# CLASSIFICATION OF POLARIMETRIC SAR DATA OVER ARID AND WET REGIONS OF INDIA

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**Abstract**

Western part of India, particularly Rajasthan state experiences drought conditions throughout the year due to low rainfall (100 to 200 mm). In spite of arid conditions, farmers are growing some type crops (Bajra, Jowar, etc.) which can take less water. Eastern part of India, particularly West Bengal state, experiences flooding due to backwaters of sea and the growth of rice crops. Some regions of Mumbai, particularly mangrove vegetation covered areas, are always wet due to sea water. In our study, we processed the SIR-C, ALOS PALSAR and ENVISAT ASAR data for soil moisture mapping and classificaiton of these areas.

For the study of arid regions, we used the ALOS PALSAR data acquired on Nov. 19, 2006 and May 28, 2007 covering two test sites in Rajasthan state. For wet regions of Eastern India, we used the SIR-C data acquired in Oct. 1994 and ALOS PALSAR data acquired on March 7 and April 22 2007. To map the wet regions of Mumbai, we used ENVISAT ASAR dual polarized data acquired in summer (April 2004) and rainy seasons (Aug. 2004) and also ALOS PALSAR dual polarized data acquired on June 16 and July 15, 2007.

The soil moisture maps were derived using PolSARPro software. Retrieved soil moisture using ALOS PALSAR data vary from 4 to 20% in arid regions. In May, most of the area shows less than 10% soil moisture, whereas in Nov. it is around 15%. In the wet regions of West Bengal, it is around 20% in summer.

All the images were classified using PolSARPro software. The SIR-C MLC data were imported into PolSARpro software with further multilook option of 2 in azimuth and 2 in range. Fig.1 shows the PauliRGB image for C-band data. Later, the data were speckle filtered with 5x5 window. Lee filter was used for speckle filtering. Cloud-Pottier decomposition technique was used to get eigenvalues and eigenvectors. From these parameters, entropy, alpha and anisotropy are calculated. Later, the images are classified using H-alpha and H-A-alpha Wishart unsupervised classifier. The results are shown in the Fig.2 and Fig.3. Fig.2 shows the result for C-band data and Fig.3 shows the result for L-band data with eight classes for each. By comparing L- and C-band H-alpha Wishart classified images, we observed that classification results for L- and C-bands are slightly different. For example, number of classified pixels for water is 2% more at L-band as compared to C-band. Similarly, forest vegetation is classified as one class in C-band, but it has been classified as two classes at L-band due to high penetration of microwaves at L-band. H-alpha classifier gives total of 8 classes, and H-A-alpha gives total 16 classes but we could identify only 6 classes for supervised classification for this test site. The result of supervised classification is shown in Fig. 4. Urban area and mixed urban area is higher by 2% at C-band than at L-band. Mixed urban area and mangrove areas classified with high accuracy using L-band data. But thick urban and forest area show high accuracy using C-band.

The forest areas are clearly classified using Wishart unsupervised H-alpha classification technique. H-A-alpha classifier further improves the forest classification as it takes anisotropy. H-alpha occurrence plane clearly shows the forest vegetation with high entropy. Bare agriculture areas are also clearly seen in Pauli RGB and also in classified

images. For dual polarized ALOS PALSAR Mumbai data, only supervised classification is used. We could identify 5 classes for this test site. Classification results are not good due to overlap of backscattering values for bare ground and mangrove vegetation with ocean backscattering values. When we discard bare ground area in training area selection process, we could classify image into 4 classes, but with poor classification accuracy in identifying settlements, forest vegetation and mangroves.

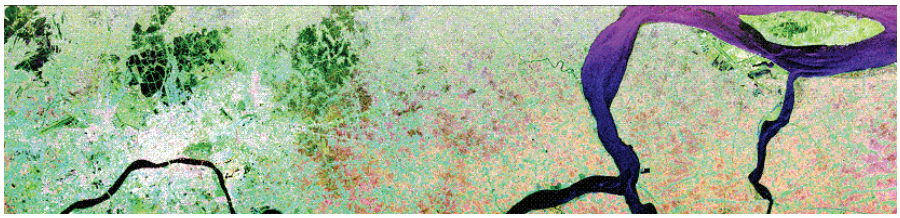

Fig.1.PauliRGB image of C-band SIR-C image around Kolkata city.

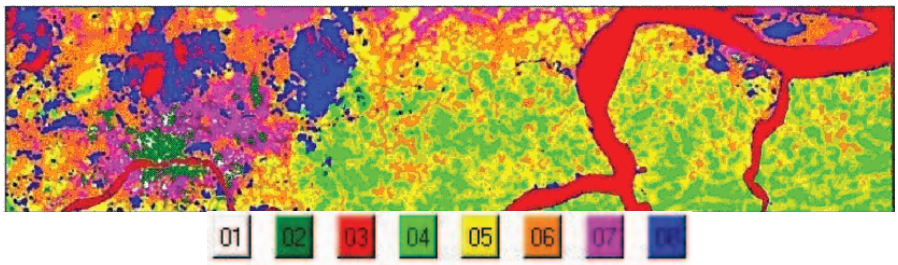


Fig.2. Wishart H-alpha unsupervised classified image obtained with SIR-C C-band data.

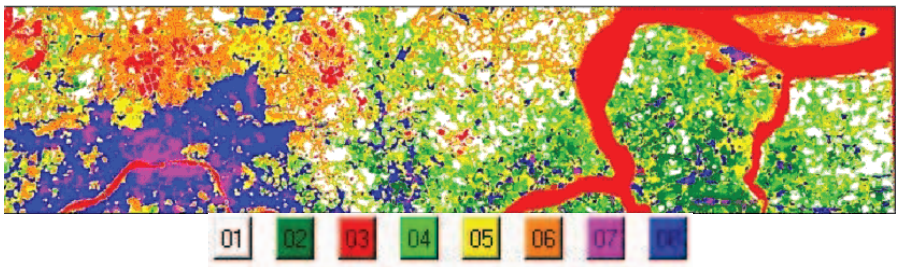


Fig.3. Wishart H-alpha unsupervised classified image obtained with SIR-C L-band data.

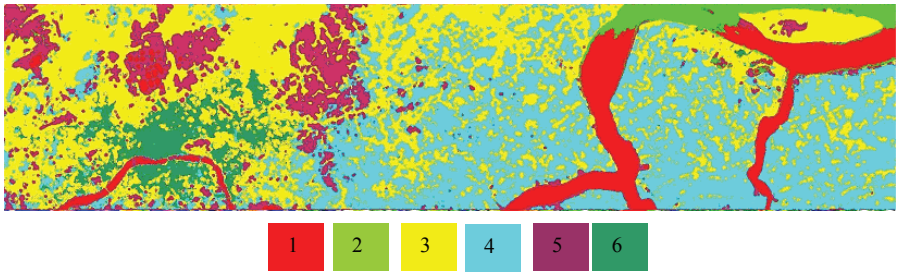


Fig.4. Supervised classified image obtained with SIR- C C-band data