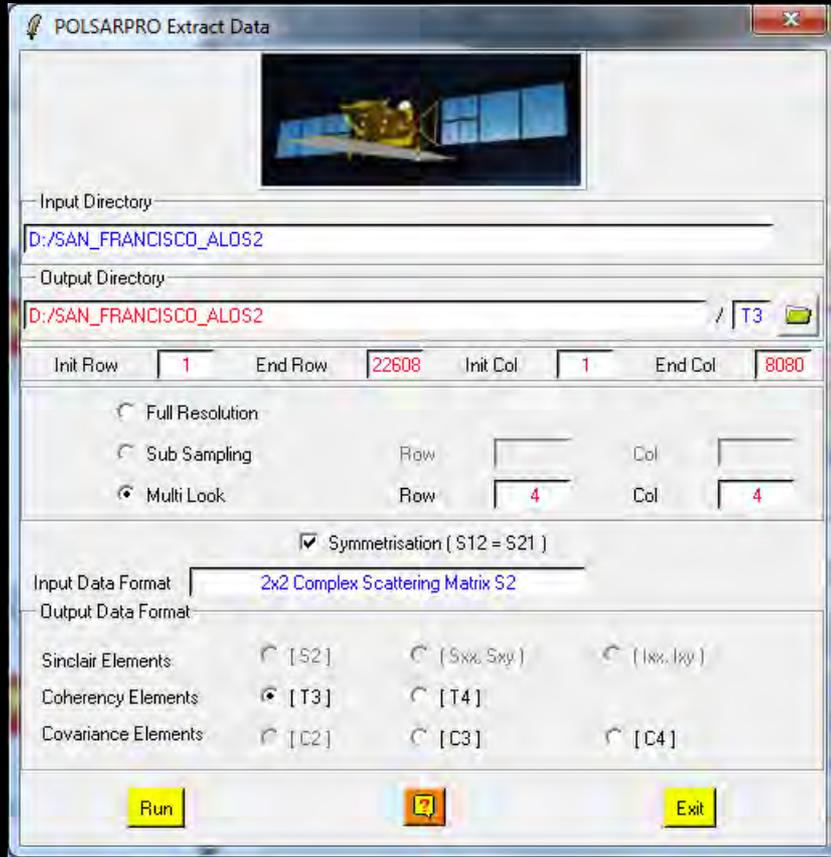
The screenshot displays the PolSARpro software interface. The main window title is "PolSARpro The Polarimetric SAR Data Processing and Educational Tool". The menu bar includes: Environment, Import, Convert, Process, Display, Calibration, Utilities, Tools, Configuration, Education, Help, and Quit. The "Import" menu is open, showing options: Raw Binary Data, Airborne Sensors, Spaceborne Sensors, Extract PolSAR images (highlighted with a blue circle), and Edit Config File. The "POLARPRO Extract Data" dialog box is open, showing a satellite image thumbnail. The "Input Directory" is "D:/SAN_FRANCISCO_ALOS2" and the "Output Directory" is "D:/SAN_FRANCISCO_ALOS2 / T3". The "Init Row" is 1, "End Row" is 22608, "Init Col" is 1, and "End Col" is 8080. The "Multi Look" option is selected with a row of 4 and a column of 4. The "Symmetrisation (S12 = S21)" checkbox is checked. The "Input Data Format" is "2x2 Complex Scattering Matrix S2". The "Output Data Format" section has "Coherency Elements" set to "[T3]". The "Run" button is highlighted in yellow. At the bottom, a "PolSARpro Run Trace" window shows "Close Window Display Menu" and "Close Window Tools Menu".

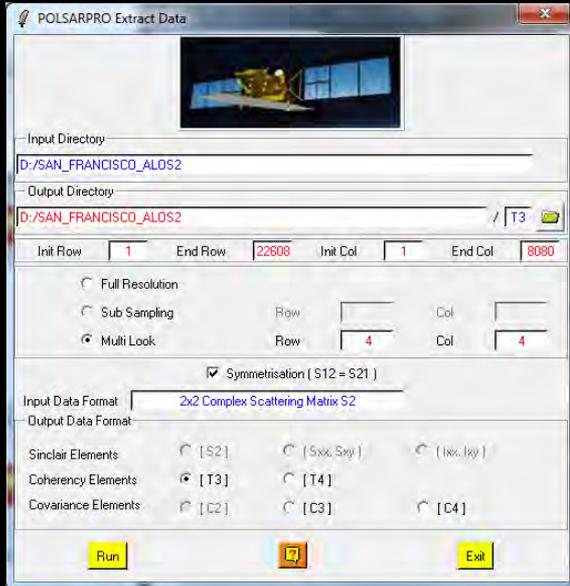


Do it Yourself:

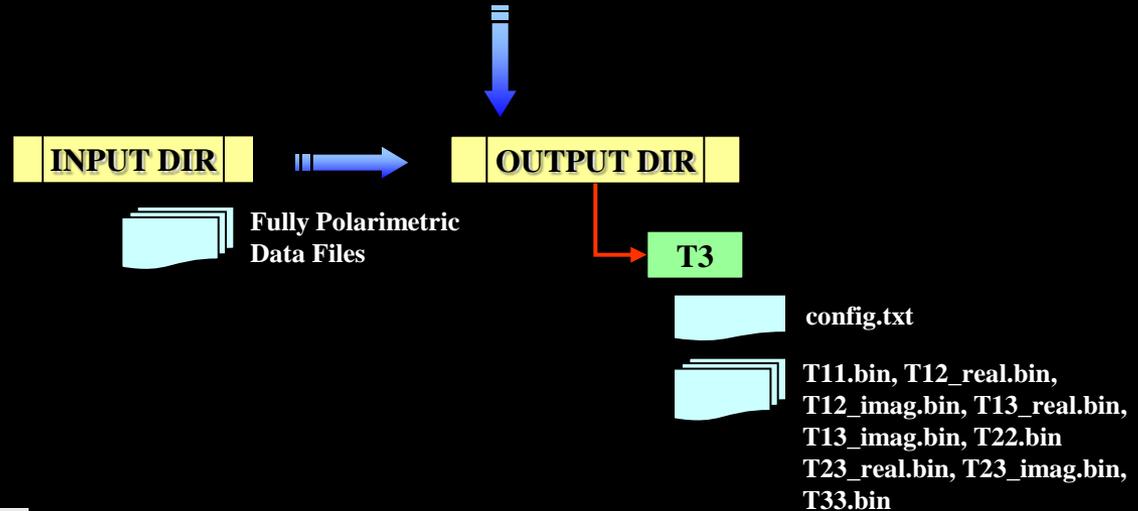
Multi Look : Row = 4 Col = 4

Run





Convert ALOS2 Fully Polarimetric Data Files to Complex (3x3) Coherency Matrix [T3]



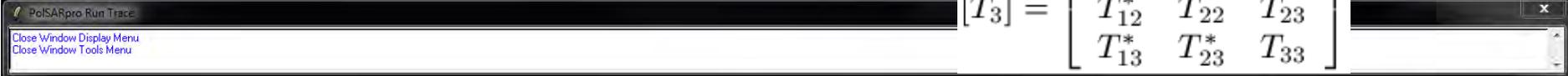
Do it Yourself:

Multi Look : Row = 4 Col = 4
Run

$$\underline{k}_{3P} = \frac{1}{\sqrt{2}} \begin{bmatrix} S_{11} + S_{22} & S_{11} - S_{22} & S_{12} + S_{21} \end{bmatrix}$$

$$\Rightarrow [T_3] = \langle \underline{k}_{3P} \cdot \underline{k}_{3P}^\dagger \rangle$$

$$[T_3] = \begin{bmatrix} T_{11} & T_{12} & T_{13} \\ T_{12}^* & T_{22} & T_{23} \\ T_{13}^* & T_{23}^* & T_{33} \end{bmatrix}$$



Display Pauli-RGB Image

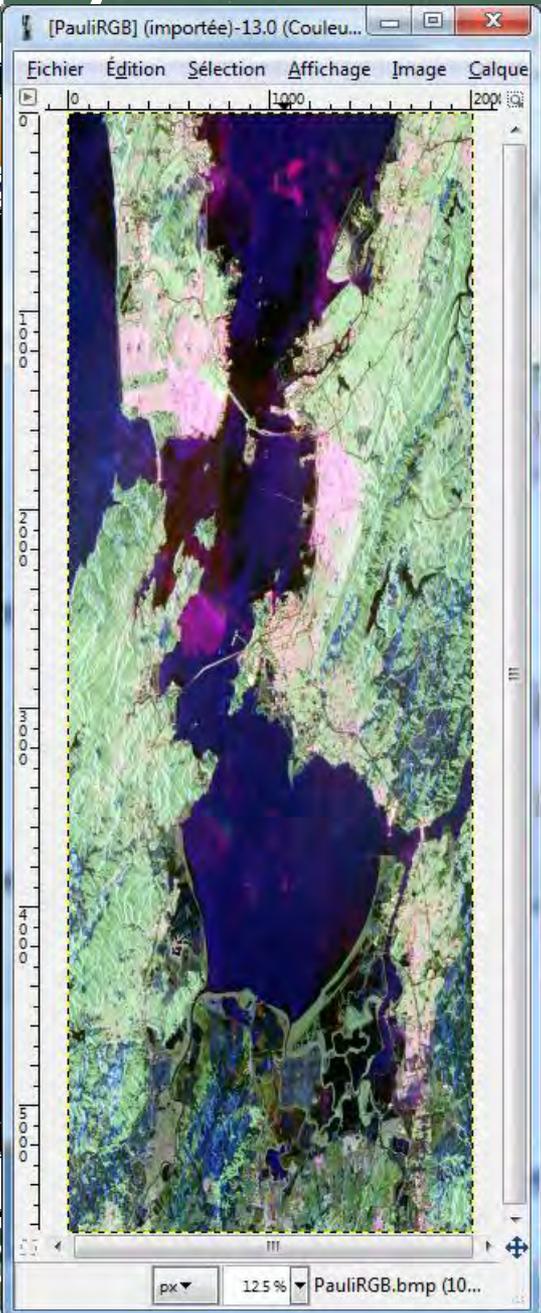
Polarimetric SAR Data Processing and Educational Tool v5.1 - Menu

esa PolSARpro
The Polarimetric SAR Data Processing and Educational Tool

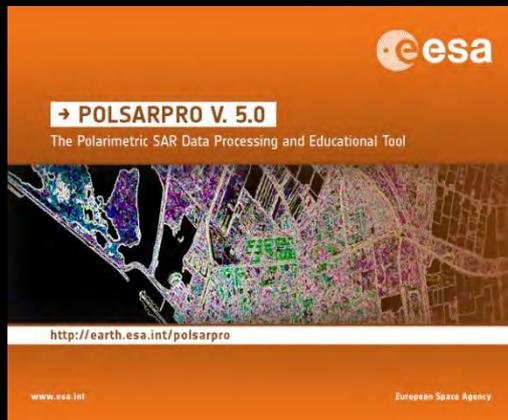
T3 5 Environment Import Convert Process Display Calibrat

PolSARpro Run Trace

- Close Window Display Menu
- Close Window Tools Menu



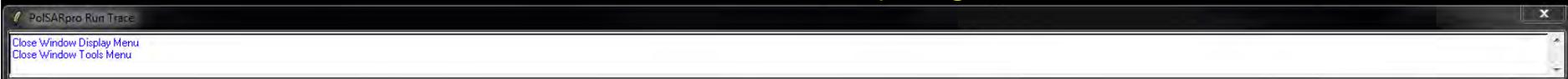
Quit



Polariametric Data Processing



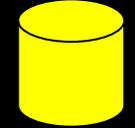
- S1 toolbox (split, deburst, merge ...)
- Geocoding toolbox
- Interferometric toolbox (co-registration, flat Earth estimation ...)




PolSARpro
The Polarimetric SAR Data Processing and Educational Tool

ESA - SNAP

T3 | S
Environment | Import | Convert | Process | Display | Calibration | Utilities | Tools | Configuration | Education | Help
Quit

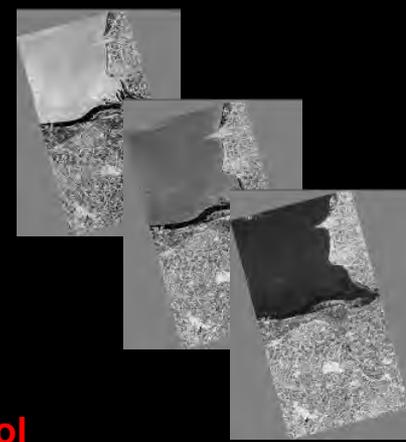


**POLARIMETRIC
DATA SETS**

**Pre-Processing
Data Extract**

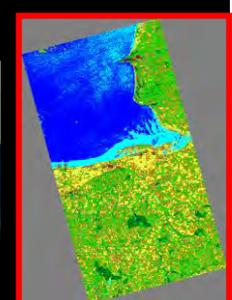



**Geo-Coding
Terrain Correct - UTM Proj.**

Post - Processing





Only valid for:
[C2] matrix: Dual-Pol
[T3] matrix: Quad-Pol

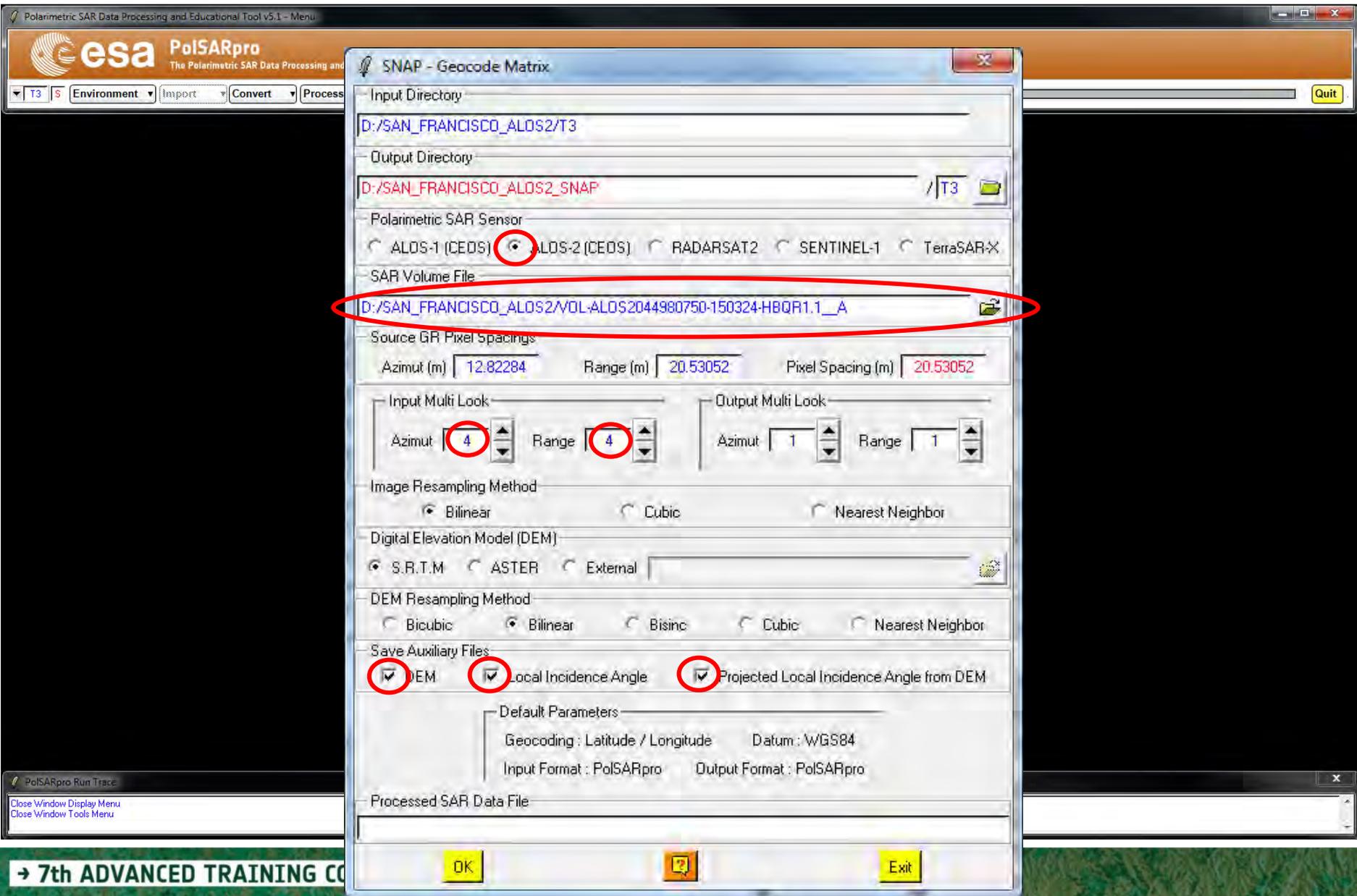
KML File generation

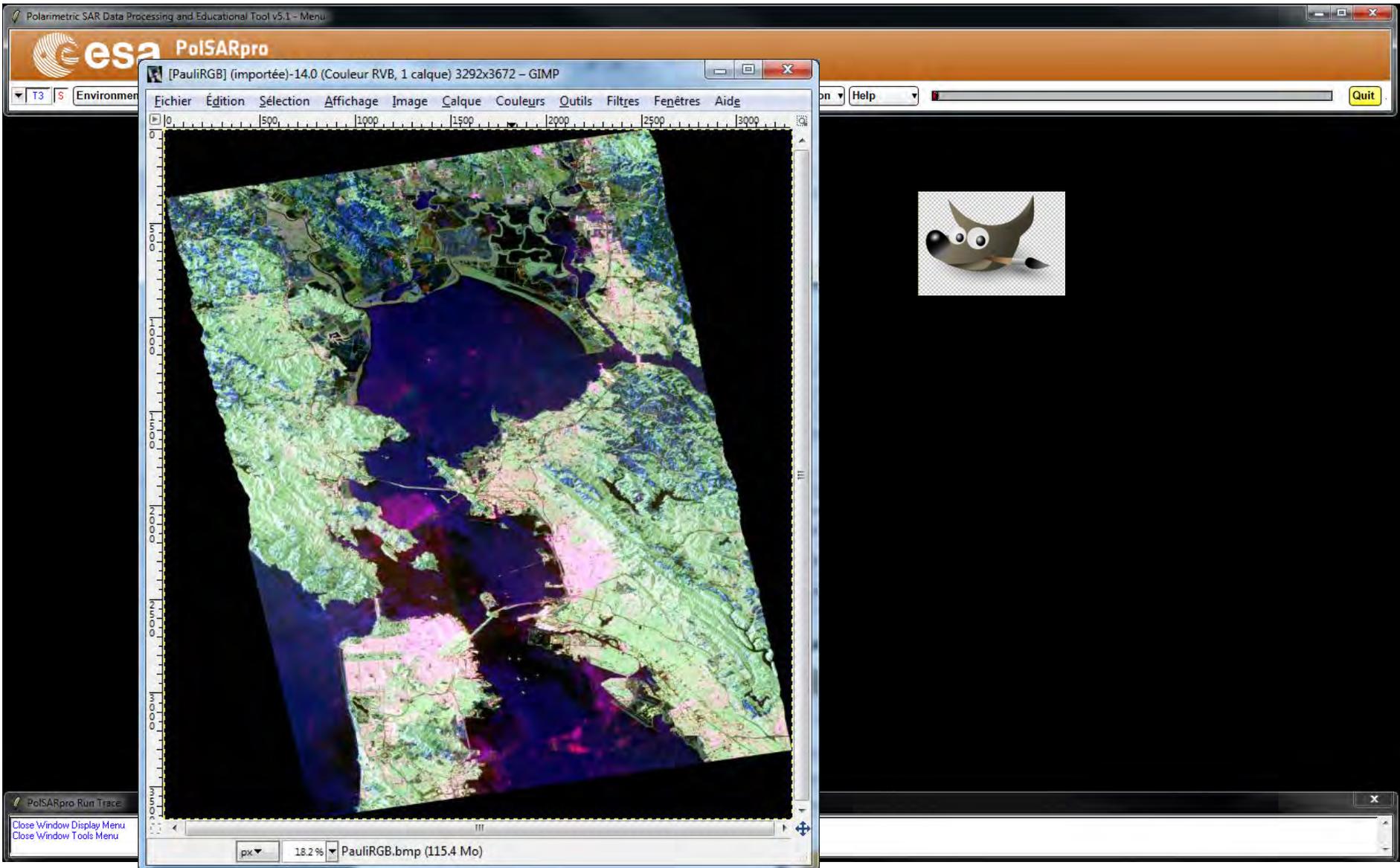
PolSARpro Run Trace

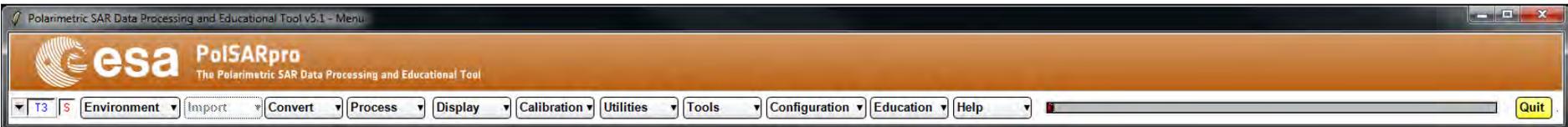
Close Window Display Menu
Close Window Tools Menu

The screenshot displays the PoISARpro v5.1 software interface. The main menu bar includes options like Environment, Import, Convert, Process, Display, Calibration, Utilities, Tools, and Configuration. The Utilities menu is open, showing options such as PoISARpro - Calculator, PoISARpro - Display, PoISARpro - SIM, PoISARpro - Viewer, SATIM Map Algebra, SNAP - S1 TBX, SRTM, ASTER, GIMP, GOOGLE EARTH, and Close All Widgets. The SNAP - S1 TBX option is highlighted with a blue oval. A yellow arrow points from this option to a secondary menu box containing Geocode [C2] matrix, Geocode [T3] matrix, and Geocode Parameter. The Geocode [T3] matrix option is also highlighted with a blue oval. A second yellow arrow points from this option to the SNAP - Geocode Matrix dialog box. The dialog box shows the following settings:

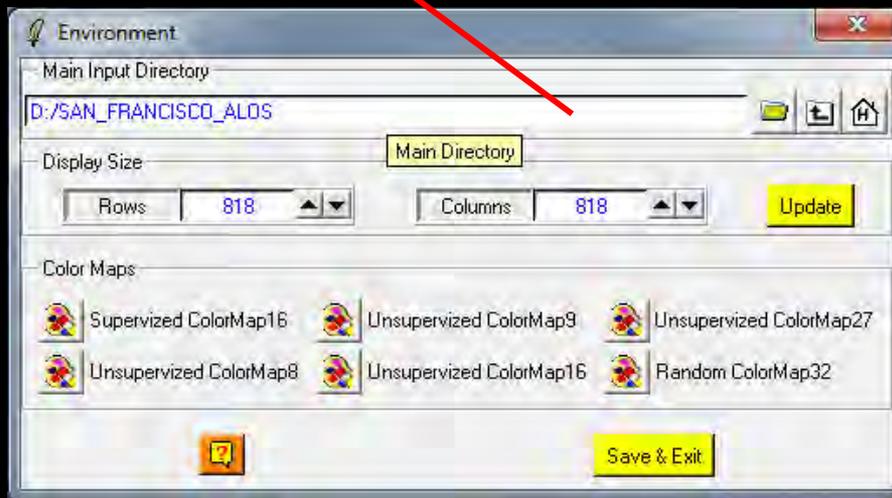
- Input Directory: D:/SAN_FRANCISCO_ALOS2/T3
- Output Directory: D:/SAN_FRANCISCO_ALOS2_SNAP
- Polarimetric SAR Sensor: ALOS-2 (CEOS)
- SAR Volume File: D:/SAN_FRANCISCO_ALOS2/VOL-ALOS2D44980750-150324-HBQR1.1_A
- Source GR Pixel Spacings: Azimut (m) 12.82284, Range (m) 20.53052, Pixel Spacing (m) 20.53052
- Input Multi Look: Azimut 4, Range 4
- Output Multi Look: Azimut 1, Range 1
- Image Resampling Method: Bilinear
- Digital Elevation Model (DEM): S.R.T.M
- DEM Resampling Method: Bilinear
- Save Auxiliary Files: DEM, Local Incidence Angle, Projected Local Incidence Angle from DEM
- Default Parameters: Geocoding: Latitude / Longitude, Datum: WGS84, Input Format: PoISARpro, Output Format: PoISARpro





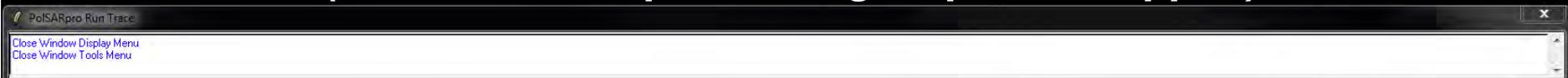


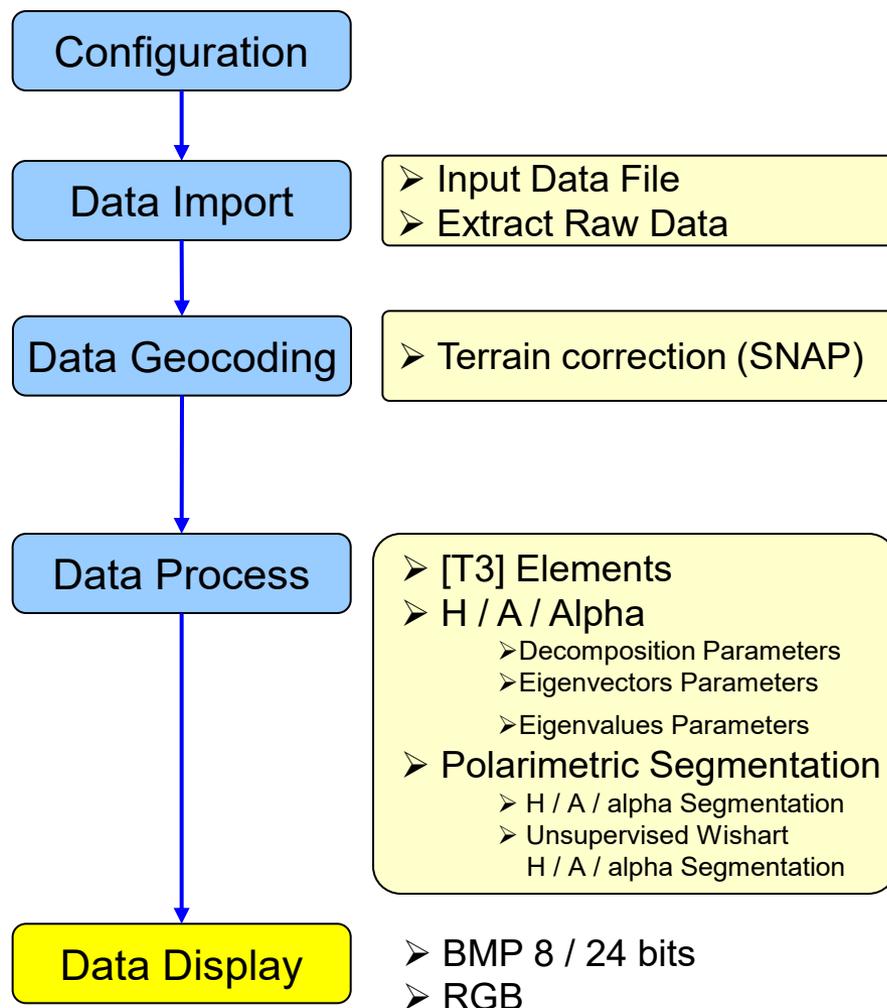
Configure Data Main Directory location

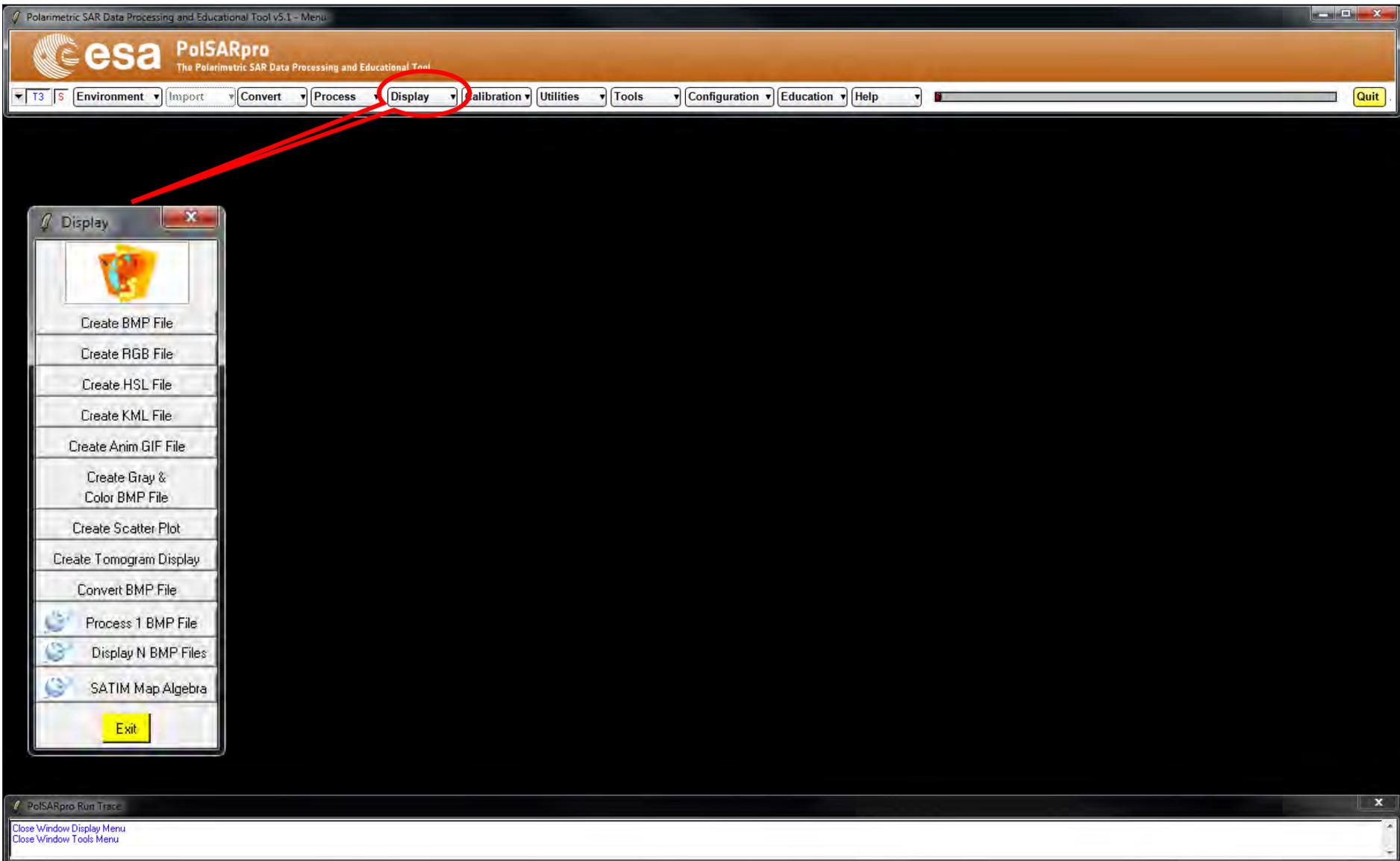


Input Data Directory :

SAN_FRANCISCO_ALOS2_SNAP
(If the first data processing steps are skipped)





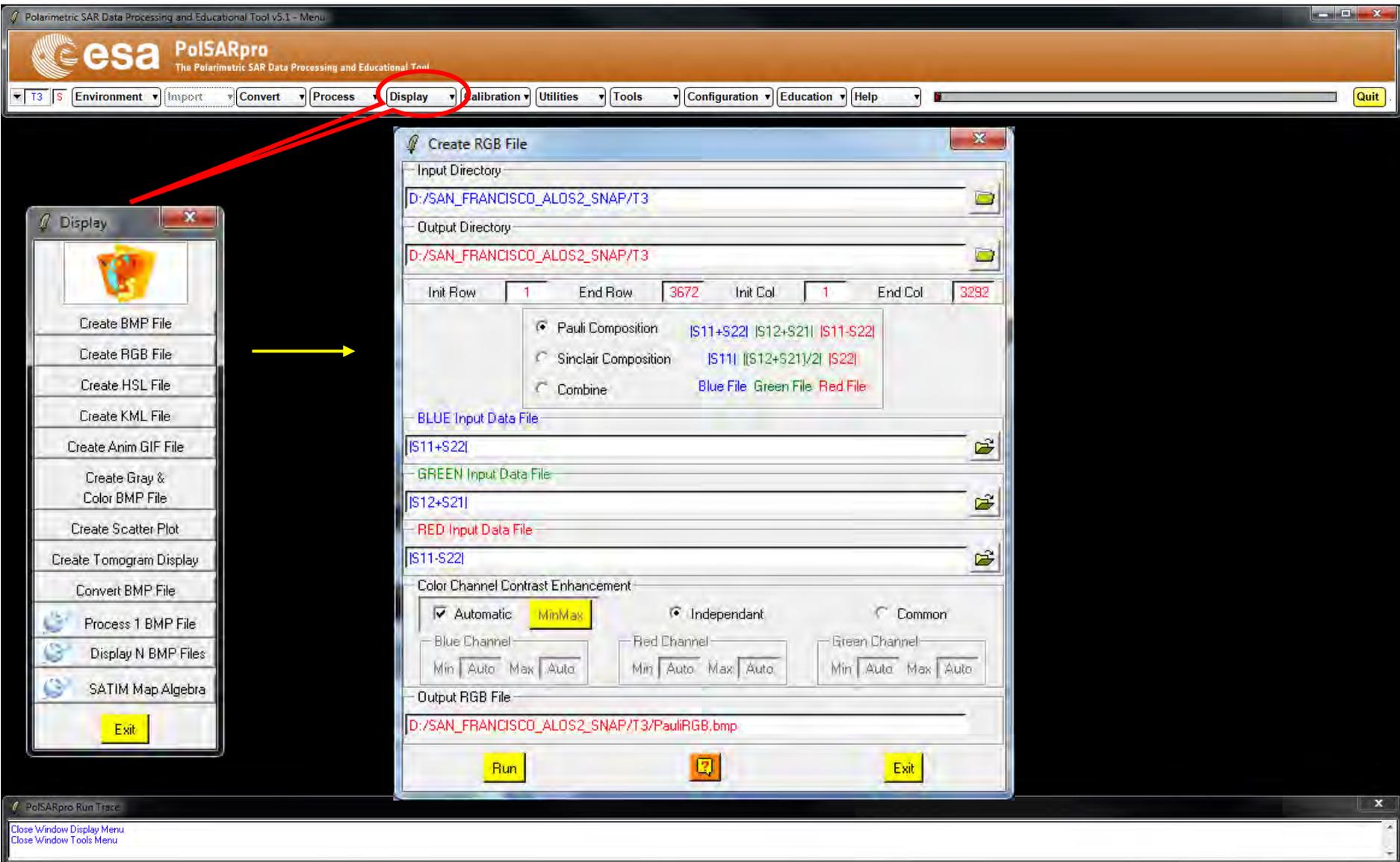


The screenshot shows the PolSARpro software interface. The 'Display' menu is highlighted with a red circle and a red arrow pointing to a 'Display' dialog box on the left. This dialog box contains a list of options: 'Create BMP File', 'Create RGB File', 'Create HSL File', 'Create KML File', 'Create Anim GIF File', 'Create Gray & Color BMP File', 'Create Scatter Plot', 'Create Tomogram Display', 'Convert BMP File', 'Process 1 BMP File', 'Display N BMP Files', and 'SATIM Map Algebra'. A yellow arrow points from the 'Create BMP File' option to the 'Create BMP File' dialog box in the center.

The 'Create BMP File' dialog box contains the following fields and options:

- Input Data File:** D:/SAN_FRANCISCO_ALOS2_SNAP/T3/entropy.bin
- Output BMP Directory:** D:/SAN_FRANCISCO_ALOS2_SNAP/T3
- Init Row:** 1, **End Row:** 3672, **Init Col:** 1, **End Col:** 3292
- Data Format:** Complex, Float, Integer
- Show:** Modulus, 10log(Mod), 20log(Mod), Phase, Real, Imag
- ColorMap JET:** (ColorMap GRAY: (ColorMap HSV:)
- ColorMap File:** C:/Users/epottier/AppData/Roaming/PolSARpro_5.1.0/Config/ColorMapJET.pal
- Initial Number of Cols:** 3292
- Minimum / Maximum Values:**
 - Automatic: Min: 0.012592, Max: 0.998529
 - Enhanced Contrast: Min E.C: 0.379729, Max E.C: 0.920730
- Valid Pixel Mask File:** D:/SAN_FRANCISCO_ALOS2_SNAP/T3/mask_valid_pixels.bin
- Output BMP File:** D:/SAN_FRANCISCO_ALOS2_SNAP/T3/entropy_real.bmp

Buttons at the bottom of the dialog include 'Run', a help icon, and 'Exit'.



The screenshot shows the PolSARpro software interface. The 'Display' menu is highlighted with a red circle and a red arrow pointing to the 'Display' dialog box. The 'Create RGB File' dialog box is open, showing the following settings:

- Input Directory:** D:/SAN_FRANCISCO_ALOS2_SNAP/T3
- Output Directory:** D:/SAN_FRANCISCO_ALOS2_SNAP/T3
- Init Row:** 1, **End Row:** 3672, **Init Col:** 1, **End Col:** 3292
- Composition:** Pauli Composition (selected), Sinclair Composition, Combine
- BLUE Input Data File:** |S11+S22|
- GREEN Input Data File:** |S12+S21|
- RED Input Data File:** |S11-S22|
- Color Channel Contrast Enhancement:** Automatic (checked), MinMax (highlighted), Independent, Common
- Blue Channel:** Min: Auto, Max: Auto
- Red Channel:** Min: Auto, Max: Auto
- Green Channel:** Min: Auto, Max: Auto
- Output RGB File:** D:/SAN_FRANCISCO_ALOS2_SNAP/T3/PauliRGB.bmp

The 'Display' dialog box contains the following options:

- Create BMP File
- Create RGB File
- Create HSL File
- Create KML File
- Create Anim GIF File
- Create Gray & Color BMP File
- Create Scatter Plot
- Create Tomogram Display
- Convert BMP File
- Process 1 BMP File
- Display N BMP Files
- SATIM Map Algebra

Buttons: Run, Exit

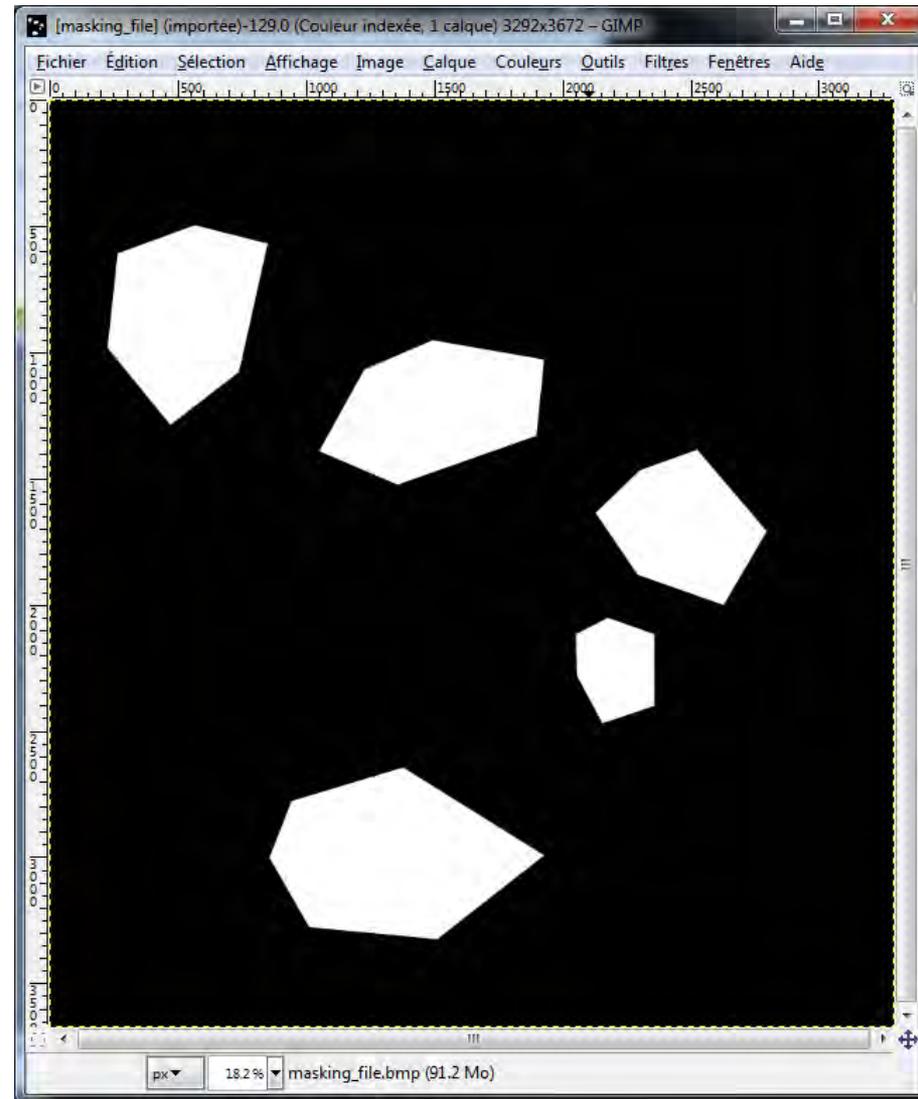
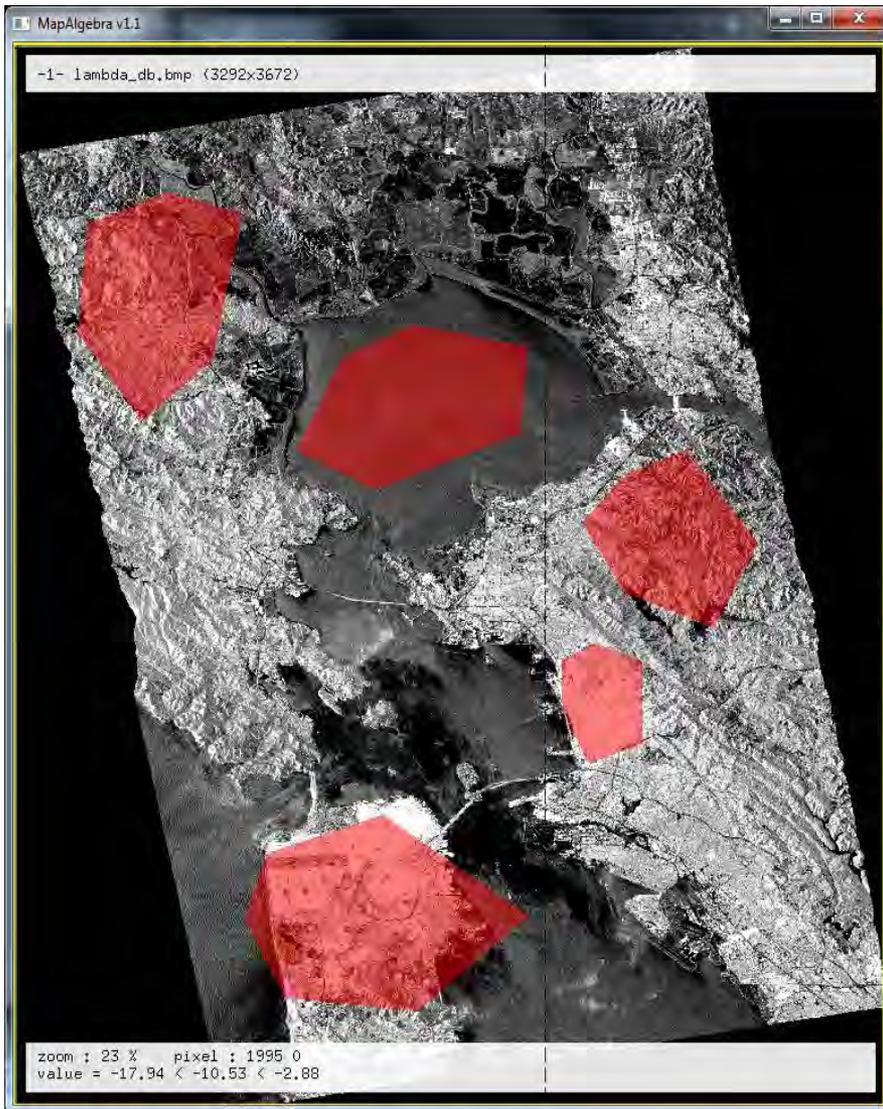
The screenshot shows the PolSARpro software interface. The main menu bar includes: Environment, Import, Convert, Process, Display (highlighted with a red circle), Calibration, Utilities, Tools, Configuration, Education, Help, and Quit. A red arrow points from the 'Display' menu to a 'Display' sub-menu. This sub-menu contains options: Create BMP File, Create RGB File, Create HSL File, Create KML File, Create Anim GIF File, Create Gray & Color BMP File, Create Scatter Plot, Create Tomogram Display, Convert BMP File, Process 1 BMP File, Display N BMP Files, and SATIM Map Algebra. A yellow arrow points from the 'Create HSL File' option to the 'Create HSL File' dialog box.

