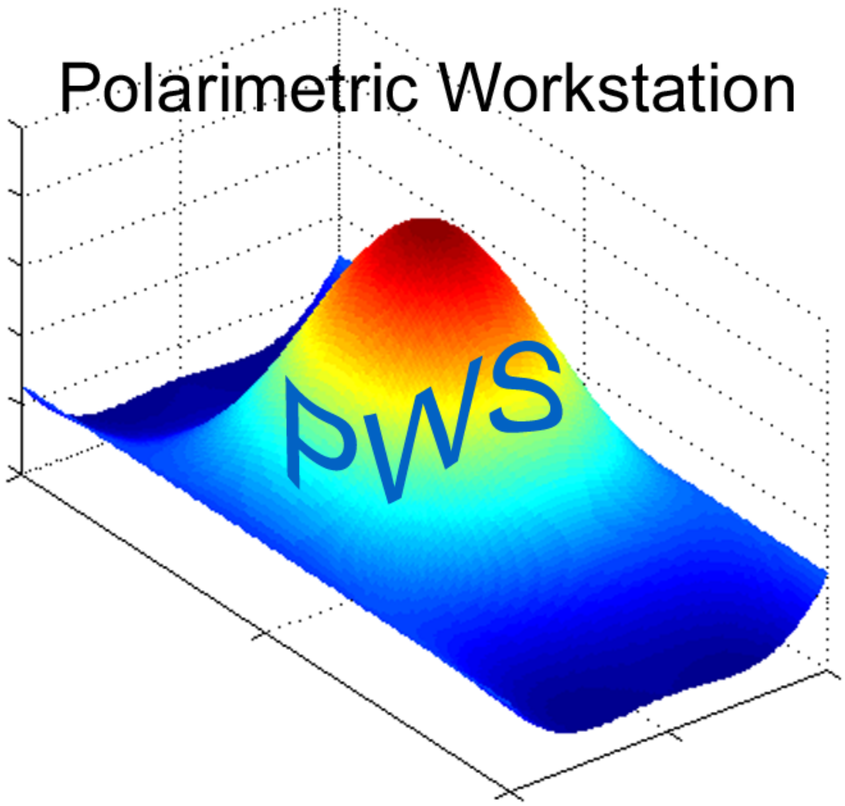
User Guide



PWS.v5r5.3

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Acknowledgements

This is the version 5.3 of the PWS that has been initiated in 2000. Stefan Nedelcu is thanked for his help in upgrading the PWS since 2008. F. Charbonneau is thanked for his contribution to PWS code implementation and maintenance between 2001 and 2004 when he was working with R. Touzi as a Research Assistant under contract with TGIS. Aleksandar Jevtic (while he was at CCRS as a coop-student from Waterloo University) is thanked for having adapted the Touzi polarimetric Fortran code (developed from 1988 to 1998) to the Matlab GUI interface and the development of polarimetric graphic tools under the supervision of John Wolfe while he was at CCRS. PWS includes Target analysis subroutine, which is an extension of the software “Targ-analysis” developed in 1996 by Dr. R.K. Hawkins, Dr. C. Livingstone, and J. Wolfe. We would like to thank all of them for their contribution.

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1. Introduction

Polarimetry has started a new era with the recent launch of RADARSAT-2 and ALOS. That are equipped with fully polarimetric synthetic aperture radar (SAR). In contrast to RADARSAT-1, which measures only the one-dimensional projection of the received wave along the receiving antenna of linear horizontal polarization (H), polarimetric RADARSAT-2 and ALOS measure almost simultaneously the amplitude and phase of the reflected wave at the four possible combinations of transmitting and receiving antenna linear polarizations (HH, HV, VH, VV). This quadruple vector measure allows the user to synthesize the target radar return for any combination of transmitting-receiving antenna polarizations. This should permit a more complete characterization of the physical properties of the targets being illuminated by the radar wave.

In 1989, the Canada Centre for Remote Sensing (CCRS), Natural Resources Canada, was among the first institutions in the world to fly a polarimetric SAR. The polarimetric capabability was added to conventional dual polarization at X and C- band SARs on the Convair-580 aircraft in 1989, and 1990 (Livingstone et al. 1995). To promote the unique polarimetric capabilities of RADARSAT 2, CCRS has investigated various applications using fully polarimetric data collected by Convair-580 SARs. The results obtained depend significantly on the tools used for polarimetric information extraction. The CCRS polarimetric workstation (PWS) is the fruit of more then twenty years experience in polarimetric image analysis (Touzi and Charbonneau 2004). The heart of the PWS is based on the software developed twenty years ago by R. Touzi while he was research scientist in France (Touzi et al. 2002). PWS was firstly used at CCRS in 1991 to validate the calibration of Polarimetric Convair -580 X band. While R. Touzi was working at the College Militaire Royal de St Jean, part of the Fortran codes were then passed to C. Livingstone, and inserted in a package named Polsig. Polsig was used between 1992 and 1998 by many CCRS scientists for the development of polarimetric applications. In 2000, the software was updated and adapted to the GUI PC interface in Matlab environment. Since that, the PWS has been used intensively by CCRS for the promotion of RADARSAT2 polarimetric applications. In the context of the preparation of Canada to Radarsat2 mission, PWS was licensed to more than 20 institutions (governments, university, and industry) in Canada, and has been extensively used for the initiation in polarimetry, and development of new polarimetric applications. With the most recent launch of RADARSAT2 and ALOS, we have decided to upgrade the PWS for the analysis of RADARSAT2 and ALOS polarimetric C and L band SLC data.

PWS includes the most efficient set of tools selected from the wide set of tools published in the open literature. Extensive effort resulted in an efficient workstation that will help users in the the learning and exploration of the very promising and exciting technique of polarimetry. Our objective is to maintain PWS updated with the edge leading tools. This version includes in particular the Touzi decomposition (Touzi 2007, 2009), which is becoming among the standard tools for optimum polarimetric information extraction.

