Do It Yourself 1

Getting started with PolSARpro

The objectives of this first *Do It Yourself* concern the import of various POLSAR data formats to PolSAR pro as well as the visualization of basic polarimetric quantities.

Remark:

The following data manipulations have been realized on an "IEEE little endian convention" machine (a PC). Users working on an "IEEE big endian convention" computer will have to toggle the IEEE conversion option wherever it is proposed.

1. BASIC SETUP

Sample data sets, delivered with the PolSARpro software, have been stored at a specific location ~/PSP_demo/Sample_data, where ~ represents the home directory /home/laurent.

The ~/PSP_demo/DATA directory has been created to host the data sets converted to the PolSARpro format.

It can be seen on **Figure 1** that the ~/PSP_demo/Sample_data contains data sets acquired with various sensors.

•			PSP_demo - Konqueror 🗌 🗙
Location Edit View Go Bookmarks	s <u>T</u> ools <u>S</u> e	ettings <u>W</u> indow <u>H</u> el	p
🔍 🔊 🐴 🖓 🕲 🖾 🛛	0, 0,	1 🗖 🗖	、
Location: Ame/laurent/PSP_d	emo/		• J
Name	Size	File Type 🛛 😽	Modified Permissions
	4.0 KB	Folder	2006-07-19 23:16 drwxr-xr-x la
- ESample_data	4.0 KB	Folder	2006-07-19 21:10 drwxr-xr-x la
⊨ ≧ AIRSAR	4.0 KB	Folder	2006-07-19 21:09 dr-xr-xr-x
AIRSAR_with_HEADER	4.0 KB	Folder	2006-07-19 21:09 dr-xr-xr-x la
AIRSAR_with_NO_HEADER	4.0 KB	Folder	2006-07-19 21:09 dr-xr-xr-x la
	4.0 KB	Folder	2006-07-19 21:09 dr-xr-xr-x
🗄 🔁 ICE	4.0 KB	Folder	2006-07-19 21:09 dr-xr-xr-x
🗄 🔁 OTTAWA	4.0 KB	Folder	2006-07-19 21:09 dr-xr-xr-x la
🖻 📄 EMISAR	4.0 KB	Folder	2006-07-19 21:09 dr-xr-xr-x la
	4.0 KB	Folder	2006-07-19 21:09 dr-xr-xr-x
	4.0 KB	Folder	2006-07-19 21:09 dr-xr-xr-x
🖻 🔁 ESAR	4.0 KB	Folder	2006-07-19 21:09 dr-xr-xr-x
	4.0 KB	Folder	2006-07-19 21:10 dr-xr-xr-x
⊨- 🔁 PISAR	4.0 KB	Folder	2006-07-19 21:10 dr-xr-xr-x
🗄 🔁 NIIGATA_L	4.0 KB	Folder	2006-07-19 21:10 dr-xr-xr-x
	4.0 KB	Folder	2006-07-19 21:10 dr-xr-xr-x
	5.4 MB	PDF Document	2006-07-19 21:10 -r-xr-xr-x
III.			\$
17 Items - One File (5.4 MB Total) - 16 Fol	ders		

Figure 1 Basic directory setup

2. SENSOR SPECIFIC DATA SET IMPORT

2.1 Flevoland data import

2.1.1 Main input directory selection

PolSARpro is run and the full version is selected.



Figure 2 Main PolSARpro widget

- From the main PolSARpro widget represented, click Environment: the main input directory window appears.
- It is recommended to unselect the ENVI config option in order to avoid the creation of numerous header files.
- Then set the input directory to the Flevoland data set directory: ~/PSP_demo/Sample_data/AIRSAR/AIRSAR_with_HEADER/FLEVOLAND.
- The main input directory is a key basic internal variable for PolSARpro and its value may change during the processing. It is then recommended to let this window open when using PolSARpro.

•		Environment _ 🗌 🗙
- Main Input Directory		
/home/laurent/PSP_demo/Sample_data/AIR	SAR/AIRSAR_with_HEADER/	FLEVOLAND 📃 🖻 🚹
🔟 Automatic Data Check	ENVI Config File	🔄 Run Trace 💦 .
—Display Size		
Rows 800 🔺 💌	Columns 800	▲ ▼ Save
- Color Maps		
Supervized ColorMap16 🛛 🛞 Uns	upervized ColorMap9 🛛 🔶	Unsupervized ColorMap27
🛞 Unsupervized ColorMap8 🛞 Uns	upervized ColorMap16	
		Exit

Figure 3 Main input directory widget with the Flevoland data settings

2.1.2 Declaration of input data type

Click Import \rightarrow Airborne Sensor \rightarrow AirSAR : The AirSAR import interface appears

- The Flevoland data set has been acquired by the AirSAR sensor prior to 1993 : select the appropriate v3.56 option
- The polarimetric data format is Multilook Complex : select the MLC option
- Set the input Stokes parameter file to ~/PSP_demo/Sample_data/ AIRSAR/AIRSAR_with_HEADER/FLEVOLAND/FLEVOL.STK. Depending on the operating system, you may have to unselect the STK filter to do enter the file name.
- Read the header information by pressing the Read Header button: the image number of rows and columns appear.
- Click OK.