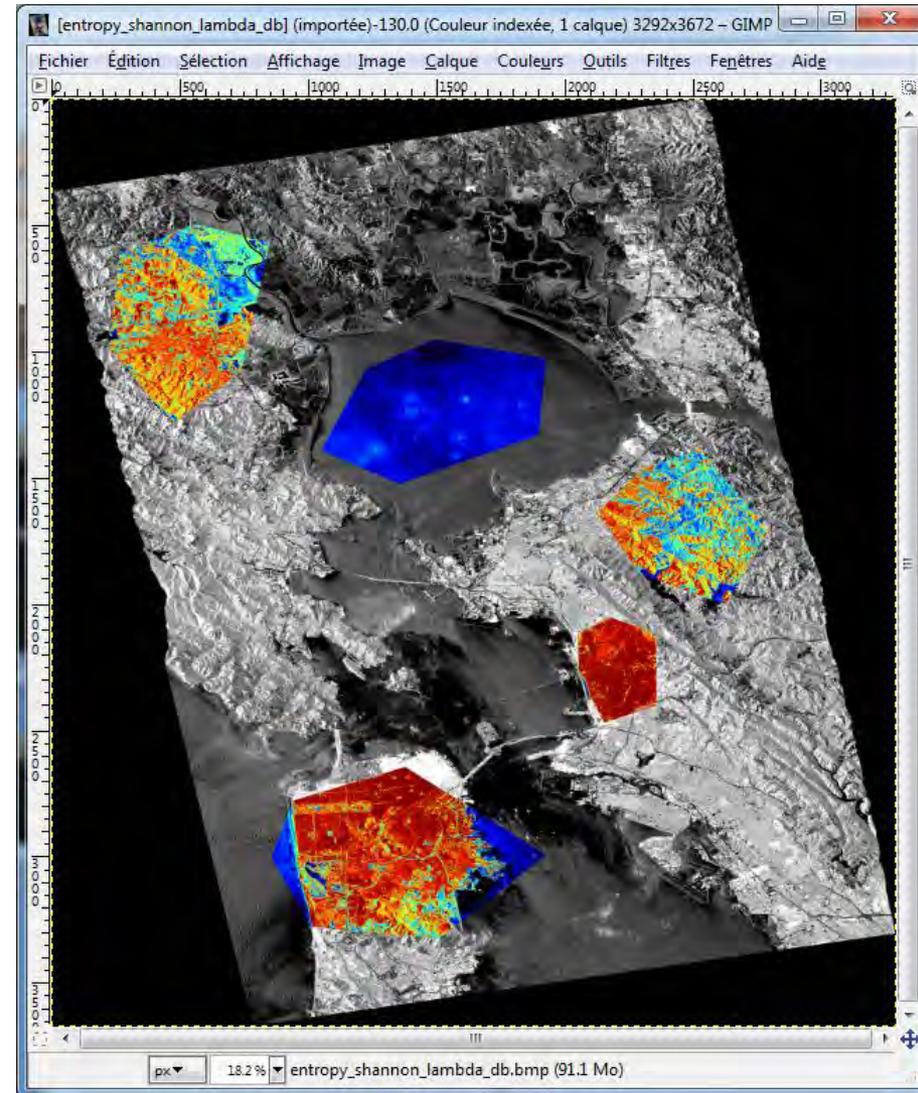
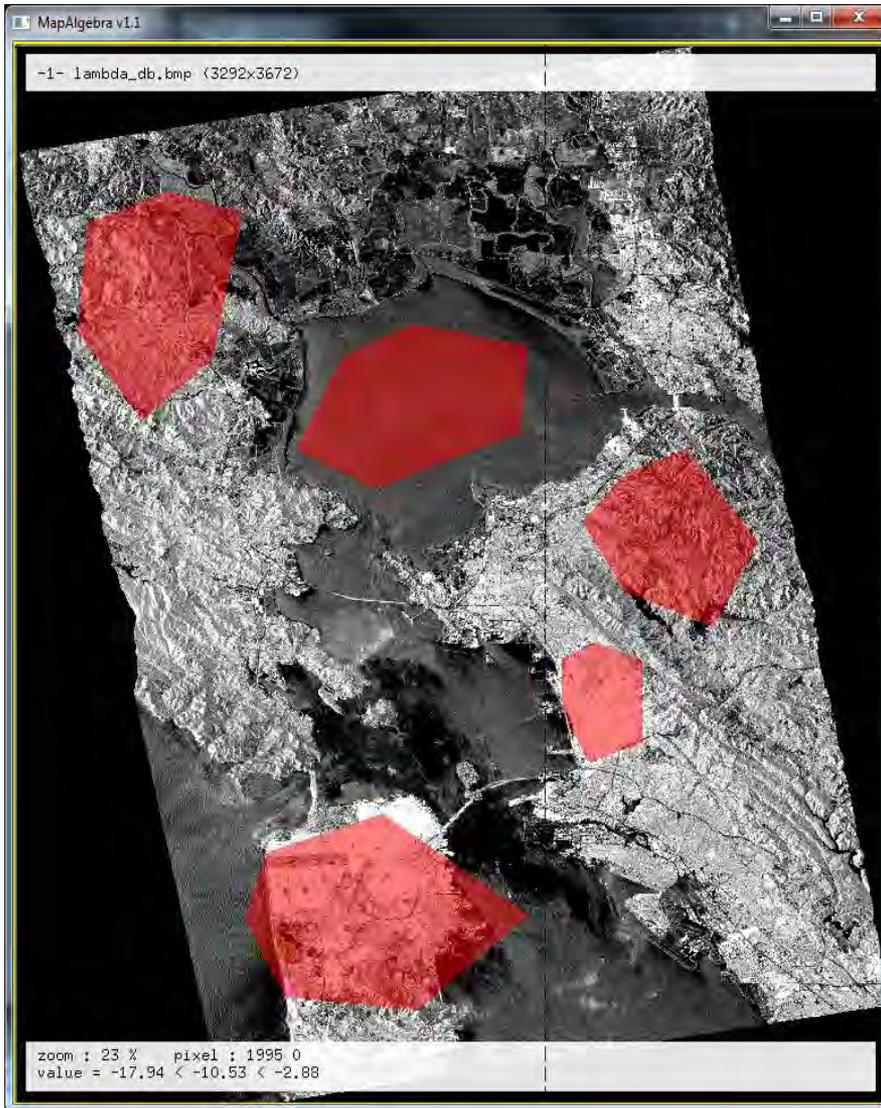
The 'Create HSL File' dialog box has the following fields and options:

- Input Directory: D:/SAN_FRANCISCO_ALOS2_SNAP/T3
- Output Directory: D:/SAN_FRANCISCO_ALOS2_SNAP/T3
- Init Row: 1, End Row: 3672, Init Col: 1, End Col: 3292
- Radio buttons for Polar Decomposition:
 - Polar Decomposition : Hue (Alpha) / Sat (1 - Entropy) / Light (Span)
 - Polar Decomposition : Hue (Alpha) / Sat (1 - Entropy) / Light (Anisotropy)
 - Combine : Hue File / Sat File / Light File
- HUE Input Data File: alpha
- SAT Input Data File: entropy
- LIGHT Input Data File: span
- Color Channel Contrast Enhancement:
 - Automatic (with MinMax button) Independent Common
 - Hue Channel: Min [Auto] Max [Auto]
 - Val Channel: Min [Auto] Max [Auto]
 - Light Channel: Min [Auto] Max [Auto]
- Output HSL File: D:/SAN_FRANCISCO_ALOS2_SNAP/T3/Polar1HSV.bmp
- Buttons: Run, Exit

The screenshot displays the PolSARpro software interface. The main menu bar includes: Environment, Import, Convert, Process, Display (highlighted with a red circle), Calibration, Utilities, Tools, Configuration, Education, and Help. A red arrow points from the 'Display' menu to a 'Display' dialog box on the left. This dialog box contains the following options: Create BMP File, Create RGB File, Create HSL File, Create KML File, Create Anim GIF File, Create Gray & Color BMP File, Create Scatter Plot, Create Tomogram Display, Convert BMP File, Process 1 BMP File, Display N BMP Files, and SATIM Map Algebra. A yellow arrow points from the 'Create HSL File' option to a GIMP window titled '[Polar1HSV] (importée)-106.0 (Couleur RVB, 1 calque) 3292x3672 - GIMP'. The GIMP window shows a satellite image of a landscape with a large body of water. The status bar at the bottom of the GIMP window indicates 'Polar1HSV.bmp (115.4 Mo)'. At the bottom of the PolSARpro interface, there is a 'PolSARpro Run Trace' window with the text: 'Close Window Display Menu' and 'Close Window Tools Menu'.

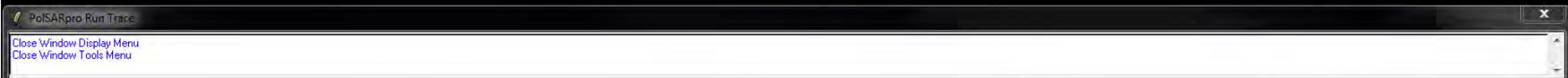
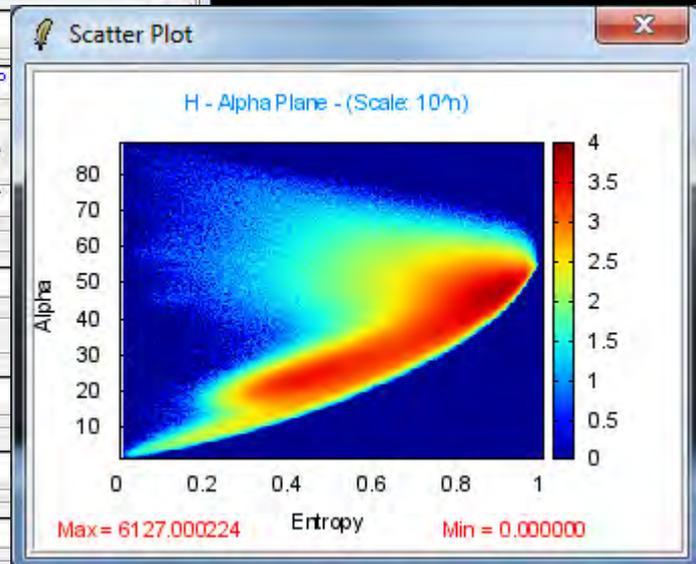
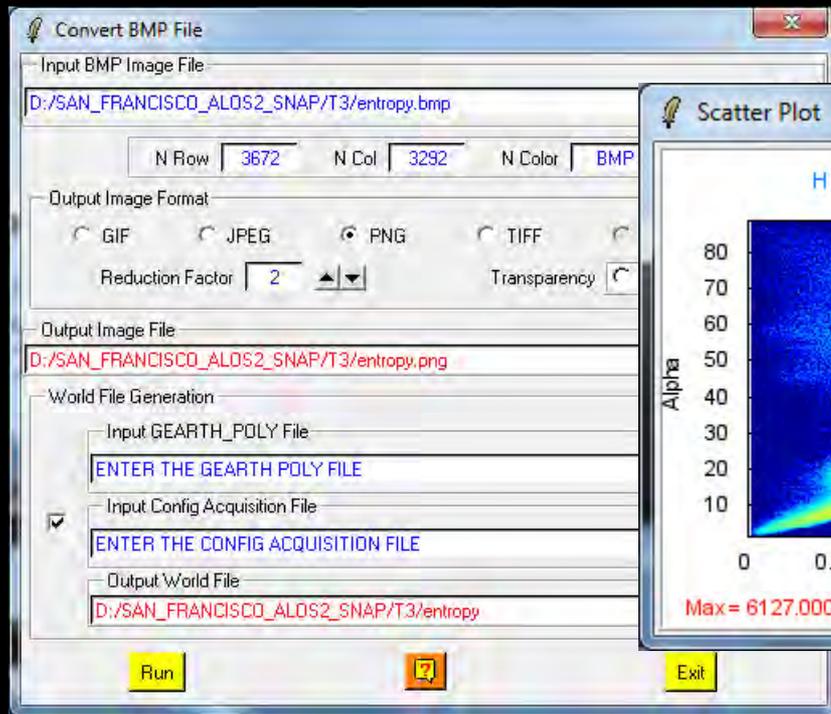
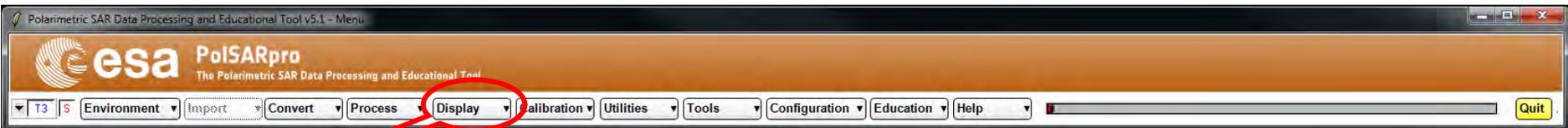
The screenshot shows the PolSARpro software interface. The main menu bar includes: Environment, Import, Convert, Process, Display (highlighted with a red circle), Calibration, Utilities, Tools, Configuration, Education, Help, and Quit. A red arrow points from the 'Display' menu to a 'Display' sub-menu. This sub-menu contains options: Create BMP File, Create RGB File, Create HSL File, Create KML File, Create Anim GIF File, Create Gray & Color BMP File (highlighted with a yellow arrow), Create Scatter Plot, Create Tomogram Display, Convert BMP File, Process 1 BMP File, Display N BMP Files, and SATIM Map Algebra. The 'Create Gray & Color BMP File' dialog box is open, showing input fields for 8-bit BMP Gray Scale File, 8-bit BMP Color Scale File, and Input Mask File. The Gray Scale File is set to 'D:/SAN_FRANCISCO_ALDS2_SNAP/T3/lambda_db.bmp' with dimensions 3672x3292 and 256 colors. The Color Scale File is set to 'D:/SAN_FRANCISCO_ALDS2_SNAP/T3/entropy_shannon.bmp' with the same dimensions and 256 colors. The Input Mask File is 'D:/SAN_FRANCISCO_ALDS2_SNAP/T3/masking_file.bin' with dimensions 3672x3292 and an 'Invert Mask' checkbox. The Output BMP Directory is 'D:/SAN_FRANCISCO_ALDS2_SNAP/T3' and the Output BMP File is 'D:/SAN_FRANCISCO_ALDS2_SNAP/T3/entropy_shannon_lambda_db.bmp'. Buttons for 'Check Files', 'Run', and 'Exit' are visible. A 'PolSARpro Run Trace' window at the bottom shows 'Close Window Display Menu' and 'Close Window Tools Menu'.





The screenshot shows the PolSARpro software interface. The 'Display' menu is highlighted with a red circle and a red arrow pointing to a 'Display' sub-window. The 'Create Scatter Plot' dialog box is open, showing settings for two input data files. The first file is 'D:/SAN_FRANCISCO_ALOS2_SNAP/T3/entropy.bin' and the second is 'D:/SAN_FRANCISCO_ALOS2_SNAP/T3/alpha.bin'. Both are set to 'Float' format and 'Real' display. The dialog also includes options for 'Show' (Modulus, 10log(Mod), 20log(Mod), Phase, Real, Imag), 'Minimum / Maximum Values' (Automatic, Enhanced Contrast, Min, Max, Min E.C., Max E.C.), and 'Label' fields for X and Y axes. The X-axis is labeled 'Entropy' and the Y-axis is labeled 'Alpha'. The title of the scatter plot is 'Entropy-- Alpha plane'. A yellow arrow points from the 'Create Scatter Plot' option in the 'Display' menu to the dialog box. At the bottom, a 'PolSARpro Run Trace' window shows the command 'Close Window Display Menu'.

The screenshot shows the PolSARpro software interface. The main menu bar includes: Environment, Import, Convert, Process, Display (highlighted with a red circle), Calibration, Utilities, Tools, Configuration, Education, Help, and Quit. A red arrow points from the 'Display' menu to a 'Display' sub-menu. This sub-menu contains the following options: Create BMP File, Create RGB File, Create HSL File, Create KML File, Create Anim GIF File, Create Gray & Color BMP File, Create Scatter Plot, Create Tomogram Display, Convert BMP File (highlighted with a yellow arrow), Process 1 BMP File, Display N BMP Files, and SATIM Map Algebra. Below the sub-menu is an 'Exit' button. The 'Convert BMP File' dialog box is open, showing the following fields and options: Input BMP Image File: D:/SAN_FRANCISCO_ALOS2_SNAP/T3/entropy.bmp; N Row: 3672, N Col: 3292, N Color: BMP 8 Bits; Output Image Format: GIF, JPEG, PNG (selected), TIFF, BMP24 >> BMP8; Reduction Factor: 2; Transparency: [off], [on], [alpha]; Output Image File: D:/SAN_FRANCISCO_ALOS2_SNAP/T3/entropy.png; World File Generation: Input GEARTH_POLY File: ENTER THE GEARTH POLY FILE; Input Config Acquisition File: ENTER THE CONFIG ACQUISITION FILE; Output World File: D:/SAN_FRANCISCO_ALOS2_SNAP/T3/entropy; Buttons: Run, [Help], Exit. At the bottom, a 'PolSARpro Run Trace' window shows: Close Window Display Menu, Close Window Tools Menu.



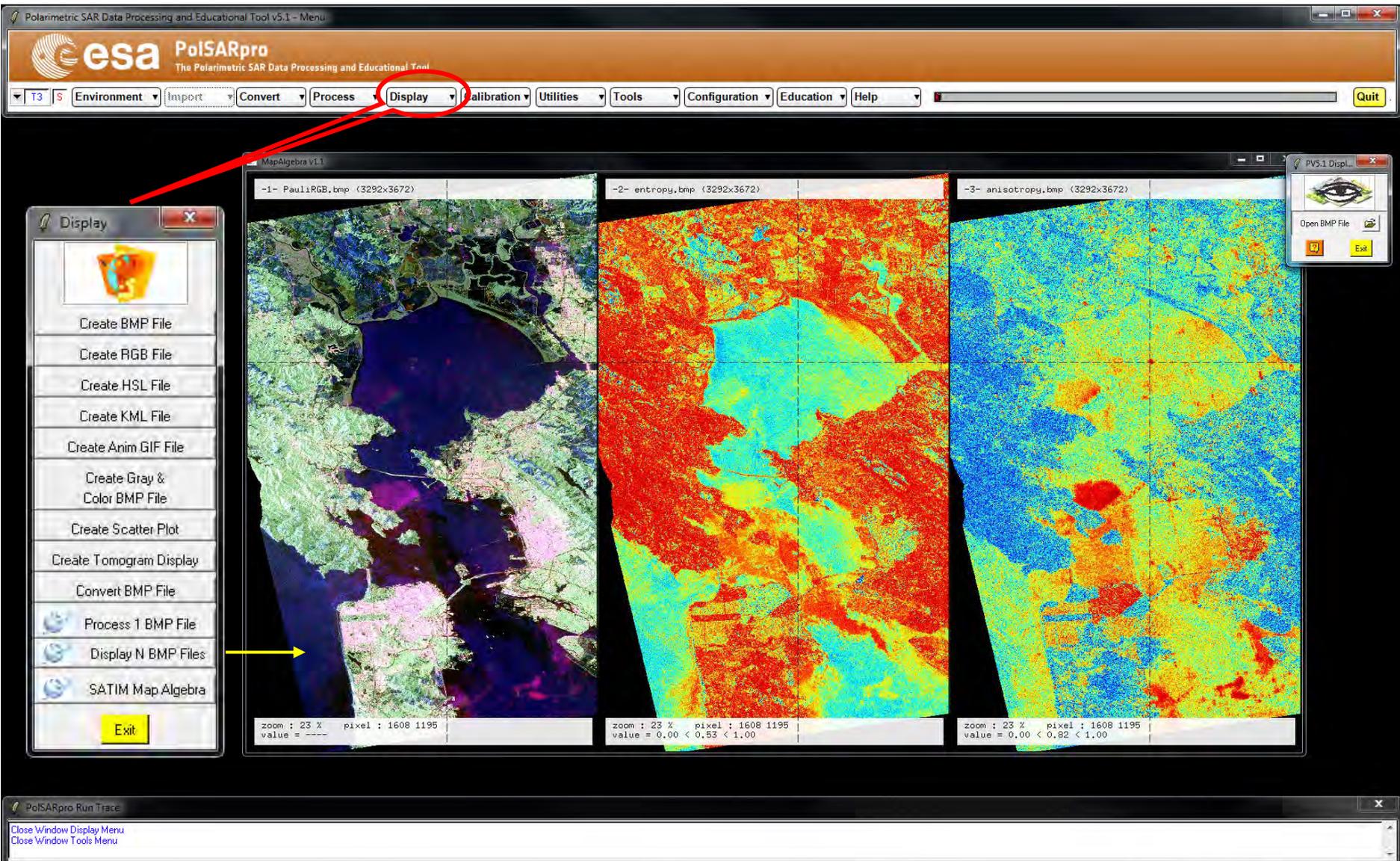
The screenshot shows the PolSARpro software interface. The main menu bar includes: Environment, Import, Convert, Process, Display, Calibration, Utilities, Tools, Configuration, Education, Help, and Quit. The 'Display' and 'Utilities' menus are circled in red. Red arrows point from these menus to their respective sub-menus. The 'Display' sub-menu (left) includes options like 'Create BMP File', 'Process 1 BMP File', 'Display N BMP Files', and 'SATIM Map Algebra'. The 'Utilities' sub-menu (middle) includes 'SATIM Map Algebra' and other tools. A yellow arrow points from 'SATIM Map Algebra' in the Utilities sub-menu to a box containing 'Process 1 BMP File' and 'Display N BMP Files'. A 'PolSARpro Run Trace' window at the bottom shows the command history.

Process 1 BMP Image

The screenshot displays the PolSARpro software interface. The main window, titled "MapAlgebra v1.1", shows a SAR image named "PauliRGB.bmp" with dimensions 3292x3672. The image is a false-color composite of Pauli decomposition results, showing a large body of water in the center, surrounded by land with various textures and colors (green, blue, purple, pink). A "Display" menu is open on the left, listing various output options. A yellow arrow points to the "Process 1 BMP File" option. On the right, a "PV5.1process" panel is visible, showing an eye icon, image size settings (C: 3292, R: 3672), color selection options, and tool icons. The bottom status bar shows "zoom : 23 % pixel : 1814 1909 value = ----".

PolSARpro Run Trace
Close Window Display Menu
Close Window Tools Menu

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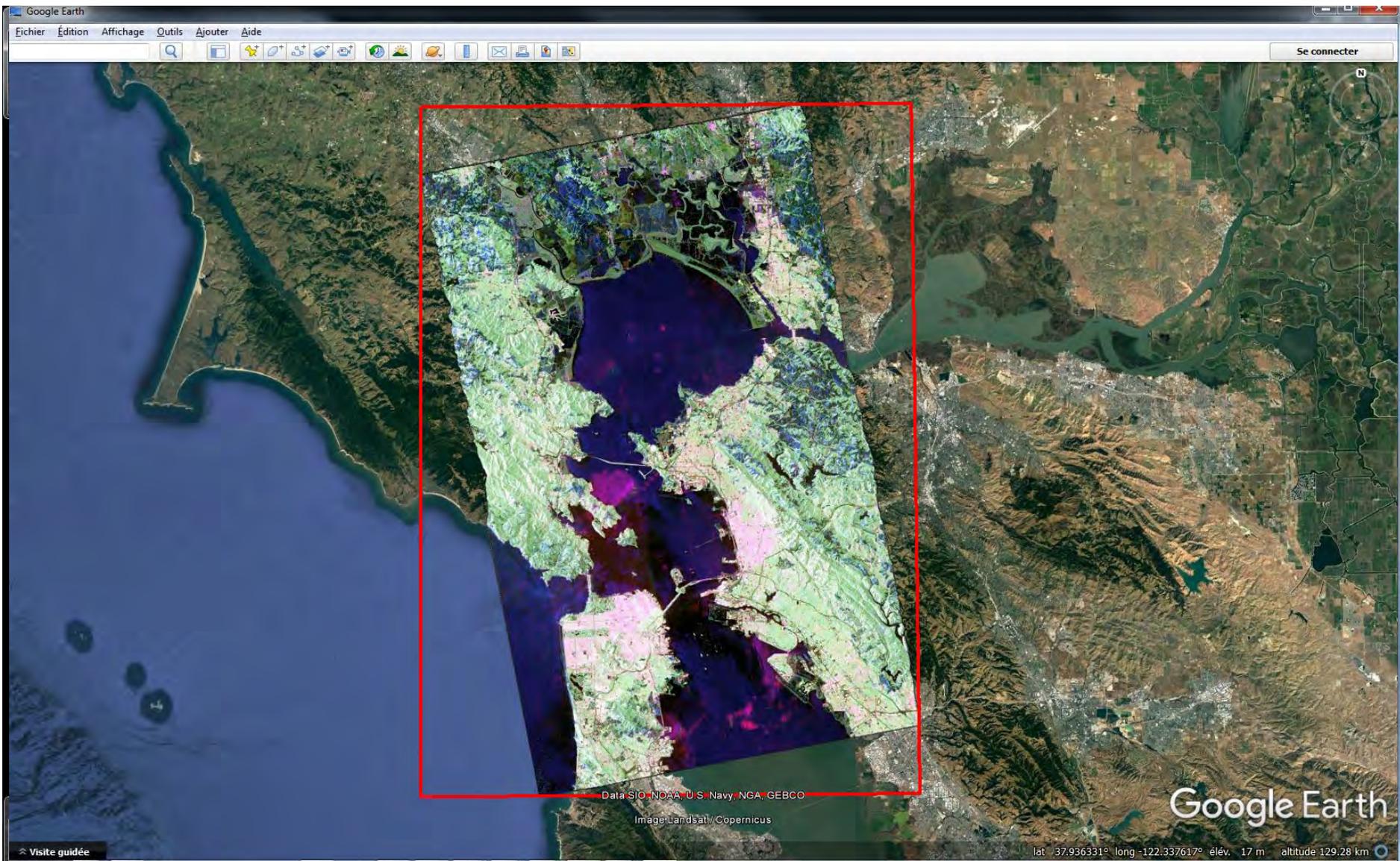


The screenshot shows the PolSARpro software interface. The main menu bar includes: Environment, Import, Convert, Process, Display, Calibration, Utilities, Tools, Configuration, Education, Help, and Quit. The 'Display' menu is open, showing options like 'Create BMP File', 'Create RGB File', 'Create HSL File', 'Create KML File', 'Create Anim GIF File', 'Create Gray & Color BMP File', 'Create Scatter Plot', 'Create Tomogram Display', 'Convert BMP File', 'Process 1 BMP File', 'Display N BMP Files', and 'SATIM Map Algebra'. A yellow arrow points from the 'Create KML File' option to the 'Create BMP - KML File' dialog box. The dialog box has the following fields and controls:

- Input BMP File: D:/SAN_FRANCISCO_ALDS2_SNAP/T3/PauliRGB.bmp
- Output KML Directory: D:/SAN_FRANCISCO_ALDS2_SNAP/T3
- Dimensions: N Row: 3672, N Col: 3292, N Color: BMP 24 Bits
- Input GEARTH_POLY File: D:/SAN_FRANCISCO_ALDS2_SNAP/GEARTH_POLY.kml
- Output KML File: D:/SAN_FRANCISCO_ALDS2_SNAP/T3/PauliRGB.kml
- Reduction Factor: 2
- Transparency:
- Buttons: Run, Exit

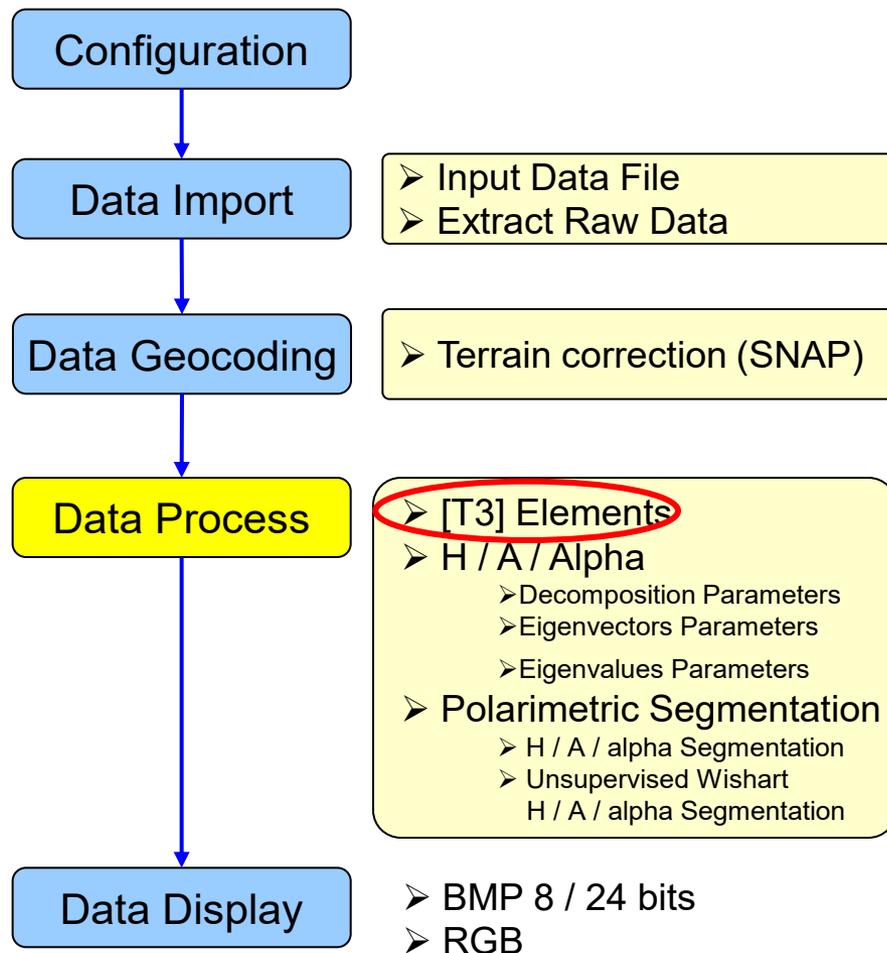
A 'PolSARpro Run Trace' window at the bottom shows the following log entries:

- Close Window Display Menu
- Close Window Tools Menu



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PolSARpro v5.1 - Menu

esa PolSARpro
The Polarimetric SAR Data Processing and Educational Tool

Environment | Import | Convert | Process | Display | Calibration | Utilities | Tools | Configuration | Education | Help

Process Menu:

- Matrix Elements
- Correlation Coefficients
- Elliptical Basis Change
- Polarimetric Speckle Filter
- H / A / Alpha Decomposition
- Polarimetric Decompositions
- Polarimetric Functionalities - 1
- Polarimetric Functionalities - 2
- Polarimetric Segmentation
- Polarimetric Data Analysis
- Polarimetric Data Clustering
- Batch Process

Linear (+45 / -45) / Circular (L / R) / Elliptical (phi, tau)

- Box Car Filter
- Box Car - Edge Filter
- C. Lopez Filter
- Gaussian Filter
- IDAN Filter
- J.S. Lee Refined Filter
- J.S. Lee Sigma Filter
- P.W.F Filter
- Edge Detector

Decomposition Parameters

- Eigenvector Set Parameters
- Eigenvalue Set Parameters

Decompositions:

- JRH : Huynen Decomposition
- RMB1 : Barnes 1 Decomposition
- RMB2 : Barnes 2 Decomposition
- SRC : Cloude Decomposition
- WAH1 : Holm 1 Decomposition
- WAH2 : Holm 2 Decomposition
- HAA : H / A / Alpha Decomposition
- FRE2 : Freeman 2 Components Decomposition
- FRE3 : Freeman 3 Components Decomposition
- VZ3 : Van Zyl 3 Components Decomposition
- YAM3 : Yamaguchi 3 Components Decomposition
- YAM4 : Yamaguchi 4 Components Decomposition
- NEU : Neumann 2 Components Decomposition
- KRO : Krogager Decomposition
- CAM : Cameron Decomposition
- TSVM : Touzi Decomposition

Classification & Analysis:

- H / A / Alpha Classification
- H / A / Alpha - Wishart Classification
- Fuzzy - H / Alpha Classification
- Wishart Supervised Classification
- Rule-Based Hierarchical Classification
- Basic Scattering Mechanism Identification
- SVM Supervised Classification
- Data Statistics
- Data Histograms
- Data Profiles
- Histogram Based Statistics
- Texture Analysis
- Clustering Process
- Parameter Averaging
- Data Sets Averaging

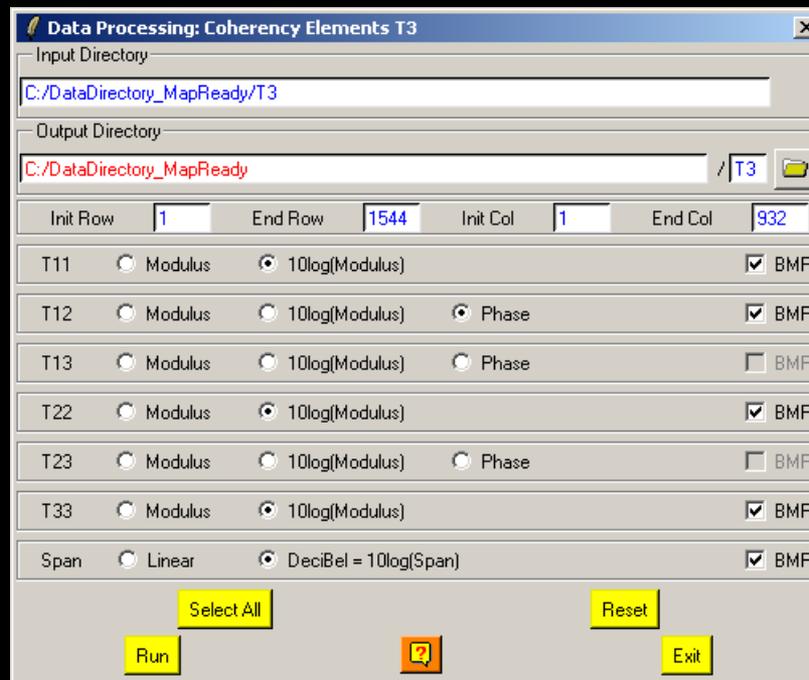
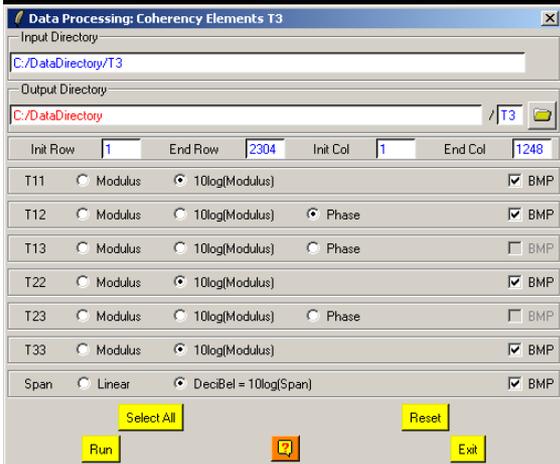
Faraday Rotation Estimation:

- Conformity Coefficient
- Scattering Predominance
- Scattering Diversity
- Degree of Purity
- Depolarisation Index
- Alpha Approximation (Praks & Colin)
- Entropy Approximation (Praks & Colin)
- Scattering Mechanism Entropy (Freeman)
- Scattering Mechanism Entropy (Van Zyl)
- Kozlov Anisotropy
- Lueneburg Anisotropy
- Polarized Point Scatterer Detection
- Reflectivity Ratio
- Differential Reflectivity (ZDR)

Polarisation Synthesis:

- Polarimetric Signature
- Stokes Parameters
- Compact Polarimetric Mode
- O.P.C.E
- R.C.S Max
- Surface Inversion
- RVOG PolSAR Inversion
- Sub-Aperture Analysis
- DEM Estimation
- Polarisation Orientation Compensation

Decomposition Applications:



DATADIR

T3

config.txt

[T3x3] Elements

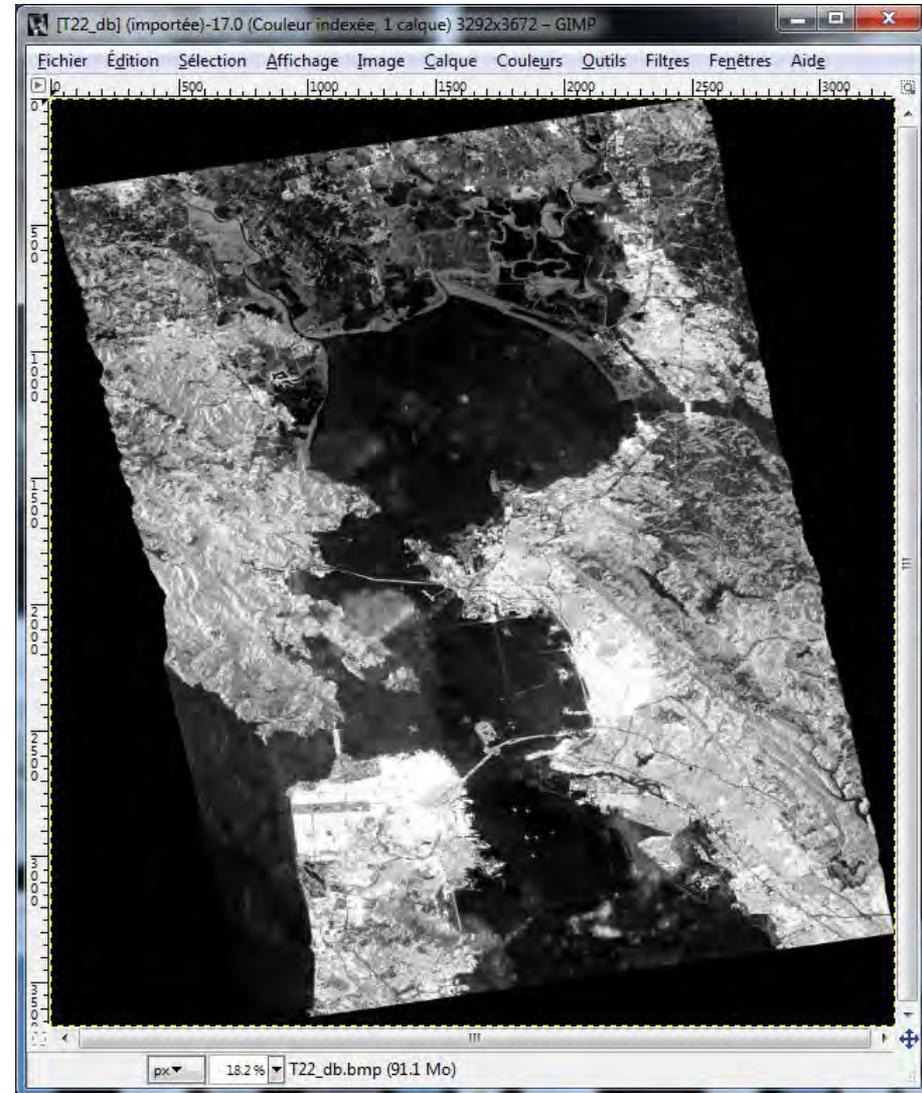
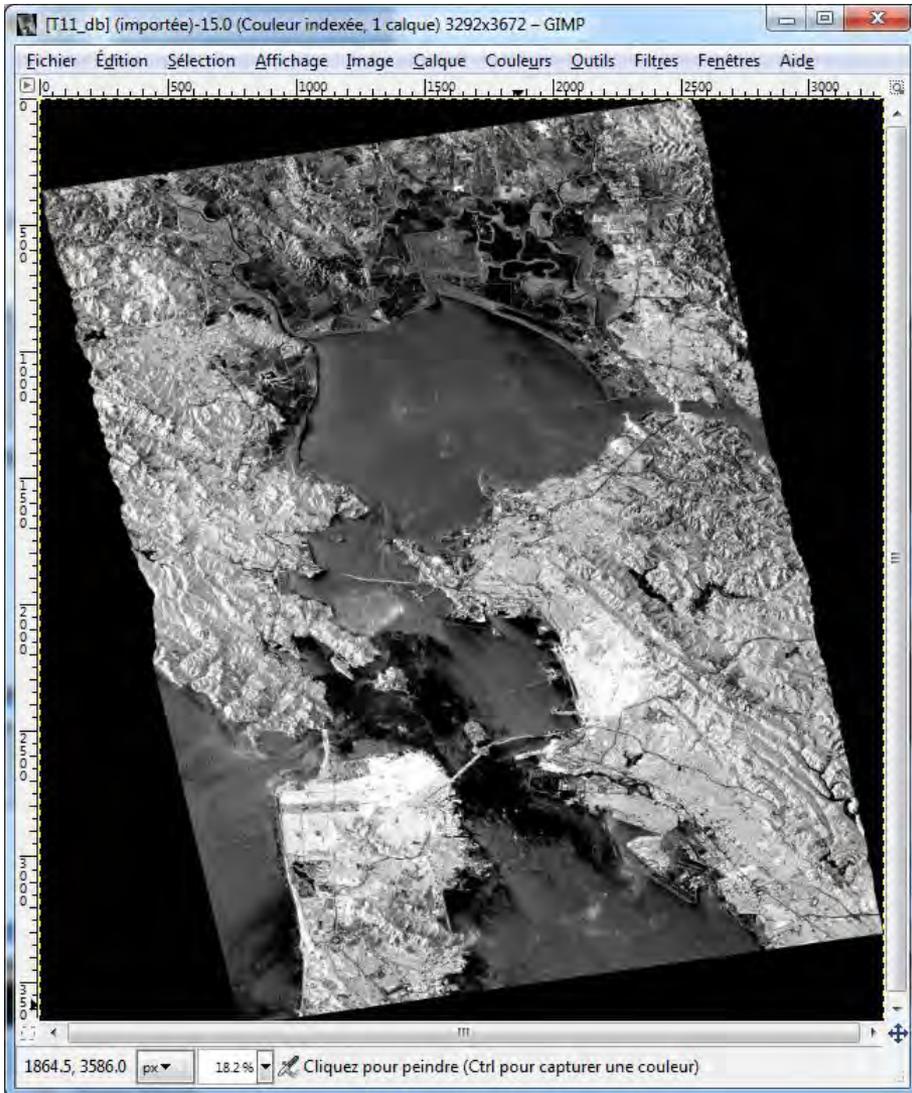
Txy_mod.bin
Txy_db.bin
Txy pha.bin

Txy_mod.bmp
Txy_db.bmp

Do it Yourself:
Select some elements, set the parameters and view the corresponding BMP files (select BMP).