PWS can ingest data coming from various polarimeters, such as Radarsat2, ALOS, the Convair-580 SAR, as well as SIR-C and the NASA-JPL AIRSAR. PWS offers the possibility to calibrate ALOS for Faraday rotation errors. With the increasing cycle of solar activity, Faraday rotation contamination has to be removed for meaningful exploitation of fully polarimetric ALOS-PALSAR data.

1.1 Requirements

Operating System:	Windows XP Pro.
CPU :	P4 3.0 GHz (tested)
RAM :	1Gb min., 2Gb . suggested
Hard Disk :	560 MB Full installation with sample images 220 MB Full installation without samples images 30 MB Base installation without demo movie and sample images

1.2 Installation

1. Double-click on **PWS_Setup.exe** on the PWS CD
2. Double-click on **MRCInstaller** to install Matlb Library
3. Reboot the system

Be sure that PWS users have the securi ty permission to read\write in the PWS folder and sample data folder.

Warning: If execution problem, DO NOT COPY .dll files in your \winnt\system32 folder. PWS will not run correctly and it will be very difficult to fix it.

2. PWS Function Description

2.1 Tools panel

When you execute PWS, the tools panel appears on t he desktop. The tools panel contains:

- Radarsat-2 to CCRS image conversion

- Load image
- Local Area Analysis
- Image Synthesis
- View data
- Demo
- Display PWS Output Images

2.2 Data Format

The PWS can read the following data:

Polarimetric Radarsat-2:
Single-Look Complex (SLC): 4 channels of complex values HH, VV, HV and VH

Polarimetric ALOS:
Single-Look Complex (SLC): 4 channels of complex values HH, VV, HV and VH

Convair-580:

Single-Look Complex (SLC): 4 channels of complex values HH, VV, HV and VH. Geocor product: Geocoded data under Kennaugh matrix format. The JPL compressed format was used to save data volume, under target and system reciprocity assumption (HV=VH).

JPL:

SIR-C (quad-pol) SLC

SIR-C (quad-pol) MLC

AIRSAR

2.3 Conversion to CCRS image format + Load image

2.3.a Radarsat-2 to CCRS image file format conversion.

Radarsat-2 image file scene is in TIFF format. Since PWS processes the SLC data under the to CCRS format, the conversion of RADARSAT2 Tiff file to CCRS format file is required.

1) Click on "**Radarsat-2-ALOS-PALSAR to CCRS Image Conversion**".

2) Go to the directory which contains Rasarsat-2 scene.

3) Select "**product.xml**" file

4) After the file is selected you will be prompt to enter line and pass number (between 1 and 9) in order to build the output file names. (CCRS file format)

5) When the file format conversion is completed Please load the Radarsat-2 CCRS format data as indicated in Section. (2.3d)

2.3.b ALOS-PALSAR to CCRS image file format conversion.

Since PWS processes the SLC data under the to CCRS format, the conversion of ALOS-PALSAR SLC files to CCRS format files is required.

1) Click on "**Radarsat-2-ALOS-PALSAR to CCRS Image Conversion**".

2) Go to the directory which contains the ALOS scene.

3) Select the LED file

4) After the file is selected you will be prompt to enter line and pass number (between 1 and 9) in order to build the output file names. (CCRS file format)

5) When the file format conversion is completed Please load the ALOS image. (2.3d)

2.3.c ALOS Faraday rotation correction

The Faraday rotation is measured using the Bickel and Bates method (Bickel and Bates 1965, Touzi and Shimada 2009). Farday rotation can be removed as follows:

1) Load the ALOS image (2.3d) under the CCRS SLC format.

2) Go to the Image Synthesis

3) Select Faraday Rotation

4) Select a sample (sub-image) for the computation of the Faraday rotation angle and Run

5) The Faraday rotation angle is viewed. If the angle is larger than 3 degree, Please ask for Faraday removal.

6) PWS generate the SLC files corrected for Faraday rotation.

2.3.d Load image

1) Click on "**Load image**" on the top of the GUI.
2) Select the header or image file that you want to display.
   - The CCRS-SLC files are generally named "l#p#??polgasp.hdr" for the header files and "l#p#??polgasp.img" for the image files. All four complex channel images HH, VV, HV, and VH are needed.

3) After selecting your file, specify which type of data it is : SLC or Geocor product – (not yet implemented)

4) An image size limit has been set to 50,000 columns or 2 Gb (decompressed GEOCOR product). If the image is larger than the limit, you will be prompted to crop the image. If desired, a cropping function will start automatically.

5) The selected image will be displayed in a new window. The other polarizations can be visualized by clicking on the polarization menu at the top of that window. If this is the first time that the selected image/polarization has been loaded, a magnitude conversion process that converts the 32-bits Floats Complex data to 8-bits unsigned integers, is automatically launched.

2.4 Local Analysis Tools

Local analysis tools provide polarization information of a given sample selected with the Polygon function.