	AIRSAR Input Data File 👝 🗌 🗙
- Input Directory	annaraan a 1
/home/laurent/PSP_demo/Sample_data/AIRSAR/AIRSAR_with_HEADER/FL	EVOLAND
- AIRSAR Processor	
 ◆ v3.56 (prior to 1993) ◇ v5.01 and more (sin 	nce 1993) 🛛 🗸 TOPSAR
 AIRSAR Data Format Single Look Complex Compressed Stokes Format (SLC) Multi Look Compressed Stokes Format (MLC) 	
AIRSAR Input Data File (STK)	
//nome/laurent/PSP_demo/Sample_data/AIRSAR/AIRSAR_with_HEADER/FL	LEVOLAND/FLEVOL.STK
Read Header	Edit Header
Initial Number of Rows 750 Initial Num	ber of Cols 1024
Convert Input IEEE binary Format	(LE<->BE)
ок	Cancel

Figure 4 AirSAR import declaration interface with Flevoland data settings

2.1.3 Data import

Now that the data format has been specified, it is possible to extract and convert the POLSAR information.

- On PolSARpro main widget, click Import \rightarrow Extract \rightarrow Full Resolution : the extraction widget appears
- In order to extract data to a specific directory, set the Output Directory value to ~/PSP_demo/DATA/Flevoland/
- In this windows, click Full resolution to convert the whole data set.

- Since we are dealing with incoherent Stokes data, [T3] and [C3] matrix formats are the only conversion possibilities. Let the [T3] option selected
- Click Run

•	POLSARPRO Extract Data 👝 🗌 🗙			
- Input Directory				
/home/laurent/PSP_demo/S	Sample_data/AIRSA	R/AIRSAR_with_H	EADER/FLEVOL/	
Output Directory				
/home/laurent/PSP_demo/E	ATA/Flevoland		/ T3 🧰	
Init Row 1 Er	nd Row 750	Init Col 1	End Col 1024	
Full Resolution				
💠 Sub Sampling	Row		Col	
💠 Multi Look	Row		Col	
ŗ	r Symmetrisation	i (S12 = S21)		
Input Data Format Cod	led Stokes Element	s		
– Output Data Format –				
Sinclair Elements	🔷 [S2]	🔷 (Sxx, Sxy) 💠 (lxx, lxy)	
Coherency Elements	🔶 [ТЗ]			
Covariance Elements	🔶 [C2]	💠 [C3]	� [C4]	
Run		ţ.	Exit	

Figure 5 AirSAR data extraction interface.

Check that the ~/PSP_demo/DATA/Flevoland/ ~/PSP_demo/DATA/Flevoland/T3 directories have been created and contain the desires polarimetric data files.

	DATA - Konqueror				
Location <u>E</u> dit <u>V</u> iew <u>Go</u> Boo	okmarks <u>T</u> ools <u>S</u> e	ettings <u>W</u> indow <u>H</u> elp			
۹ 🕨 🔬 🍙 🖉 🕴		1 🖬 🛋		20	
build the second	PSP_demo/DATA	· <u> </u>		*	
Name	Size	File Type 👻	Modified	Permissions	
🗄 🔁 Flevoland	4.0 KB	Folder	2006-07-19 23:24	drwxr-xr-x	
Ė- ≧ T3	4.0 KB	Folder	2006-07-19 23:24	drwxr-xr-x	
- PauliRGB.bmp	2.2 MB	BMP Image	2006-07-19 23:24	-rw-rr	
🚺 config.txt	85 B	Plain Text Document	2006-07-19 23:24	-rw-rr	
T 11.bin	2.9 MB	Unknown	2006-07-19 23:24	-rw-rr	
	2.9 MB	Unknown	2006-07-19 23:24	-rw-rr	
	2.9 MB	Unknown	2006-07-19 23:24	-rw-rr	
	2.9 MB	Unknown	2006-07-19 23:24	-rw-rr	
	2.9 MB	Unknown	2006-07-19 23:24	-rw-rr	
T22.bin	2.9 MB	Unknown	2006-07-19 23:24	-rw-rr	
	2.9 MB	Unknown	2006-07-19 23:24	-rw-rr	
	2.9 MB	Unknown	2006-07-19 23:24	-rw-rr	
	2.9 MB	Unknown	2006-07-19 23:24	-rw-rr	
	+11				

Figure 6 Created Flevoland directory and files

2.1.4 Visualization of polarimetric quantities

As it can be observed in **Figure 6**, an image file, PauliRGB.bmp, was created during the conversion. It can be viewed using PolSARpro viewing facilities or with any other image display tools.



