Do It Yourself 5

Polarimetric segmentation

The objectives of this fifth *Do It Yourself* concern the segmentation of POLSAR data using the Wishart distribution of second order matrix data sets.

1. UNSUPERVISED H-ALPHA CLASSIFICATION

The alpha and entropy parameters provide substantial information on the polarimetric properties of a scene and can be used to classify an image in a very simple way.

This incoherent decomposition method works with filtered T3 matrix images.

- Set the main input directory to ~/PSP_demo/DATA/Frisco_LEE.

- On PolSARpro main widget, select Process→T3→Single data set→Polarimetric classification→H-A-Alpha classification : the H-Alpha classification widget appears

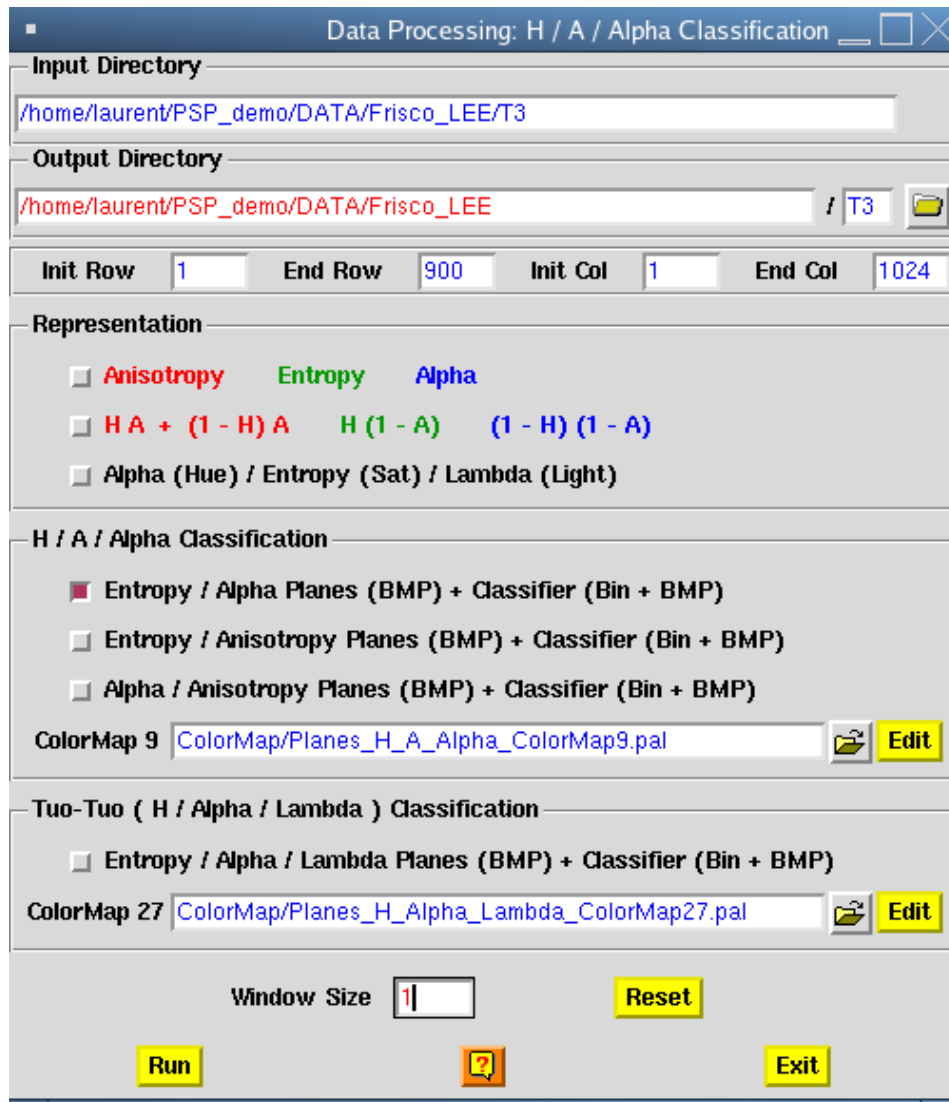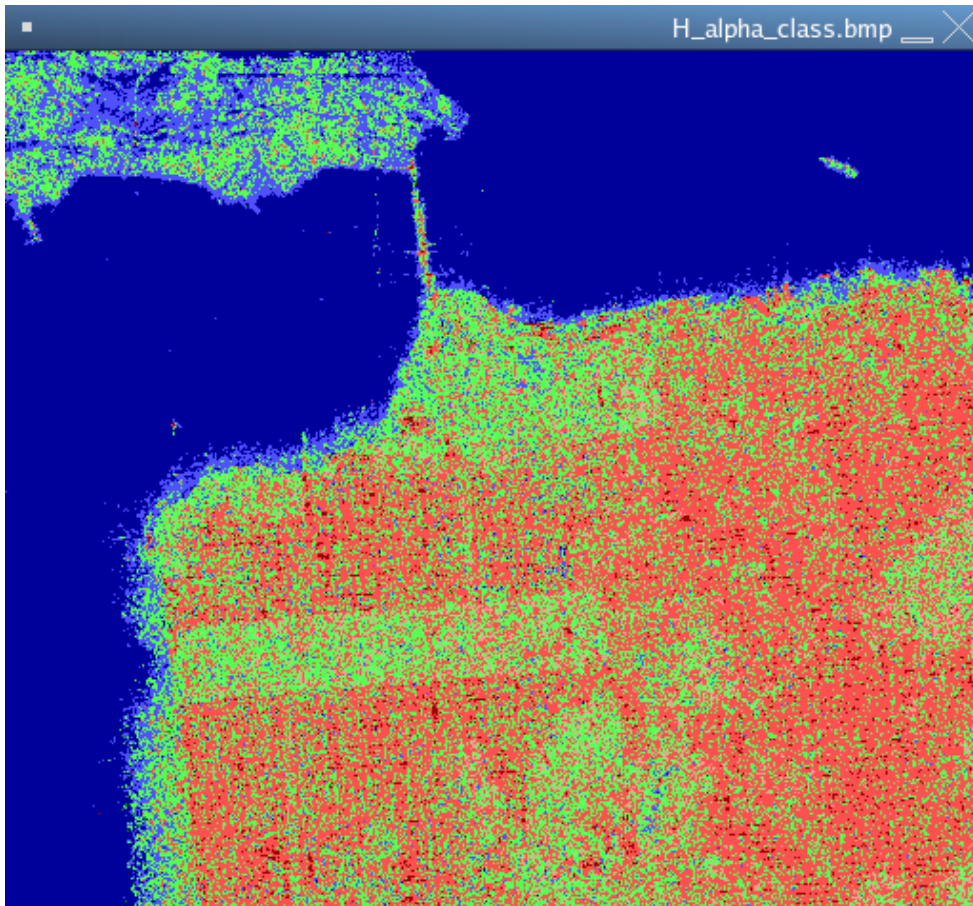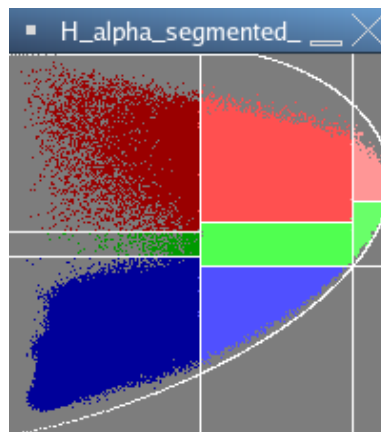- Select the H-Alpha classification option and set the window size to 1, run.

Figure 1

- Visualize the Entropy Alpha classification result stored in ~/PSP_demo/DATA/Frisco_LEE/H_alpha_class.bmp.

Figure 2

The color coding is detailed in the file ~/PSP_demo/DATA/Frisco_LEE/ H_alpha_segmented_plane.bmp, describing the distribution of the 8 classes in the H-Alpha plane.