2.4.1 Define polygons

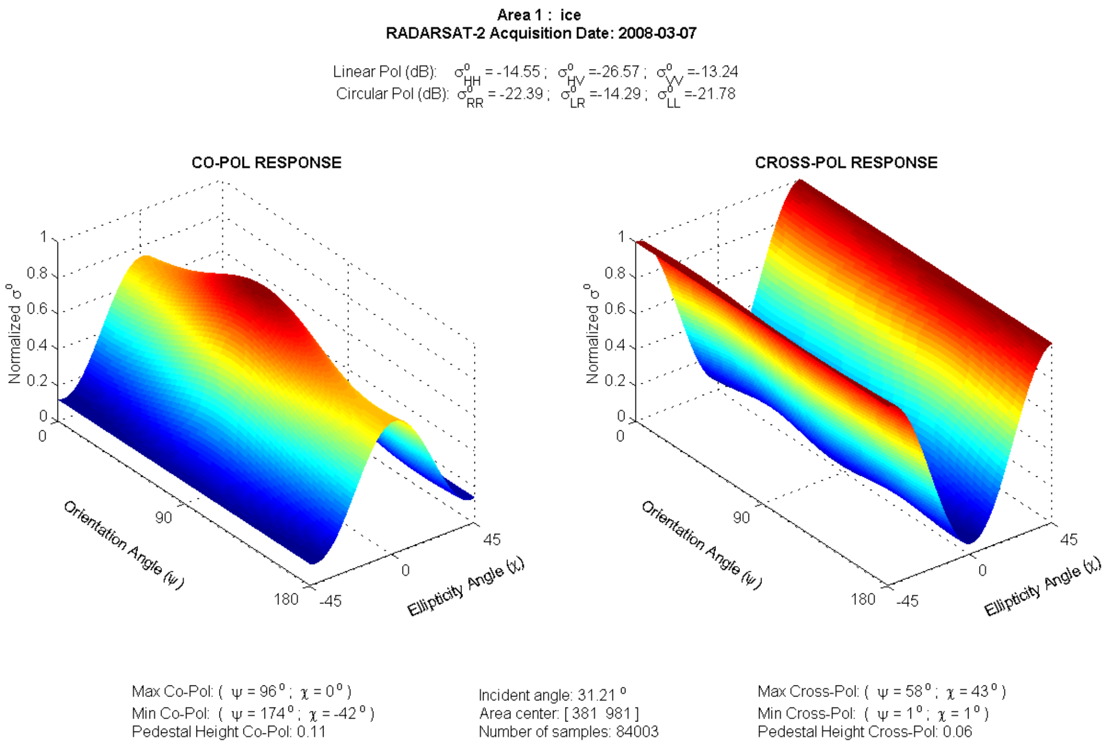
To use one of the local analysis tools, first you need to define a polygon by clicking on the “define polygon” button. You won’t be able to zoom in on the image during the polygon selection, so zoom in your area, if needed, before clicking on define polygon.

1) To create your polygon, use the left mouse button to select corners of your area.
2) To delete the last point, use “backpace” on your keyboard. Clicking the right button of your mouse sets the last point of your polygon.
3) If you accept this polygon, you will be prompt to provide a name for that area.
4) If some polygons have already been created, you can select one of them or create a new one. Created polygons are permanently saved.

2.4.2 Local area tools

a) Polarimetric signature

Generate the co-polarized and cross-polarized polarimetric signatures of the selected polygon. Select “Save” in the File menu if you wish to save the results. The pedestal of the polarimetric signature is provided as well as the antenna illumination (incidence) angle. A minimum of 400 independent samples per pol ygon is required for accurate estimation of the polarimetric parameters.



b) Statistics

Provide estimates of the polarimetric parameters that characterize the scattered and the received waves. The parameters computed for each selected polygon are saved in a "Co mma Separated Values" .csv ASCII file. The following parameters are estimated for the polygon under study:

1) σ^o - mean and standard deviation in dB for the linear polarizations HH, VV, and HV.

2) σ^o mean and standard deviation for the right (R) and left (L) circular polarizations RR, LL, and RL.

3) Span, which corresponds to the total scattered wave intensity.

4) Extrema of the scattered wave intensity R_o^{max} and R_o^{min}.

5) Extema of the degree of polarization p_{max} and p_{min}. The combination of these two parameters with R_o^{max} and R_o^{min} permits an excellent characterization of the type of scattering mechanism and its heterogeneity (Touzi et al. 1992).

6) Extrema of the completely polarized wave intensity CP_{MAX} and CP_{MIN}.

7) Extrema of the completely unpolarized wave intensity CUP_{MAX} and CUP_{MIN}.

8) Extrema of the received power P_{MAX} and P_{MIN}.

9) Extrema of the cross-matched power PX_{MAX} and P_{XMIN}; the scattered wave is maximized and the received antenna polarization is cross-matched to the scattered wave.

10) Van Zyl coefficient of variation P_{MIN}/P_{MAX}.

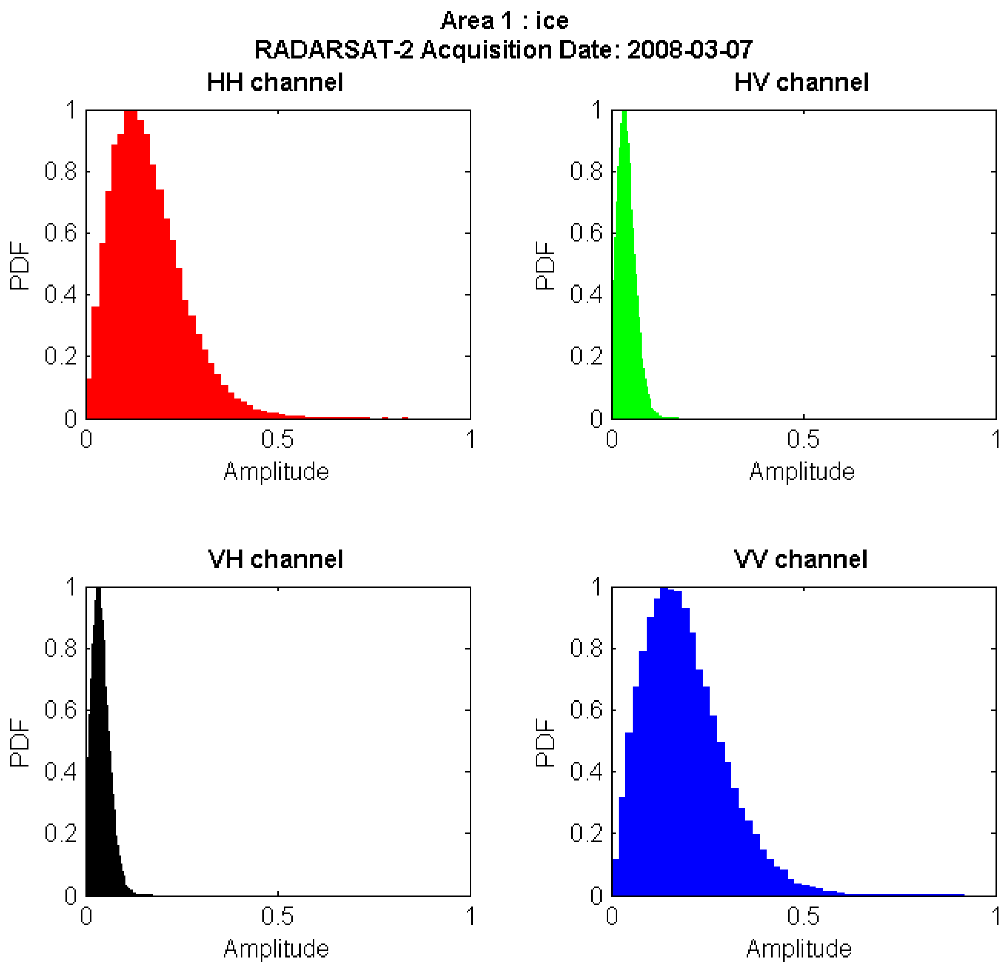
11) Polarization signature pedestals.