Figure 7 PauliRGB.bmp image

PolSARpro offers the possibility to display polarimetric SAR information.

An image of the T11 polarimetric intensity channel can be created as follows:

- Check that the current main input directory is set to ~/PSP_demo/DATA/Flevoland/.
- On PolSARpro main widget click Display→T3→create BMP file
- Set the input file to ~/PSP_demo/DATA/Flevoland/T11.bin.
- Select, the float (real float values), 10*log(Mod) (log scale display) and the gray color palette options.
- Select the automatic (automatic min and max value setting) and enhanced contrast (reduced dynamic) options
- The output format is set to 8-bit BMP.
- Run
- The output ~/PSP_demo/DATA/Flevoland/T11_dB.bmp image is presented in Figure 8.



Figure 8 T11_dB image

Note that the PolSARpro viewer permits to visualize the numerical range of the observed image (from -29.87 dB to -15.94 dB).



Figure 9 PolSARpro viewer with an image numerical range.

2.2 San-Francisco data set import.

A similar manipulation can be applied to the other sample data sets and is summarized in the following for the San-Francisco data set.

- The input directory is set to ~/PSP_demo/Sample_data/AIRSAR/AIRSAR_with_no_HEADER/ SAN_FRANCISCO

•		Environment 🔤 🗌 🗙
- Main Input Directory		
/home/laurent/PSP_demo/Sample	_data/AIRSAR/AIRSAR_with_NO_HEADE	ER/SAN_FRANCISCO
🔄 Automatic Data Check	ENVI Config File	🔄 Run Trace 💦 .
– Display Size		
Rows 800	Columns 800	▲ ▼ Save
– Color Maps –		
Supervized ColorMap16	🛞 Unsupervized ColorMap9 🛛 🔬 ।	Insupervized ColorMap27
🛞 Unsupervized ColorMap8	🛞 Unsupervized ColorMap16	
2		Exit

- The data format declaration id led similarly to the Flevoland data case. Note that clicking on the Read Header button leads to a warning indicating that the data set contains no header information. In this case, the image row and column numbers have to be provided by the user.

•	AIR	SAR Input Data File _ 🗌 🗙
Input Directory		
/nome/laurent/PSP_demo/Sample_data/	RIKSAR/AIRSAR_WIII_NO_HEADER/SAN_FRANCISCO	
 AINSAR Processor • v3.56 (prior to 1993) 	\checkmark v5.01 and more (since 1993)	🔷 TOPSAR
 Single Look Complex Compres Multi Look Compressed Stoke AIRSAR Input Data File (STK) 	sed Stokes Format (SLC) s Format (MLC)	
/home/laurent/PSP_demo/Sample_data/	AIRSAR/AIRSAR_with_NO_HEADER/SAN_FRANCISCO/	san_francisco900×1024.stk 崖
<u></u>		
		<u></u>
		l 🖉
Read Header	Edit I	leader .
Initial Numb	er of Rows 900 Initial Number of Cols 1	024
ок	Convert Input IEEE binary Format (LE<->BE)	Cancel

- After a full resolution extraction to [T3] matrices, the Pauli color coded image is given by the following figure.



2.3 Oberpfaffenhofen data set import.

- The input directory is set to ~/PSP_demo/Sample_data/ESAR/OP_AIRFIELD_L/
- The data format declaration is represented in the following figure. The data files do not contain any header information and the row and column numbers have to be set manually (from the provided .asc file).