Figure 3

The pixel density in each class may be found in ~/PSP_demo/DATA/Frisco_LEE/ H_alpha_occurence.bmp
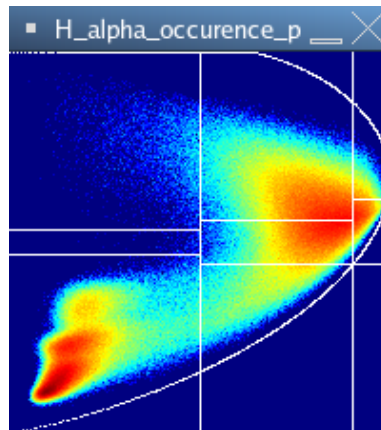
Figure 4

The H-alpha classification provides an important amount of information:

- The sea is considered as a deterministic surface

- In urban areas, double bounce scattering dominates

- Over vegetated areas, the scattering mechanism is more random and is associated to anisotropic scatterers

This classification is strongly based on physical interpretation but does not account for the whole polarimetric information contained in a [T3] matrix.

2. UNSUPERVISED WISHART SEGMENTATION

This procedure exploits the joint statistics of [T3] matrix elements.

- On PolSARpro main widget, select Process→T3→Single data set→Polarimetric classification→H-A-Alpha classification: the Wishart classification widget appears