T11_dB

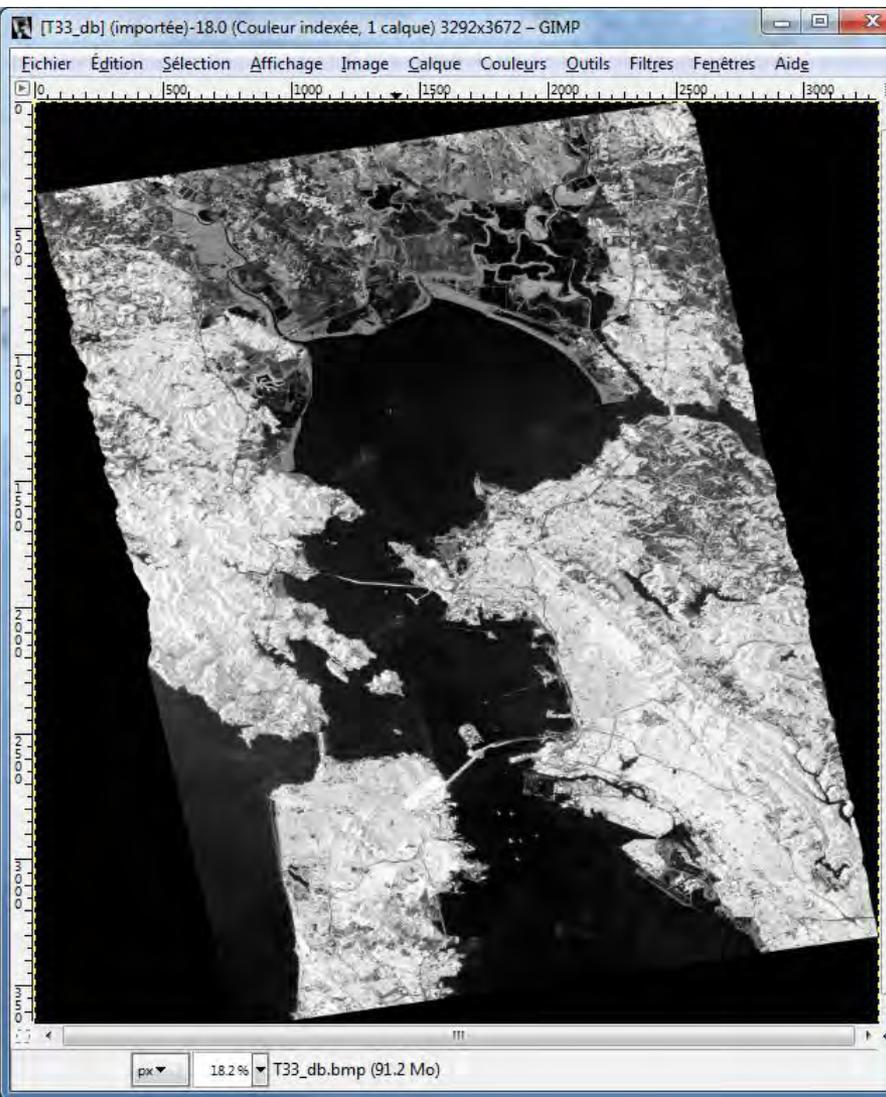
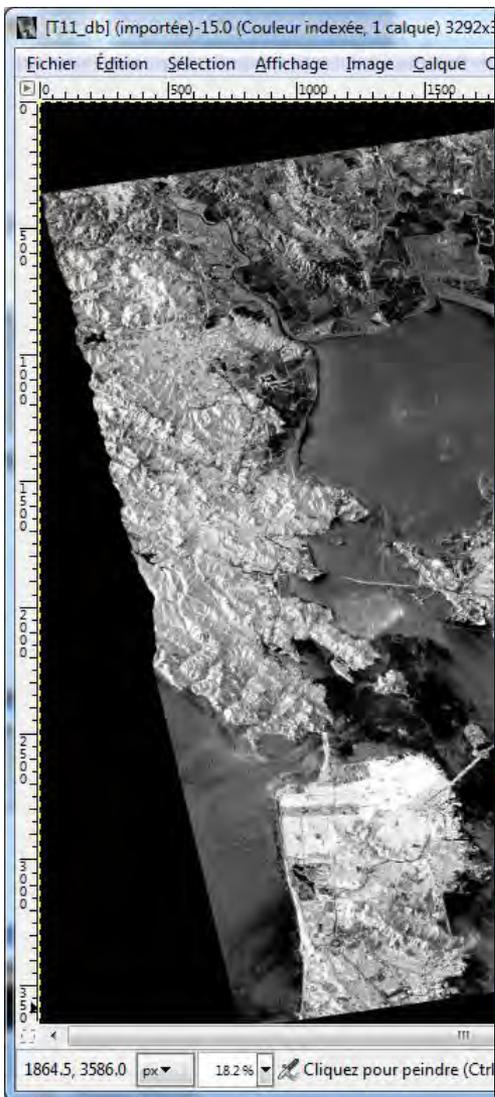
T22_dB



T11_dB

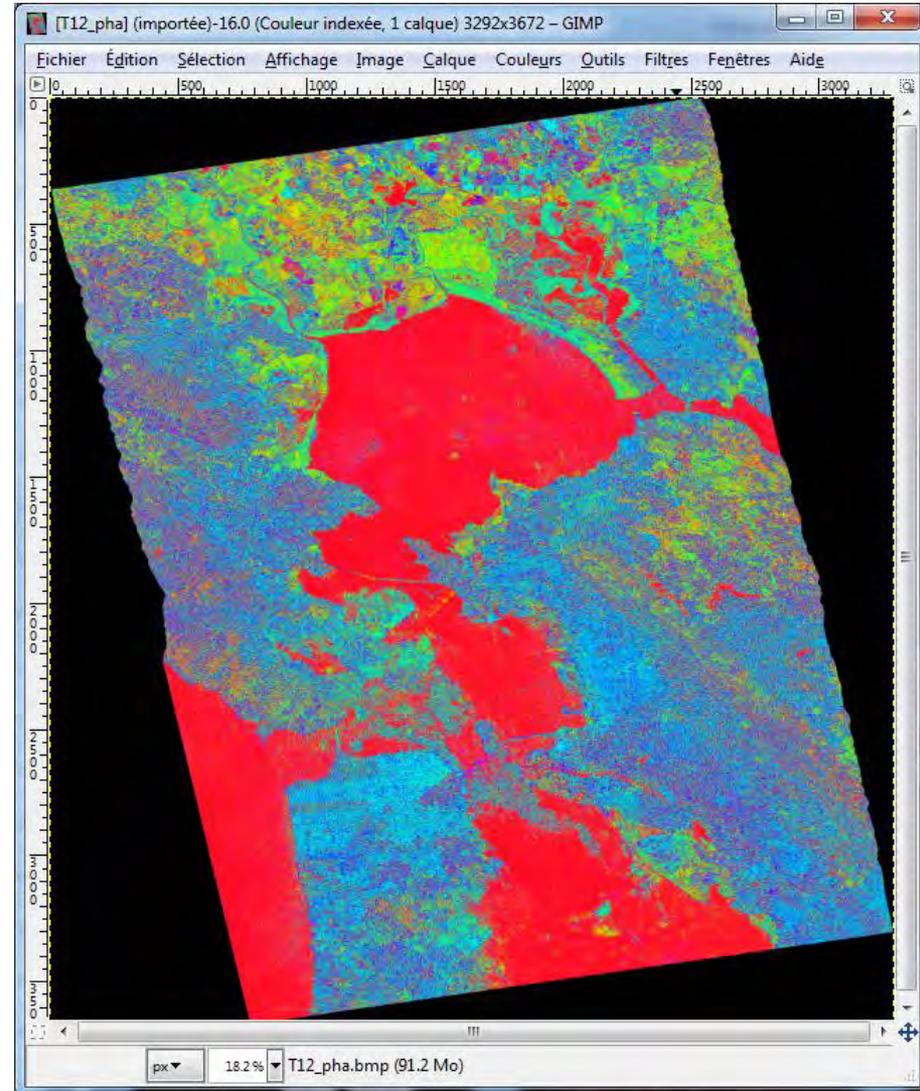
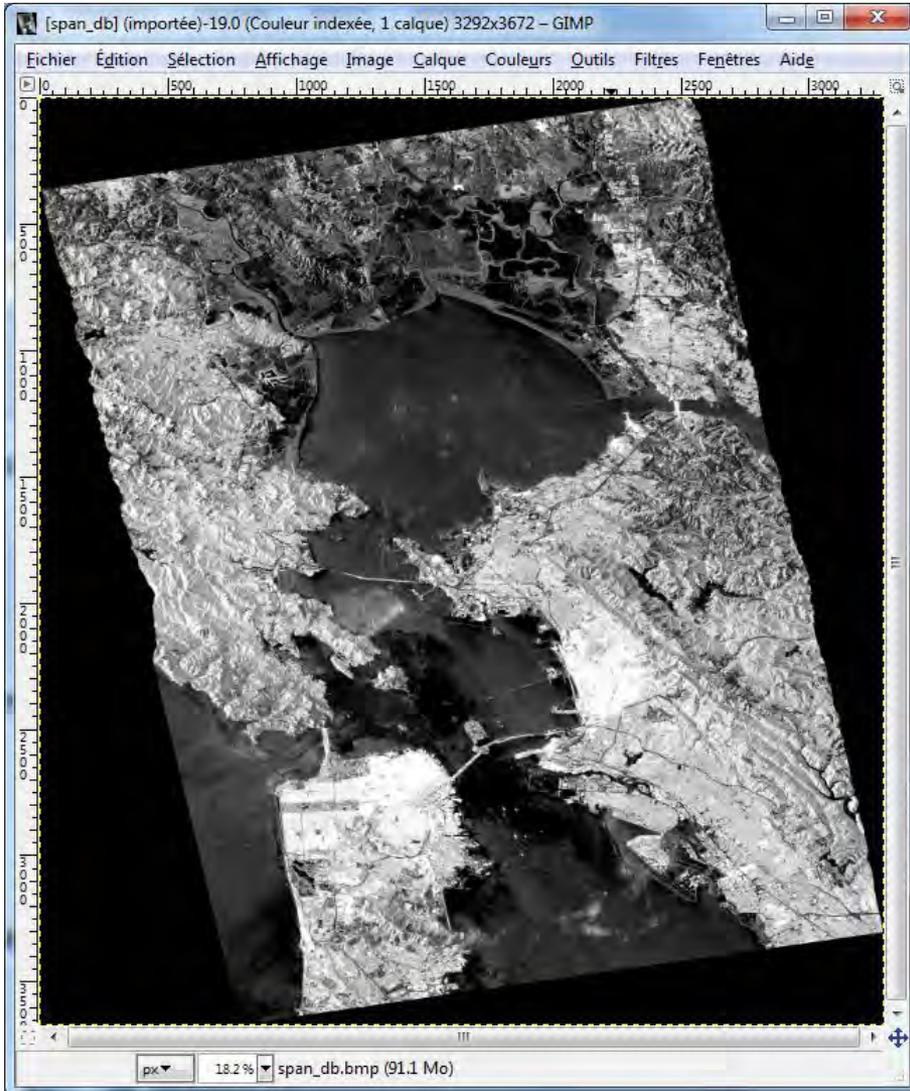
T33_dB

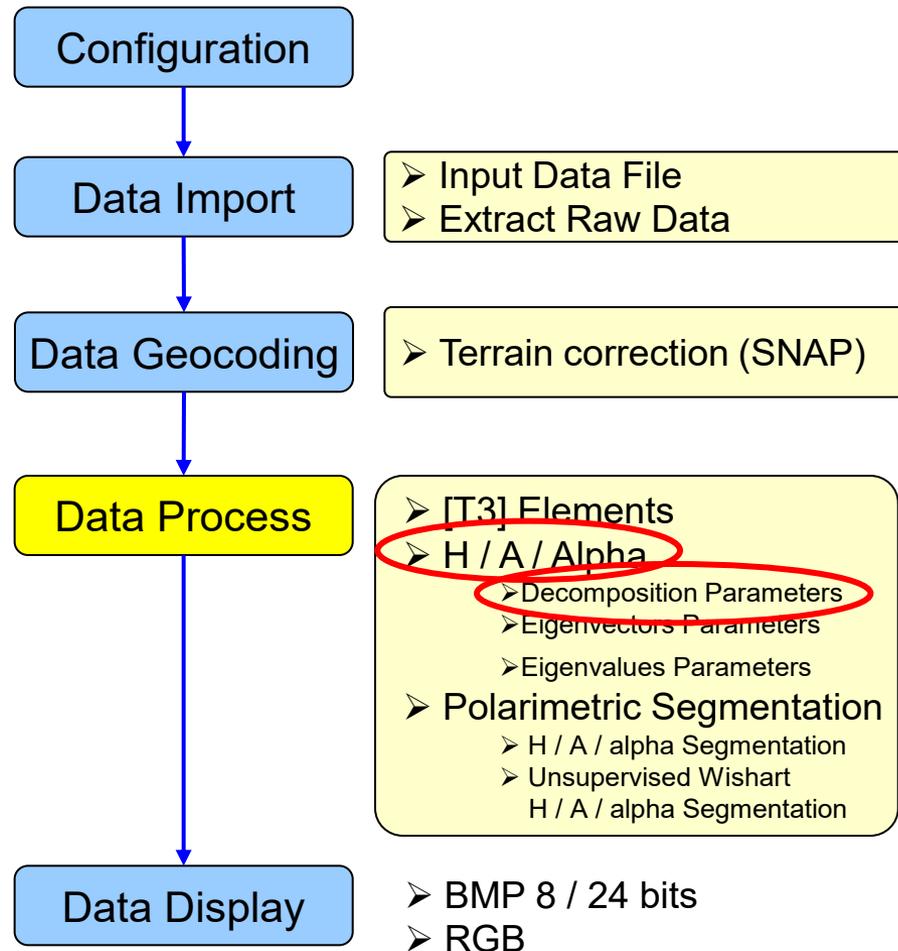
T22_dB



span_db

T12_pha





PolSARpro v5.1 - Menu

esa PolSARpro
The Polarimetric SAR Data Processing and Educational Tool

T3 | S | Environment | Import | Convert | **Process** | Display | Calibration | Utilities | Tools | Configuration | Education | Help | Quit

Linear (+45 / -45)
Circular (L / R)
Elliptical (phi, tau)

Box Car Filter
Box Car - Edge Filter
C. Lopez Filter
Gaussian Filter
IDAN Filter
J.S. Lee Refined Filter
J.S. Lee Sigma Filter
P.W.F Filter
Edge Detector

JRH : Huynen Decomposition
RMB1 : Barnes 1 Decomposition
RMB2 : Barnes 2 Decomposition
SRC : Cloude Decomposition
WAH1 : Holm 1 Decomposition
WAH2 : Holm 2 Decomposition
HAA : H / A / Alpha Decomposition

FRE2 : Freeman 2 Components Decomposition
FRE3 : Freeman 3 Components Decomposition
VZ3 : Van Zyl 3 Components Decomposition
YAM3 : Yamaguchi 3 Components Decomposition
YAM4 : Yamaguchi 4 Components Decomposition
NEU : Neumann 2 Components Decomposition

KRO : Krogager Decomposition

CAM : Cameron Decomposition

TSVM : Touzi Decomposition

Matrix Elements
Correlation Coefficients
Elliptical Basis Change
Polarimetric Speckle Filter
H / A / Alpha Decomposition
Polarimetric Decompositions
Polarimetric Functionalities - 1
Polarimetric Functionalities - 2
Polarimetric Segmentation
Polarimetric Data Analysis
Polarimetric Data Clustering
Batch Process

Decomposition Parameters
Eigenvector Set Parameters
Eigenvalue Set Parameters

H / A / Alpha Classification
H / A / Alpha - Wishart Classification
Fuzzy - H / Alpha Classification
Wishart Supervised Classification
Rule-Based Hierarchical Classification
Basic Scattering Mechanism Identification
SVM Supervised Classification

Faraday Rotation Estimation
Conformity Coefficient
Scattering Predominance
Scattering Diversity
Degree of Purity
Depolarisation Index
Alpha Approximation (Praks & Colin)
Entropy Approximation (Praks & Colin)
Scattering Mechanism Entropy (Freeman)
Scattering Mechanism Entropy (Van Zyl)
Kozlov Anisotropy
Lueneburg Anisotropy
Polarized Point Scatterer Detection
Reflectivity Ratio
Differential Reflectivity (ZDR)

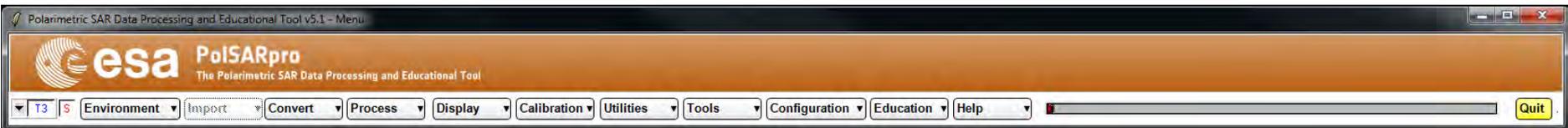
Polarisation Synthesis
Polarimetric Signature
Stokes Parameters
Compact Polarimetric Mode
O.P.C.E
R.C.S Max
Surface Inversion
RVOG PolSAR Inversion
Sub-Aperture Analysis
DEM Estimation
Polarisation Orientation Compensation

Data Statistics
Data Histograms
Data Profiles
Histogram Based Statistics
Texture Analysis

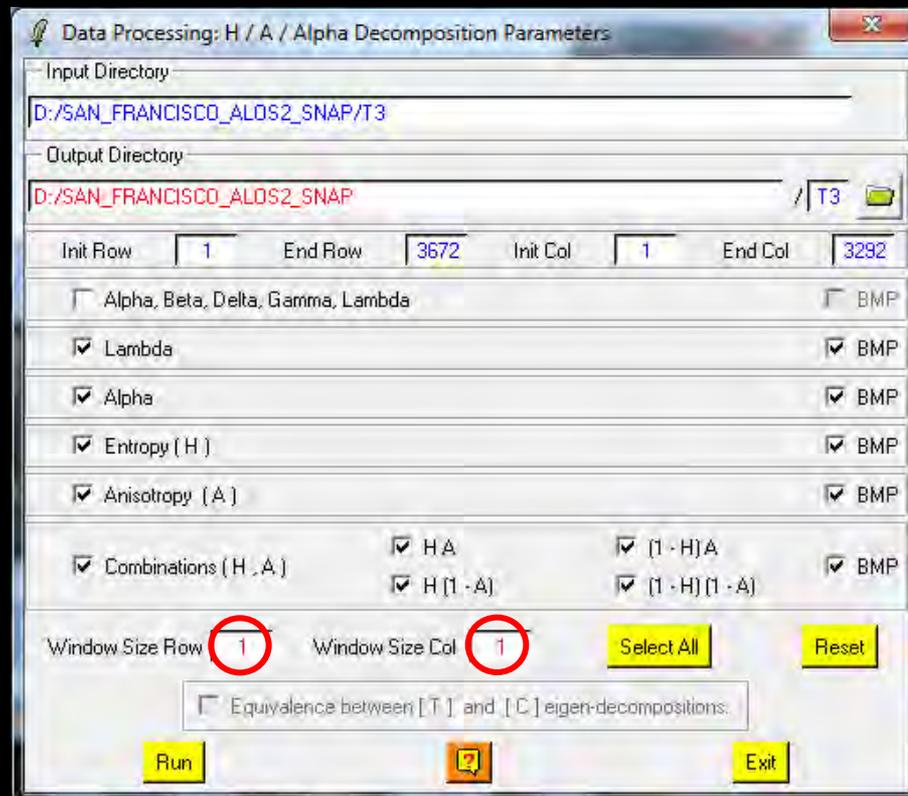
Clustering Process
Parameter Averaging
Data Sets Averaging

Decomposition Applications

PolSARpro Run Trace
Close Window Display Menu
Close Window Tools Menu

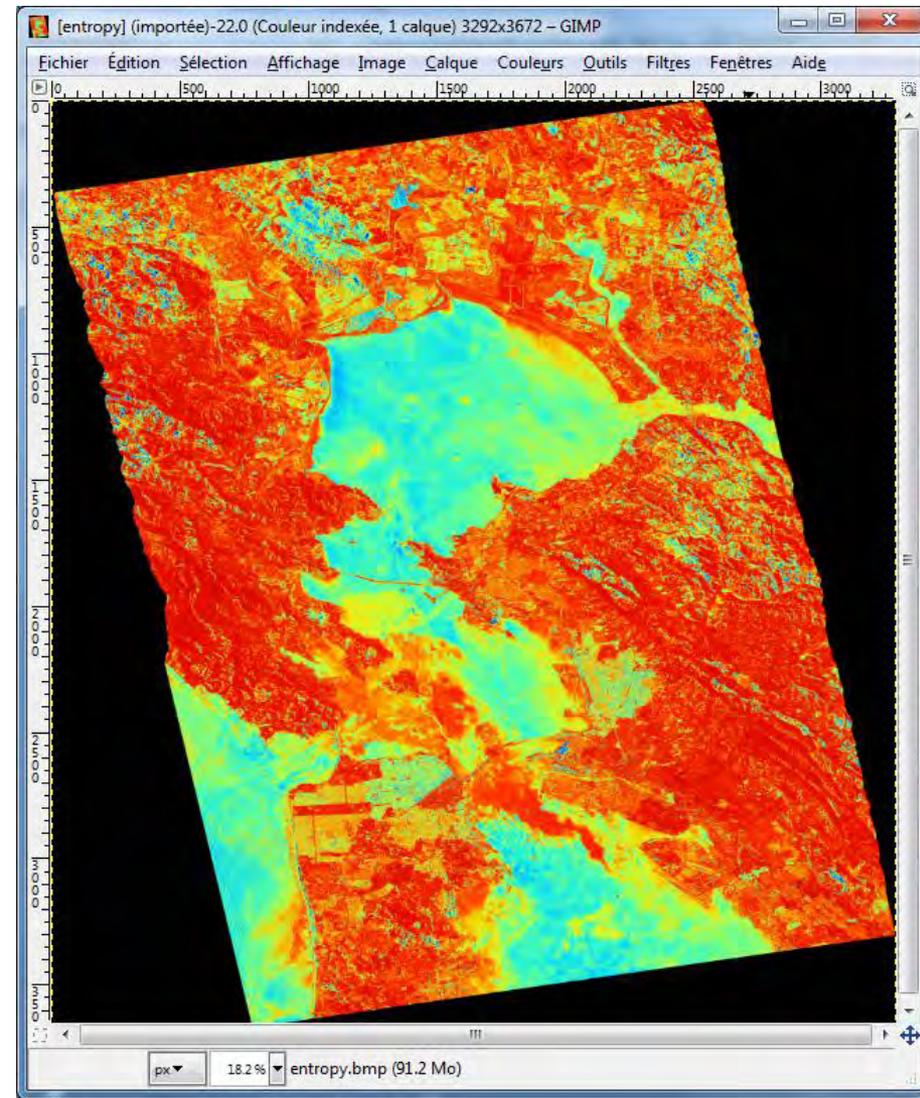
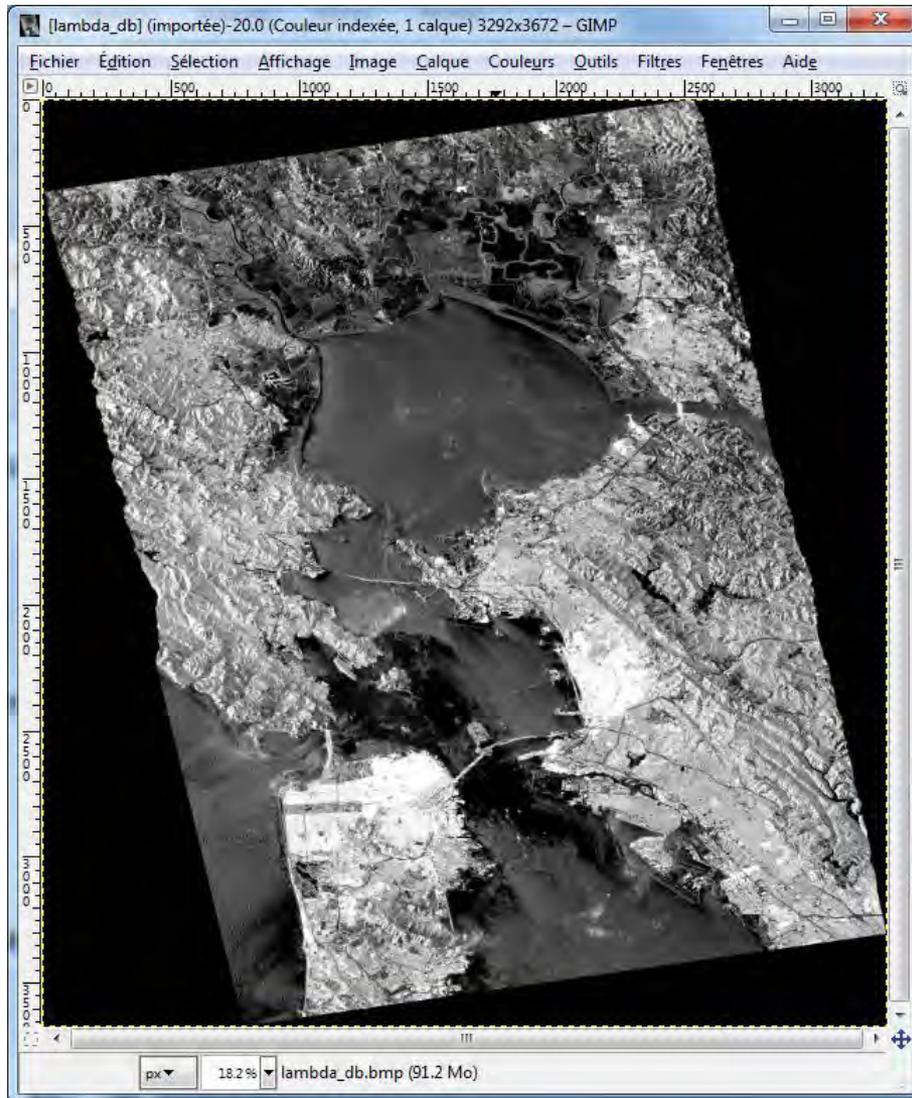


Do it Yourself:
 Select some elements, set the parameters ($N_{win} = 1$) and view the corresponding BMP files (select BMP).



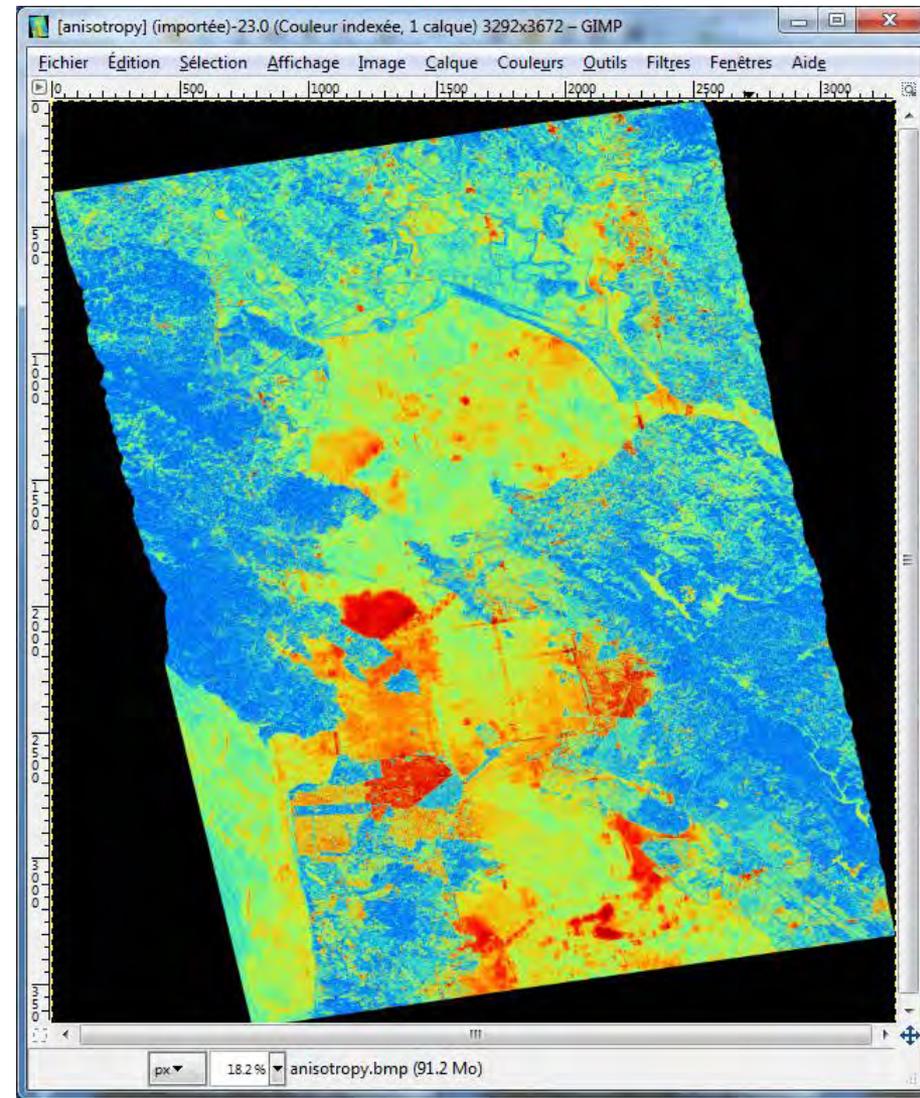
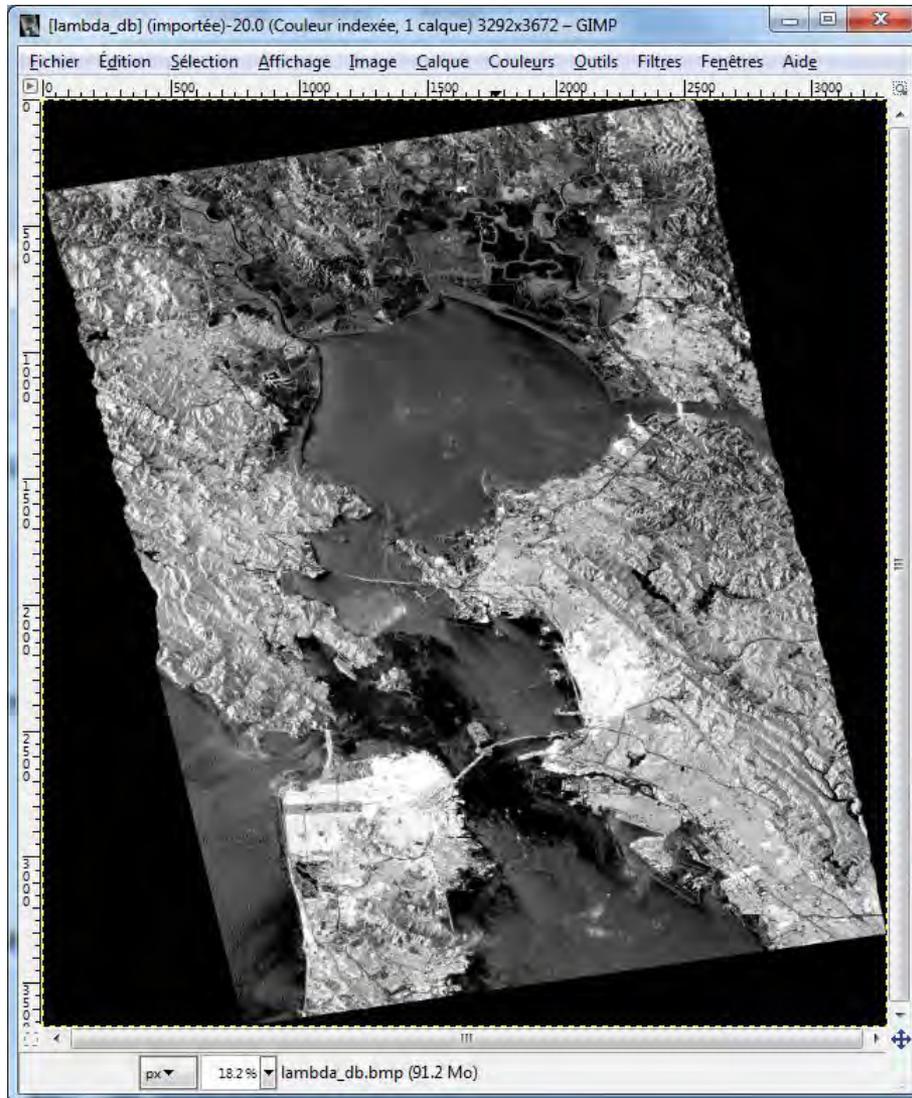
Lambda

Entropy



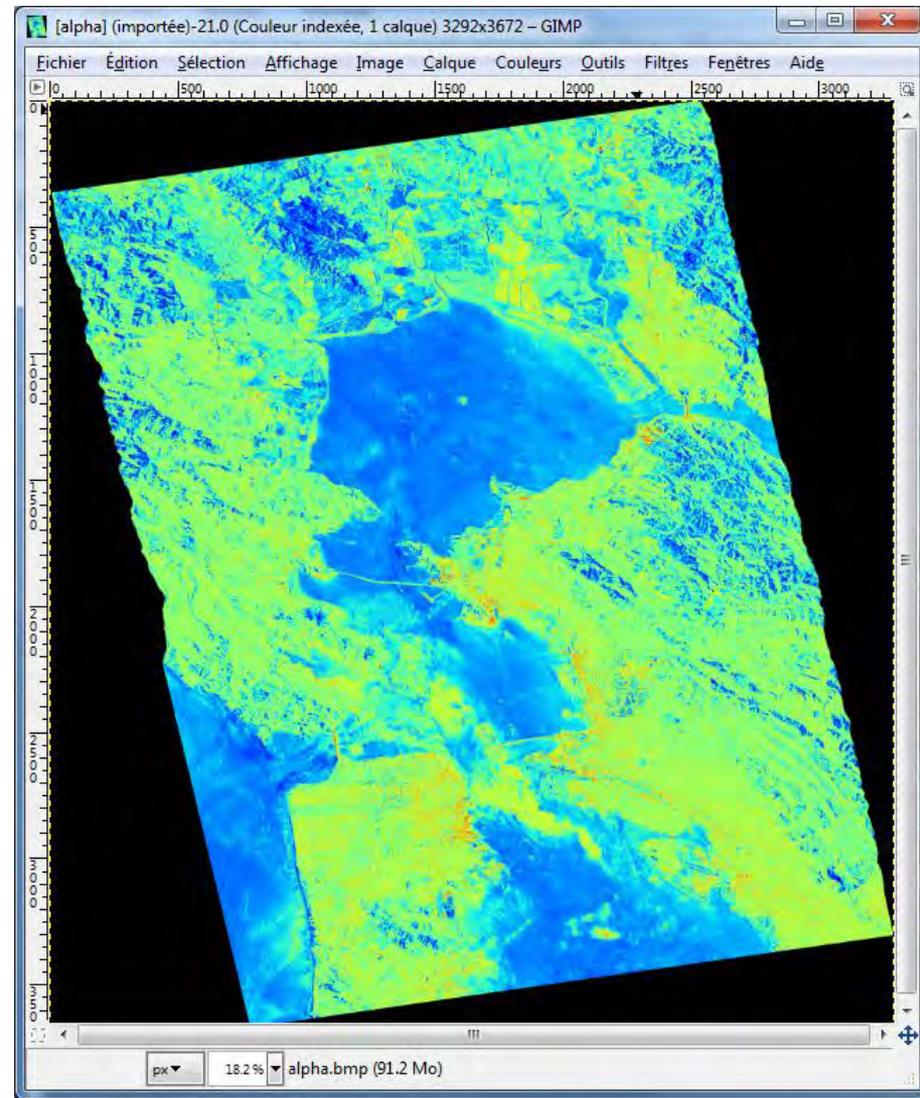
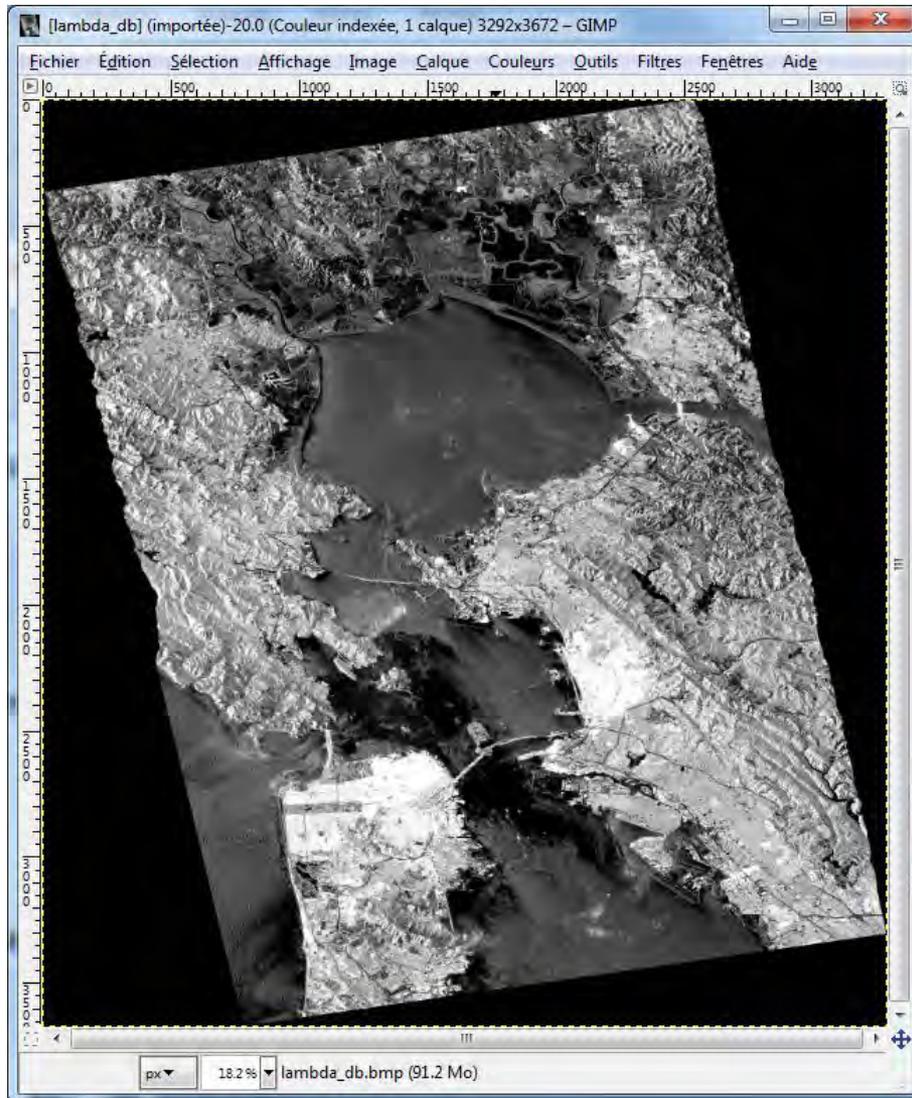
Lambda

Anisotropy



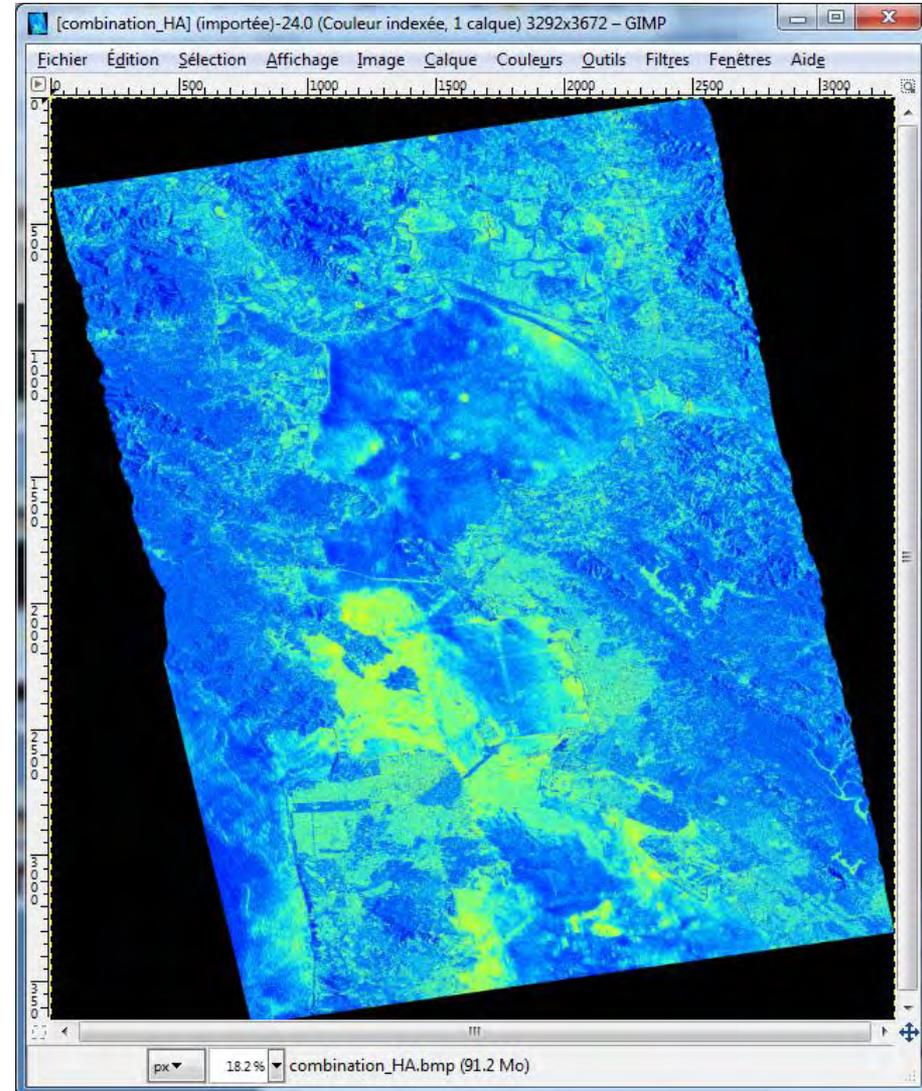
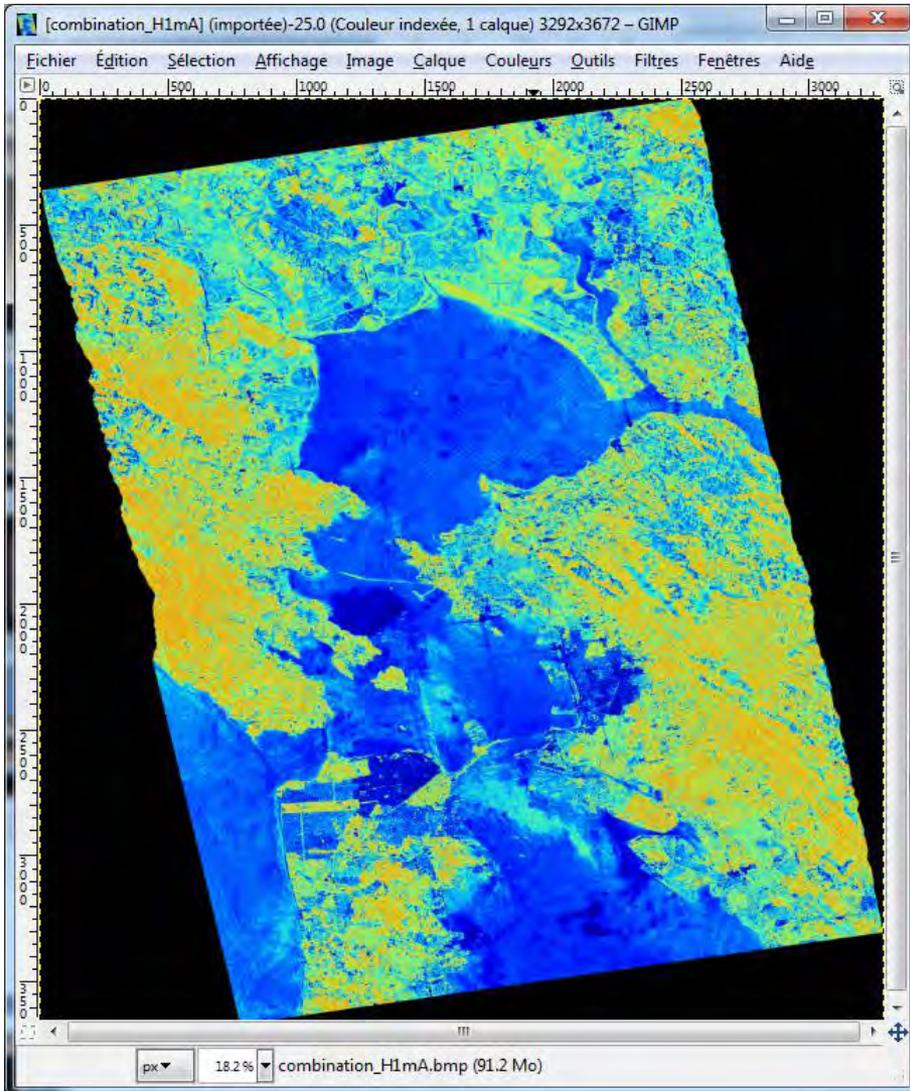
Lambda