12) Channel coherence amplitude γ and phase ϕ (in degree) for HH-VV, HH-HV, and VV-HV.

13) The number of pixels per polygon, as well as the incidence angle (θ) for Radarsat-2 SLC products, are also provided.

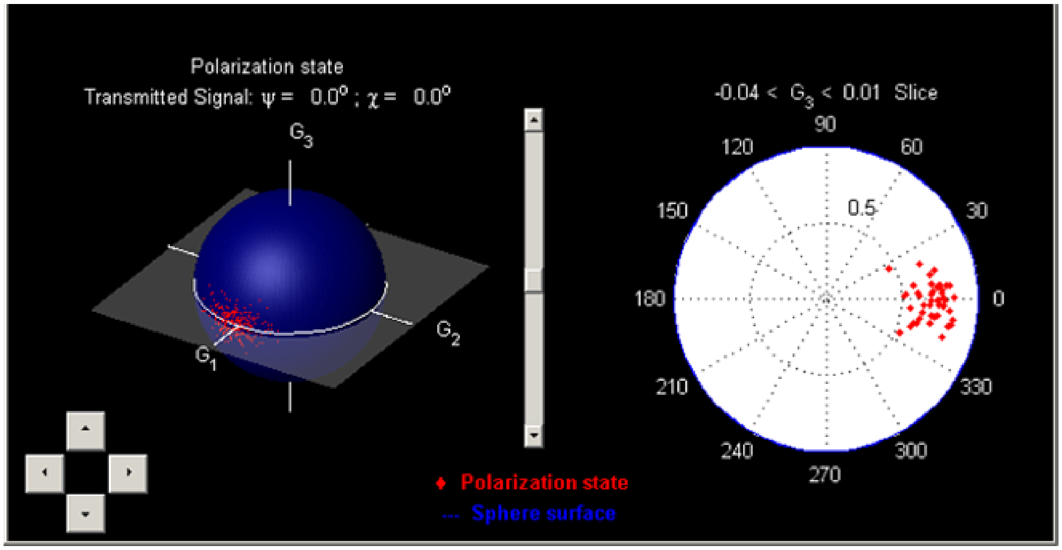
c) Histogram

Generate the amplitude hist ogram of the 4 polarizatio ns. Select "Save" in the File menu if you wish to save the results.



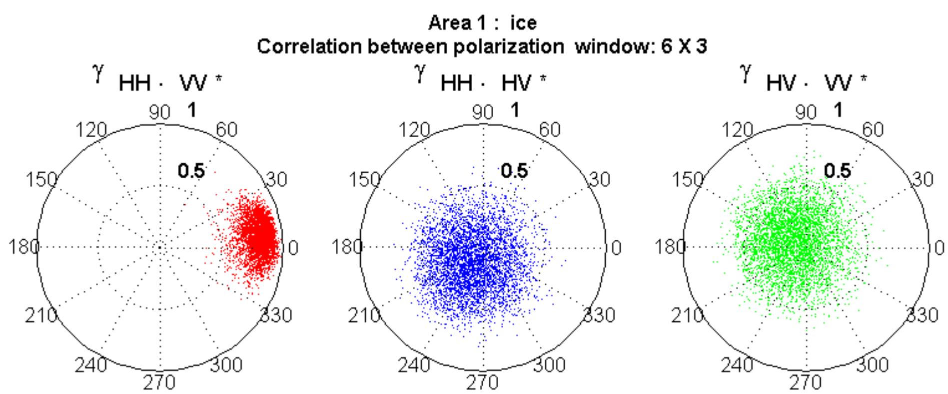
d) **Poincaré Sphere**

Map (as a red dot) the polariz ation state of the scattered wave on the Poincaré sphere. Multi-look data Polari zation state of a partially polarized wave is m apped within the Poincaré sphere. The user can select the transmitted signal configuration and the number of l ooks (per pixel). T o show the position of the polarization state within the sphere, a longitudinal section of the Poincaré sphere is presented. The longitude, as well as the thickness of the section can be sele cted using the slider control. Blue circles represent the longitudinal sect ion intersection with the surface of the sphere. Red dots indicate the polar ization states and their distance t o the blue circles provides an indication of the degree of polarization. Select "Save" in the File menu if you wish to save the results.