- Simply use the default settings (note that the windows could be set to 1)
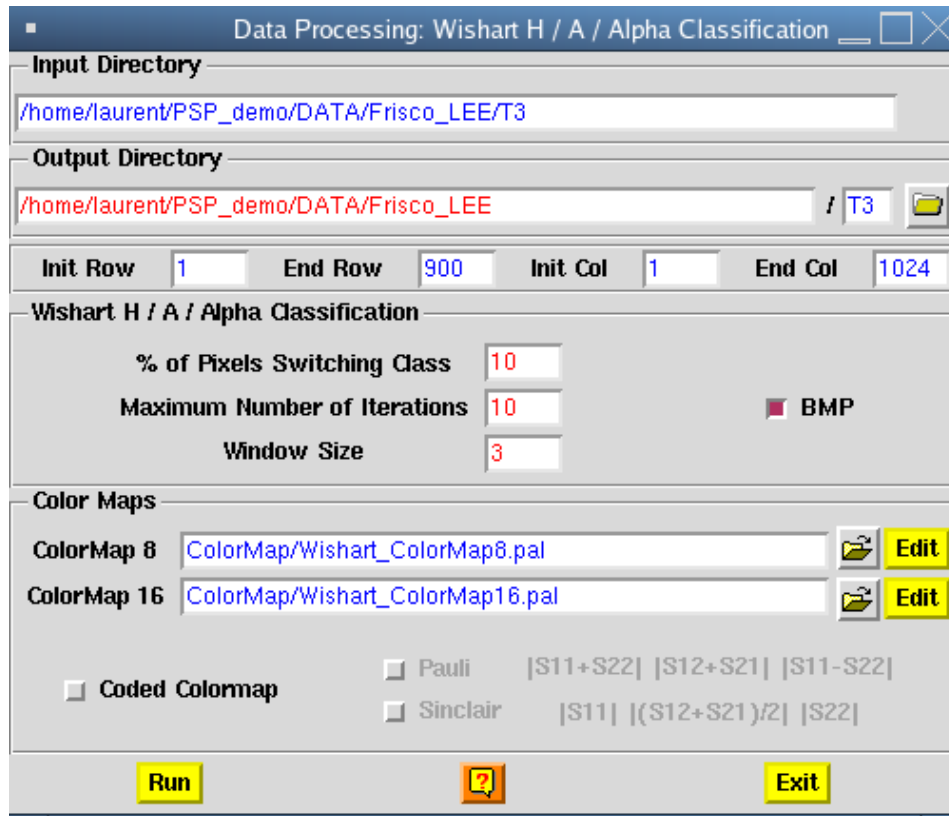