Alpha



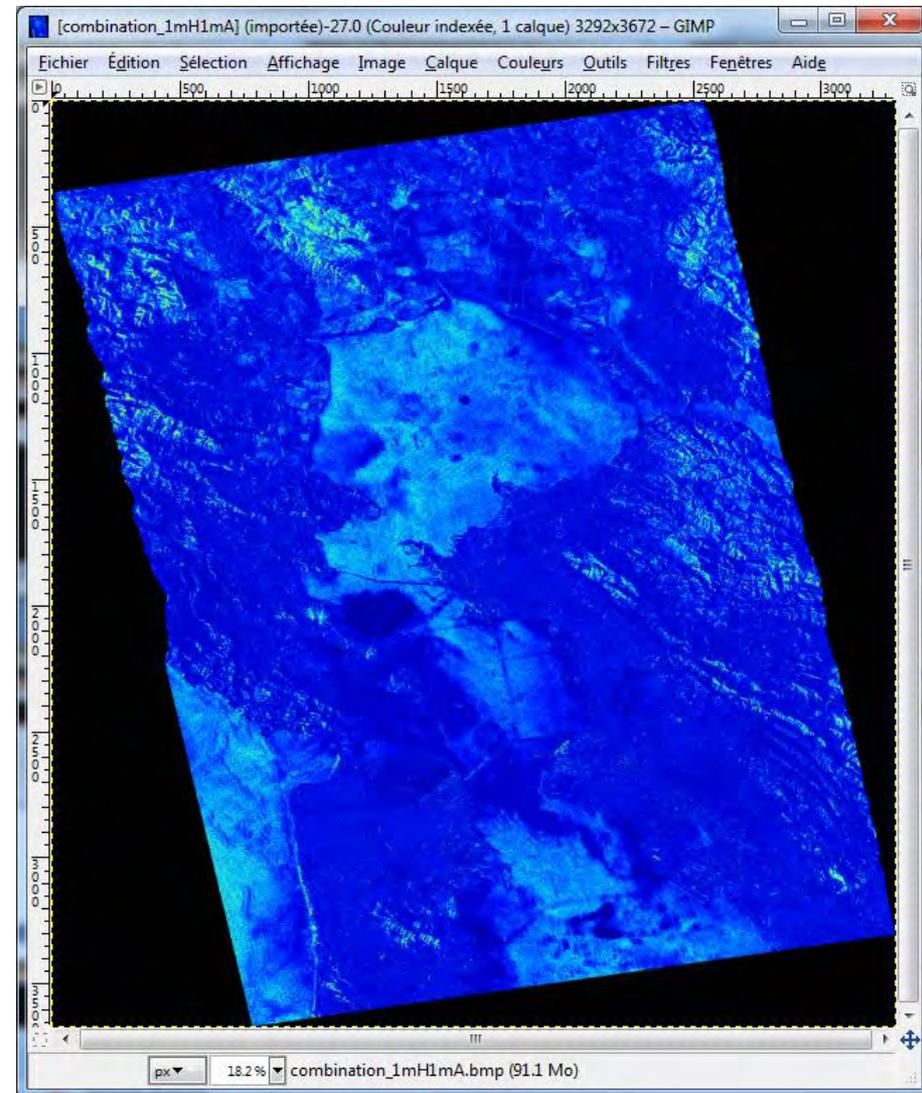
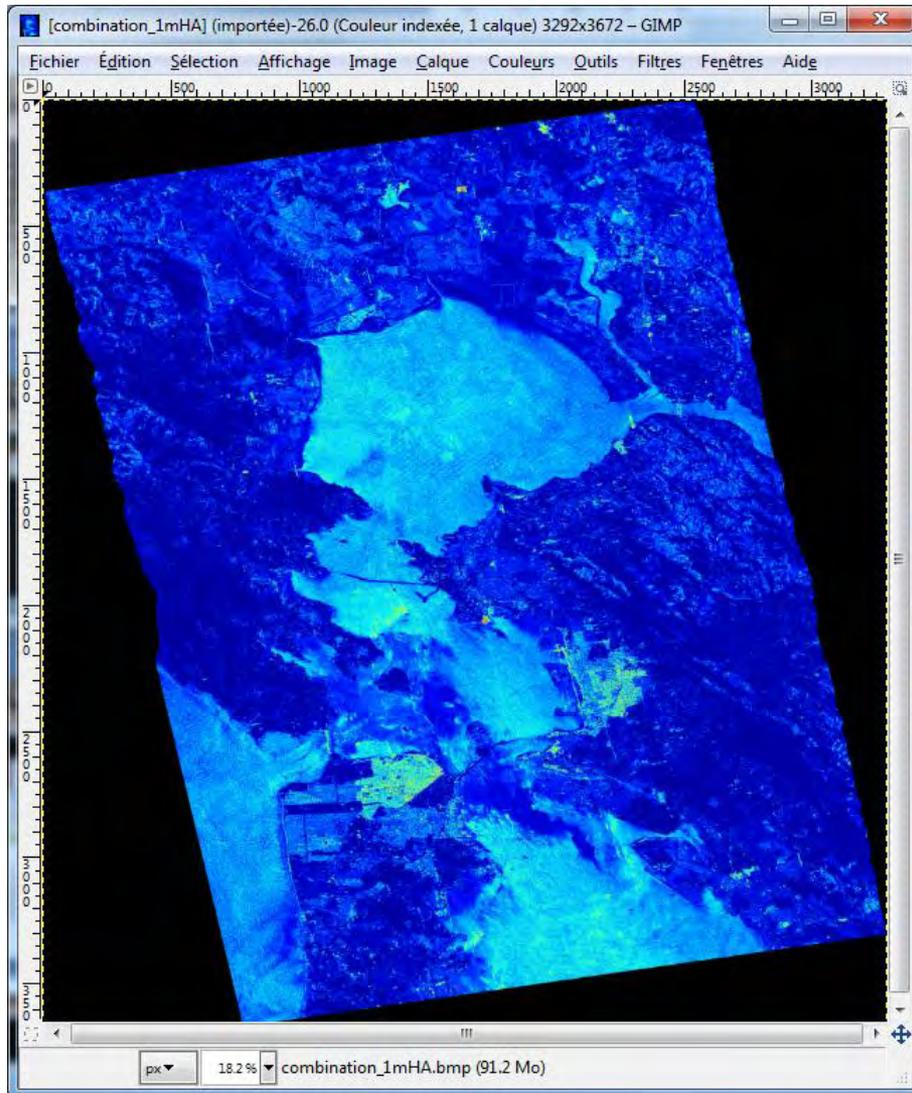
H (1-A)

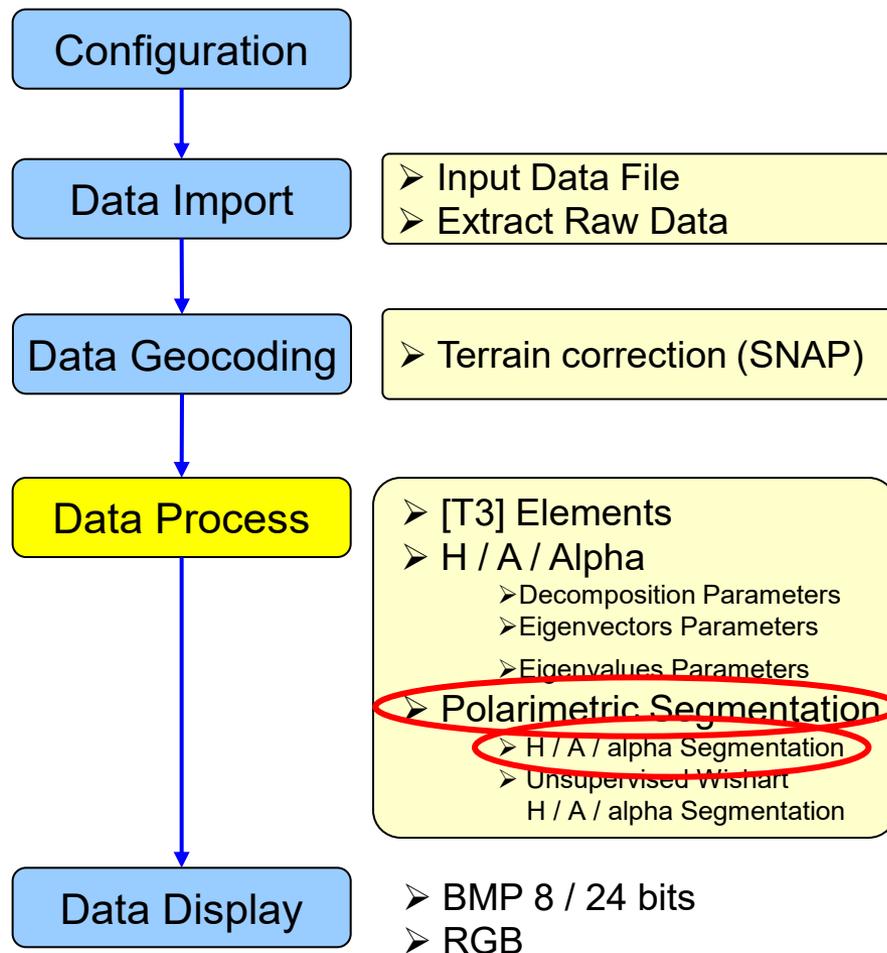
HA



(1-H) A

(1-H) (1-A)





PolSARpro v5.1 - Menu


PolSARpro
 The Polarimetric SAR Data Processing and Educational Tool

T3 | S | Environment | Import | Convert | **Process** | Display | Calibration | Utilities | Tools | Configuration | Education | Help | Quit

Process Sub-menu:

- Linear (+45 / -45)
- Circular (L / R)
- Elliptical (phi, tau)

Process Sub-menu:

- Box Car Filter
- Box Car - Edge Filter
- C. Lopez Filter
- Gaussian Filter
- IDAN Filter
- J.S. Lee Refined Filter
- J.S. Lee Sigma Filter
- P.W.F Filter
- Edge Detector

Process Sub-menu:

- Decomposition Parameters
- Eigenvector Set Parameters
- Eigenvalue Set Parameters

Process Sub-menu:

- JRH : Huynen Decomposition
- RMB1 : Barnes 1 Decomposition
- RMB2 : Barnes 2 Decomposition
- SRC : Cloude Decomposition
- WAH1 : Holm 1 Decomposition
- WAH2 : Holm 2 Decomposition
- HAA : H / A / Alpha Decomposition
- FRE2 : Freeman 2 Components Decomposition
- FRE3 : Freeman 3 Components Decomposition
- VZ3 : Van Zyl 3 Components Decomposition
- YAM3 : Yamaguchi 3 Components Decomposition
- YAM4 : Yamaguchi 4 Components Decomposition
- NEU : Neumann 2 Components Decomposition
- KRO : Krogager Decomposition
- CAM : Cameron Decomposition
- TSVM : Touzi Decomposition

Process Sub-menu:

- Matrix Elements
- Correlation Coefficients
- Elliptical Basis Change
- Polarimetric Speckle Filter
- H / A / Alpha Decomposition
- Polarimetric Decompositions
- Polarimetric Functionalities - 1
- Polarimetric Functionalities - 2
- Polarimetric Segmentation**
- Polarimetric Data Analysis
- Polarimetric Data Clustering
- Batch Process

Polarimetric Segmentation Sub-menu:

- H / A / Alpha Classification
- H / A / Alpha - wishart Classification
- Fuzzy - H / Alpha Classification
- Wishart Supervised Classification
- Rule-Based Hierarchical Classification
- Basic Scattering Mechanism Identification
- SVM Supervised Classification

Polarimetric Segmentation Sub-menu:

- Data Statistics
- Data Histograms
- Data Profiles
- Histogram Based Statistics
- Texture Analysis

Polarimetric Segmentation Sub-menu:

- Clustering Process
- Parameter Averaging
- Data Sets Averaging

Polarimetric Segmentation Sub-menu:

- Faraday Rotation Estimation
- Conformity Coefficient
- Scattering Predominance
- Scattering Diversity
- Degree of Purity
- Depolarisation Index
- Alpha Approximation (Praks & Colin)
- Entropy Approximation (Praks & Colin)
- Scattering Mechanism Entropy (Freeman)
- Scattering Mechanism Entropy (Van Zyl)
- Kozlov Anisotropy
- Lueneburg Anisotropy
- Polarized Point Scatterer Detection
- Reflectivity Ratio
- Differential Reflectivity (ZDR)

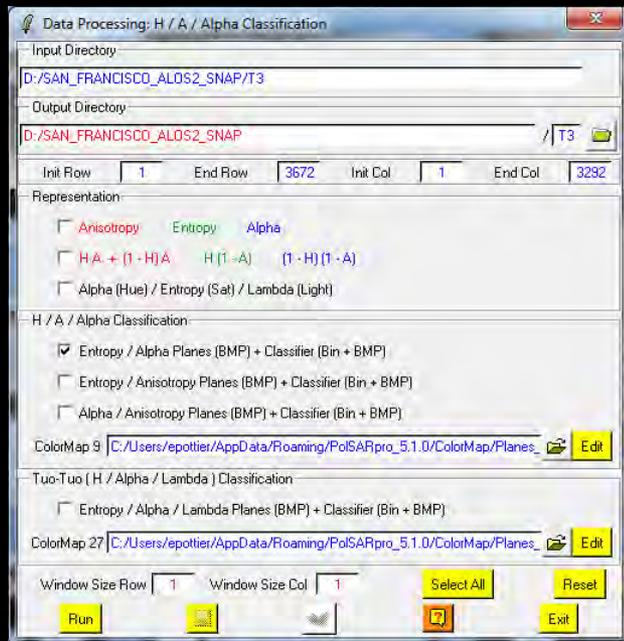
Polarimetric Segmentation Sub-menu:

- Polarisation Synthesis
- Polarimetric Signature
- Stokes Parameters
- Compact Polarimetric Mode
- O.P.C.E
- R.C.S Max
- Surface Inversion
- RVOG PolSAR Inversion
- Sub-Aperture Analysis
- DEM Estimation
- Polarisation Orientation Compensation

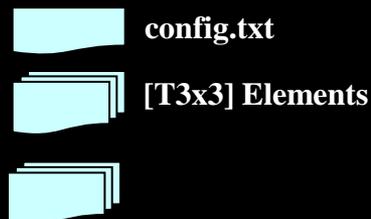
Polarimetric Segmentation Sub-menu:

- Decomposition Applications

Do it Yourself:
 Select some elements, set the parameters (**Nwin = 1**) and view the corresponding BMP files.



DATADIR

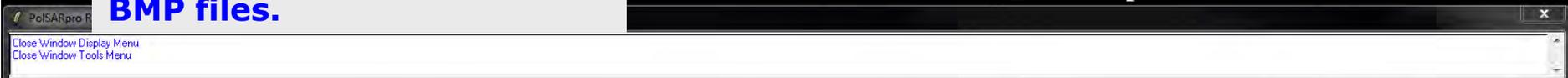


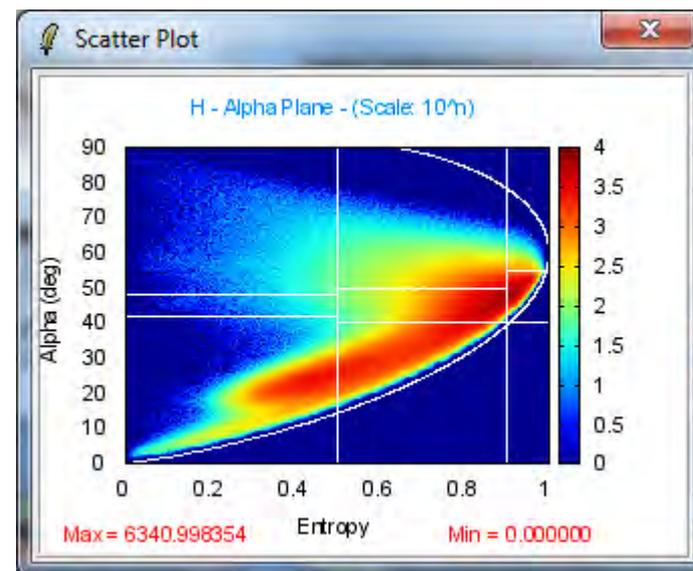
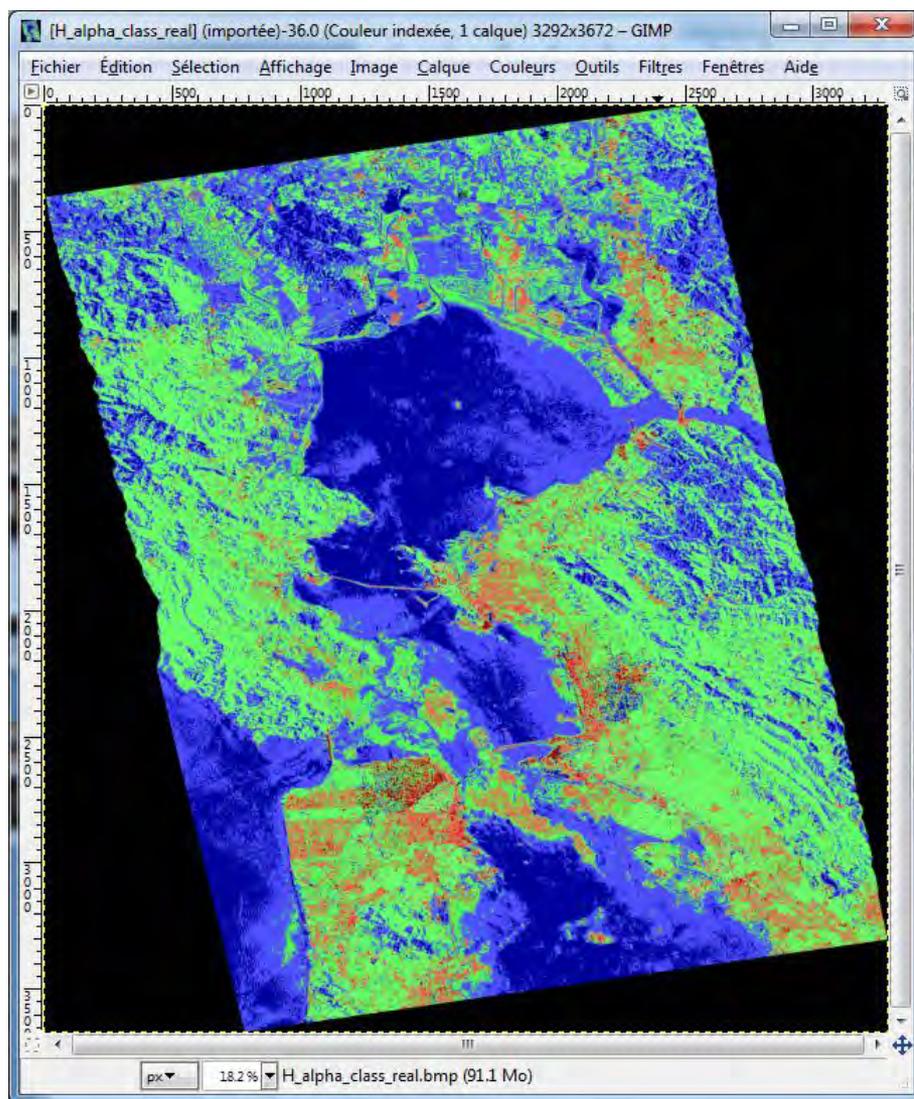
entropy.bin, anisotropy.bin, alpha.bin
 combination_HA.bin, combination_1mHA.bin,
 combination_H1mA.bin, combination_1mH1mA.bin
 H_A_class.bin, H_Alpha_class.bin, A_Alpha_class.bin



entropy.bmp, anisotropy.bmp, alpha.bmp
 combination_HA.bmp, combination_1mHA.bmp,
 combination_H1mA.bmp, combination_1mH1mA.bmp
 H_A_class.bmp, H_Alpha_class.bmp, A_Alpha_class.bmp
 H_A_occurrence.bmp, H_Alpha_occurrence.bmp,
 A_Alpha_occurrence.bmp, H_A_segmented.bmp,
 H_Alpha_segmented.bmp, A_Alpha_segmented.bmp
 HAlphaLambda_RGB.bmp, HAlpha_RGB.bmp
 HAlphaCombinations_RGB.bmp

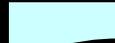
Do it Yourself:
 Select some elements, set the parameters (**Nwin = 1**) and view the corresponding BMP files.







DATDIR

 config.txt

 [T3x3] Elements

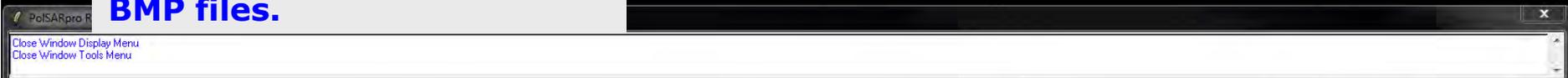


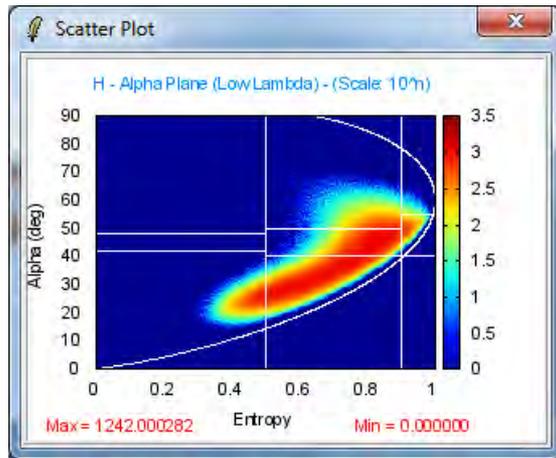
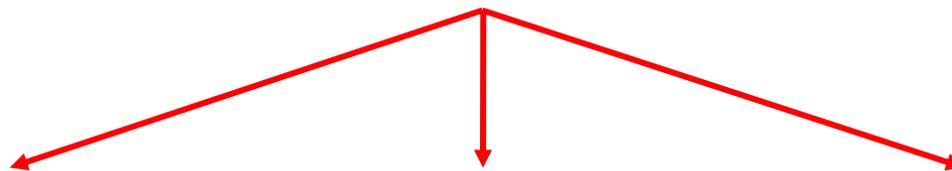
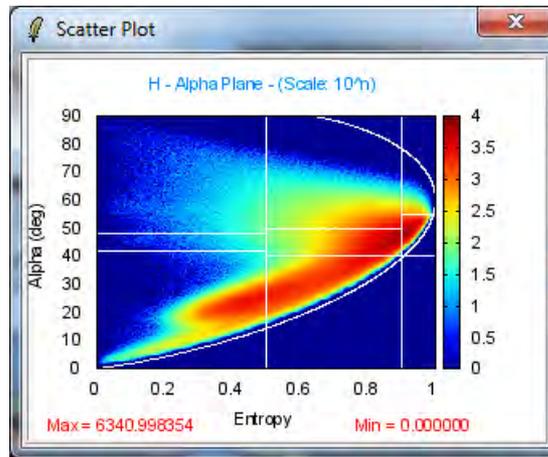
H_alpha_lambda_class1(2,3).bin,
H_alpha_lambda_occurrence_class1(2,3).bin,
H_alpha_lambda_segmented_class1(2,3).bin,
H_alpha_lambda_class.bin,



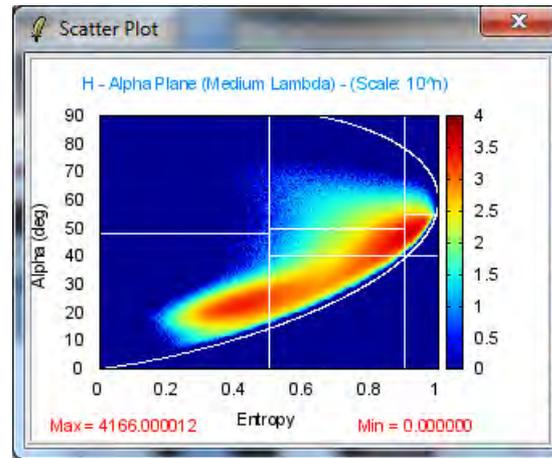
H_alpha_lambda_class1(2,3).bmp,
H_alpha_lambda_occurrence_class1(2,3).bmp,
H_alpha_lambda_segmented_class1(2,3).bmp,
H_alpha_lambda_class.bmp,

Do it Yourself:
Select some elements, set the parameters (Nwin = 1) and view the corresponding BMP files.

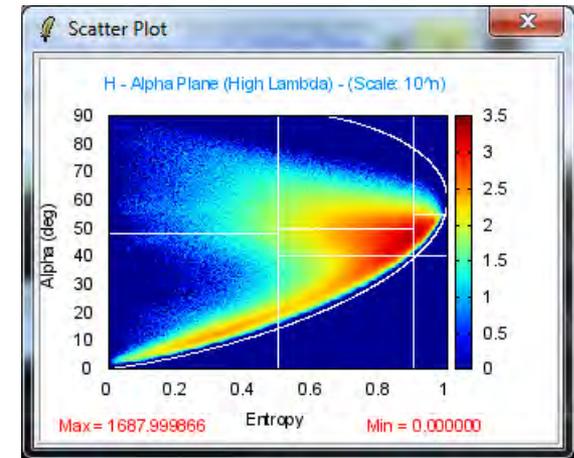




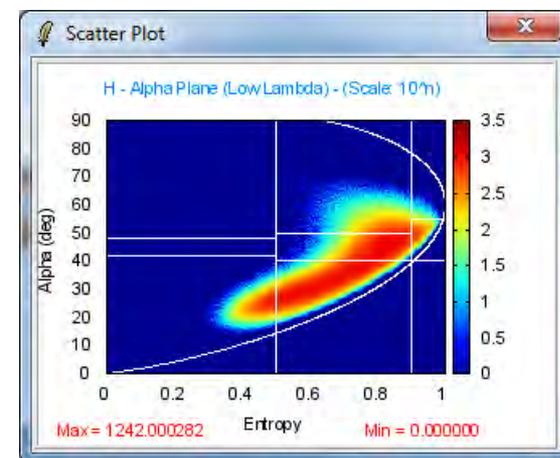
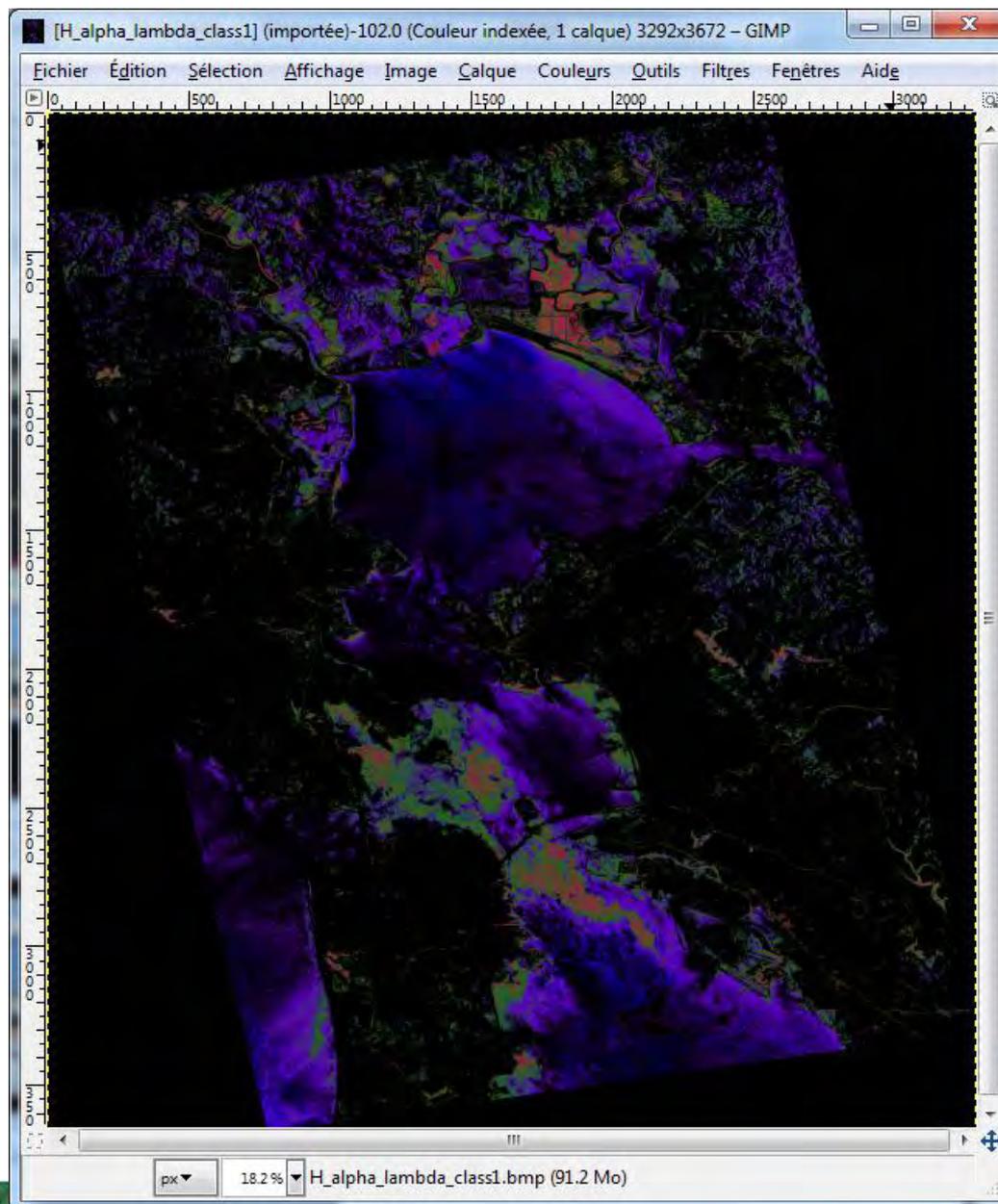
Low λ



Medium λ

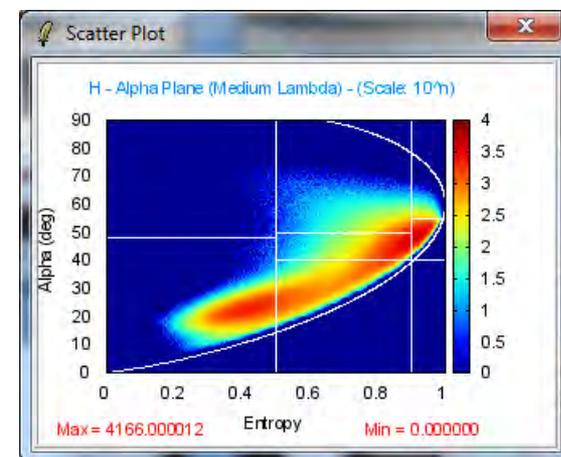
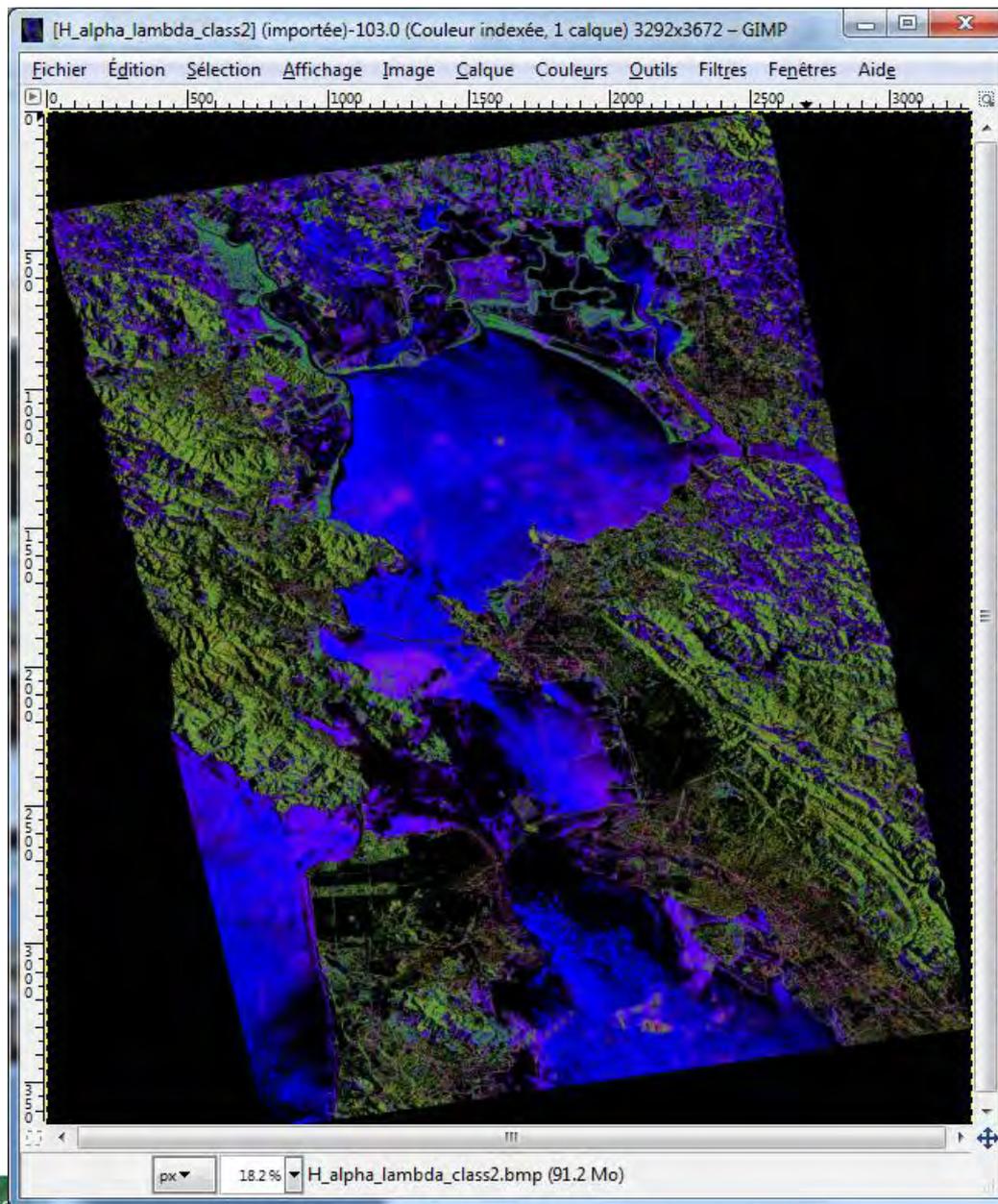


High λ



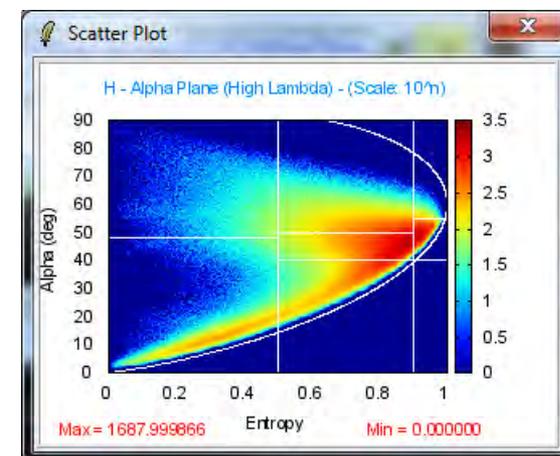
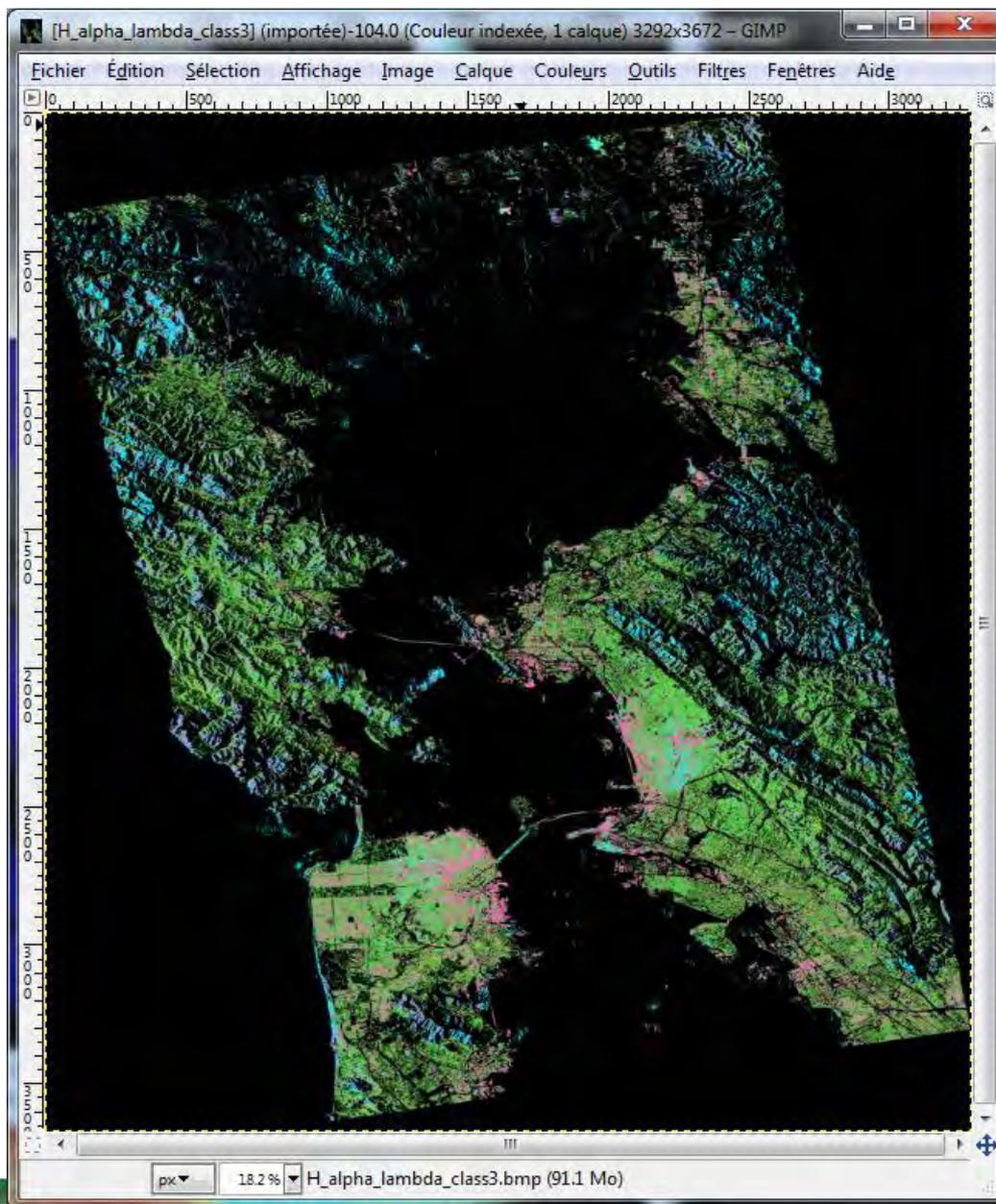
Low λ

H / A / alpha CLASSIFICATION



Medium λ

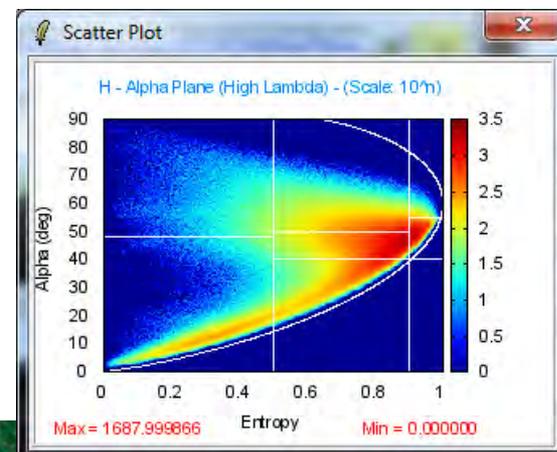
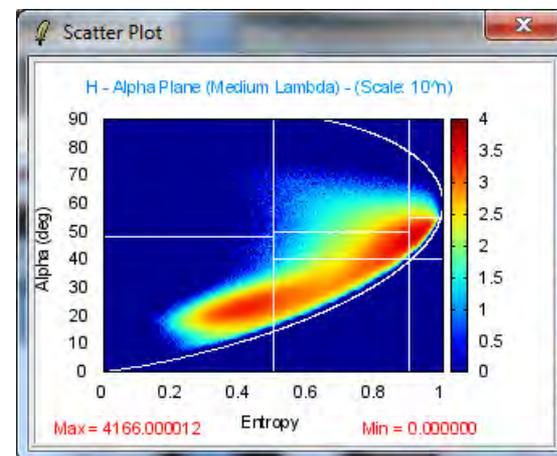
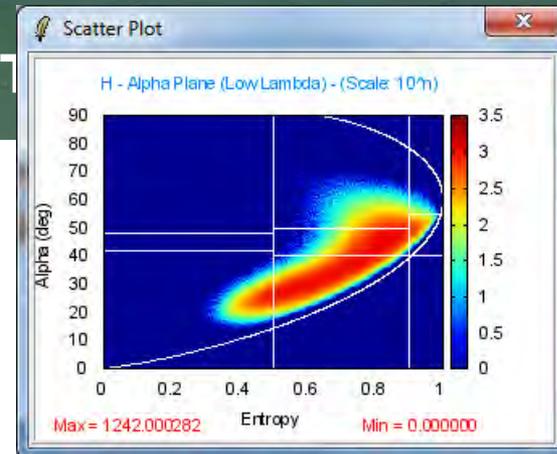
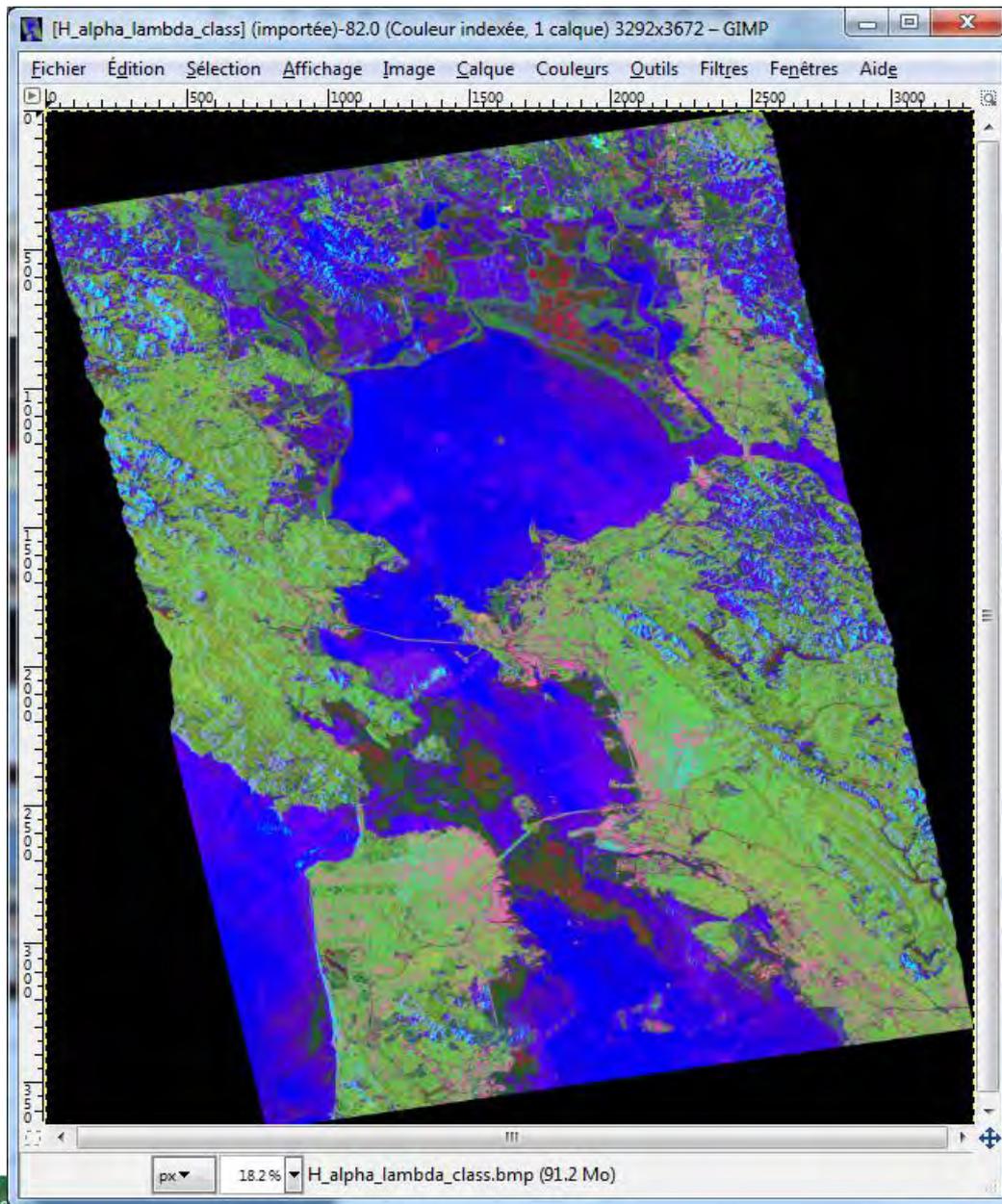
H / A / alpha CLASSIFICATION



High λ

H / A / alpha CLASSIFICATION

a



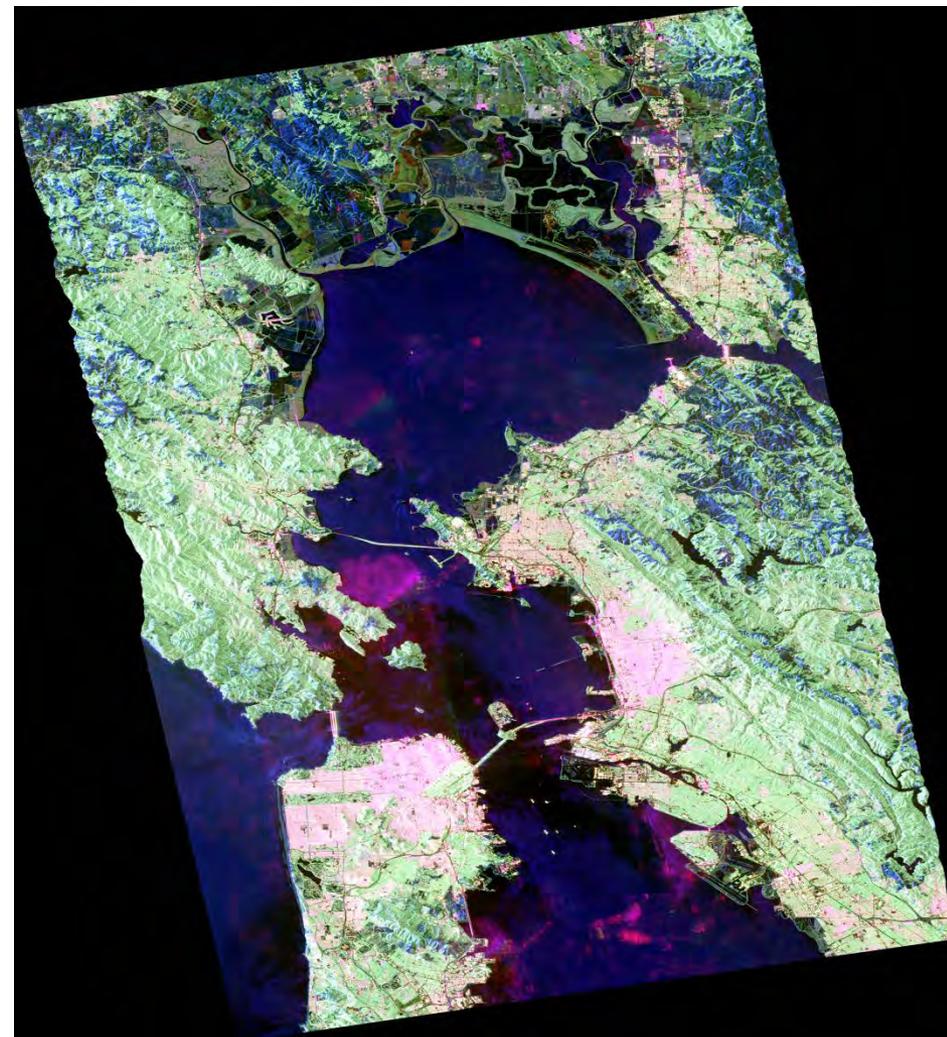
Questions ?