e) **Channel Coherence (magnitude and Phase difference)**

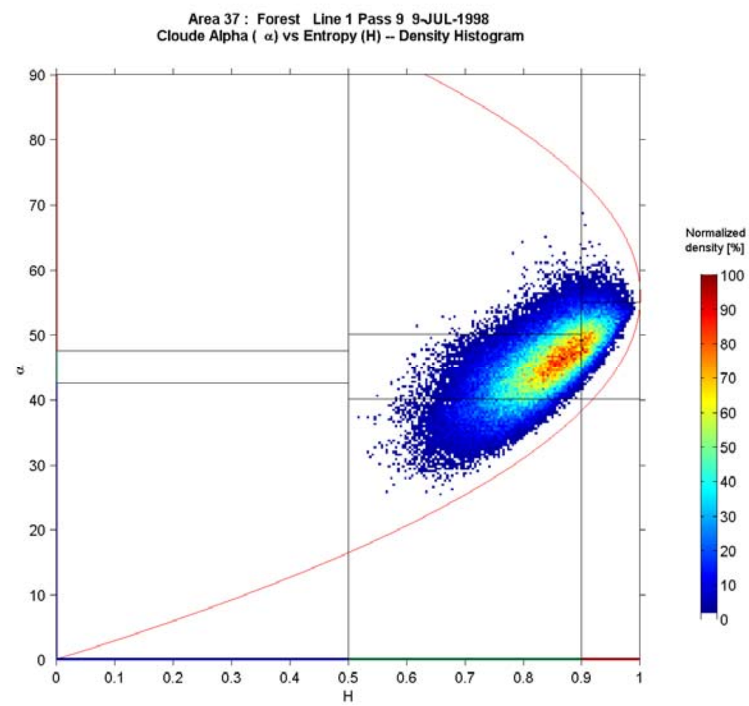
The polar representation is used to present the magnitude and phase of the complex coherence.



f) Cloude's decomposition

Derive Cloude's parameters (H), anisotropy (A), α and β, derived from Cloude's decomposition algorithm (Cloude and Pottier 1996). Two options are offered:

1) Estimate of the means of Cloude's parameters H, A, α and β. To obtain unbaised estimates, the averaged coher ency matrix is calculated over the polygon area under study, and used to derive the parameters.
2) Display the histogram of α as a function of ent ropy H within Cloude's parabola. α and H are derived using coherency matrix derived from multi-look samples. The number of looks (i.e. number of independent samples per pixel) can be fixed in terms of pixel window size.



g) Batch-Tool

Execute above functions in a batch processing over selected polygons. By selecting this function and clicking on 'APPLY', you are prompt to select the polygon(s) to process. You can select all the polygons by clicking on "Select all" button. Holding <CTRL> button and clicking on desired polygons can do specific selection. By clicking on "ok" button, you are prompt to select function(s) to process. Resulting figures are saved with a name based on the general header file, the polygon number, the function used and graphic format (.tiff, .bmp or .ps).

Example:

Header: l2p3.hdr
Function: polarimetric signature
Polygon #: 3
Format: PS
Output: l2p3_ID_3_sig.ps

Mask option: A bit map file, generated by a classification/segmentation software, might be used as an input to the PWS to compute the statistics of the different classes/segments. All the pixels of each segment should have the same value in the bitmap file. The segment number is an integer number between 1 to 255, and pixels that are assigned the zero value are not considered. The bitmap file name is based on the general header file name, ex: 1) SLC case: "l1p8polgasp.hdr", the corresponding bitmap name is "l1p8polgasp**bmp**.img"; 2) GEOCOR case: "imageken.hdr", the corresponding bitmap name is "imageken**bmp**.img". The bitmap should have the same dimension as the SAR image. The user will not be prompt to select bitmap file, if the default file name exist, it uses it.

h) Class Stats

Evaluates the Polarimetric Signature (a) and the Statistics (b) on a selected class name. Two options:

3) **Polygons:** Regroups all polygons with the same name; evaluates the average Kennaugh matrix; and computes the average statistic for that class name. User select polygons name on the pop-up list. Statistics results are saved in the default output.csv file. The Polarimetric signature figure is not automatically saved, user need to select "file/save" if desired.
4) **Bitmap:** Regroups all image samples corresponding to a specific class defined by a bitmap image (mask) and evaluates the statistics. User needs to select a bitmap file , previously created from a classification/segmentation software. The bitmap is a 8 bits file, where samples value correspond to a specific class. "0" is reserved for unclassified samples. The bitmap image name need to have the extension ".img" and its corresponding header file ".hdr" should respect the structure of the following example:

```
number_lines     300
number_samples   3000
line_up          101
line_down        400
sample_left      1001
sample_right     4000
Bitmap_begin
1 Wheat
2 Deciduous
5 Grass
10 Barley
Bitmap_end
```

number_lines and number_samples are the number of lines and samples per line in the bitmap image; line_up, line_down, sample left and sample_right correspond to location of the bitmap in the full SAR image (optional if the bitmap image is the same size as the SAR image); Bitmap_begin and Bitmap_end are the markers defining the beginning and the end of the class list. Each class in the class list is composed by a number (1-255, corresponding to value in the bitmap) and a class name.

User can select more than one class to run under batch mode.

i) **Saving and viewing the results**

Once the local area analysis tool is selected, select the "Apply" button to execute the function. Numerical output values are saved in a file such as "image_output.csv" (the csv extension is for Comma Separated Values format). View the results by clicking on the "View data" button on the bottom-left of the control tools panel. Microsoft Excel, Corel QuattroPro, and Lotus123 will automatically import the "image_output.csv" file.

2.5 Image Synthesis Tools

Image synthesis tools permits the synthesis of the received radar reflectivity images for any combination of transmitting-receiving antenna polarizations. The synthesis is performed on the portion of the image selected by the user. Define the coordinates of the sub-image before running the synthesis tool by selecting the "Define sub-image" button.

2.5.1 Define sub-image

You can define the sub-image in 3 ways:

a) **Full image:** The synthesis will be performed on the entire image.
b) **Interactive:** With your left mouse button select a corner of your sub-image, hold and drag your cursor to generate the area. Release the button when the rectangle covers the desired area.
c) **Coordinates:** The user is prompted to enter the top-left and bottom-right coordinates of the desired sub-image.

The user can specify the output sample spacing:

Full resolution: 1-look image.

Square samples: set automatic ally the size of the multi-look pixel to synthesize an image with square pixel. For example, a sample of 9x1 pixels is used with the Convair-580 1-look SLC data.

User defined: The user specifies the multi-look pixel size (number of pixels in azimuth and range per multi-look sample).