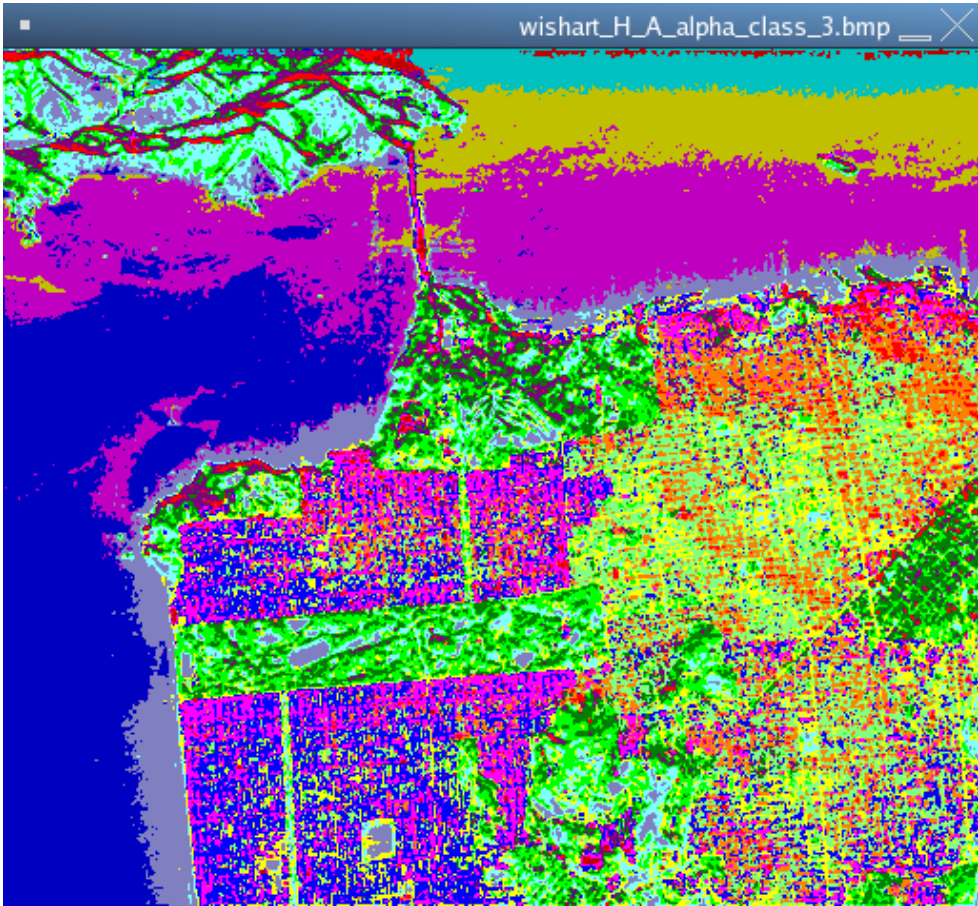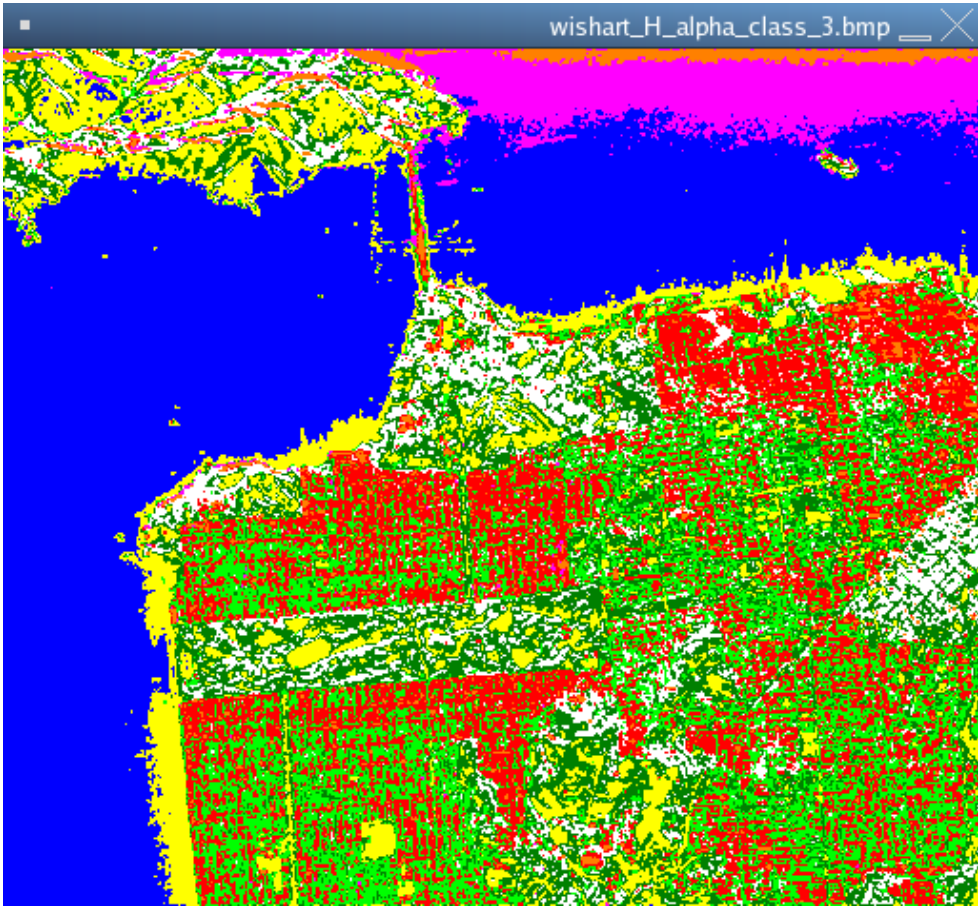
Figure 5