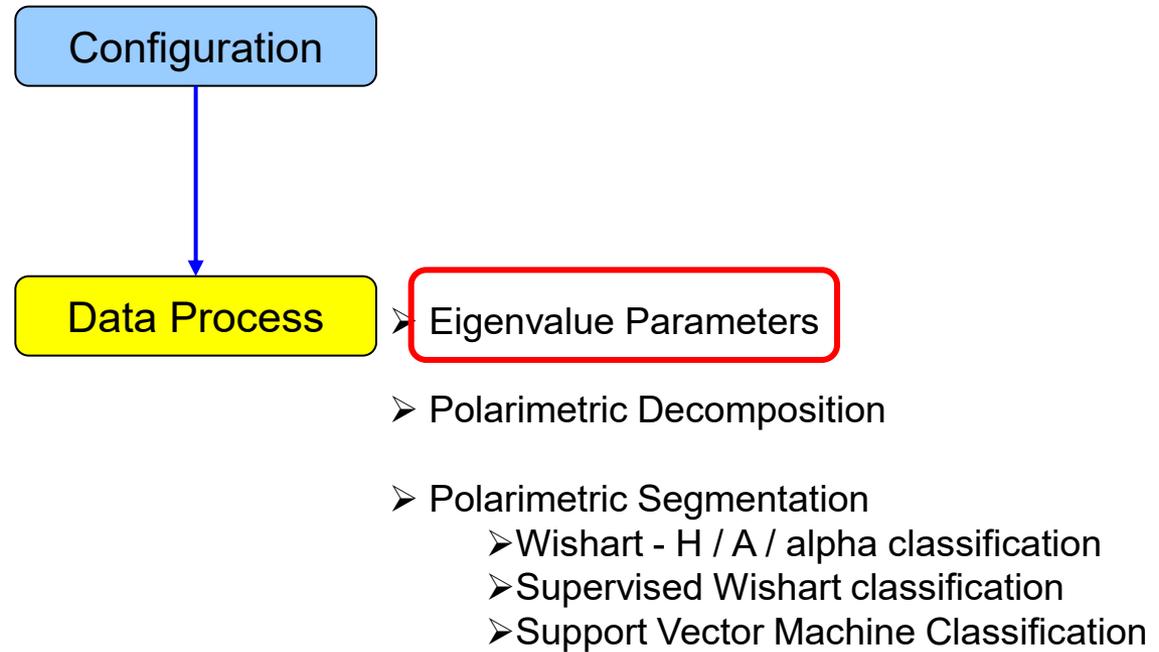
©2004, László J. János, 854008 L.



PolSARpro v5.1 Software Practical advanced session



ALOS : Advanced Land Observing Satellite
PALSAR : Phase Array L-Band SAR



PolSARpro v5.1 - Menu

esa PolSARpro
The Polarimetric SAR Data Processing and Educational Tool

T3 | S | Environment | Import | Convert | **Process** | Display | Calibration | Utilities | Tools | Configuration | Education | Help | Quit

Process menu items:

- Linear (+45 / -45)
- Circular (L / R)
- Elliptical (phi, tau)
- Box Car Filter
- Box Car - Edge Filter
- C. Lopez Filter
- Gaussian Filter
- IDAN Filter
- J.S. Lee Refined Filter
- J.S. Lee Sigma Filter
- P.W.F Filter
- Edge Detector
- Decomposition Parameters
- Eigenvector Set Parameters
- Eigenvalue Set Parameters**
- JRH : Huynen Decomposition
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- KRO : Krogager Decomposition
- CAM : Cameron Decomposition
- TSVM : Touzi Decomposition

Process sub-menu items:

- Matrix Elements
- Correlation Coefficients
- Elliptical Basis Change
- Polarimetric Speckle Filter
- H / A / Alpha Decomposition**
- Polarimetric Decompositions
- Polarimetric Functionalities - 1
- Polarimetric Functionalities - 2
- Polarimetric Segmentation
- Polarimetric Data Analysis
- Polarimetric Data Clustering
- Batch Process

H / A / Alpha Decomposition sub-menu items:

- H / A / Alpha Classification
- H / A / Alpha - Wishart Classification
- Fuzzy - H / Alpha Classification
- Wishart Supervised Classification
- Rule-Based Hierarchical Classification
- Basic Scattering Mechanism Identification
- SVM Supervised Classification

Decomposition Parameters sub-menu items:

- Faraday Rotation Estimation
- Conformity Coefficient
- Scattering Predominance
- Scattering Diversity
- Degree of Purity
- Depolarisation Index
- Alpha Approximation (Praks & Colin)
- Entropy Approximation (Praks & Colin)
- Scattering Mechanism Entropy (Freeman)
- Scattering Mechanism Entropy (Van Zyl)
- Kozlov Anisotropy
- Lueneburg Anisotropy
- Polarized Point Scatterer Detection
- Reflectivity Ratio
- Differential Reflectivity (ZDR)

Decomposition Applications sub-menu items:

- Polarisation Synthesis
- Polarimetric Signature
- Stokes Parameters
- Compact Polarimetric Mode
- O.P.C.E
- R.C.S Max
- Surface Inversion
- RVOG PolSAR Inversion
- Sub-Aperture Analysis
- DEM Estimation
- Polarisation Orientation Compensation

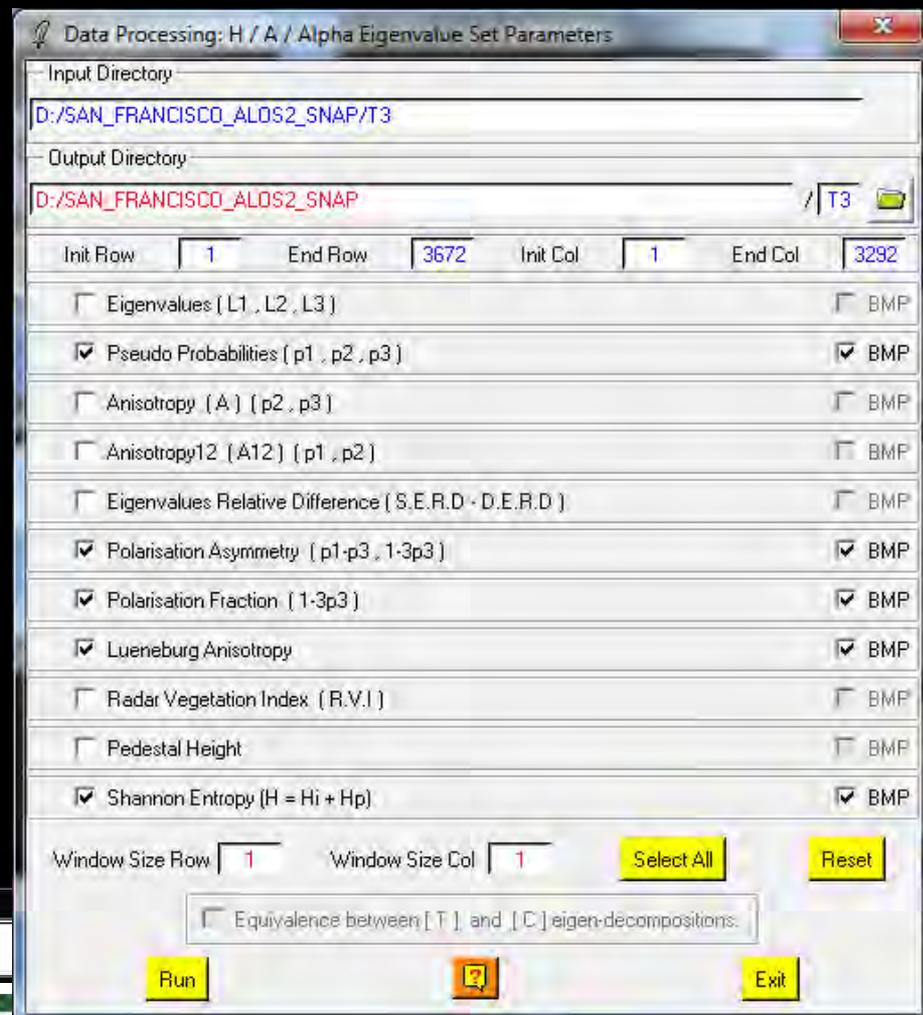
Other sub-menu items:

- Data Statistics
- Data Histograms
- Data Profiles
- Histogram Based Statistics
- Texture Analysis
- Clustering Process
- Parameter Averaging
- Data Sets Averaging



Do it Yourself:
Select some elements, set the parameters and view the corresponding BMP files (select BMP).

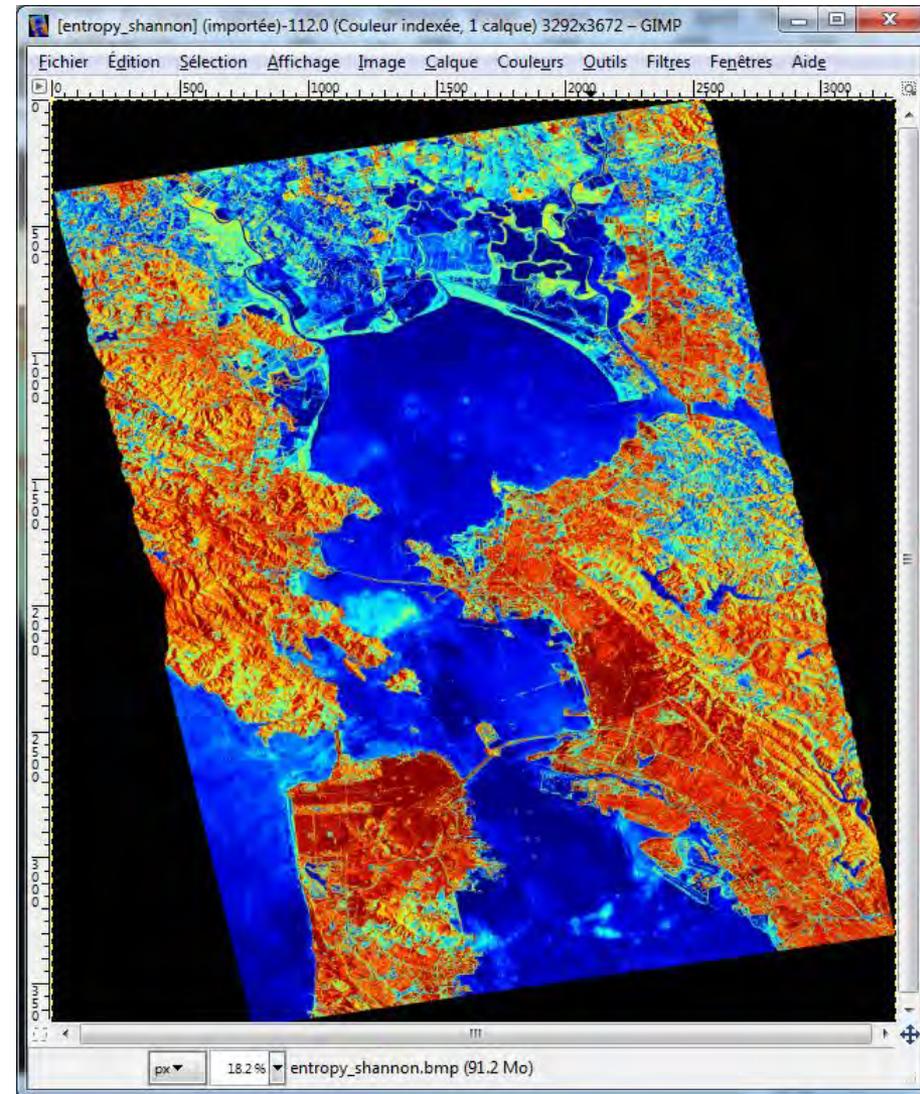
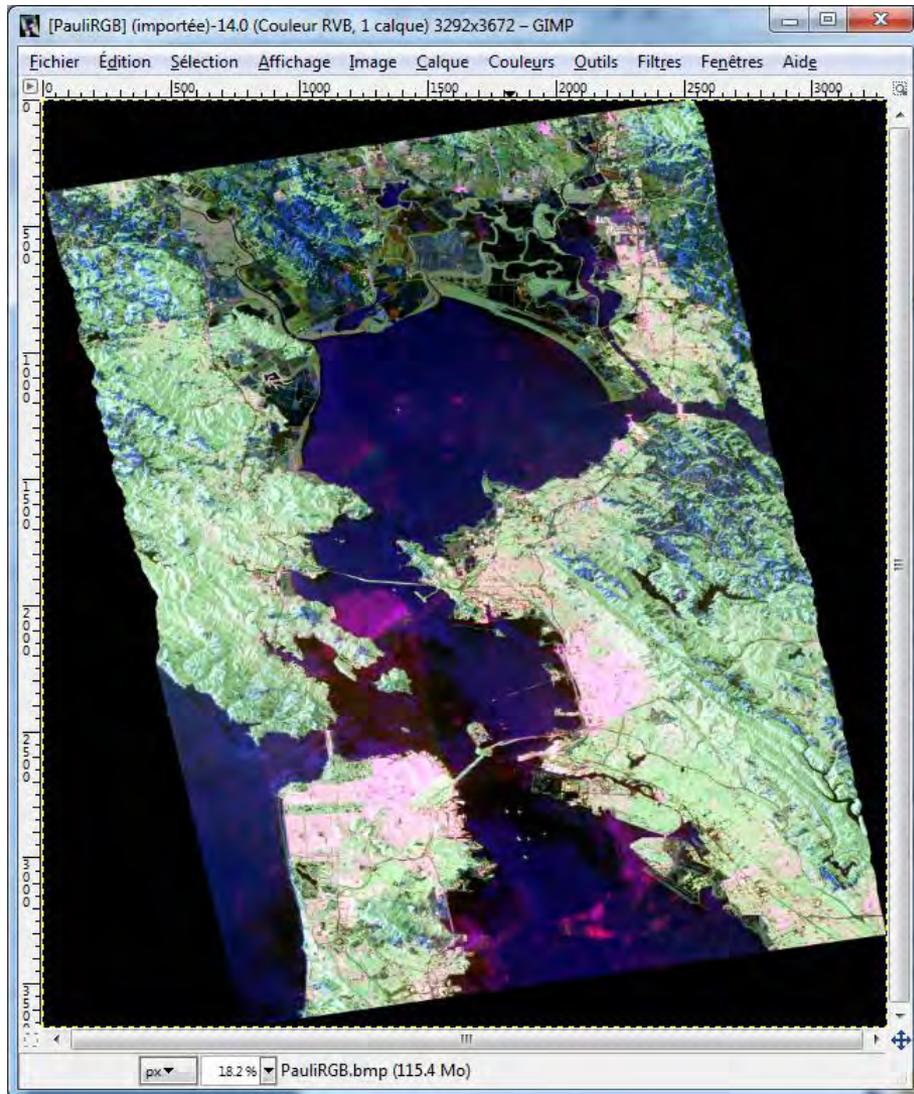
Window Size = 1



PolSARpro Run Trace

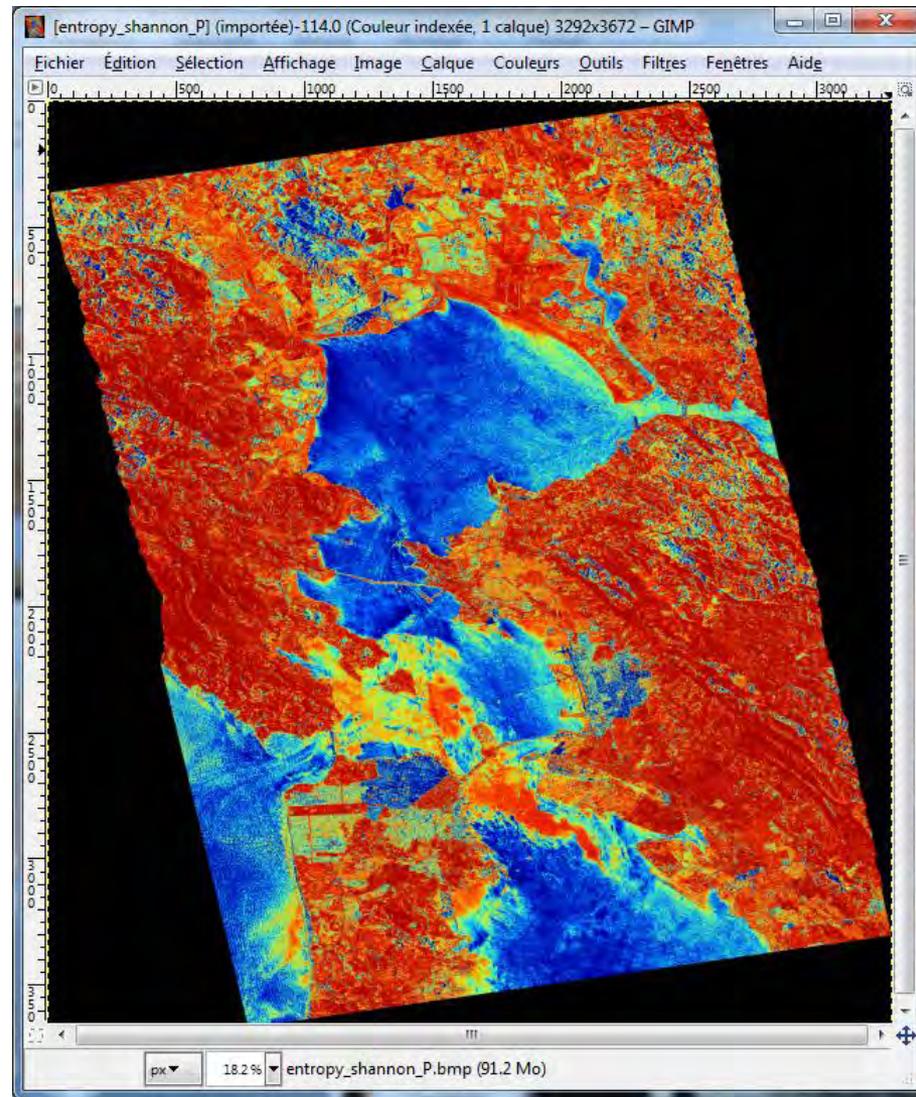
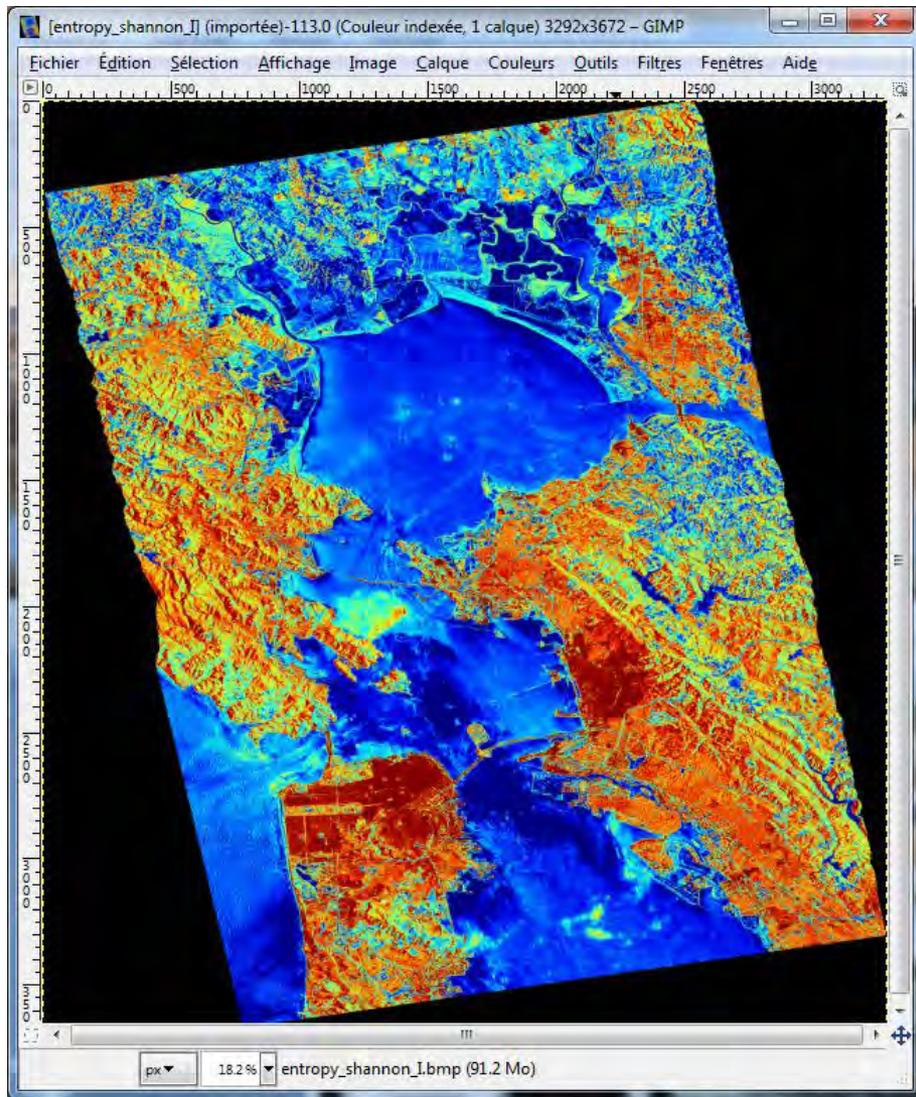
Close Window Display Menu
Close Window Tools Menu

Entropy Shannon

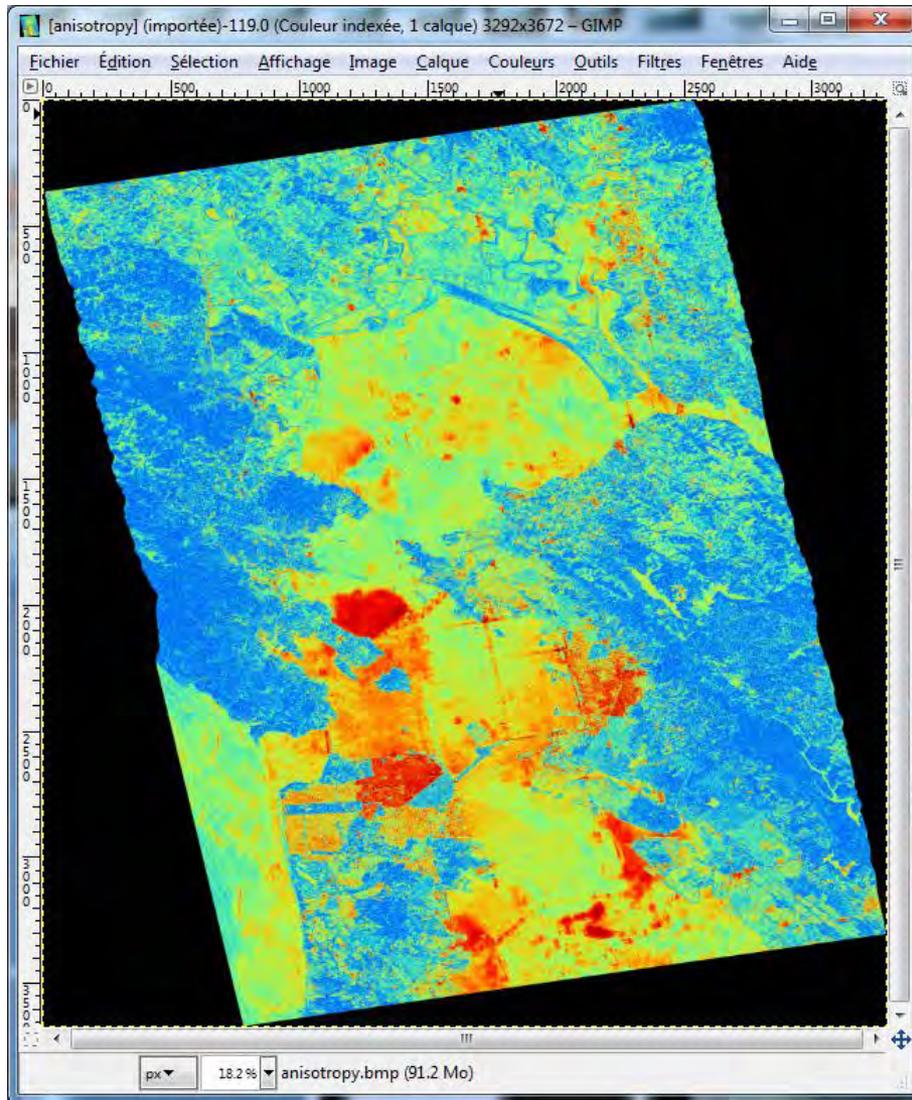


Entropy I

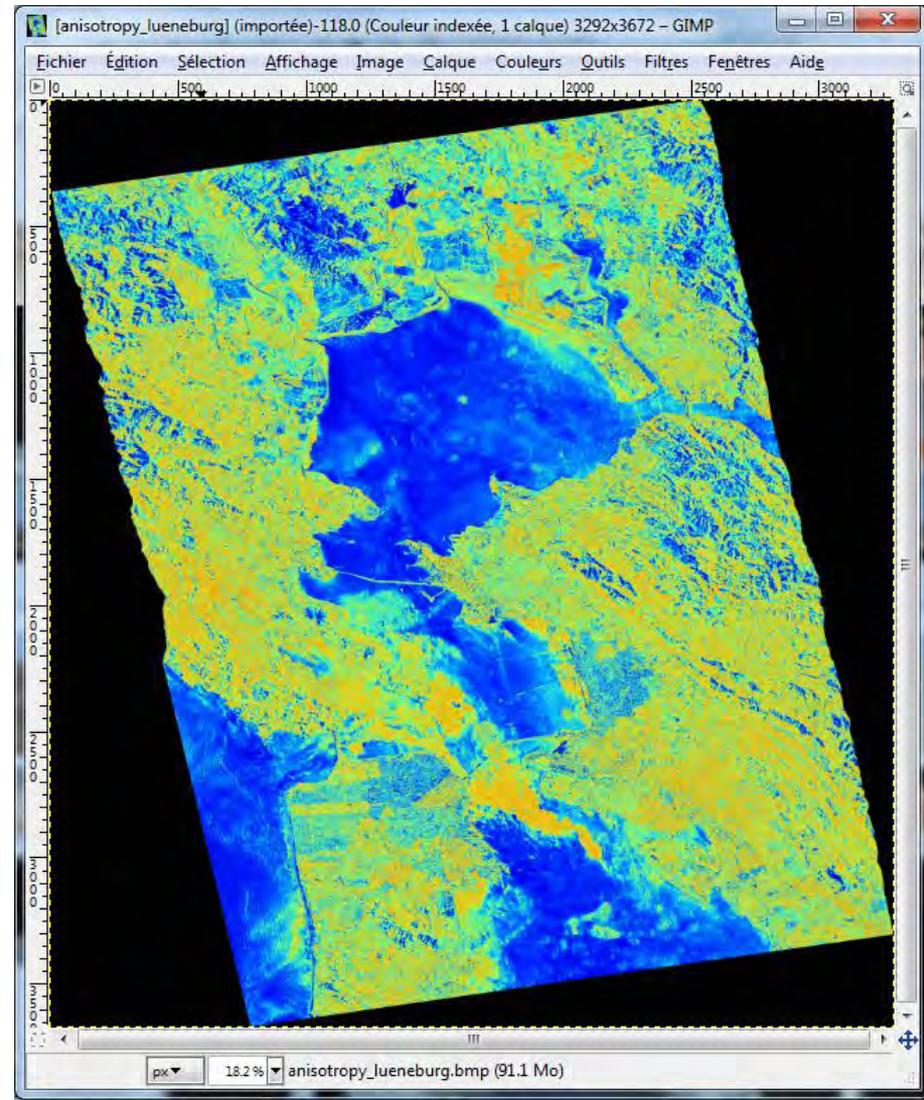
Entropy P

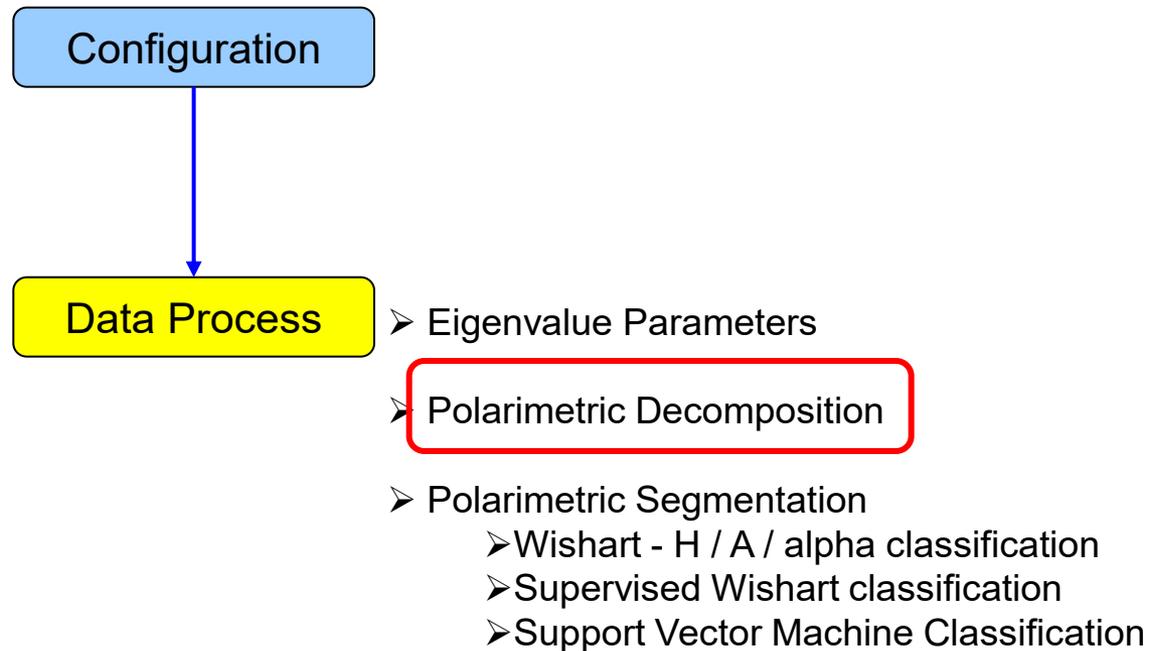


Anisotropy



Lueneburg Anisotropy





PolSARpro v5.1 - Menu

esa PolSARpro
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Conformity Coefficient
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Scattering Diversity
Degree of Purity
Depolarisation Index
Alpha Approximation
Entropy Approximation
Scattering Mechanism
Scattering Mechanism

Kozlov Anisotropy
Lueneburg Anisotropy
Polarized Point Scatterer Detection
Reflectivity Ratio
Differential Reflectivity (ZDR)

DEM Estimation
Polarisation Orientation Compensation

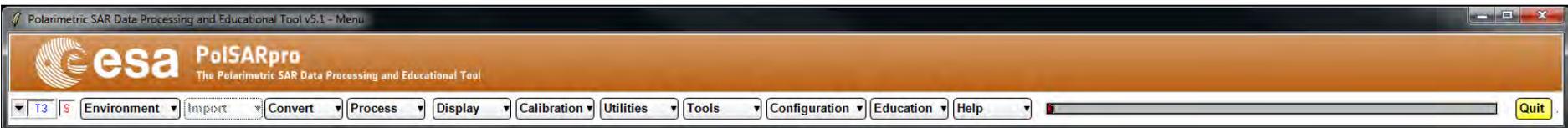
Clustering Process
Parameter Averaging
Data Sets Averaging

Decomposition Applications

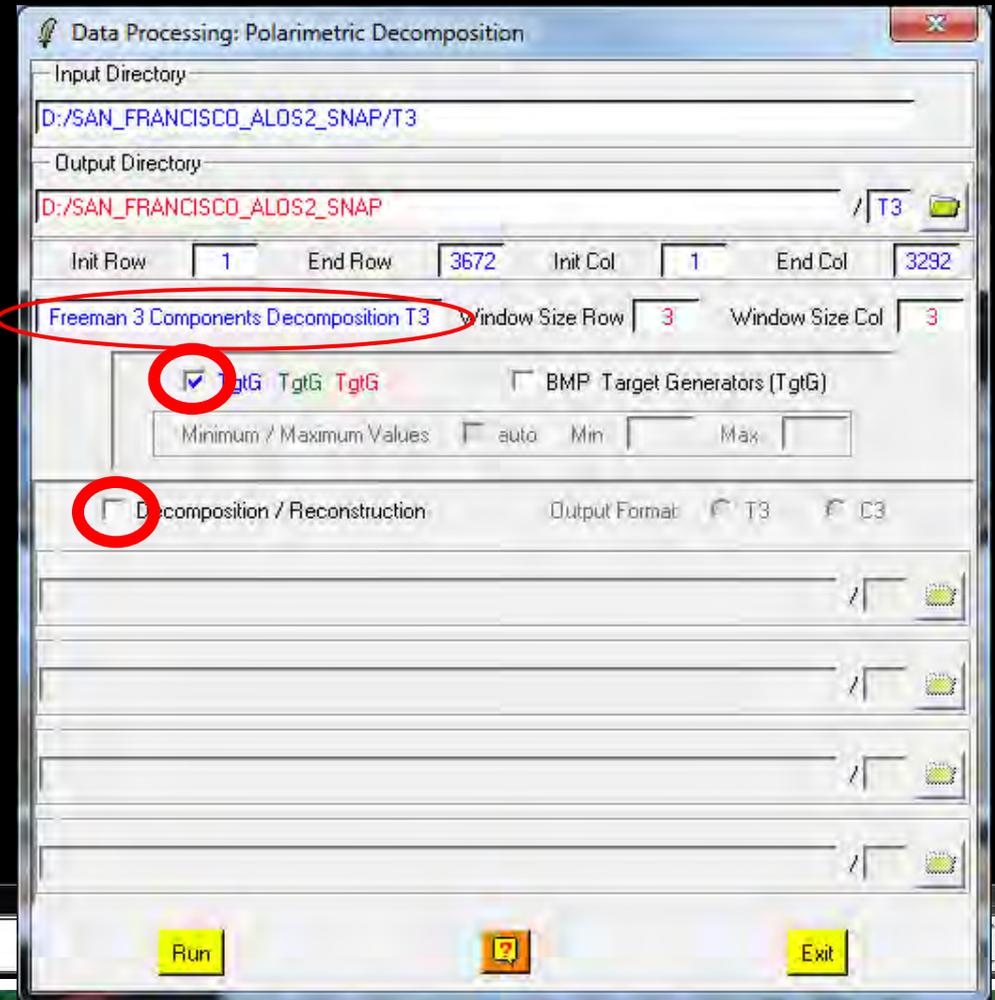
KRO : Krogager Decomposition
CAM : Cameron Decomposition
HAA : H / A / Alpha Decomposition
JRH : Huynen Decomposition
RMB1 : Barnes 1 Decomposition
RMB2 : Barnes 2 Decomposition
SRC : Cloude Decomposition
UHDx : Unified Huynen Decomposition
WAH1 : Holm 1 Decomposition
WAH2 : Holm 2 Decomposition
AN3 : An & Yang 3 Component Decomposition
AN4 : An & Yang 4 Component Decomposition
BF4 : Bhattacharya & Frey 4 Component Decomposition
FRE2 : Freeman 2 Component Decomposition
FRE3 : Freeman 3 Component Decomposition
NEU : Neumann 2 Component Decomposition
NNED : Arie 3 Component NNED Decomposition
ANNED : Arie 3 Component ANNED Decomposition
VZ3 : Van Zyl (1992) 3 Component Decomposition
SIN4 : Singh 4 Component Decomposition
YAM3 : Yamaguchi 3 Component Decomposition
YAM4 : Yamaguchi 4 Component Decomposition
MCSM5 : L. Zhang 5 Component Decomposition
TSVM : Touzi Decomposition
Aghababaei Decomposition
2KR : Raney Decomposition
CPD : Compact-Pol Decomposition

PolSARpro Run Trace

Close Window Display Menu
Close Window Tools Menu

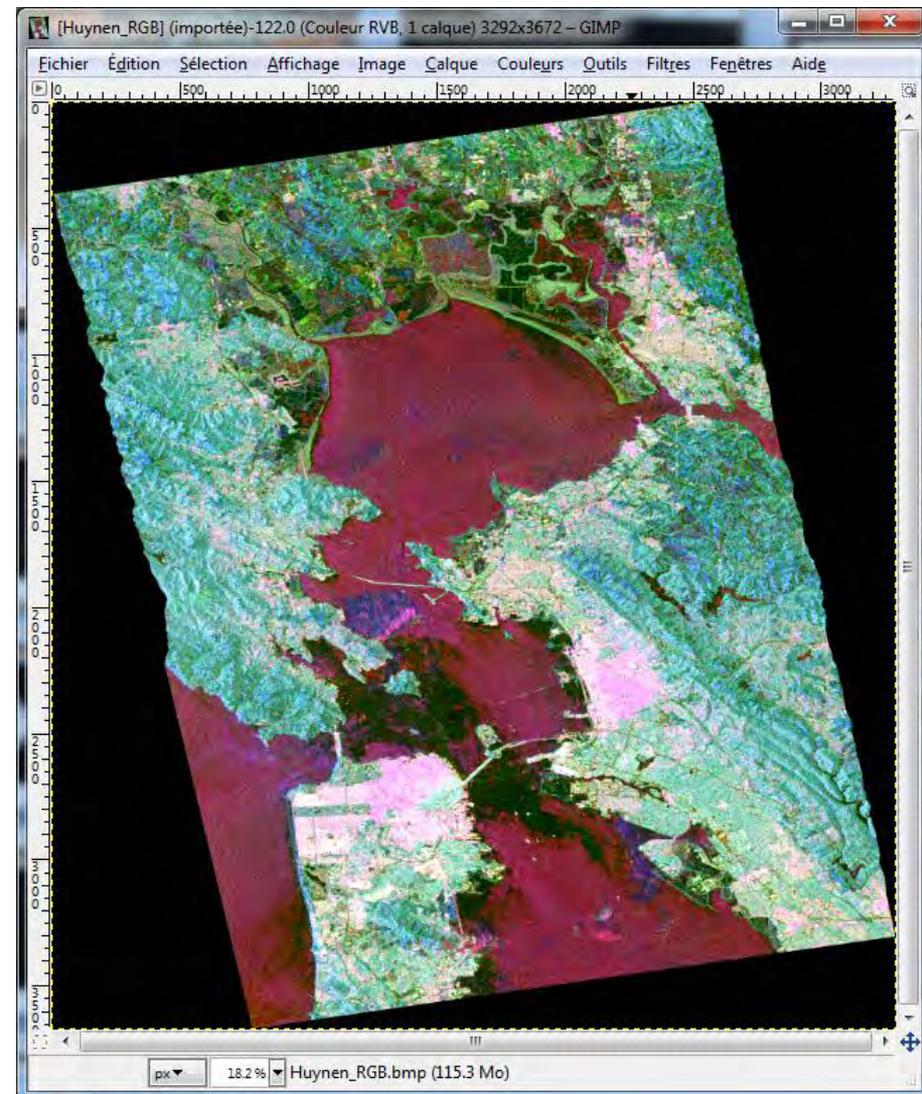
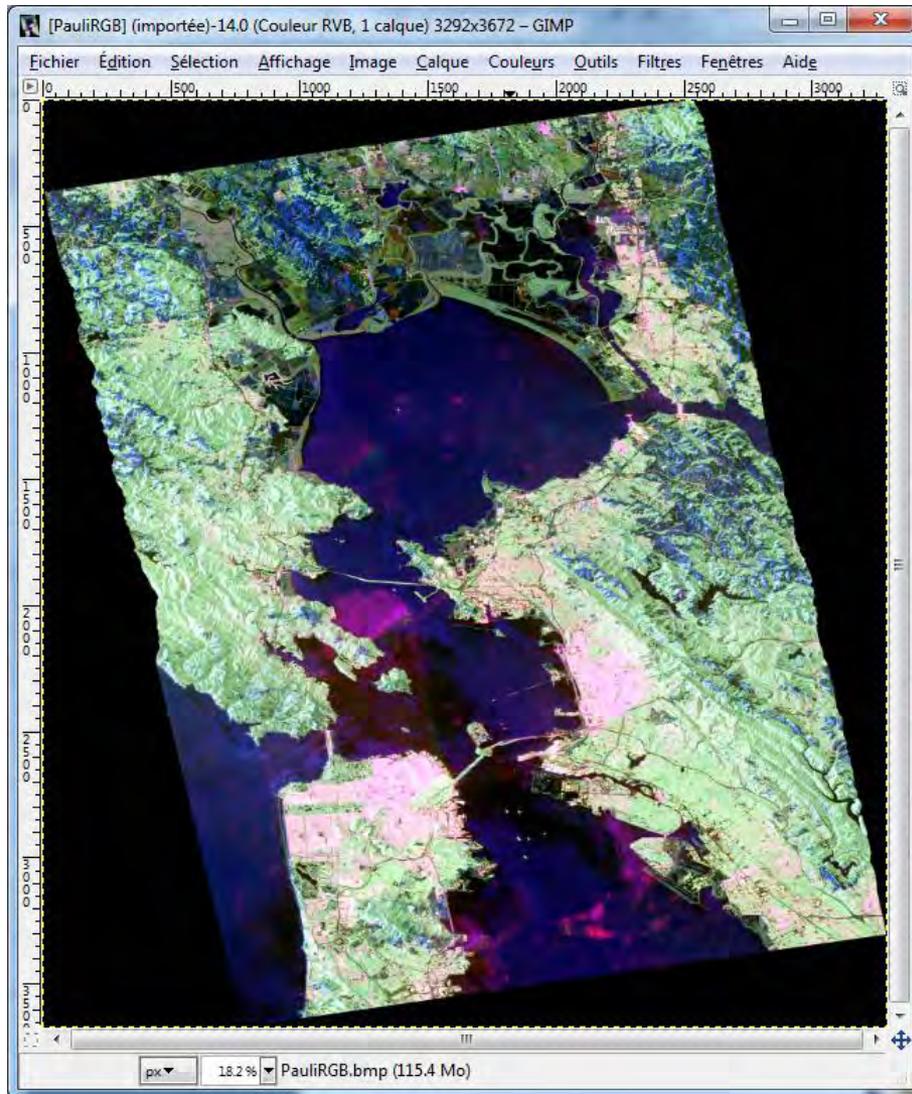