				ESAR Input Data File	$\Box $
— Input Direc	tory				
/home/laurer	t/PSP_demo/Sample_	data/ESAR/OP_AIP	RFIELD_L		
- Input Data	File (s11)				
/home/laurer	nt/PSP_demo/Sample_	data/ESAR/OP_AIP	RFIELD_L/opainfie	ld1pre12_I_hh.bin	- 2
Input Data	File (s12)				
/home/laurer	nt/PSP_demo/Sample_	data/ESAR/OP_AIP	RFIELD_L/opairfie	ld1pre12_I_hv.bin	- 🖻
-Input Data	File (s21)				
/home/laurer	t/PSP_demo/Sample_	data/ESAR/OP_AIP	RFIELD_L/opainfie	ld1pre12_l_vh.bin	
-Input Data	File (s22)				
/home/laurer	t/PSP_demo/Sample_	data/ESAR/OP_AIP	RFIELD_L/opainfie	ld1pre12_l_vv.bin	- Z
ESAR Data with Header Initial Number of Rows 2816 Initial Number of Cols 1540					
Convert Input IEEE binary Format (LE<->BE)					
	ок	2		Cancel	

Figure 13

- After a full resolution extraction to coherent [S] matrices, the Pauli color coded image is given by the following figure.



3. FINAL DATA DIRECTORY ORGANIZATION

The final organization of the data directory is represented in the following figure

•			PSP_demo - Konq	ueror 🔄 🗌 🗙
Location Edit View Go Bookm	arks <u>T</u> ools <u>S</u> e	ettings <u>W</u> indow <u>H</u> elp		
🔺 🕨 🛆 🏫 🔗 🕲 🖉				ц.
		* *		
Location: Anome/laurent/PSF	P_demo/			*
Name	Size	File Type 👻	Modified	Permissions
	4.0 KB	Folder	2006-07-20 18:16	drwxr-xr-x
E-Flevoland	4.0 KB	Folder	2006-07-19 23:24	drwxr-xr-x
	4.0 KB	Folder	2006-07-20 15:16	drwxr-xr-x
	2.2 MB	BMP Image	2006-07-19 23:24	-rw-rr
T11_db.bmp	751.1 KB	BMP Image	2006-07-20 15:16	-rw-rr
	85 B	Plain Text Document	2006-07-19 23:24	-rw-rr
T 11.bin	2.9 MB	Unknown	2006-07-19 23:24	-rw-rr
	2.9 MB	Unknown	2006-07-19 23:24	-rw-rr
	2.9 MB	Unknown	2006-07-19 23:24	-rw-rr
	2.9 MB	Unknown	2006-07-19 23:24	-rw-rr
	2.9 MB	Unknown	2006-07-19 23:24	-rw-rr
	2.9 MB	Unknown	2006-07-19 23:24	-rw-rr
	2.9 MB	Unknown	2006-07-19 23:24	-rw-rr
T23_real.bin	2.9 MB	Unknown	2006-07-19 23:24	-rw-rr
T33.bin	2.9 MB	Unknown	2006-07-19 23:24	-rw-rr
⊡- 🔁 Frisco	4.0 KB	Folder	2006-07-20 00:51	drwxr-xr-x
	4.0 KB	Folder	2006-07-20 00:51	drwxr-xr-x
- RauliRGB.bmp	2.6 MB	BMP Image	2006-07-20 00:51	-rw-rr
- Config.txt	85 B	Plain Text Document	2006-07-20 00:51	-rw-rr
- T11.bin	3.5 MB	Unknown	2006-07-20 00:51	-rw-rr
T12_imag.bin	3.5 MB	Unknown	2006-07-20 00:51	-rw-rr
T12 real.bin	3.5 MB	Unknown	2006-07-20 00:51	-rw-rr
-T13 imag.bin	3.5 MB	Unknown	2006-07-20 00:51	-rw-rr
T13 real bin	3.5 MB	Unknown	2006-07-20 00:51	-rw-rr
T22.bin	3.5 MB	Unknown	2006-07-20 00:51	-rw-rr
T23 imag.bin	3.5 MB	Unknown	2006-07-20 00:51	-rw-rr
T23 real bin	3.5 MB	Unknown	2006-07-20 00:51	-rw-rr
T33 bin	3.5 MB	Unknown	2006-07-20 00:51	-rw-rr
E-COn field	4.0 KB	Folder	2006-07-20 18:17	drwxr-xr-x
PauliBGB.bmp	12.4 MB	BMP Image	2006-07-20 18:17	-rw-rr
- Config txt	86 B	Plain Text Document	2006-07-20 18:16	-rw-rr
	33.1 MB	Unknown	2006-07-20 18:16	-rw-rr
s12.bin	33.1 MB	Unknown	2006-07-20 18:16	-rw-rr
	33.1 MR	Unknown	2006-07-20 18:16	-rw-rr
s22 bin	33.1 MB	Unknown	2006-07-20 18:16	-rw-rr
	4.0 KR	Folder	2006-07-19 21:10	drwxr-xr-x
	10 10		2000 07 19 21:10	
36 Items - 29 Files (208.3 MB Total) - 7	7 Folders			

Figure 15

The remaining sample data sets may be converted to PolSARpro format in a similar way