- Visualize the results stored in ~/PSP_demo/DATA/Frisco_LEE/ Wishart_H_alpha_class_3.bmp for the Wishart H-Alpha segmentation into 8 classes and in ~/PSP_demo/DATA/Frisco_LEE/Wishart_H_A_alpha_class_3.bmp for the Wishart H-A-Alpha segmentation into 16 classes.

wishart_H_alpha_class_3.bmp

wishart_H_A_alpha_class_3.bmp

Figure 6 Wishart unsupervised segmentation into 8 classes (top) and 16 classes (bottom)

The use of of the whole polarimetric information significantly improves segmentation performance.

3.   SUPERVISED WISHART SEGMENTATION

The supervised segmentation procedure is fully described in PolSARpro help files.

A classification is run over three classes containing each two areas. These classes correspond to:

- The sea

- Urban areas

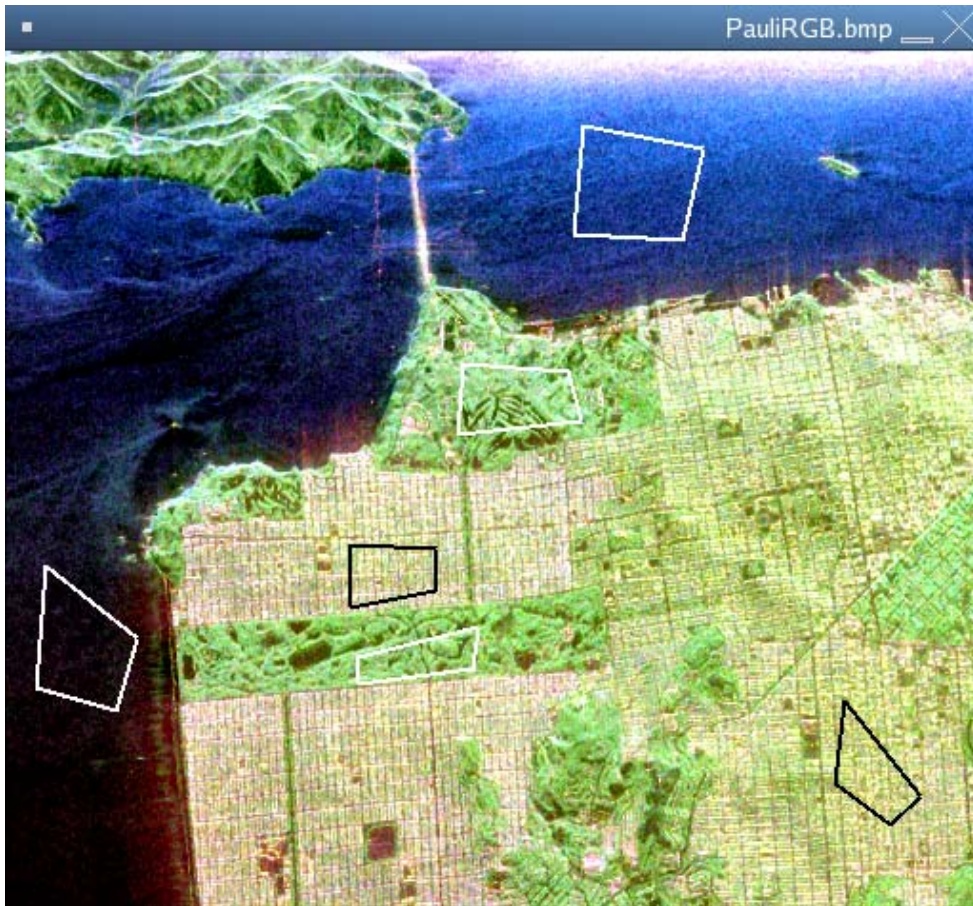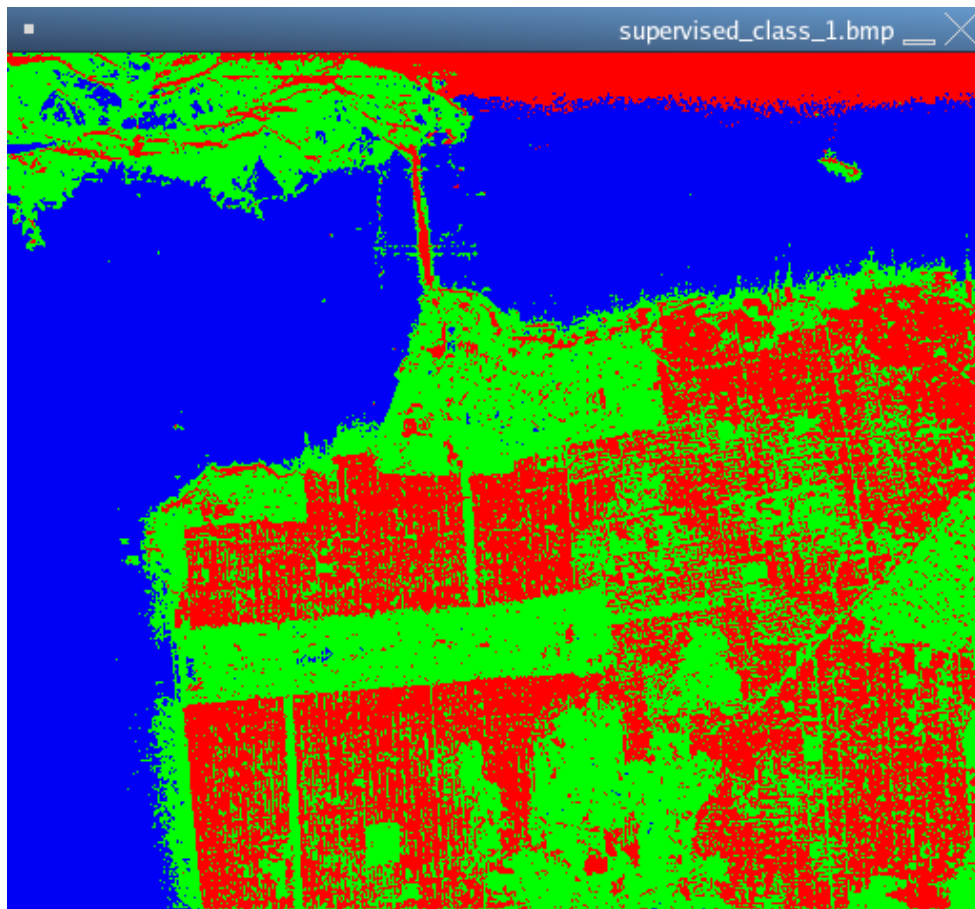- Vegetated zones

The selected areas are shown below

Figure 7

The resulting classified image is shown in the following image.

Figure 8

The confusion matrix (estimated over the training set) is

	C1	C2	C3
C1	99.96	0.00	0.04
C2	0.00	75.39	24.61
C3	0.68	5.65	93.68

Where C1 corresponds to the sea, C2 to urban areas and C3 to vegetated zones.