Do it Yourself:
 Select some elements, set the parameters and view the corresponding BMP files (select BMP).
Window Size = 1

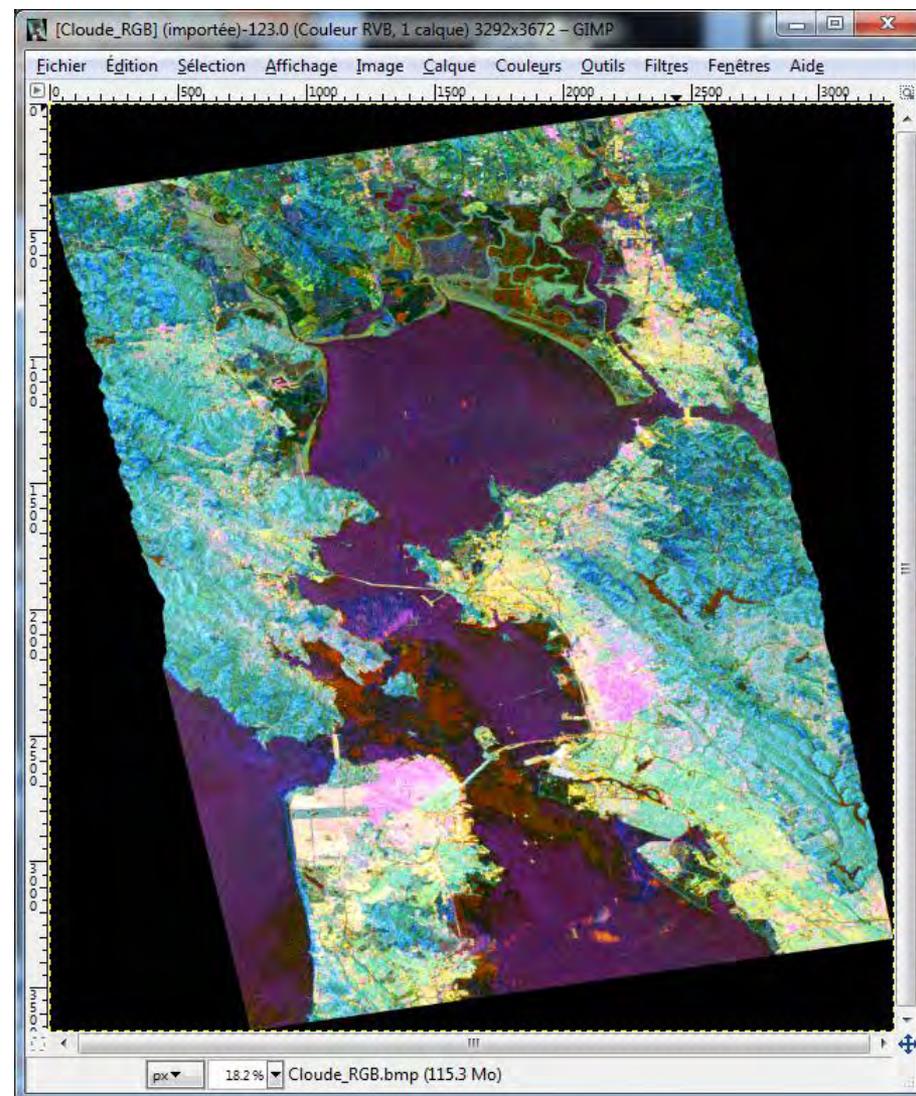
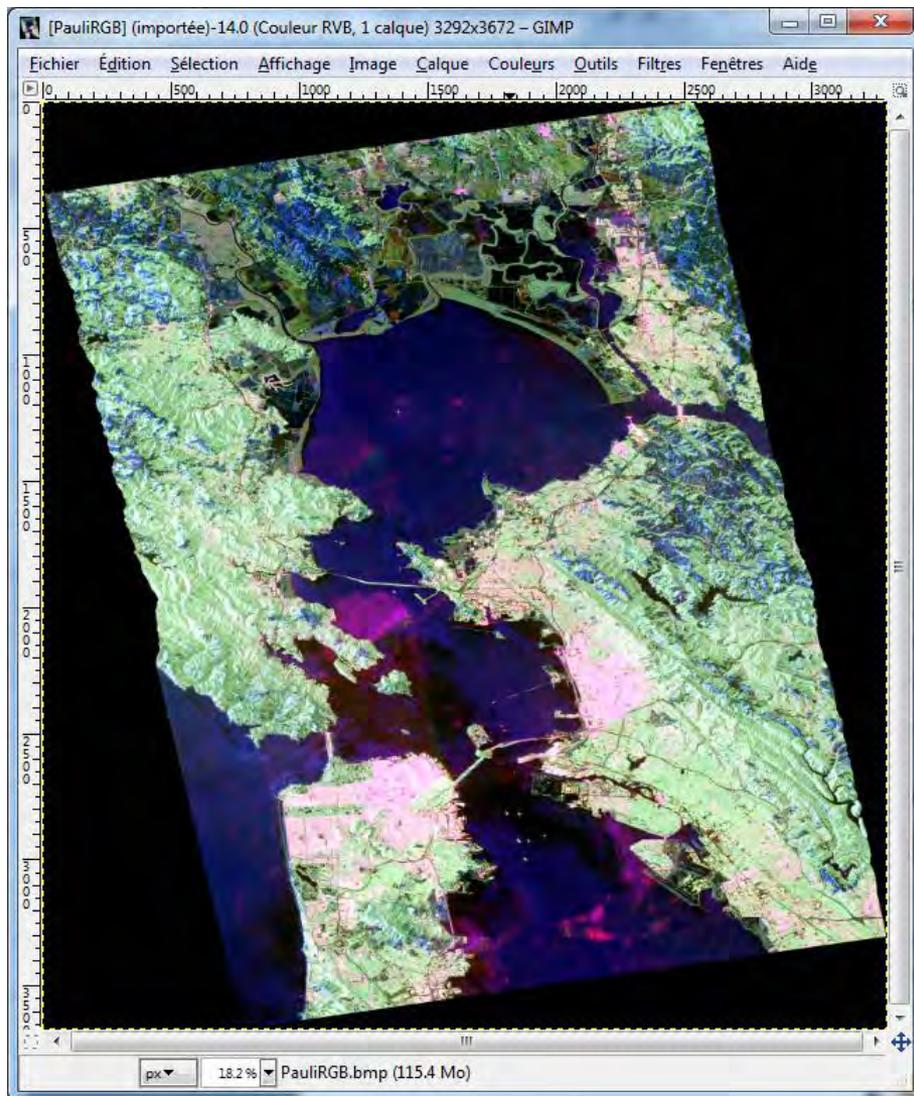


PolSARpro Run Trace
 Close Window Display Menu
 Close Window Tools Menu

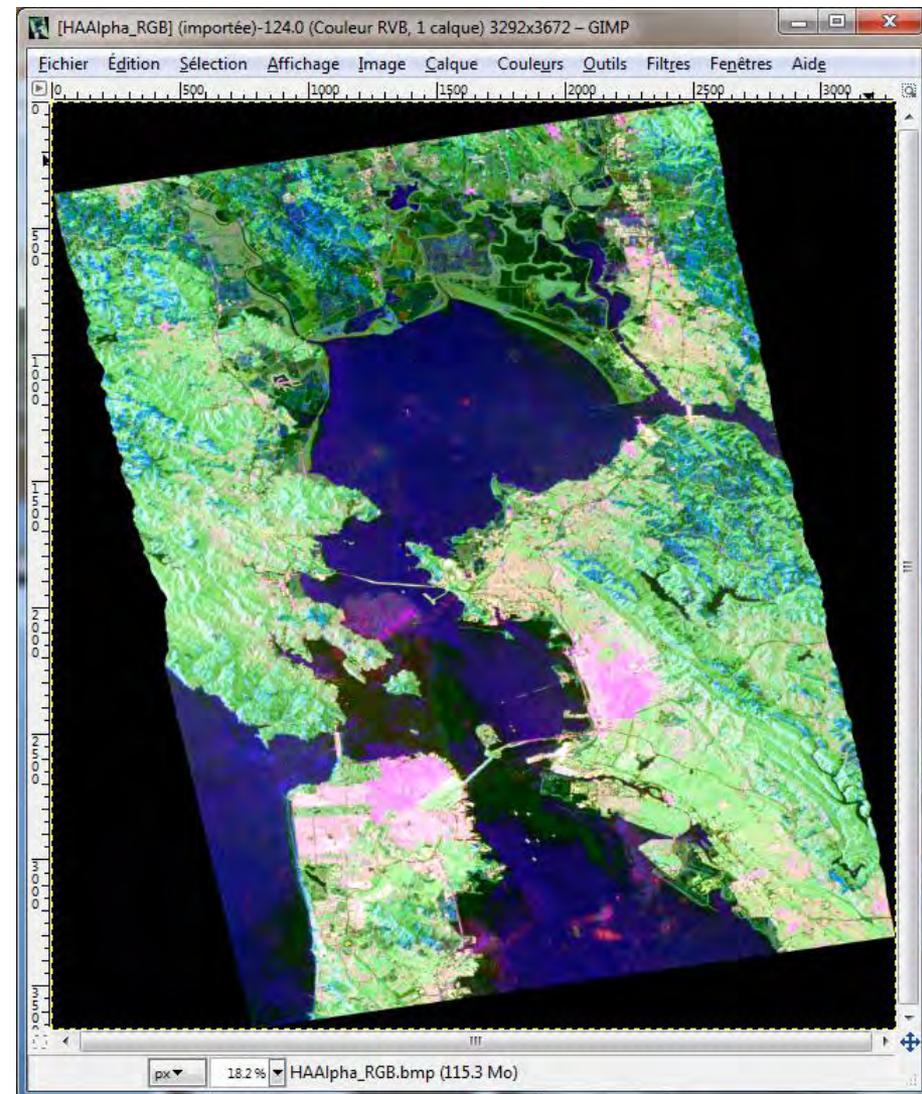
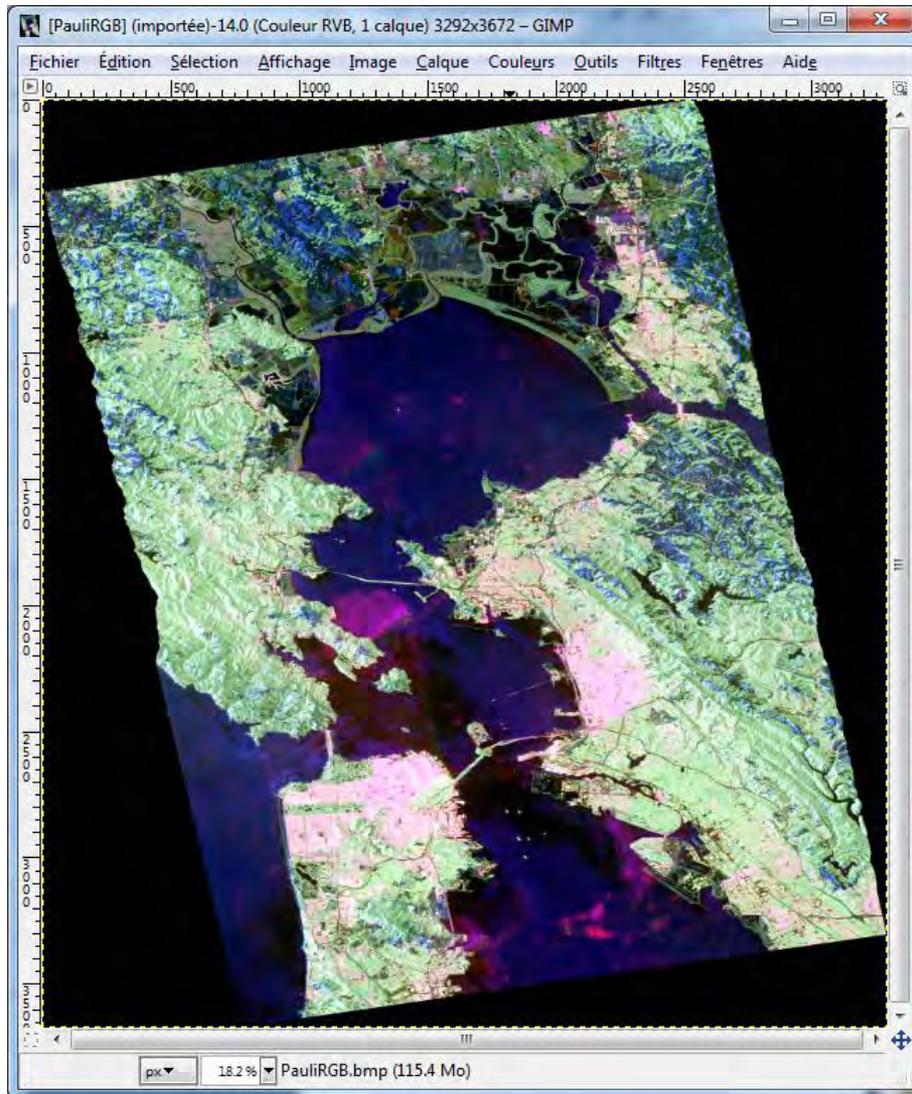
Pauli Huynen



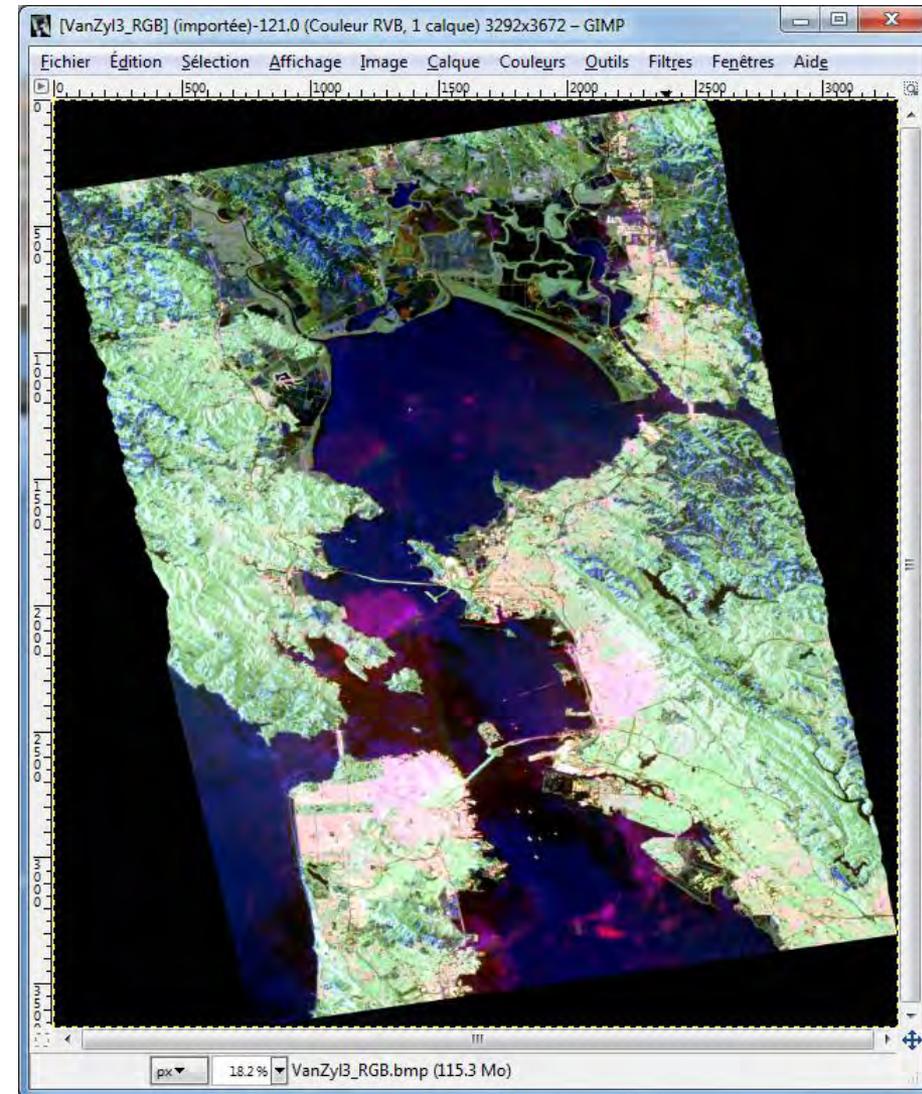
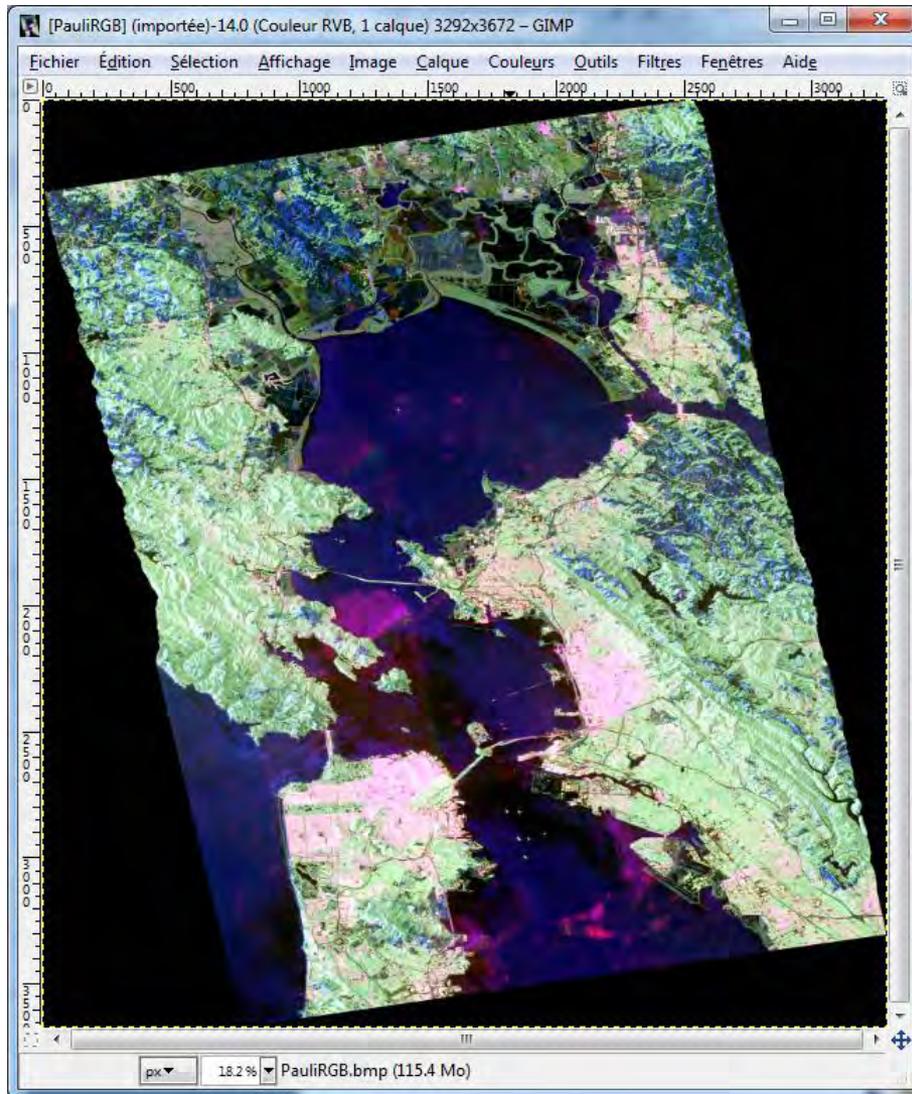
Pauli Cloude



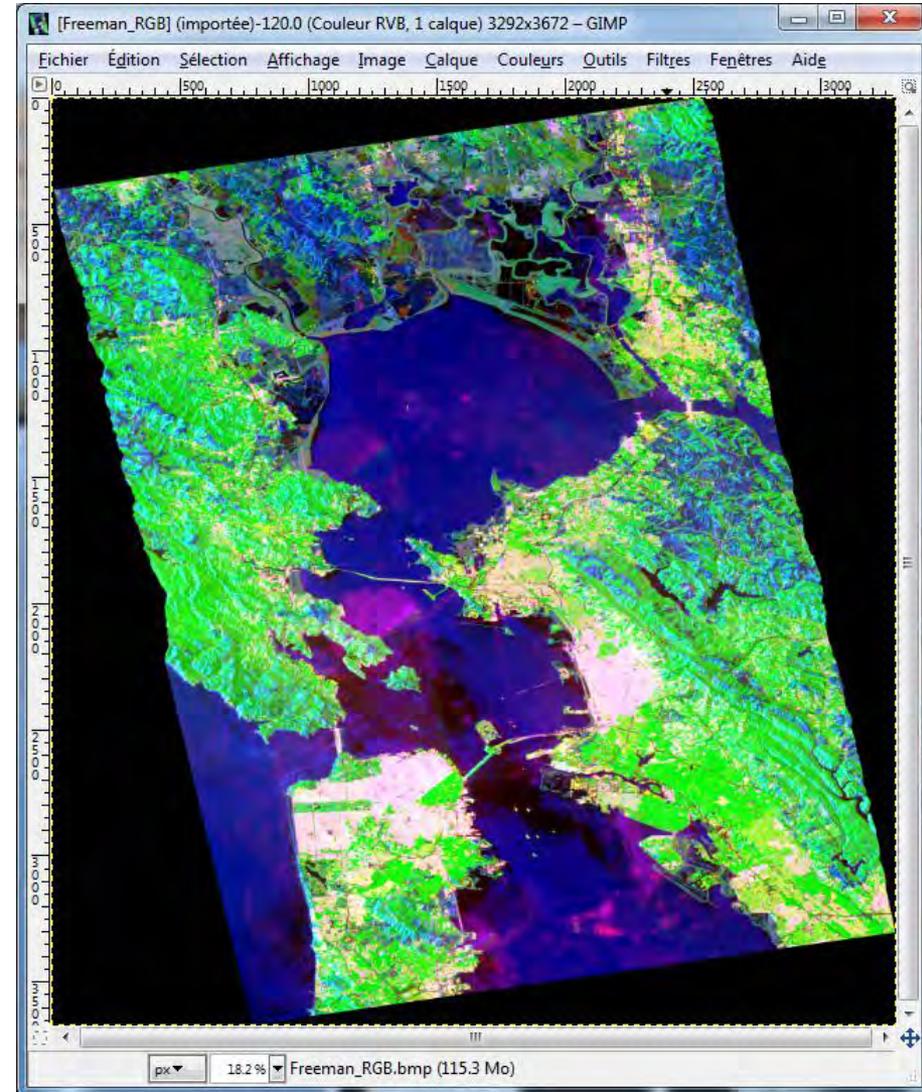
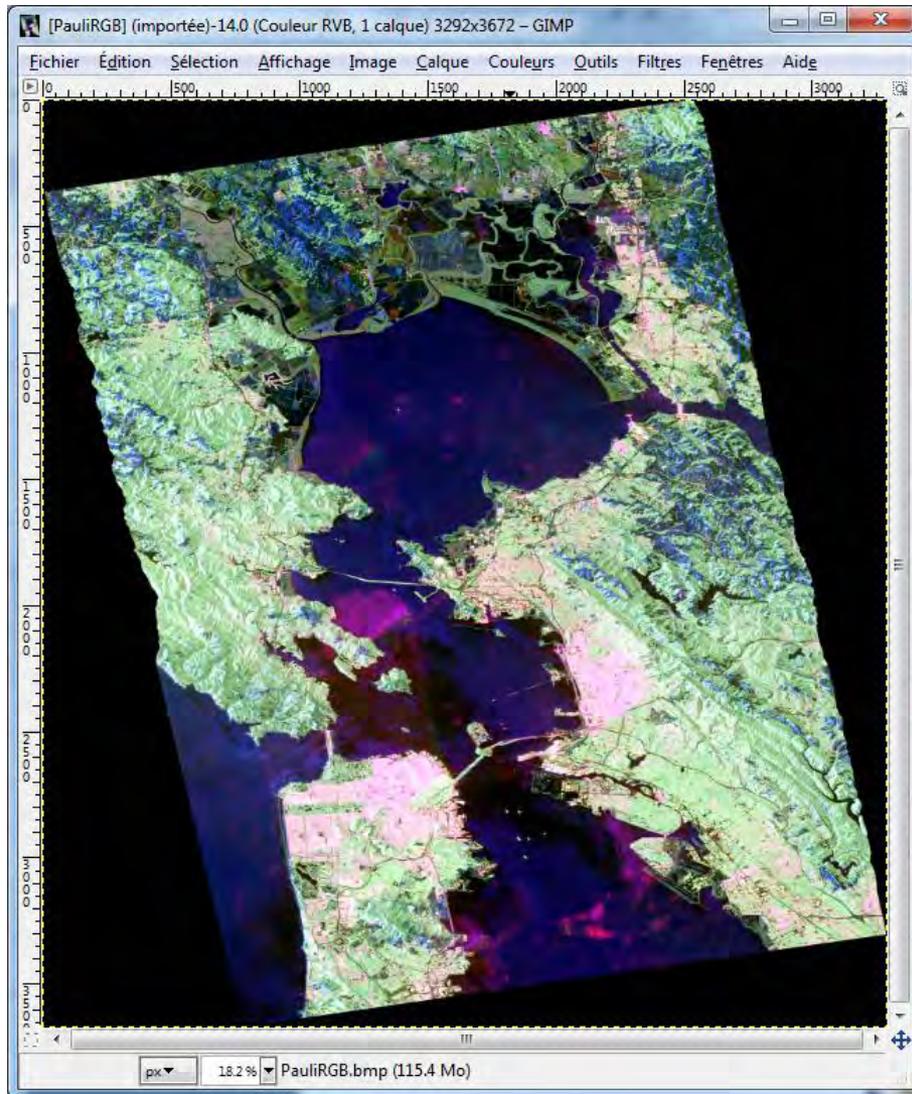
Pauli H-A-Alpha

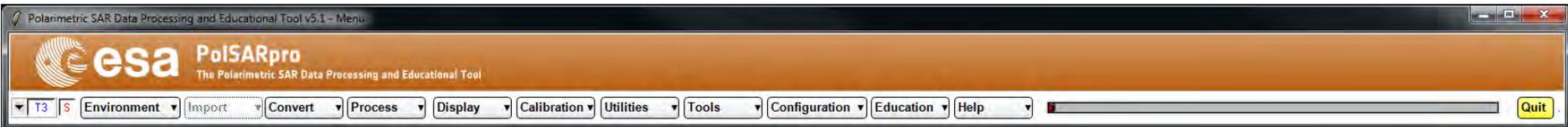


Pauli Van Zyl 3



Pauli Freeman 3

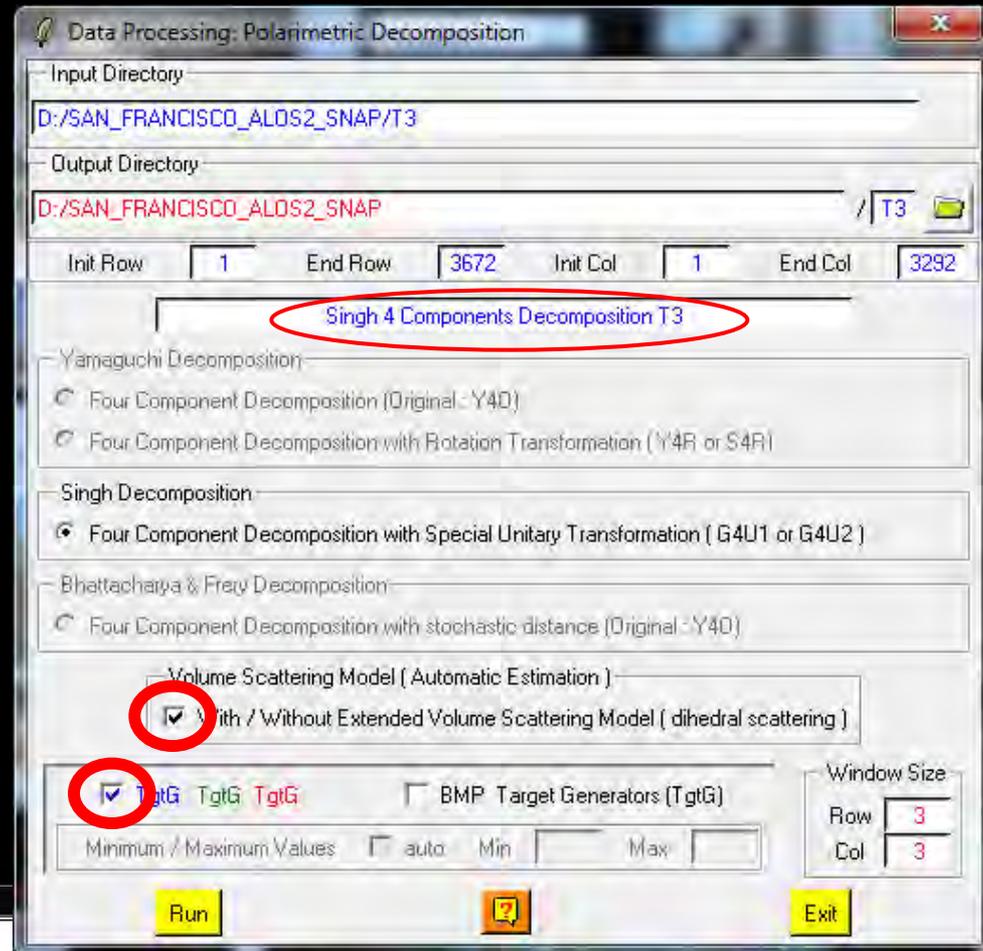




Do it Yourself:
 Select some elements, set the parameters and view the corresponding BMP files (select BMP).

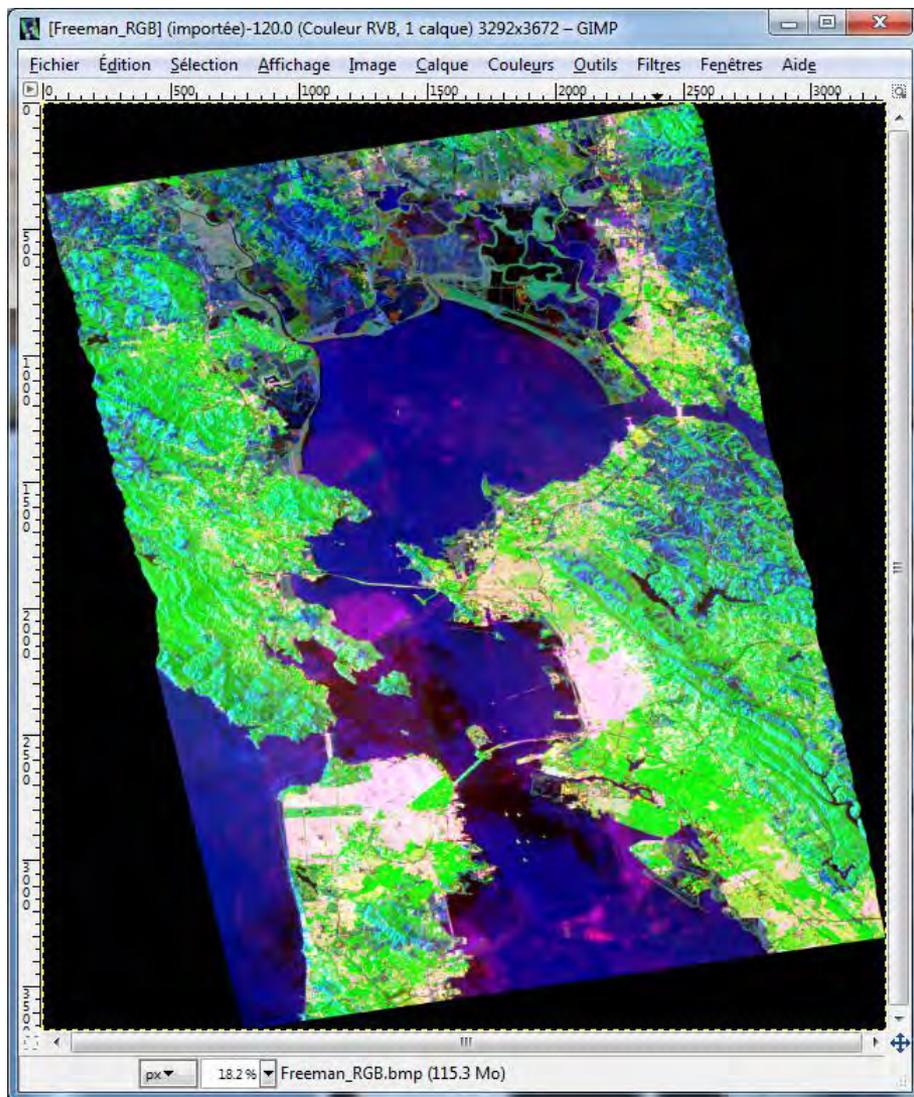
Window Size = 1

Yamaguchi Y40, Y4R, S4R
Singh G4U1, G4U2

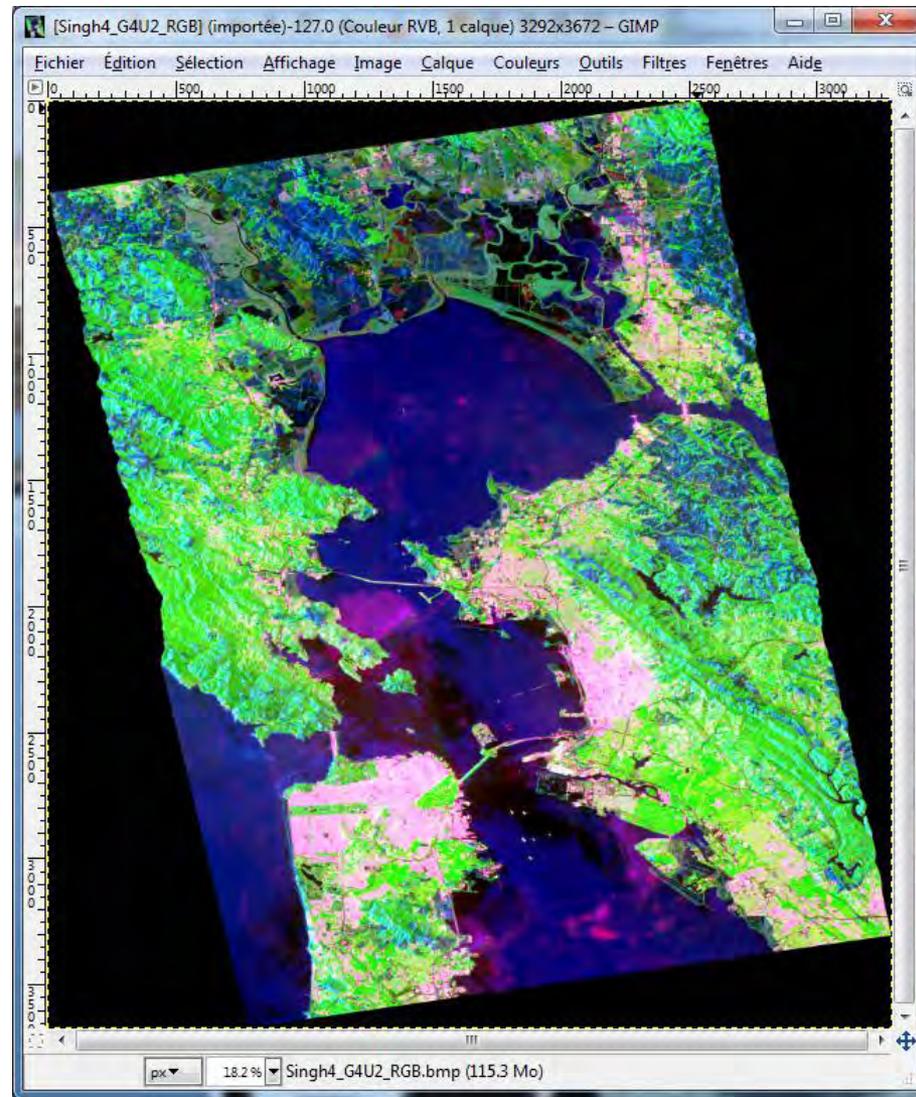


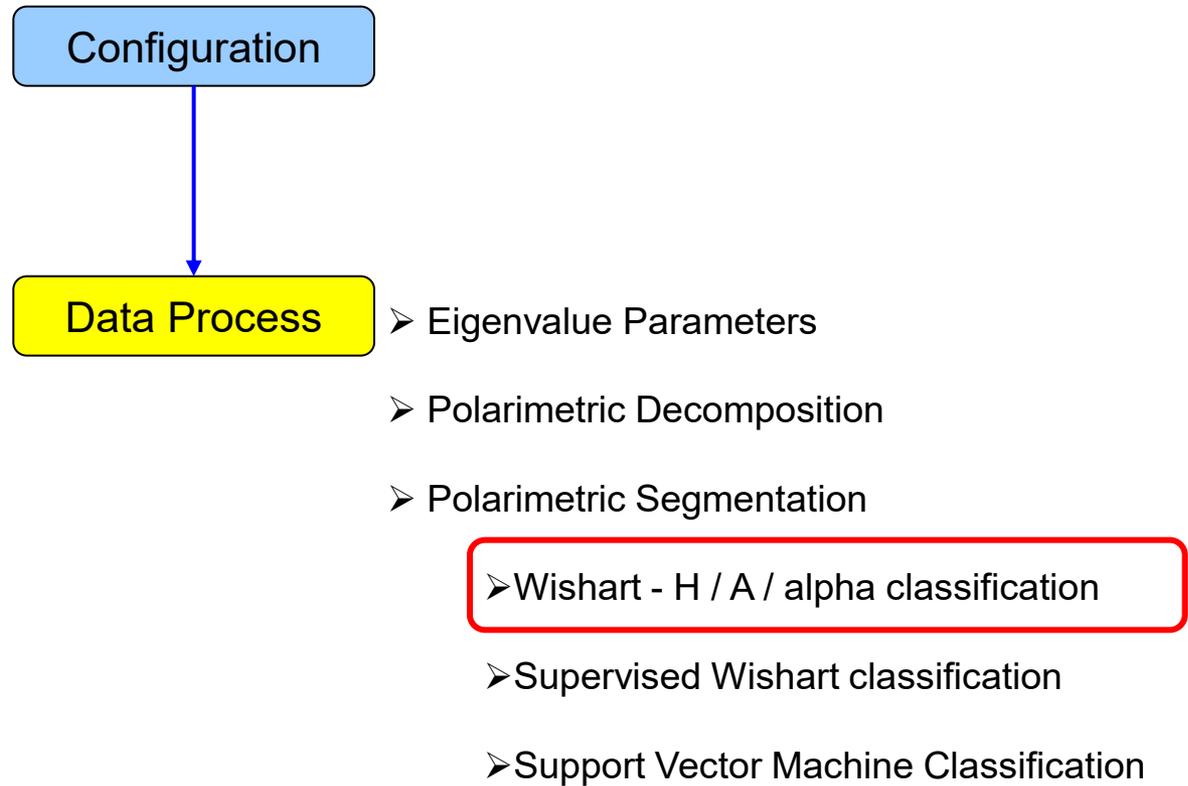
PolSARpro Run Trace
 Close Window Display Menu
 Close Window Tools Menu

Pauli Freeman 3



Pauli Singh - Yamaguchi G4U2





PolSARpro v5.1 - Menu


PolSARpro
 The Polarimetric SAR Data Processing and Educational Tool

T3 | S | Environment | Import | Convert | **Process** | Display | Calibration | Utilities | Tools | Configuration | Education | Help | Quit

Process Sub-menu items:

- Linear (+45 / -45)
- Circular (L / R)
- Elliptical (phi, tau)
- Box Car Filter
- Box Car - Edge Filter
- C. Lopez Filter
- Gaussian Filter
- IDAN Filter
- J.S. Lee Refined Filter
- J.S. Lee Sigma Filter
- P.W.F Filter
- Edge Detector
- Decomposition Parameters
- Eigenvector Set Parameters
- Eigenvalue Set Parameters
- JRH : Huynen Decomposition
- RMB1 : Barnes 1 Decomposition
- RMB2 : Barnes 2 Decomposition
- SRC : Cloude Decomposition
- WAH1 : Holm 1 Decomposition
- WAH2 : Holm 2 Decomposition
- HAA : H / A / Alpha Decomposition
- FRE2 : Freeman 2 Components Decomposition
- FRE3 : Freeman 3 Components Decomposition
- VZ3 : Van Zyl 3 Components Decomposition
- YAM3 : Yamaguchi 3 Components Decomposition
- YAM4 : Yamaguchi 4 Components Decomposition
- NEU : Neumann 2 Components Decomposition
- KRO : Krogager Decomposition
- CAM : Cameron Decomposition
- TSVM : Touzi Decomposition

Process -> Matrix Elements

- Correlation Coefficients
- Elliptical Basis Change
- Polarimetric Speckle Filter
- H / A / Alpha Decomposition
- Polarimetric Decompositions
- Polarimetric Functionalities - 1
- Polarimetric Functionalities - 2
- Polarimetric Segmentation**
- Polarimetric Data Analysis
- Polarimetric Data Clustering
- Batch Process

Process -> H / A / Alpha Classification

- H / u / v Classification (Xu & Jin)
- H / A / Alpha - Wishart Classification**
- Scattering Model Based - Wishart Classification
- Unified Huynen Classification
- Fuzzy - H / Alpha Classification
- Wishart Supervised Classification
- G.P.F. Supervised Classification
- Rule-Based Hierarchical Classification
- Basic Scattering Mechanism Identification
- SVM Supervised Classification
- Histogram based Statistics
- Texture Analysis
- Clustering Process
- Parameter Averaging
- Data Sets Averaging

Process -> Polarisation Synthesis

- Polarimetric Signature
- Stokes Parameters
- Compact Polarimetric Mode
- O.P.C.E
- R.C.S Max
- Surface Inversion
- RVOG PolSAR Inversion
- Sub-Aperture Analysis
- DEM Estimation
- Polarisation Orientation Compensation

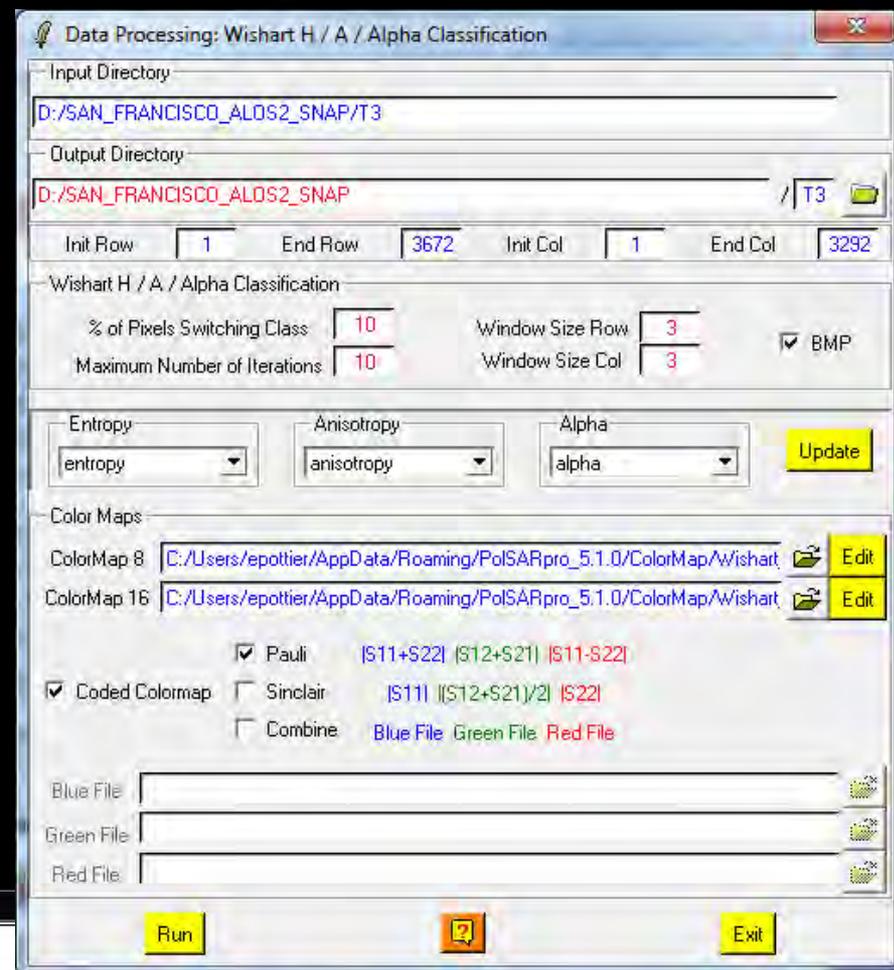
Process -> Polarized Point Scatterer Detection

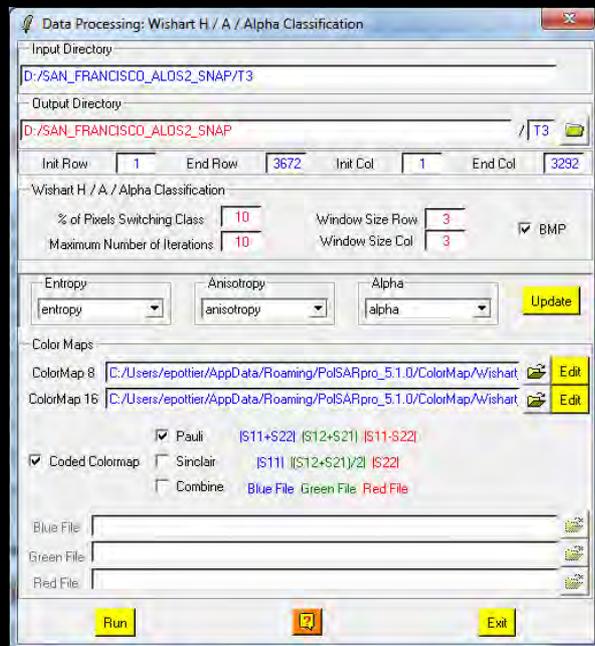
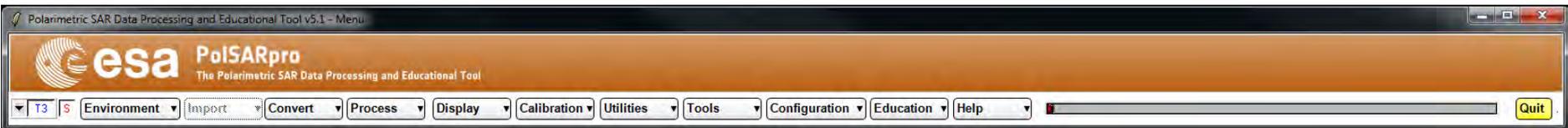
- Reflectivity Ratio
- Differential Reflectivity (ZDR)

Process -> Decomposition Applications



Do it Yourself:
Set the parameters, run and view the corresponding BMP files.