2.5.2 Tools

a) Sigma naught ($\beta° = \sigma° \sin \theta_{inc}$)

Converts the selected sub-image, to a power image of the transmitting and receiving antenna polarizations defined by the user. The channel generated is saved us ing the 32 bits floating point format and a separate header file. NOTE: Intensity value are σ^o for Radarsat-2 data

b) Coherence

Generates HH-VV, HH-HV or VV-HV c hannel coherence map for a selected sub-image. The saved Outputs are two 32 bits Real float images (amplitude and phase) with corresponding header files. If "full resolution" is selected, only a phase image will be created (coherence magnitude is 1 in this case).

c) Swartz-contrast

Optimization of two-target contras t: generate the image at the antenna polarization combination, whic h optimizes the contrast between two selected targets, using Swartz met hod (Swartz et al., 1988) developed for azimuthally symmetrical targets. At least two polygons need to be defined by the "def ine polygons" function befor e to be able to run this function.

Output header file contains information on the transmitting-receiving configuration, the two polygons used and the optimum contrast obtained

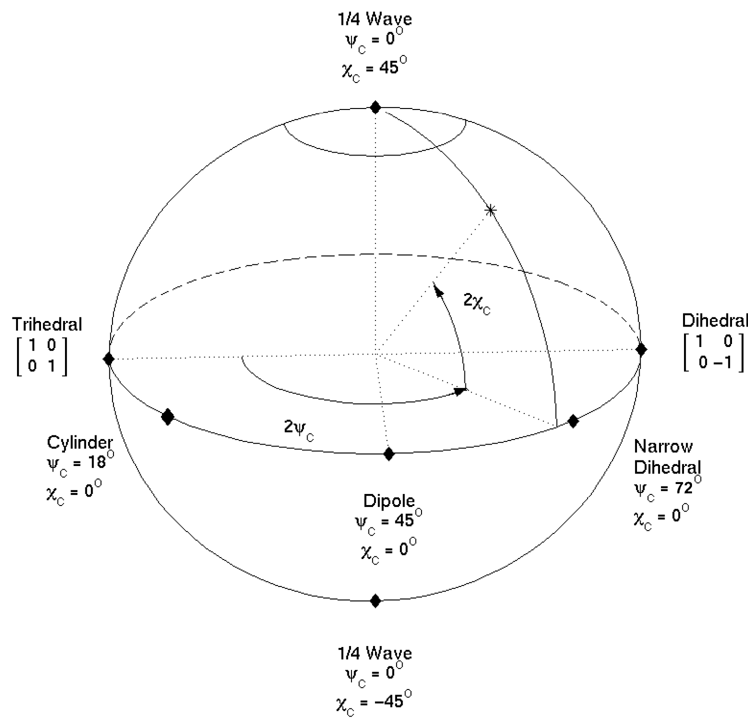
d) Channel Phase

Generate Single-Look phase and phase differences between polarizations without reciprocal assumption.

e) Touzi SSCM: Symmetric Scattering Characterization Method

The symmetric scattering characterization method, known as the Touzi SSCM, has been recently introduced by Touzi and Charbonneau (2002) for high-resolution characterization of target symmetric scattering, under coherent conditions. The Touzi SSCM is based on the target Poincaré sphere representation, which was also introduced by Touzi and Charbonneau (2002) for a high resolution mapping of the target symmetric scattering, as well as assessment and validation of the coherence nature of target scattering prior to the scattering decomposition. The method is applied on coherent scattering of significant symmetric scattering component; and the ratio of the maximized symmetric scattering component to the total scattering, named dsym, is provided to assess the results. Each coherent symmetric scatterer is uniquely mapped as a point of latitude $2\psi_c$ and longitude $2\chi_c$ on the surface of the target Poincaré sphere presented below, where the scatter angles ψ_c and χ_c are derived as a function of the symmetric scattering parameters. A partially coherent symmetric scatterer is represented as a point inside the sphere at a distance from the sphere center determined by the degree of coherence p_{sym} introduced also in Touzi and Charbonneau (2002). p_{sym} is used to assess the coherence of distributed targets; a 9x9 square pixels is coherent if the degree of coherence p_{sym} is higher than 0.86. The Rician test is used to validate the coherent nature of a point target, and a Rician threshold of 18 dB is taken. This threshold is applied on the maximum power return $|m|^2$.

To remove the rotation phase ambiguity, only half of the sphere is used with ψ_c varying within the interval $[0,\pi/2]$.



Target Poincaré Sphere

Outputs

d_{sym}: degree of symmetry	test_dsym.img
p_{sym}: degree of coherence	test_psym_w9.img
Huynen Max. Power $|m|^2$	test_Hm2.img
Coherent Target Bitmap	test_SSCMthr18g0.86w9.img
ψ_c: target poincaré sphere ½ latitude	test_psic18g0.86w9.img
χ_c: target poincaré sphere ½ longtitude	test_chic18g0.86w9.img
ψ_a : target polarization orientation	test_psia18g0.86w9.img

Generated outputs are labeled, based on the root name and threshold values.

Example: p_{sym}: 0.86 ; avg.window: 9 ; Rician: 18 dB ; and root: test

Display

By default, Huynen maximum power $|m|^2$, ψ_c and χ_c are displayed on screen when processing is done. The coherence tests are run, and the SSCM is only applied within coherent regions. Non-coherent targets are assigned zero values for ψ_c, ψ_a and χ_c. User can zoom on target, by right/left click on the images. User can also load the images: Degree of coherence, Degree of symmetry and Target Orientation from the "Load Results" option in the menu bar of the "Huynen Intensity" figure.

SSCM is a **full resolution** decomposition technique, which implies that the generated images are in full resolution sample size format, even if "square samples" or "user define" option was selected during the "Define sub-area" step.

Reprocessing with different thresholds

When the SSCM option is launch, user is prompt to generate the SSCM decomposition on the selected area (option: YES) or to use previous decomposition results (option: Use Existing). By selecting "Use Existing", the user can generate new output images from different analysis thresholds. User will be prompt to selected a previously process SSCM log file (*_sscm.log) as input. The corresponding area of the selected file doesn't need to be the same as the defined area on the "Image display" window.