DATADIR



config.txt



[T3x3] Elements



Wishart_H_alpha_class_X.bin
Wishart_H_A_alpha_class_X.bin



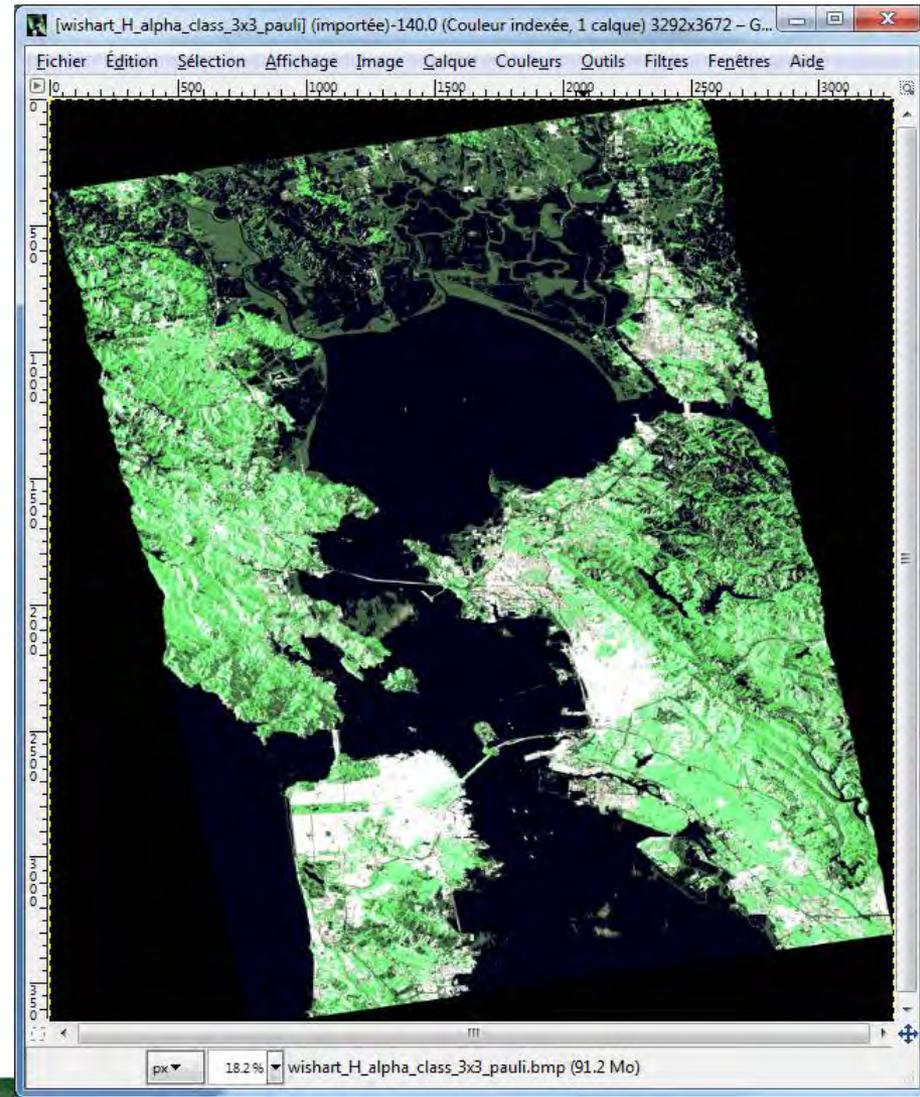
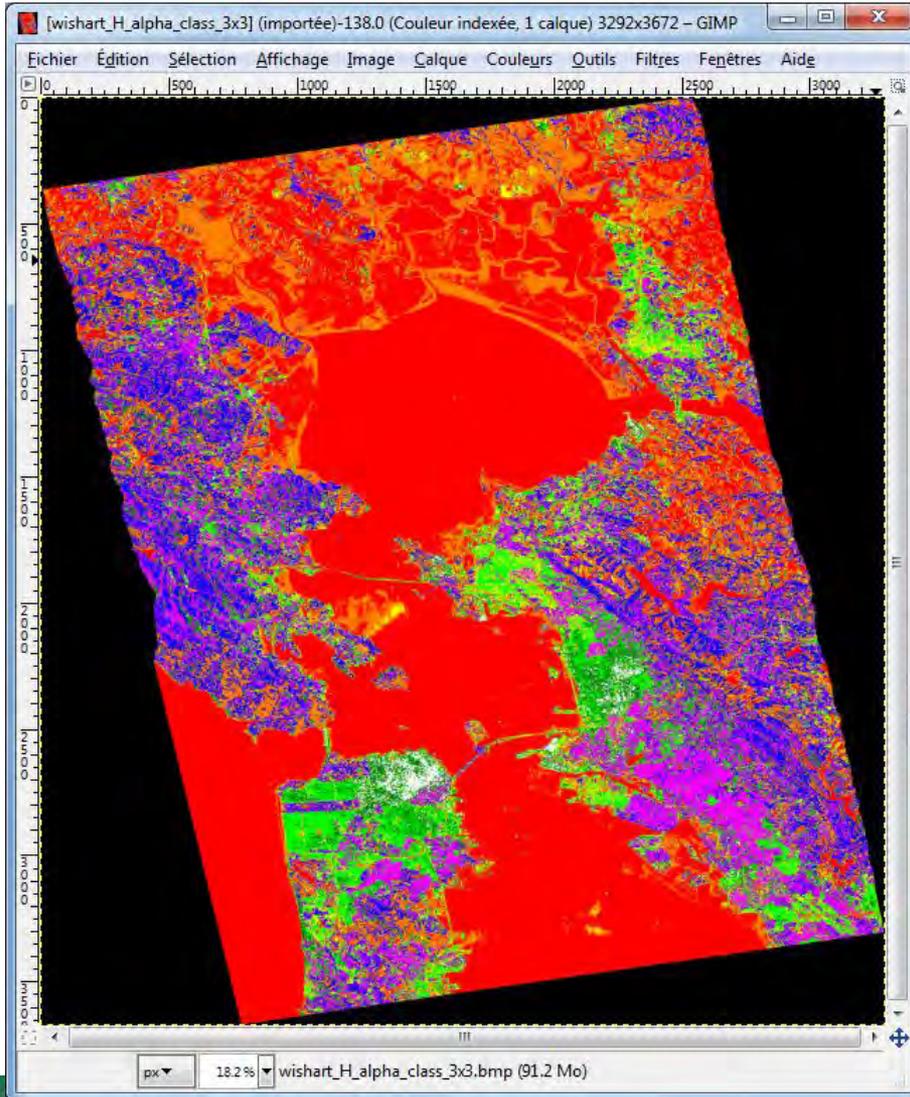
Wishart_H_alpha_class_X.bmp
Wishart_H_A_alpha_class_X.bmp

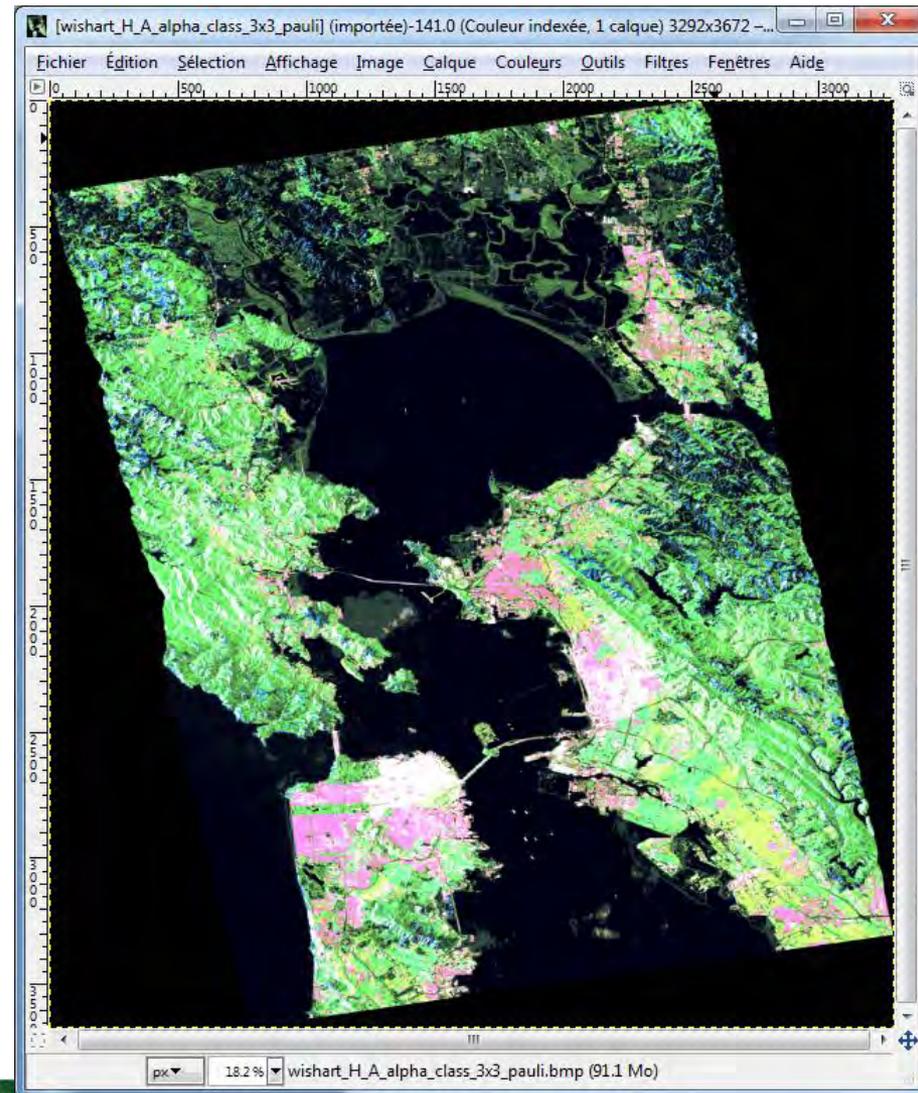
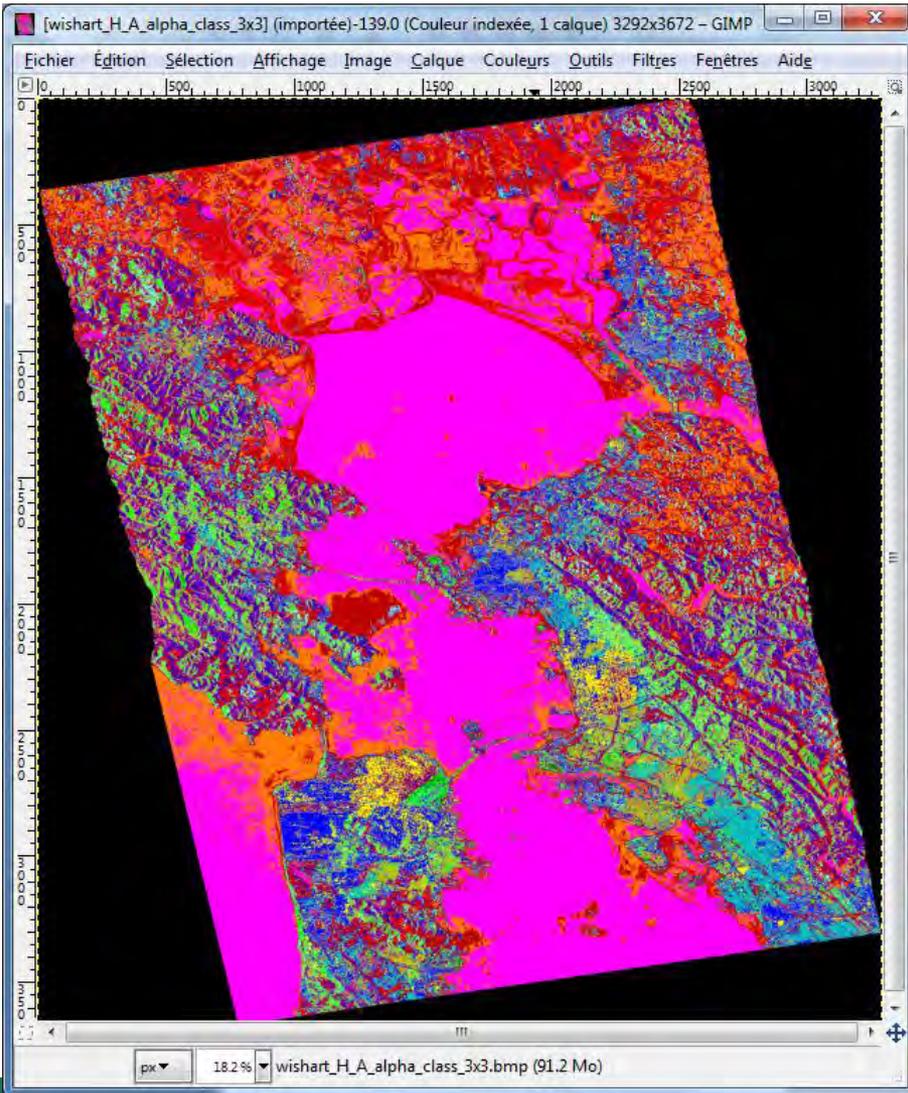
X = window size

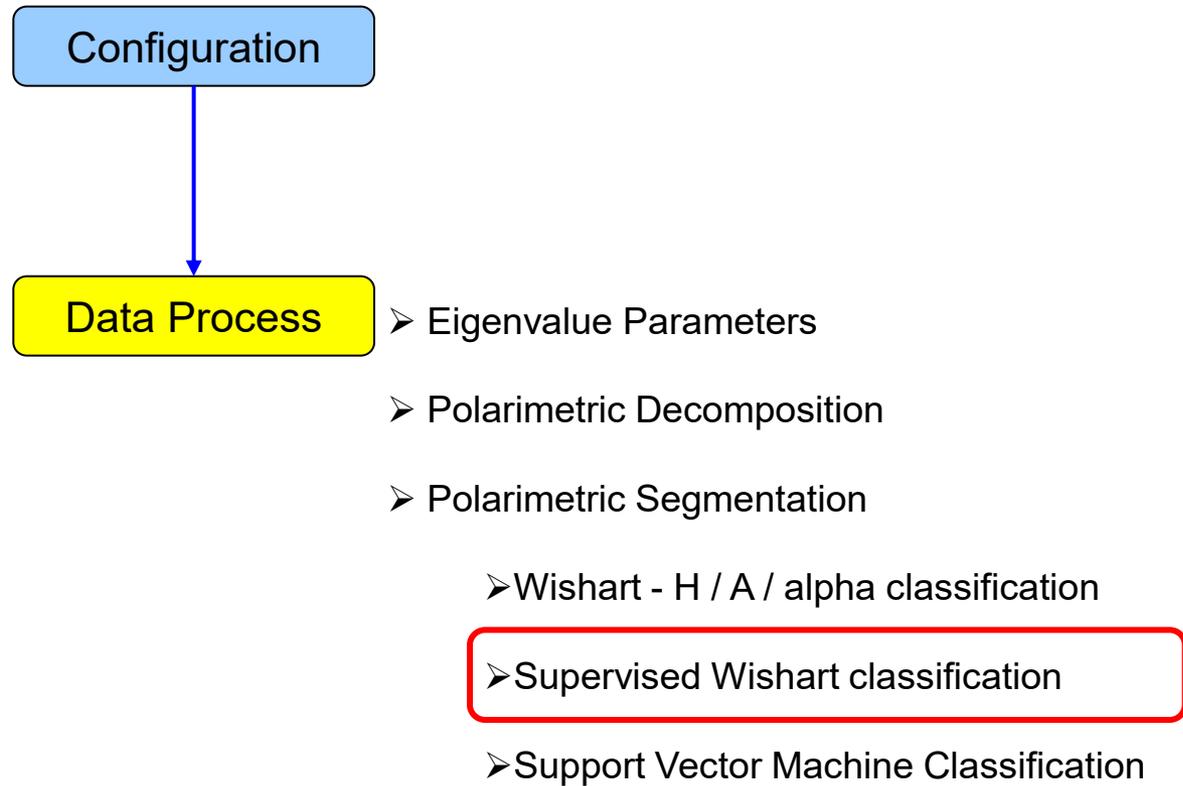
Do it Yourself:

Set the parameters, run and view the corresponding BMP files.









PolSARpro v5.1 - Menu


PolSARpro
 The Polarimetric SAR Data Processing and Educational Tool

T3 | S | Environment | Import | Convert | **Process** | Display | Calibration | Utilities | Tools | Configuration | Education | Help | Quit

Process Sub-menu items:

- Linear (+45 / -45)
- Circular (L / R)
- Elliptical (phi, tau)
- Box Car Filter
- Box Car - Edge Filter
- C. Lopez Filter
- Gaussian Filter
- IDAN Filter
- J.S. Lee Refined Filter
- J.S. Lee Sigma Filter
- P.W.F Filter
- Edge Detector
- Decomposition Parameters
- Eigenvector Set Parameters
- Eigenvalue Set Parameters
- Matrix Elements
- Correlation Coefficients
- Elliptical Basis Change
- Polarimetric Speckle Filter
- H / A / Alpha Decomposition
- Polarimetric Decompositions
- Polarimetric Functionalities - 1
- Polarimetric Functionalities - 2
- Polarimetric Segmentation**
- Polarimetric Data Analysis
- Polarimetric Data Clustering
- Batch Process

Process -> **Decomposition** Sub-menu items:

- JRH : Huynen Decomposition
- RMB1 : Barnes 1 Decomposition
- RMB2 : Barnes 2 Decomposition
- SRC : Cloude Decomposition
- WAH1 : Holm 1 Decomposition
- WAH2 : Holm 2 Decomposition
- HAA : H / A / Alpha Decomposition
- FRE2 : Freeman 2 Components Decomposition
- FRE3 : Freeman 3 Components Decomposition
- VZ3 : Van Zyl 3 Components Decomposition
- YAM3 : Yamaguchi 3 Components Decomposition
- YAM4 : Yamaguchi 4 Components Decomposition
- NEU : Neumann 2 Components Decomposition
- KRO : Krogager Decomposition
- CAM : Cameron Decomposition
- TSVM : Touzi Decomposition

Process -> **Classification** Sub-menu items:

- H / A / Alpha Classification
- H / u / v Classification (Xu & Jin)
- H / A / Alpha - Wishart Classification**
- Scattering Model Based - Wishart Classification
- Unified Huynen Classification
- Fuzzy - H / Alpha Classification
- Wishart Supervised Classification
- G.P.F. Supervised Classification
- Rule-Based Hierarchical Classification
- Basic Scattering Mechanism Identification
- SVM Supervised Classification
- Histogram based Statistics
- Texture Analysis
- Clustering Process
- Parameter Averaging
- Data Sets Averaging

Process -> **Other** Sub-menu items:

- Coherence Estimation
- Coherence Coefficient
- Coherence Dominance
- Coherence Diversity
- Coherence Entropy
- Coherence Index
- Coherence Estimation (Praks & Colin)
- Coherence Approximation (Praks & Colin)
- Scattering Mechanism Entropy (Freeman)
- Scattering Mechanism Entropy (Van Zyl)
- Coherence Entropy
- Coherence Anisotropy
- Polarized Point Scatterer Detection
- Reflectivity Ratio
- Differential Reflectivity (ZDR)
- Polarisation Synthesis
- Polarimetric Signature
- Stokes Parameters
- Compact Polarimetric Mode
- O.P.C.E
- R.C.S Max
- Surface Inversion
- RVOG PolSAR Inversion
- Sub-Aperture Analysis
- DEM Estimation
- Polarisation Orientation Compensation
- Decomposition Applications

The screenshot displays the PolSARpro software interface. The main window is titled "Data Processing: Wishart Supervised Classification". It features a menu bar with options: Environment, Import, Convert, Process, Display, Calibration, Utilities, Tools, Configuration, Education, Help, and a Quit button. The main workspace contains several configuration sections:

- Input Directory:** D:/SAN_FRANCISCO_ALOS2_SNAP/T3
- Output Directory:** D:/SAN_FRANCISCO_ALOS2_SNAP / T3
- Row/Column Selection:** Init Row: 1, End Row: 3672, Init Col: 1, End Col: 3292
- Classification Configuration:**
 - BMP, Reject Class, Confusion Matrix
 - Window Size: Row: 3, Col: 3, Reject Ratio: 0.0
 - Buttons: CM Editor, CMR Editor
- Color Maps:**
 - ColorMap 16: C:/Users/epottier/AppData/Roaming/PolSARpro_5.1.0/ColorMap/Superv
 - Coded Colormap
 - Pauli: |S11+S22| |S12+S21| |S11-S22|
 - Sinclair: |S11| |(S12+S21)/2| |S22|
 - Buttons: Edit
- Training Areas:**
 - Areas File: D:/SAN_FRANCISCO_ALOS2_SNAP/T3/2017_01_18_17_51_39_wishart_training_
 - Buttons: Graphic Editor, Run Training Process
- Set File:** D:/SAN_FRANCISCO_ALOS2_SNAP/T3/wishart_training_cluster_centers.bin
- Bottom Buttons:** Run, [Help/Info], Exit

At the bottom, a "PolSARpro Run Trace" window is visible, showing the following text:

```
Close Window Display Menu
Close Window Tools Menu
```



Step 1 :

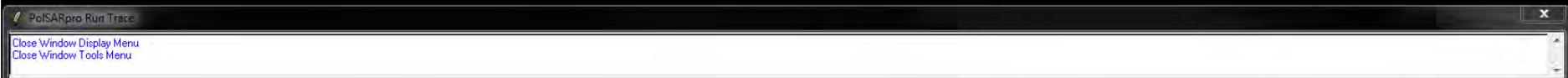
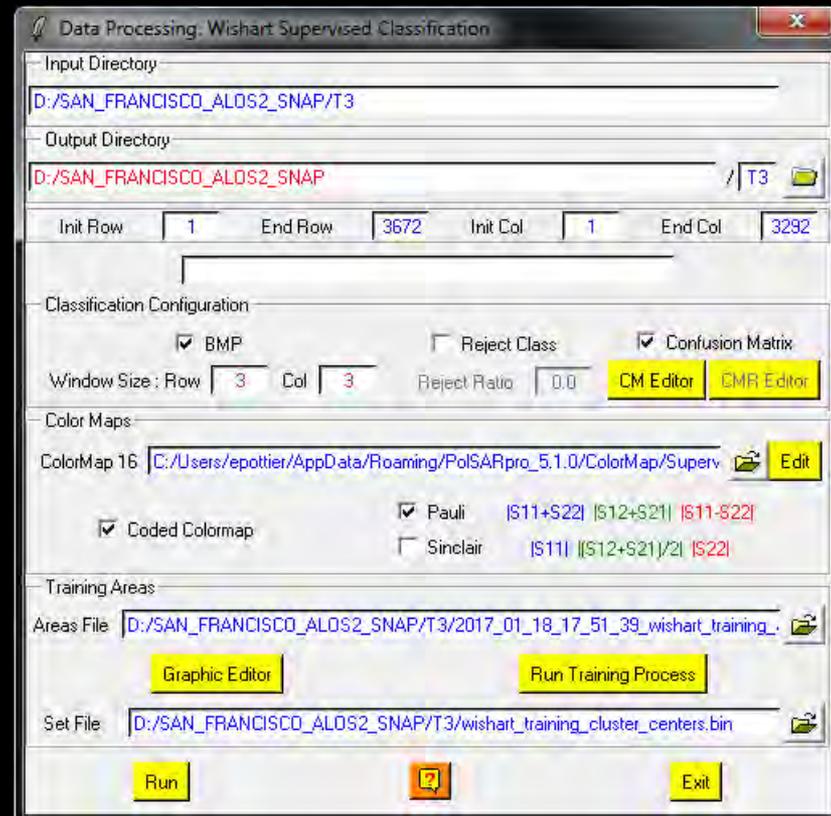
Open Graphic Editor to define graphically the Areas of Interest (AoI) or upload an existing Training Areas text file

Step 2 :

Run Training Process. This program will define the training clusters centres from the selected Areas of Interest (AoI).

Step 3 :

Run the Wishart Supervised Classification procedure



PolSARpro - The Polarimetric SAR Data Processing and Educational Tool

MapAlgebra v1.1

-1- lambda_db.bmp (3292x3672)

zoom : 23 % Class Num : 7 pixel : 2957 0
value = -17.94 < -10.53 < -2.88

Data Processing: Wishart Supervised Classification

Input Directory: D:/SAN_FRANCISCO_ALOS2_SNAP/T3

Output Directory: D:/SAN_FRANCISCO_ALOS2_SNAP / T3

Init Row: 1 End Row: 3672 Init Col: 1 End Col: 3292

Classification Configuration

BMP Reject Class Confusion Matrix

Window Size: Row 3 Col 3 Reject Ratio 0.0 **CM Editor** **CMR Editor**

Color Maps

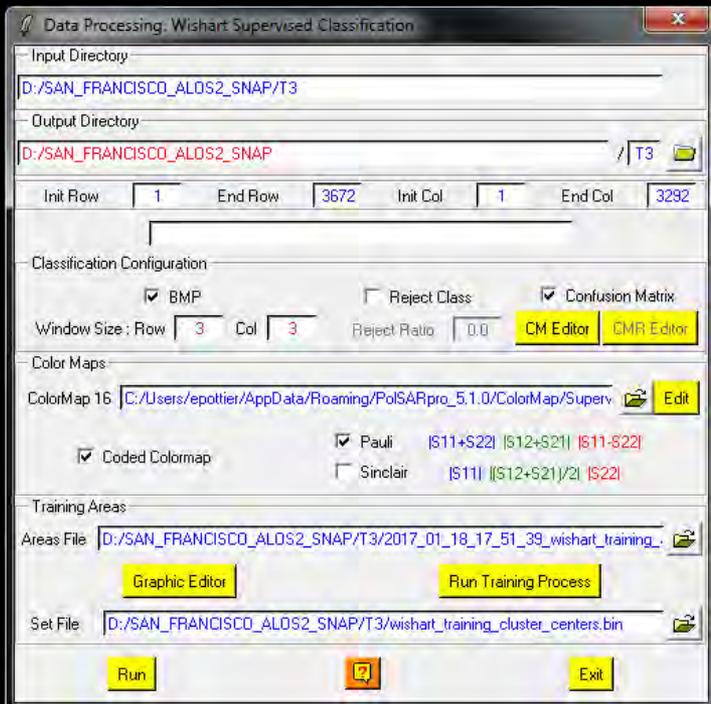
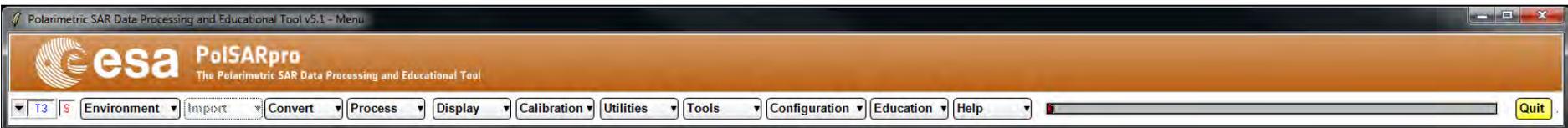
ColorMap 16 C:/Users/epottier/AppData/Roaming/PolSARpro_5.1.0/ColorMap/Superv **Edit**

Coded Colormap Pauli |S11+S22| |S12+S21| |S11-S22|
 Sinclair |S11| (|S12+S21|/2) |S22|

Training Areas

Areas File D:/SAN_FRANCISCO_ALOS2_SNAP/T3/2017_01_18_17_51_39_wishart_training_ **Graphic Editor** **Run Training Process**

Set File D:/SAN_FRANCISCO_ALOS2_SNAP/T3/wishart_training_cluster_centers.bin **Run** **Exit**



Do it Yourself:
Set the parameters, select different classes, run and view the corresponding BMP files.

DATADIR

- config.txt
- [T3x3] Elements

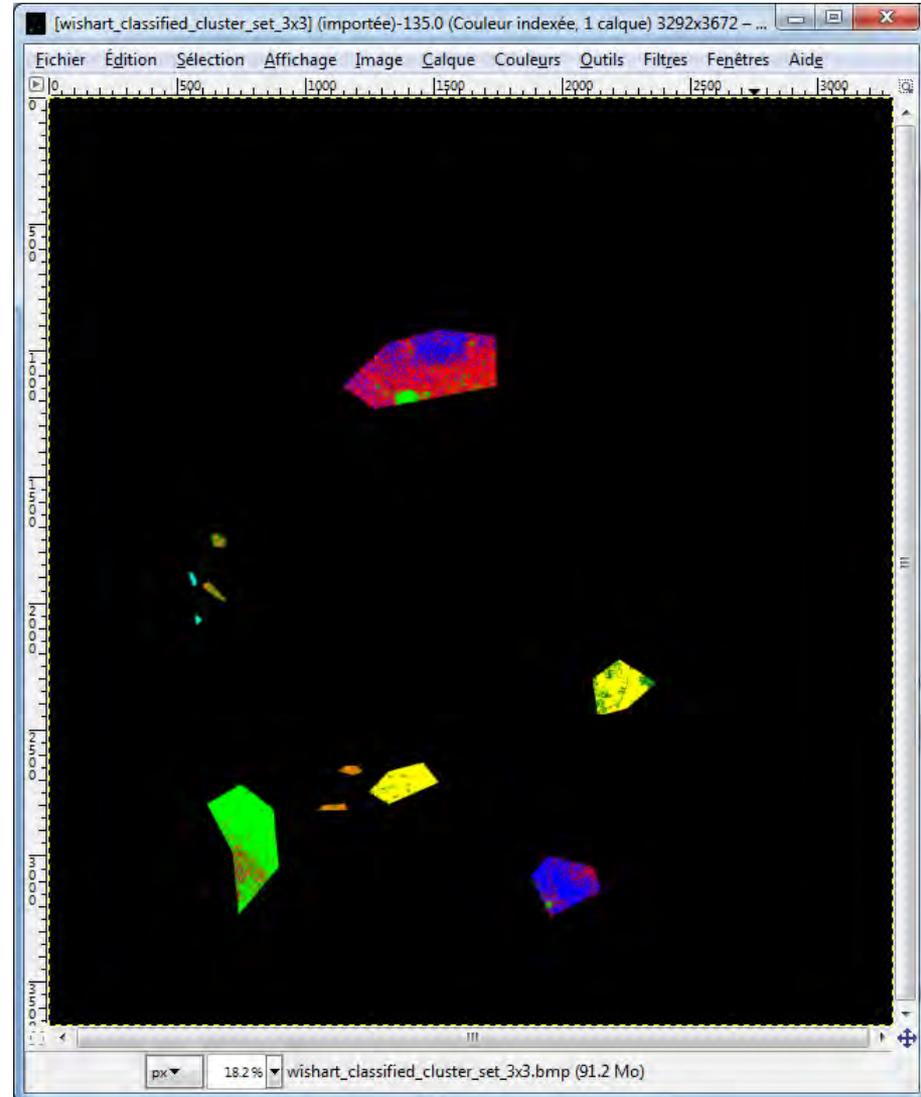
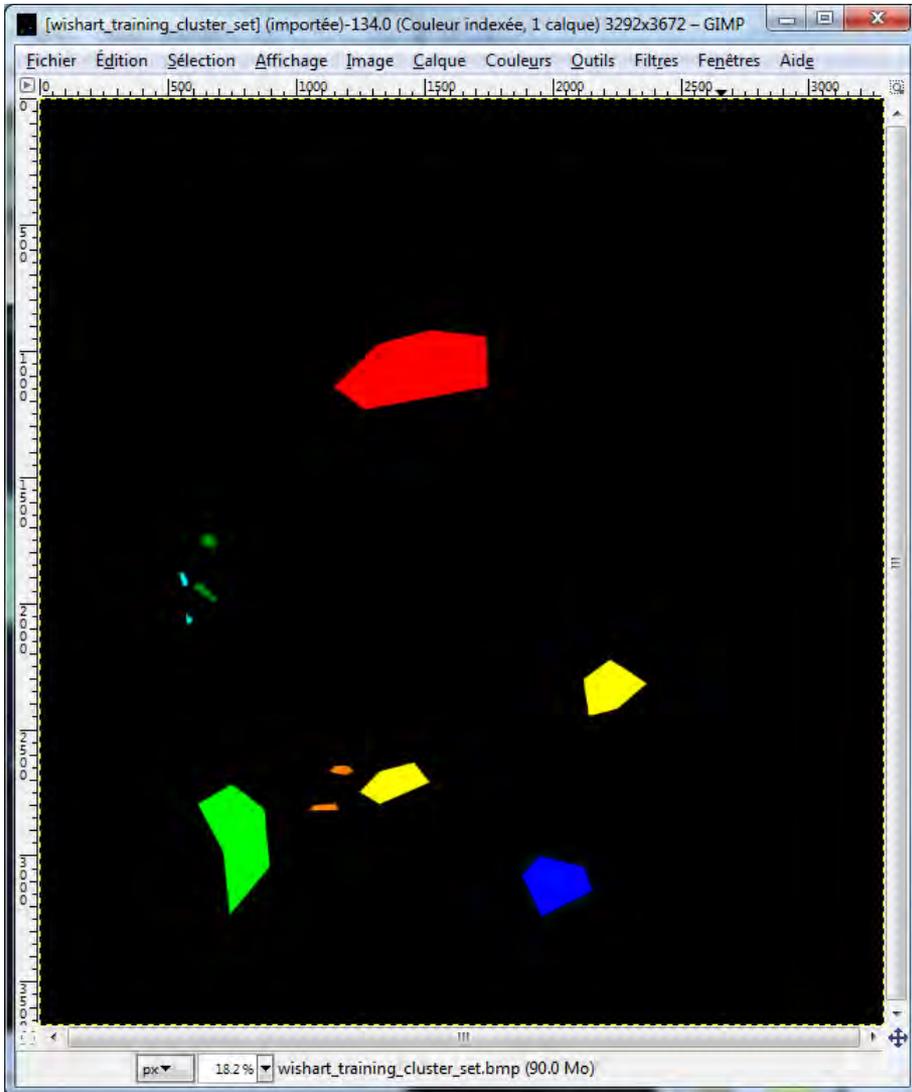
Run Training Process ← **Training_areas.txt**

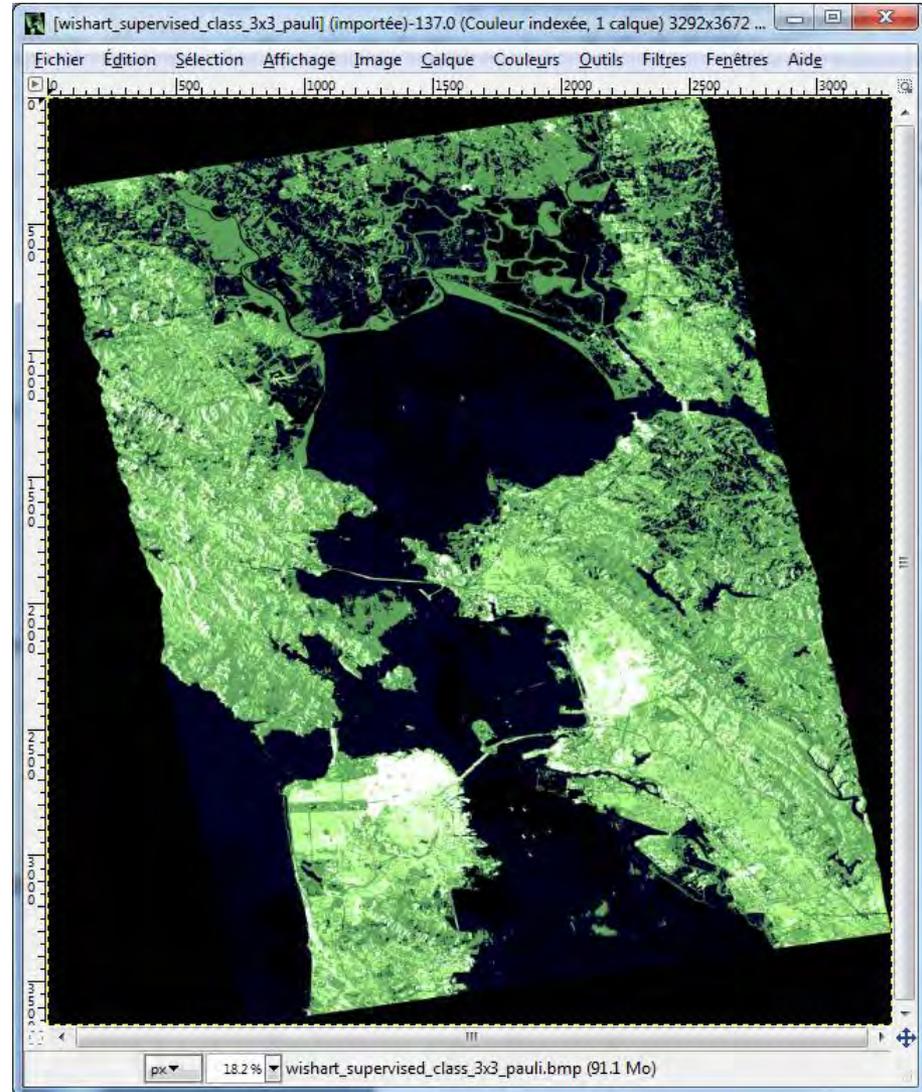
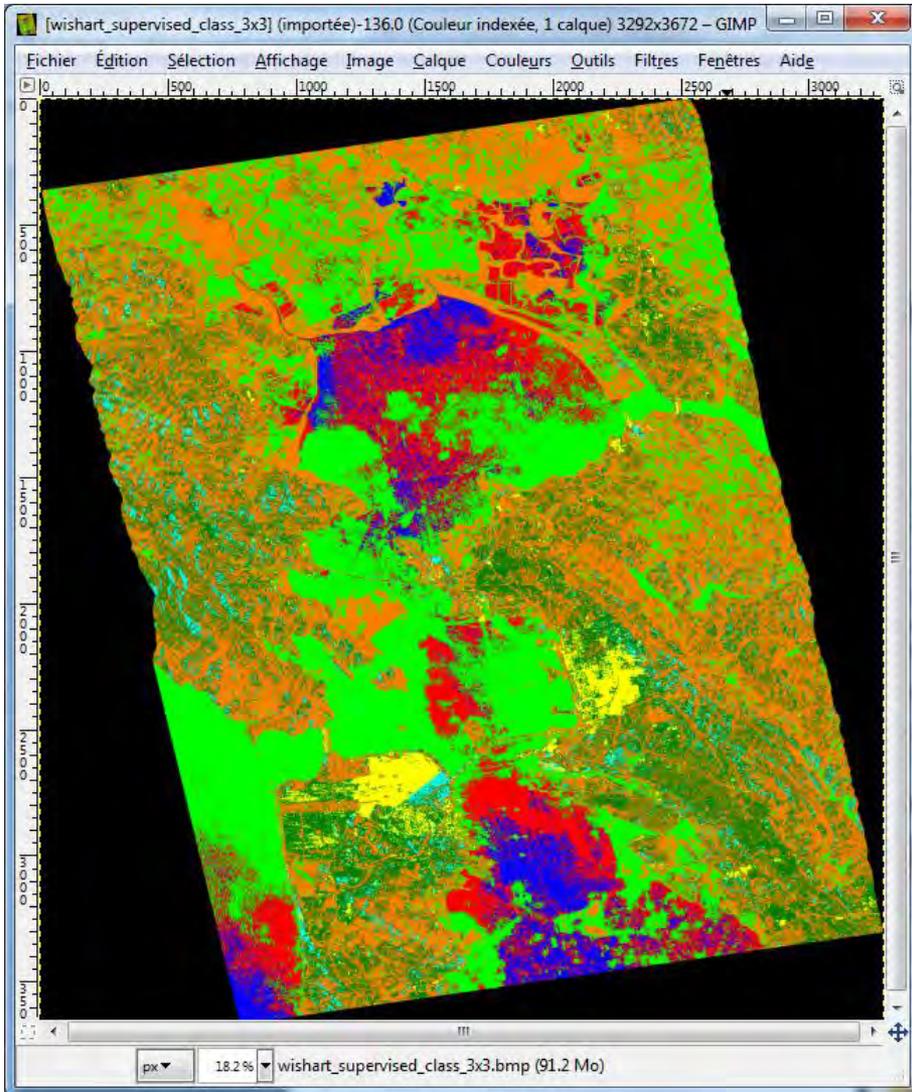
- Training_areas.bin
- Training_cluster_set.bmp