WARNING: This method is defined **only for SLC** data products.

f) Touzi Decomposition

Generates the Touzi decomposition (Touzi et al. 2007, 2009) parameters for the dominant, medium or low scattering. All the decomposition parameters are provided in floating 32-bit format. Besides, a circular coding is used to represent the Touzi phase on a tif 8-bit file. This leads to a coarse phase classification that has been shown very useful for wetland scattering classification (Touzi, Deschamps et al. 2007, Touzi et al. 2009).

g) Save Kennaugh

Generates a 10 channels image file corresponding to the Kennaugh matrix (reciprocal assumption) of the selected sub-image. User can use the output file as an image file by loading it ("Load image" button) and selecting "GEOCOR (Kennaugh)" option on the "Data Format" window. Output file names (image and header) are build from the root name provide by user ex: root = test → output: testken.img and testken.hdr. This function is useful when user want to keep a smaller image for further processing.

h) Batch-synth

Executes above points a, b, d and f , as well as the Cloude's parameters, in a batch process for the defined sub-image. User is prompted to select the options and output root name. Output filename are composed by the root name and option selected.

> **Example:**
> Root = test
> Option: HH. **output:** test_HH.img

Note: If large area is defined and multiple options selected, user should disable "Display" option to avoid running out of memory.

Cloude decomposition outputs correspond to:

Entropy (H)	test_H.img
Anisotropy (A)	test_A.img
Alpha angle (α)	test_APH.img
Beta angle (β)	test_B.img
Eigenvalues ($\lambda_{1,2,3}$)	test_EIG#.img

Outputs files generated in this section can be reo pen with t he "Raw Image" function (on the top of the "P olarimetric Workstation" window). Images are displayed in full resoluti on. If image is to large, corresponding 8 bits image is display ed. Note, if enhancement function is used, the right color bar disappears because it's bec ome useless. Any image processing software can also read these output images as RAW data format.

2.6 Full Resolution

On the **Image Display** window, there is an option **Full Resolution**. When clicking on this option, use the mouse to select the center of a sub-window t o be displayed in full resolution.

Full resolution menu

- Position

Gives the coordinates and the power in dB of the pixel under the cursor in the **Full resolution** window. The c oordinates are relative to the sub-wind ow. By click-hold left mouse button and moving the mouse, you get the distanc e between two pixels (distance is in pixel units).

- New Area

This function allows you to relocate the **Full resolution w indow** on the **Image Display**. Click on main Image to select a new area.

- Target Analysis

2.6.1 Target analysis

This tool analyses and computes reference point target signals for scene calibration [Touzi et al. 1993]. Peak signal intensity location is given for the 4 channels to assess channel registration. Channels are oversampled (by 8) using the zero-padding method, to give the exact position of the peak signal intensity. The phase and intensity of the peak, as well as the peak intensity-to-clutter ratio are computed. The intensity integration method [Gray et al. 1990] and the complex integration method [Touzi, 1992] are implemented in order to provide an accurate estimate of target phase and magnitude at the presence of system mis-focussing.

By clicking on this option, Target Analysis GUI will pop-up. You need to defined the following parameters:

Get Targets: Select point target(s) (1 or more) in the **Full Resolution** window with left mouse button. When done with selection, use right mouse button.

Deselect: Remove selected target(s) (latest add, first remove)

Get Clutter: Define the clutter area (target's background). Draw a polygon area close to the target. Be careful to not be too close to the target. Area should contain at least 400 independent samples. Use mouse to draw the polygon (left button for control points and right button to end polygon drawing).

Target Type: Select the corresponding type of your targets selected

- **Corner** corresponds to calibration corner reflector or any point target.
- **Polarimetric active radar calibrator (PARC)** corresponds to the response of a Portable Active Radar Calibrator. Active calibration target with a delay line loop that gives a series of repeated transmissions of attenuated signals at fixed time intervals. Target analysis provides the parameters needed for PARC signal assessment [touzi 93].

  For PARC, user should select (**Get Target**) only the first response (the brightest) as target, the others recirculations will be automatically detected.

Integration Window: The window used to integrate the information on targets. Its dimensions are function of the 3 dB width of the target peak (azimuth and range). User selects the number of side lobes to integrate.

Lobes = 0 : Only main lobe is integrated

Lobes = 1, 2, 3 : Integration window contains secondary lobes 1, 2, 3.

Peak intensity selection:

- **Auto:** Will look inside the integration window to find the highest point target backscattering and centred the integration window analysis on this target. This procedure is repeated for each selected target defined by **Get Targets**.
- **Manual**: Will centred the integration window analysis on the input pixel coordinates.

Filename: Output root filename of the numerical and graphical results.

Example:	**Filename =** test	
Output files:	test_target.ps	(graphical file)
	test_target.csv	(ascii text file)

The postscript (*.ps) file contains all the graphical results figures displayed. The numerical values are also saved in the *.csv (can be read with any spreadsheet handler or text software). The postscript format is used because it permits to save multiple figures in the same file. Postscript files can be open with **Ghostview** freeware available a http://www.seas.ucla.edu/~ee5cta/ghostView/ or other www sites.

RUN:

Execute the target analysis task

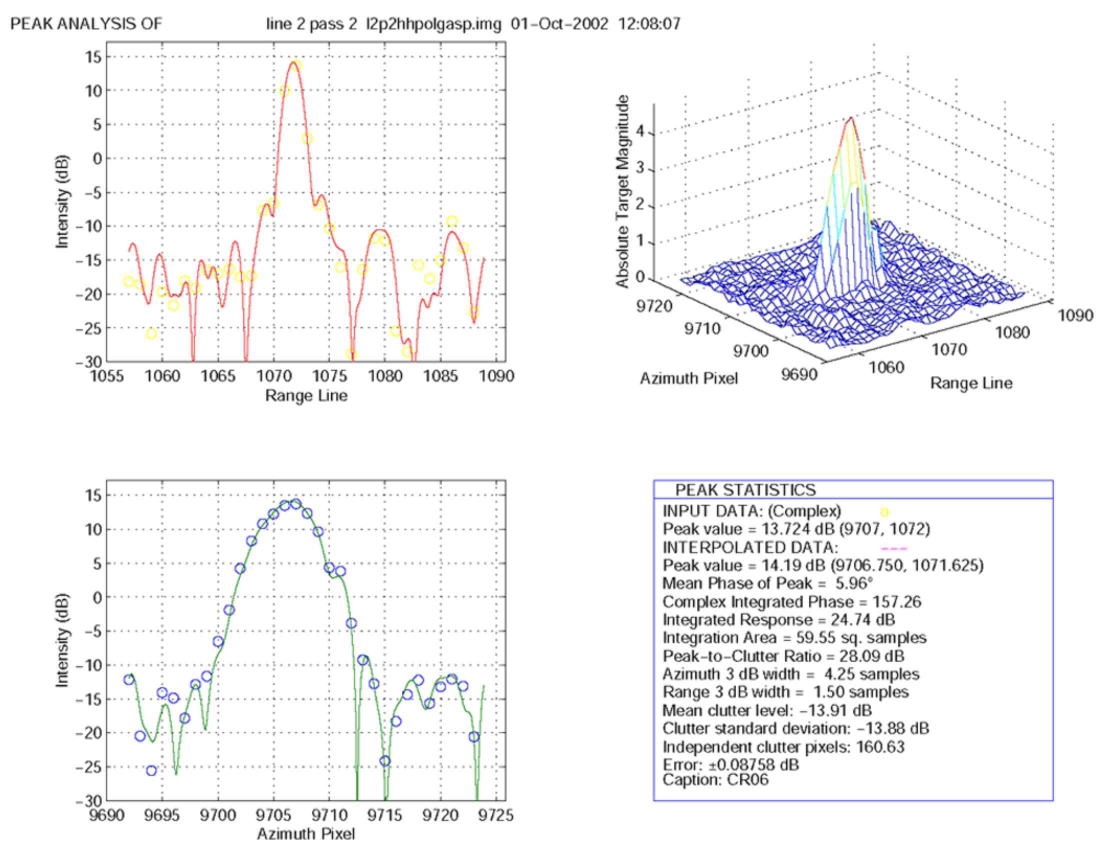
Note:

a) For a target, if the target-to-clutter for a given po larization is lo wer than clutter threshold, the analysis is not retained. The clutter threshold is given by the average clutter intensity plus one standard deviation.

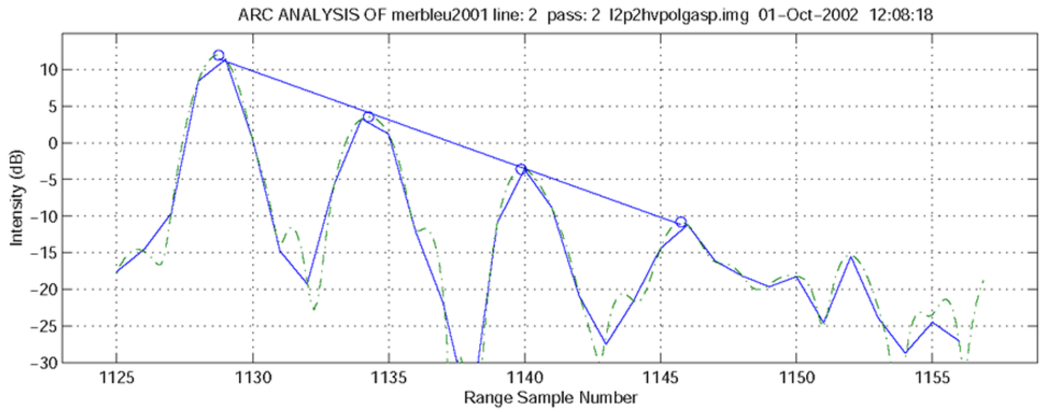
b) To avoid multiple gr aphical windows on desktop, if more than a point target is selected, the target a nalysis graphical win dows will be close automatically. The graphic results can be view after task by **ghostview**.

2.6.2 Graphical results examples:

a) Passive Target:



b) PARC



Recirc Number	Peak Location (sample#)	Peak Magnitude (dB)	Peak Phase (degrees)	C.I. Phase (degrees)	Mean Phase (degrees)	Range 3dB Width (samples)	Azimuth 3dB Width (samples)	Integrated Response (dB)	Peak-to-Clutter Ratio (dB)
0	1128.750	11.91	81.29	112.31	44.16	1.38	3.88	21.96	32.41
1	1134.250	3.52	53.01	81.32	25.38	1.75	4.38	14.99	24.02
2	1139.875	-3.61	27.60	68.10	35.88	1.50	5.00	7.98	16.89
3	1145.750	-10.80	9.39	57.04	23.23	1.50	8.00	1.59	9.70

Azimuth Line # 10719.250
Extrapolated Peak Magnitude of 0th Recirculation = 11.42 dB
Average Peak-to-Peak Separation = 5.67
Integration Area = 49.94 sq. samples
Polarisation = HV
Caption: ARC2542

2-Way Antenna Gain = 0.00 dB
Slope of Fitted Line = -1.33 dB/sample
Calculated Clutter Threshold = -16.93 dB
Aquisition time = 13-JUN-2001 14:56:30.78900
Mean clutter level = -20.50 dB
Clutter standard deviation = -19.45 dB
Independent clutter pixels = 192.19
Error factor = ±0.03902 dB

3. Demo

By selecting "Demo" on the top-left corner of the control tools panel, a demonstration movie will launch. The demo represents a sequence of $\sigma°$ images synthesized for different configurations of the transmitting-receiving antenna polarizations. The transmitting and receiving polarization ellipses are displayed on each side of the synthesized image.

4. Convair-580 data

Four complex SLC Convair-580 data are included in the CD to familiarize the User with the PWS. When using the Data in new representations, derived works and products, the User shall reference the source of information as: © 2002 Government of Canada with permission from Canada Centre for Remote Sensing at Natural Resources Canada.

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