Run Classification

- Supervised_class_X.bin
- Supervised_class_rej_X.bin
- Confusion_matrix_X.txt
- Confusion_matrix_rej_X.txt
- Supervised_class_X.bmp
- Supervised_class_rej_X.bmp
- Classified_cluster_set.bmp
- Classified_cluster_set_rej.bmp

X = window size





PolSARpro v5.1 - Menu

esa PolSARpro
The Polarimetric SAR Data Processing and Educational Tool

Environment | Import | Convert | Process | Display | Calibration | Utilities | Tools | Configuration | Education | Help | Quit

Data Processing: Wishart Supervised Classification

Input Directory: D:/SAN_FRANCISCO_ALOS2_SNAP/T3

Output Directory: D:/SAN_FRANCISCO_ALOS2_SNAP / T3

Init Row: 1 End Row: 3672 Init Col: 1 End Col: 3292

Classification Configuration

BMP Reject Class Confusion Matrix

Window Size: Row 3 Col 3 Reject Ratio: 0.0 **CM Editor** **CM Editor**

Color Maps

ColorMap 16: C:/Users/epottier/AppData/Roaming/PolSARpro_5.1.0/ColorMap/Superv **Edit**

Coded Colormap Pauli |S11+S22| |S12+S21| |S11-S22|

Sinclair |S11| (|S12+S21|)/2 |S22|

Training Areas

Areas File: D:/SAN_FRANCISCO_ALOS2_SNAP/T3/2017_01_18_17_51_39_wishart_training_

Graphic Editor **Run Training Process**

Set File: D:/SAN_FRANCISCO_ALOS2_SNAP/T3/wishart_training_cluster_centers.bin

Run **?** **Exit**

D:/SAN_FRANCISCO_ALOS2_SNAP/T3/wishart_confusion_matrix_3x3.txt

Wrap Text Mode **Exit**

CONFUSION MATRIX

Rows represent the user defined clusters
Columns represent the segmented clusters
A number located at a position IJ represents the amount of pixels in percent belonging to the user defined area I that were assigned to cluster J during the supervised classification

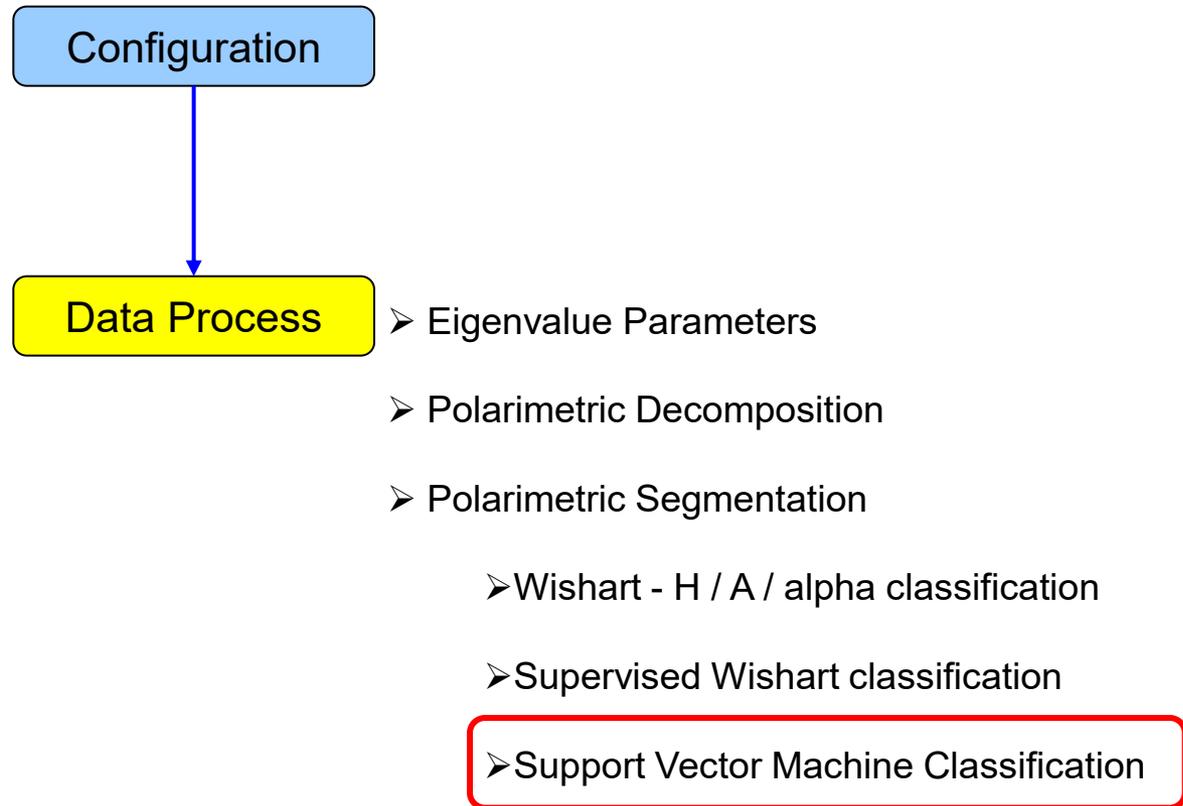
| | C1 | C2 | C3 | C4 | C5 | C6 | C7 |
|----|-------|-------|-------|-------|-------|-------|-------|
| C1 | 60.03 | 6.63 | 33.34 | 0.00 | 0.00 | 0.00 | 0.00 |
| C2 | 11.14 | 87.84 | 1.03 | 0.00 | 0.00 | 0.00 | 0.00 |
| C3 | 23.75 | 1.95 | 74.30 | 0.00 | 0.00 | 0.00 | 0.00 |
| C4 | 0.00 | 0.00 | 0.00 | 83.76 | 1.59 | 13.64 | 1.01 |
| C5 | 0.00 | 0.17 | 0.00 | 0.17 | 80.43 | 18.84 | 0.39 |
| C6 | 0.00 | 0.00 | 0.00 | 0.59 | 50.11 | 48.44 | 0.86 |
| C7 | 0.00 | 0.00 | 0.00 | 0.00 | 3.79 | 14.32 | 81.88 |

Class populations

| | |
|----|--------|
| C1 | 128255 |
| C2 | 76909 |
| C3 | 40665 |
| C4 | 56395 |
| C5 | 4603 |
| C6 | 4889 |
| C7 | 1529 |

PolSARpro Run Trace

Close Window Display Menu
Close Window Tools Menu



PolSARpro v5.1 - Menu

esa PolSARpro
The Polarimetric SAR Data Processing and Educational Tool

Environment | Import | Convert | **Process** | Display | Calibration | Utilities | Tools | Configuration | Education | Help

Process sub-menu items:

- Linear (+45 / -45)
- Circular (L / R)
- Elliptical (phi, tau)
- Box Car Filter
- Box Car - Edge Filter
- C. Lopez Filter
- Gaussian Filter
- IDAN Filter
- J.S. Lee Refined Filter
- J.S. Lee Sigma Filter
- P.W.F Filter
- Edge Detector
- Decomposition Parameters
- Eigenvector Set Parameters
- Eigenvalue Set Parameters
- Matrix Elements
- Correlation Coefficients
- Elliptical Basis Change
- Polarimetric Speckle Filter
- H / A / Alpha Decomposition
- Polarimetric Decompositions
- Polarimetric Functionalities - 1
- Polarimetric Functionalities - 2
- Polarimetric Segmentation**
- Polarimetric Data Analysis
- Polarimetric Data Clustering
- Batch Process

Decomposition sub-menu items:

- JRH : Huynen Decomposition
- RMB1 : Barnes 1 Decomposition
- RMB2 : Barnes 2 Decomposition
- SRC : Cloude Decomposition
- WAH1 : Holm 1 Decomposition
- WAH2 : Holm 2 Decomposition
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- VZ3 : Van Zyl 3 Components Decomposition
- YAM3 : Yamaguchi 3 Components Decomposition
- YAM4 : Yamaguchi 4 Components Decomposition
- NEU : Neumann 2 Components Decomposition
- KRO : Krogager Decomposition
- CAM : Cameron Decomposition
- TSVM : Touzi Decomposition

Classification sub-menu items:

- H / A / Alpha Classification
- H / u / v Classification (Xu & Jin)
- H / A / Alpha - Wishart Classification**
- Scattering Model Based - Wishart Classification
- Unified Huynen Classification
- Fuzzy - H / Alpha Classification
- Wishart Supervised Classification
- G.P.F. Supervised Classification
- Rule-Based Hierarchical Classification
- Basic Scattering Mechanism Identification
- SVM Supervised Classification
- Histogram based Statistics
- Texture Analysis
- Clustering Process
- Parameter Averaging
- Data Sets Averaging

Other sub-menu items:

- Polarisation Estimation
- Coherence
- Dominance
- Diversity
- Entropy
- Shannon Index
- Classification (Praks & Colin)
- Approximation (Praks & Colin)
- Scattering Mechanism Entropy (Freeman)
- Scattering Mechanism Entropy (Van Zyl)
- Entropy
- Anisotropy
- Polarized Point Scatterer Detection
- Reflectivity Ratio
- Differential Reflectivity (ZDR)
- Polarisation Synthesis
- Polarimetric Signature
- Stokes Parameters
- Compact Polarimetric Mode
- O.P.C.E
- R.C.S Max
- Surface Inversion
- RVOG PolSAR Inversion
- Sub-Aperture Analysis
- DEM Estimation
- Polarisation Orientation Compensation
- Decomposition Applications

PolSARpro v5.1 - Menu

esa PolSARpro
The Polarimetric SAR Data Processing and Educational Tool

T3 | Environment | Import | Convert | Process | Display | Calibration | Utilities | Tools | Configuration | Education | Help | Quit

Data Processing: SVM Supervised Classification

Input Directory: D:/SAN_FRANCISCO_ALOS2_SNAP/T3

Output Directory: D:/SAN_FRANCISCO_ALOS2_SNAP

Init Row: 1 | End Row: 3672 | Init Col: 1 | End Col: 3292

Step 1 - Training Areas
Areas File: Config/svm_training_areas.txt **Graphic Editor**

Step 2 - Classification Configuration
 BMP Confusion Matrix **CM Editor**

Step 3 - Color Maps
ColorMap 16: C:/Users/epottier/AppData/Roaming/PolSARpro_5.1.0/ColorMap/Supervised_ColorMap16.pal **Edit**

Dotted Colormap Pauli [S11+S22] [S12+S21] [S11-S22]
Sinclair [S11] [(S12+S21)/2] [S22]

Step 4 - SVM Parameter Setting
Input Polarimetric Indicators: T3 | Other **Select**
Sampling option: Training sampling 500 | If important unbalanced training point
Output SVM parameters: Class Probability BMP
 Mean Hyperplane Distance BMP
Useful but time consuming

Step 5 - Kernel Parameter
Cost: 100 | RBF | Gamma = 1/sigma: 0.4444 **RECOMMENDED** | **Setup and Run**
Optimisation parameters: Polynomial Degree: | Linear

Step 6 - Run Classification **Exit**

PolSARpro Run Trace

Close Window Display Menu
Close Window Tools Menu

→ 7th ADVANCED TRAINING COURSE ON LAND REMOTE SENSING

4-9 September 2017 | Szent István University | Gödöllő, Hungary



PolSARpro v5.1 - Menu

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Environment | Import | Convert | Process | Display | Calibration | Utilities | Tools | Configuration | Education | Help | Quit

Data Processing: SVM Supervised Classification

Input Directory: D:/SAN_FRANCISCO_ALOS2_SNAP/T3

Output Directory: D:/SAN_FRANCISCO_ALOS2_SNAP / T3

Init Row: 1 | End Row: 3672 | Init Col: 1 | End Col: 3292

Step 1 - Training Areas
Areas File: Config/svm_training_areas.txt | Graphic Editor

Step 2 - Classification Configuration
 BMP | Confusion Matrix | CM Editor

Step 3 - Color Maps
ColorMap 16: C:/Users/epottier/AppData/Roaming/PolSARpro_5.1.0/ColorMap/Supervised_ColorMap16.pal | Edit

Coded Colormap | Pauli | IS11+S22 | IS12+S21 | IS11-S22 | Sinclair | IS11 | (IS12+S21)/2 | IS22

Step 4 - SVM Parameter Setting
Input Polarimetric Indicators: T3 | Other: Select | Sampling option: Training sampling: 500 | If important unbalanced training point | Output SVM parameters: Class Probability | Mean Hyperplane Distance | Useful but time consuming | BMP

Step 5 - Kernel Parameter
Cost: 100 | Gamma = 1/sigma: 0.4444 | RBF | Polynomial | Linear
RECOMMENDED Optimisation parameters: Setup and Run

Step 6 - Run Classification | Exit

SVM RBF Kernel Parameters Optimisation (Cross Validation) (Ne répond pas)

| | | | |
|---------|---------|---------|---------|
| Log2(C) | C | Log2(G) | G |
| Min: 8 | 256.0 | Min: -5 | 0.03125 |
| Max: 14 | 16384.0 | Max: 0 | 1.0 |
| Step: 2 | | Step: 1 | |

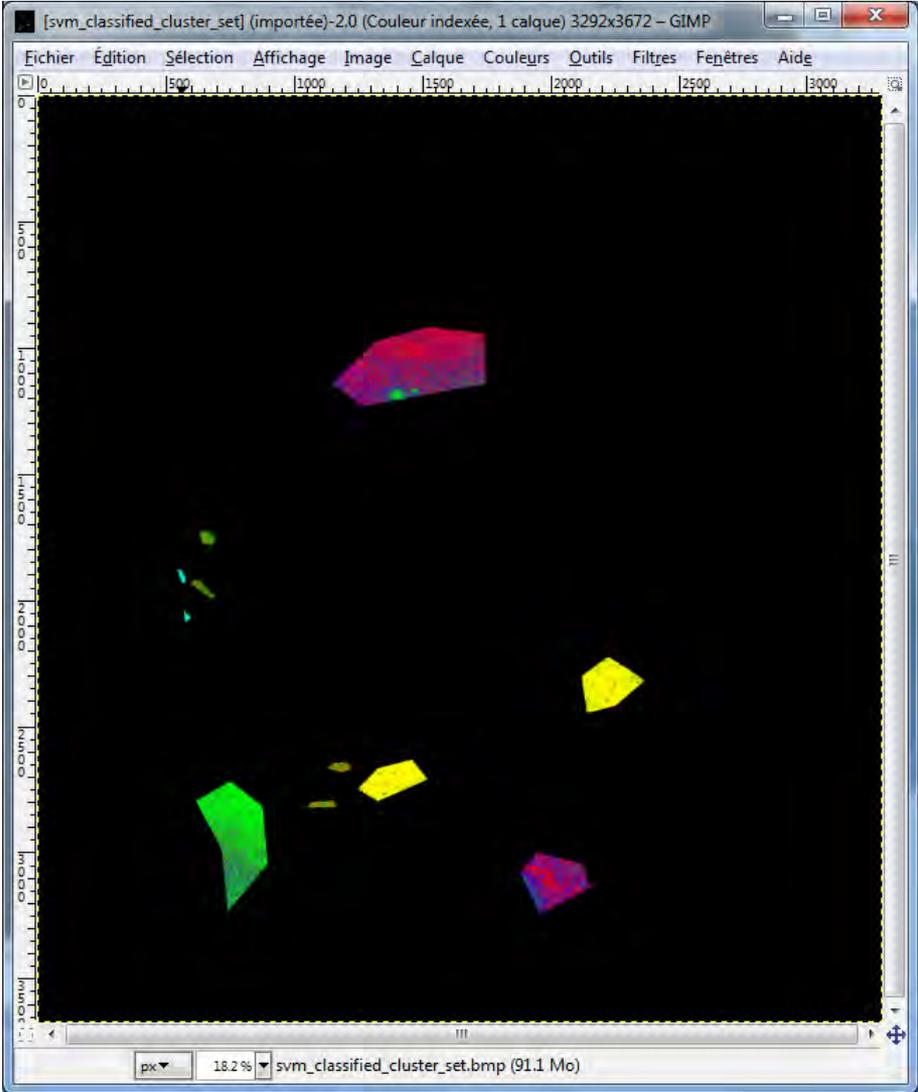
ISO Accuracy: 93.5%, 93.8%, 92.5%, 91.5%, 91.8%

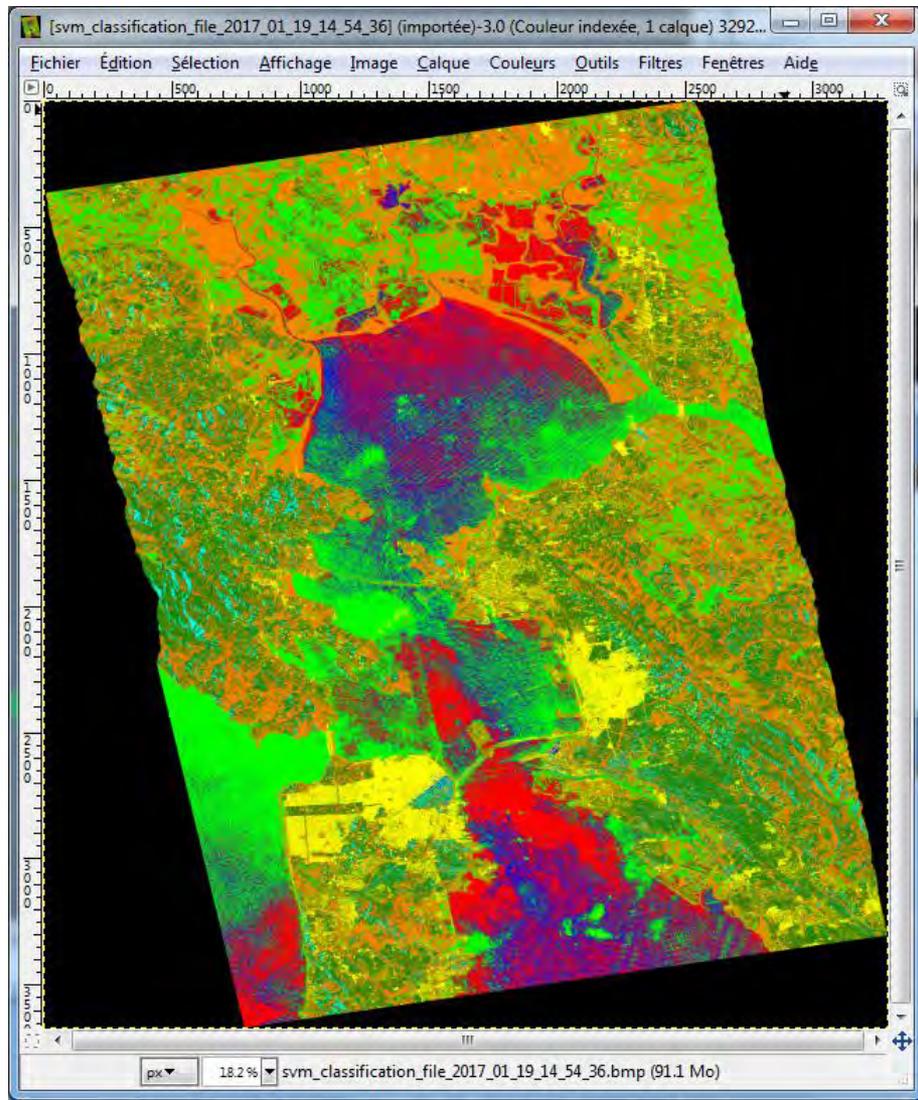
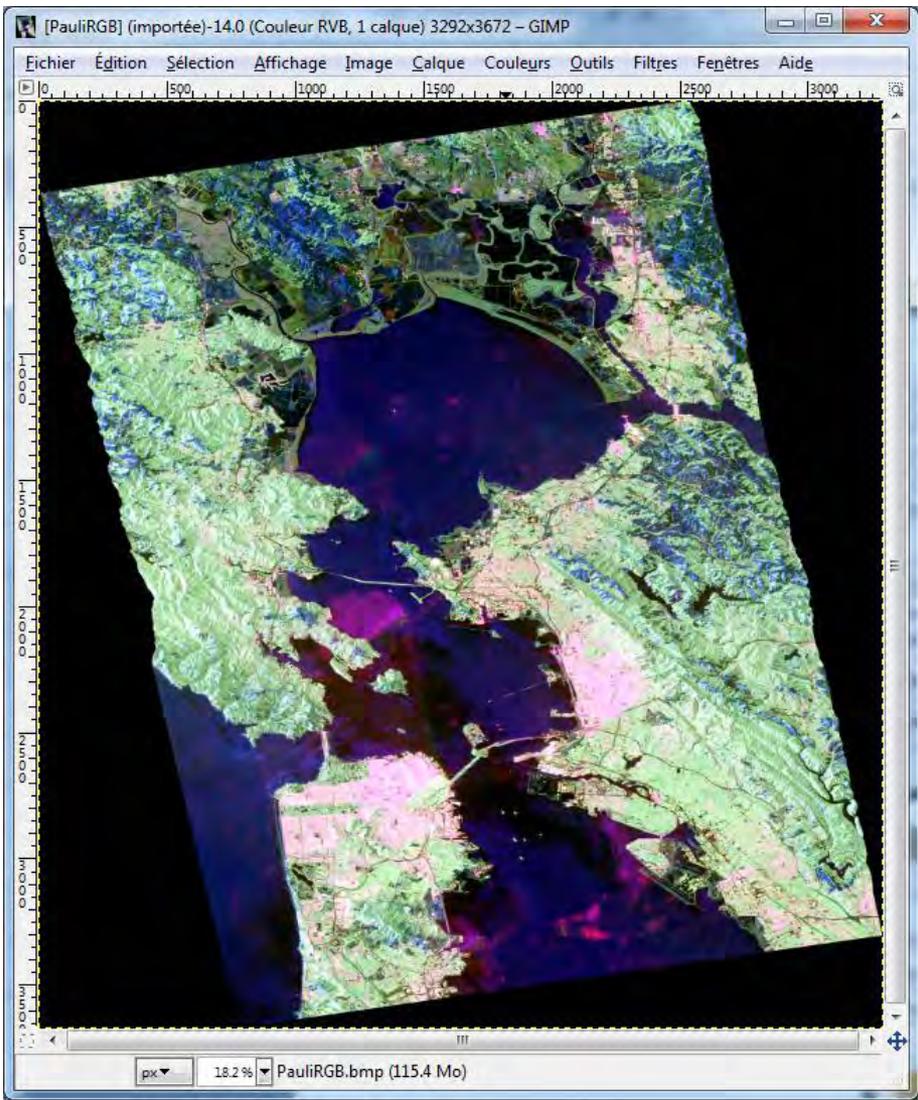
Run RBF Kernel Parameters Optimisation

One best couple [C,G]
C: | G: |

Exit and Save CV Parameters

50mn







SUPPORT VECTOR MACHINE CLASSIFICATION



PolSARpro The Polarimetric SAR Data Processing and Educational Tool

Environment Import Convert Process Display Calibration Utilities Tools Configuration Education Help Quit

Data Processing: SVM Supervised Classification

Input Directory: D:/SAN_FRANCISCO_ALOS2_SNAP/T3

Output Directory: D:/SAN_FRANCISCO_ALOS2_SNAP / T3

Init Row: 1 End Row: 3672 Init Col: 1 End Col: 3292

Step 1 - Training Areas
Areas File: Config/svm_training_areas.txt **Graphic Editor**

Step 2 - Classification Configuration
 BMP Confusion Matrix **CM Editor**

Step 3 - Color Maps
ColorMap 16: C:/Users/epottier/AppData/Roaming/PolSARpro_5.1.0/ColorMap/Supervised_ColorMap16.pal **Edit**

Coded Colormap Pauli |S11+S22| |S12+S21| |S11-S22|
 Sinclair |S11| (|S12+S21|/2) |S22|

Step 4 - SVM Parameter Setting
Input Polarimetric Indicators: T3
Sampling option: Training sampling 500
Output SVM parameters: Class Probability BMP
 Mean Hyperplane Distance BMP
Useful but time consuming

Step 5 - Kernel Parameter
Cost: 100 Gamma = 1/sigma: 0.4444 RECOMMENDED
Optimisation parameters: **Setup and Run**

Polynomial Degree: Linear

Step 6 - Run Classification **Exit**

D:/SAN_FRANCISCO_ALOS2_SNAP/T3/svm_confusion_matrix_2017_01_19_14_5...

Wrap Text Mode **Exit**

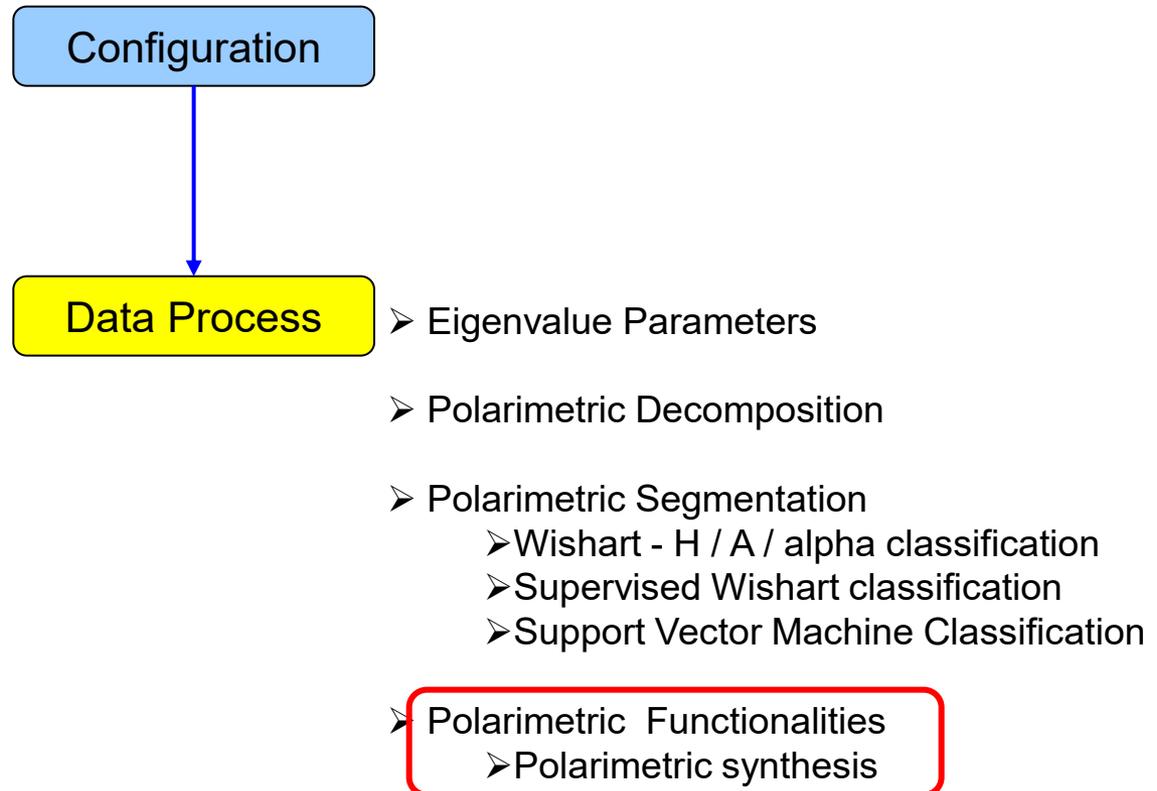
CONFUSION MATRIX

Rows represent the user defined clusters
Columns represent the segmented clusters
A number located at a position IJ represents the amount of pixels in percent belonging to the user defined area I that were assigned to cluster J during the supervised classification

| | C1 | C2 | C3 | C4 | C5 | C6 | C7 |
|----|-------|-------|-------|-------|-------|-------|-------|
| C1 | 55.41 | 10.00 | 34.59 | 0.00 | 0.00 | 0.00 | 0.00 |
| C2 | 8.40 | 76.77 | 14.82 | 0.00 | 0.01 | 0.00 | 0.00 |
| C3 | 50.70 | 7.10 | 42.20 | 0.00 | 0.00 | 0.00 | 0.00 |
| C4 | 0.00 | 0.20 | 0.78 | 91.44 | 2.38 | 4.77 | 0.43 |
| C5 | 0.00 | 0.78 | 0.00 | 1.24 | 49.19 | 46.90 | 1.89 |
| C6 | 0.00 | 0.00 | 0.04 | 3.19 | 26.41 | 67.07 | 3.29 |
| C7 | 0.00 | 0.00 | 0.00 | 0.46 | 1.50 | 17.46 | 80.58 |

Class populations

| | |
|----|--------|
| C1 | 128254 |
| C2 | 76909 |
| C3 | 40665 |
| C4 | 56395 |
| C5 | 4603 |
| C6 | 4889 |
| C7 | 1529 |



PolSARpro v5.1 - Menu

esa PolSARpro
The Polarimetric SAR Data Processing and Educational Tool

T3 | S | Environment | Import | Convert | **Process** | Display | Calibration | Utilities | Tools | Configuration | Education | Help | Quit

Linear (+45 / -45)
Circular (L / R)
Elliptical (phi, tau)

Box Car Filter
Box Car - Edge Filter
C. Lopez Filter
Gaussian Filter
IDAN Filter
J.S. Lee Refined Filter
J.S. Lee Sigma Filter
P.W.F Filter
Edge Detector

Decomposition Parameters
Eigenvector Set Parameters
Eigenvalue Set Parameters

JRH : Huynen Decomposition
RMB1 : Barnes 1 Decomposition
RMB2 : Barnes 2 Decomposition
SRC : Cloude Decomposition
WAH1 : Holm 1 Decomposition
WAH2 : Holm 2 Decomposition
HAA : H / A / Alpha Decomposition

FRE2 : Freeman 2 Components Decomposition
FRE3 : Freeman 3 Components Decomposition
VZ3 : Van Zyl 3 Components Decomposition
YAM3 : Yamaguchi 3 Components Decomposition
YAM4 : Yamaguchi 4 Components Decomposition
NEU : Neumann 2 Components Decomposition

KRO : Krogager Decomposition
CAM : Cameron Decomposition
TSVM : Touzi Decomposition

Matrix Elements
Correlation Coefficients
Elliptical Basis Change
Polarimetric Speckle Filter
H / A / Alpha Decomposition
Polarimetric Decompositions
Polarimetric Functionalities - 1
Polarimetric Functionalities - 2
Polarimetric Segmentation
Polarimetric Data Analysis
Polarimetric Data Clustering
Batch Process

H / A / Alpha Classification
H / A / Alpha - Wishart Classification
Fuzzy - H / Alpha Classification
Wishart Supervised Classification
Rule-Based Hierarchical Classification
Basic Scattering Mechanism Identification
SVM Supervised Classification

Data Statistics
Data Histograms
Data Profiles
Histogram Based Statistics
Texture Analysis

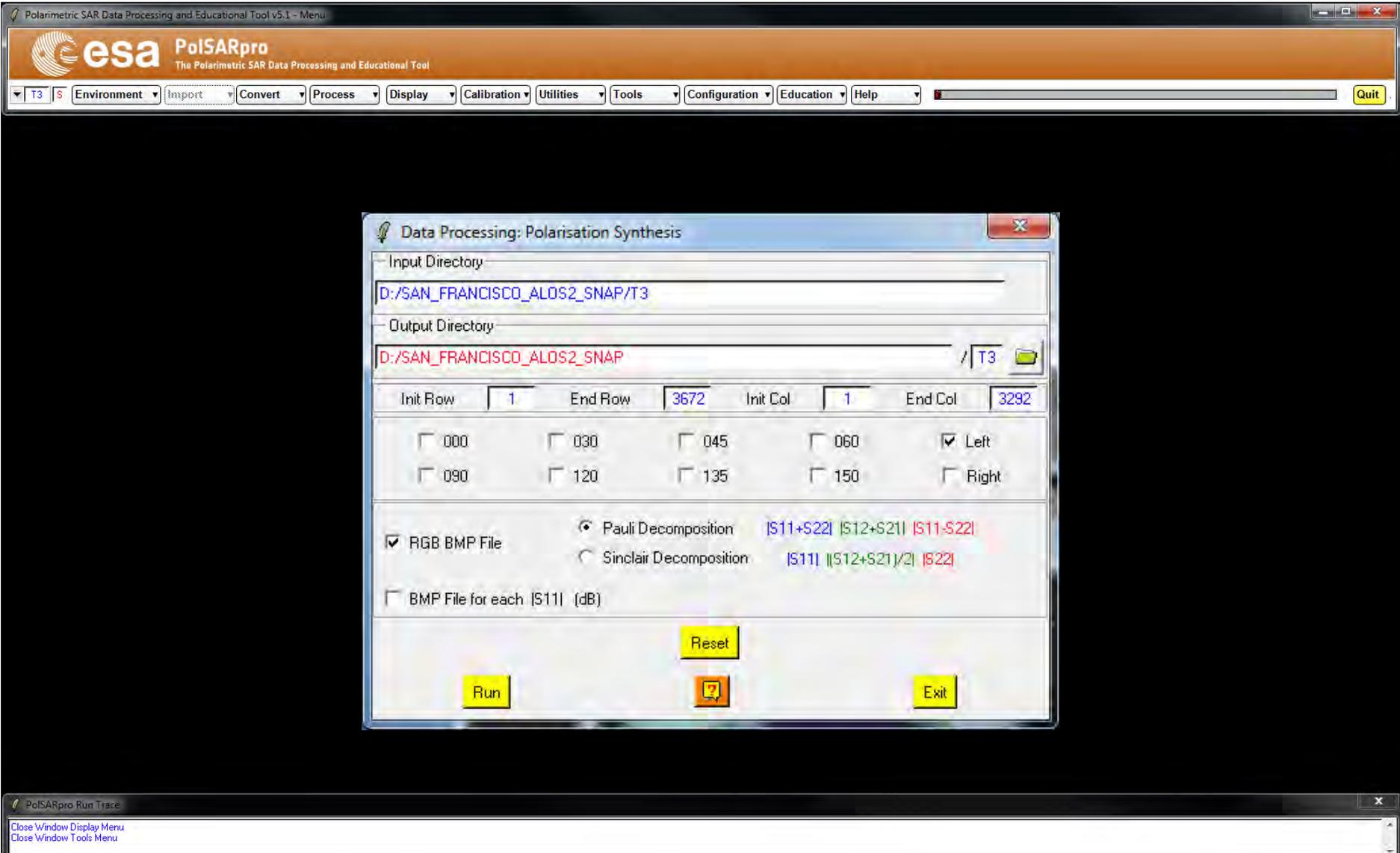
Clustering Process
Parameter Averaging
Data Sets Averaging

Faraday Rotation Estimation
Conformity Coefficient
Scattering Predominance
Scattering Diversity
Degree of Purity
Depolarisation Index
Alpha Approximation (Praks & Colin)
Entropy Approximation (Praks & Colin)
Scattering Mechanism Entropy (Freeman)
Scattering Mechanism Entropy (Van Zyl)
Kozlov Anisotropy
Lueneburg Anisotropy
Polarized Point Scatterer Detection
Reflectivity Ratio
Differential Reflectivity (ZDR)

Polarisation Synthesis
Polarimetric Signature
Stokes Parameters
Compact Polarimetric Mode
O.P.C.E
R.C.S Max
Surface Inversion
RVOG PolSAR Inversion
Sub-Aperture Analysis
DEM Estimation
Polarisation Orientation Compensation

Decomposition Applications

PolSARpro Run Trace
Close Window Display Menu
Close Window Tools Menu



The screenshot shows the PolSARpro software interface. The main window title is "PolSARpro The Polarimetric SAR Data Processing and Educational Tool". The menu bar includes: Environment, Import, Convert, Process, Display, Calibration, Utilities, Tools, Configuration, Education, Help, and a Quit button.

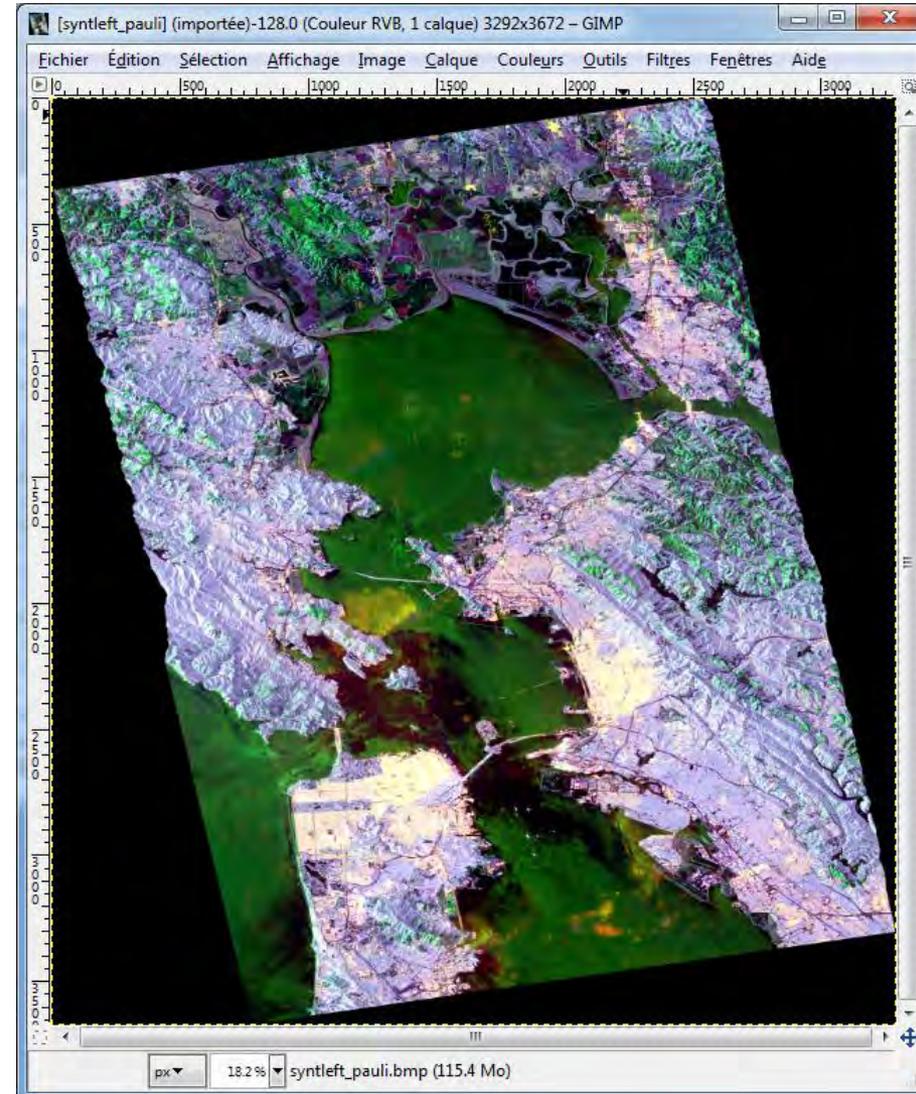
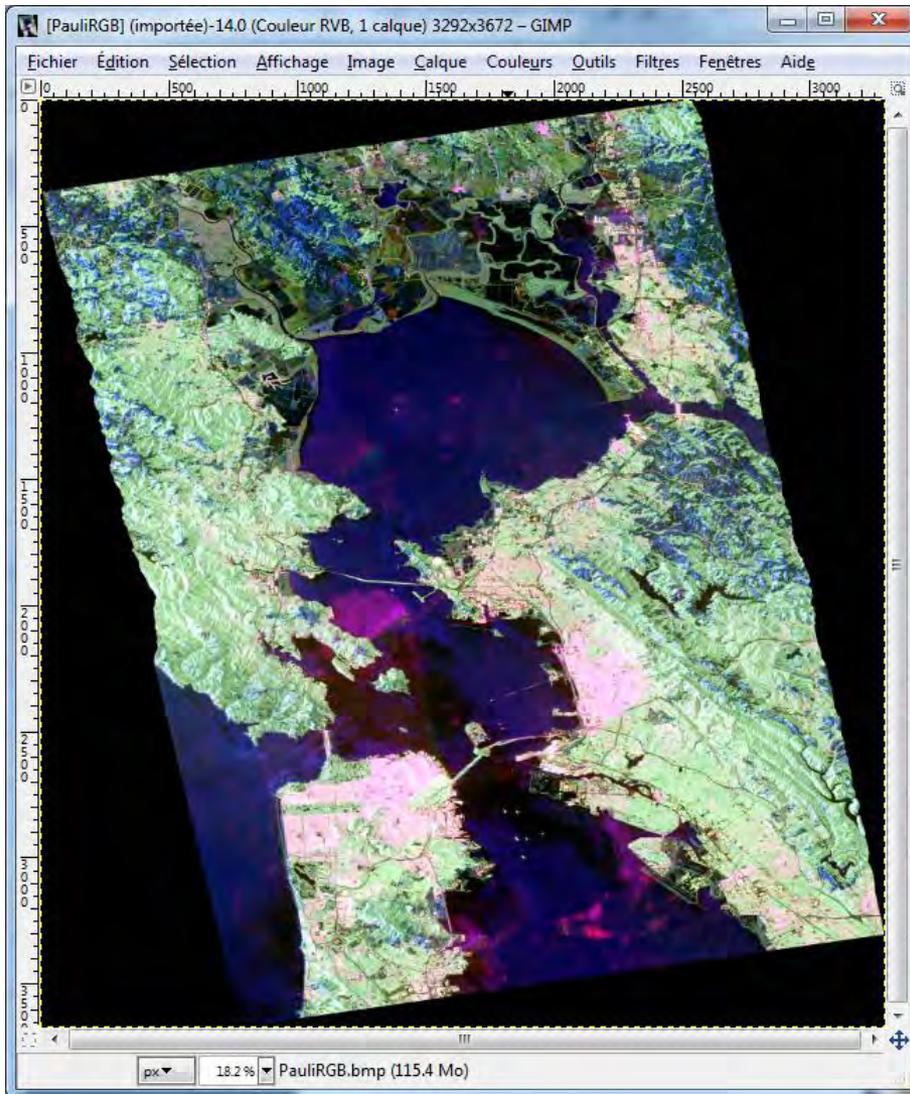
A dialog box titled "Data Processing: Polarisation Synthesis" is open, showing the following settings:

- Input Directory: D:/SAN_FRANCISCO_ALOS2_SNAP/T3
- Output Directory: D:/SAN_FRANCISCO_ALOS2_SNAP / T3
- Init Row: 1, End Row: 3672, Init Col: 1, End Col: 3292
- Decomposition options:
 - 000, 030, 045, 060, Left
 - 090, 120, 135, 150, Right
- Decomposition type:
 - Pauli Decomposition: |S11+S22| |S12+S21| |S11-S22|
 - Sinclair Decomposition: |S11| |(S12+S21)/2| |S22|
- BMP File for each |S11| (dB)

Buttons at the bottom of the dialog: Run, Reset, and Exit.

A "PolSARpro Run Trace" window is visible at the bottom, showing:

- Close Window Display Menu
- Close Window Tools Menu



Questions ?



KODÁK LÁSZLÓ INTÉZMÉNY 854008 L