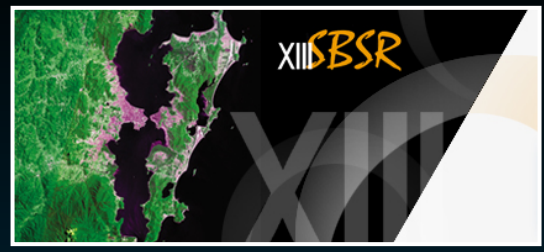

Textural classification of R99SAR data as an aid to flood mapping in Coari City, Western Amazon region, Brazil

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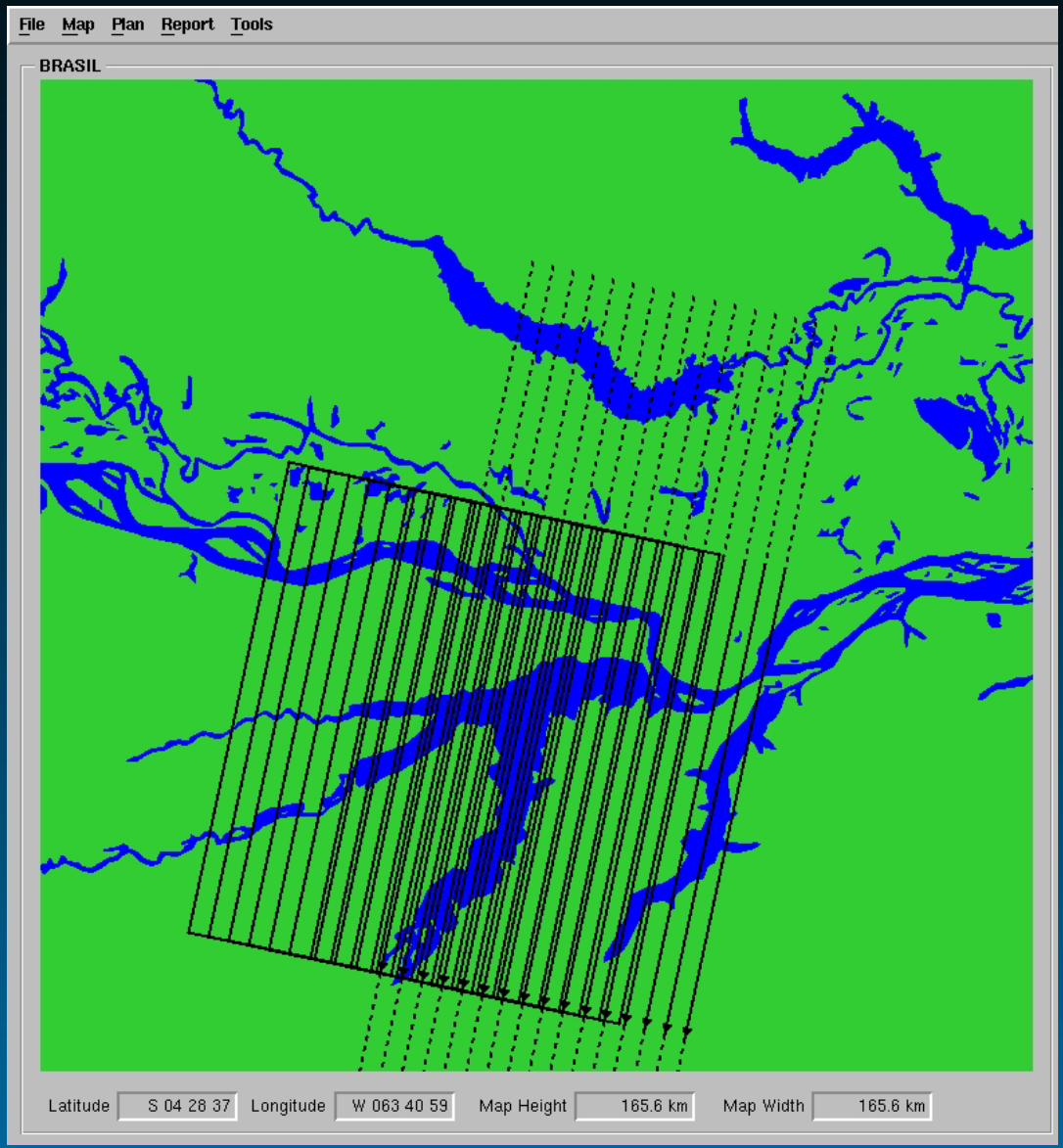
APRIL/2007 – FLORIANÓPOLIS, SC

R99SAR OBJECTIVES

The objectives of this project are:

- To carry out the radiometric calibration of the R99SAR images for future polarimetric classification;
- To adjust R99SAR data to the MAPSAR Mission requirements;
- To assess the use of the Unsupervised Semivariogram Textural Classifier (USTC) algorithm applied to the high resolution data of R99SAR obtained in L-band and HH, HV and VV polarizations in the Coari floodplain region;
- To identify sensitive environments on a local scale directly from the high flood season data based on textural signatures in each multi-polarized L-band image mosaic.

ACQUISITION PLAN OF R99SAR DATA OVER COARI REGION



- DATE ACQUISTION:
  - 01/June/2006
    (High flood season)

- 16 DESCENDING STRIPS

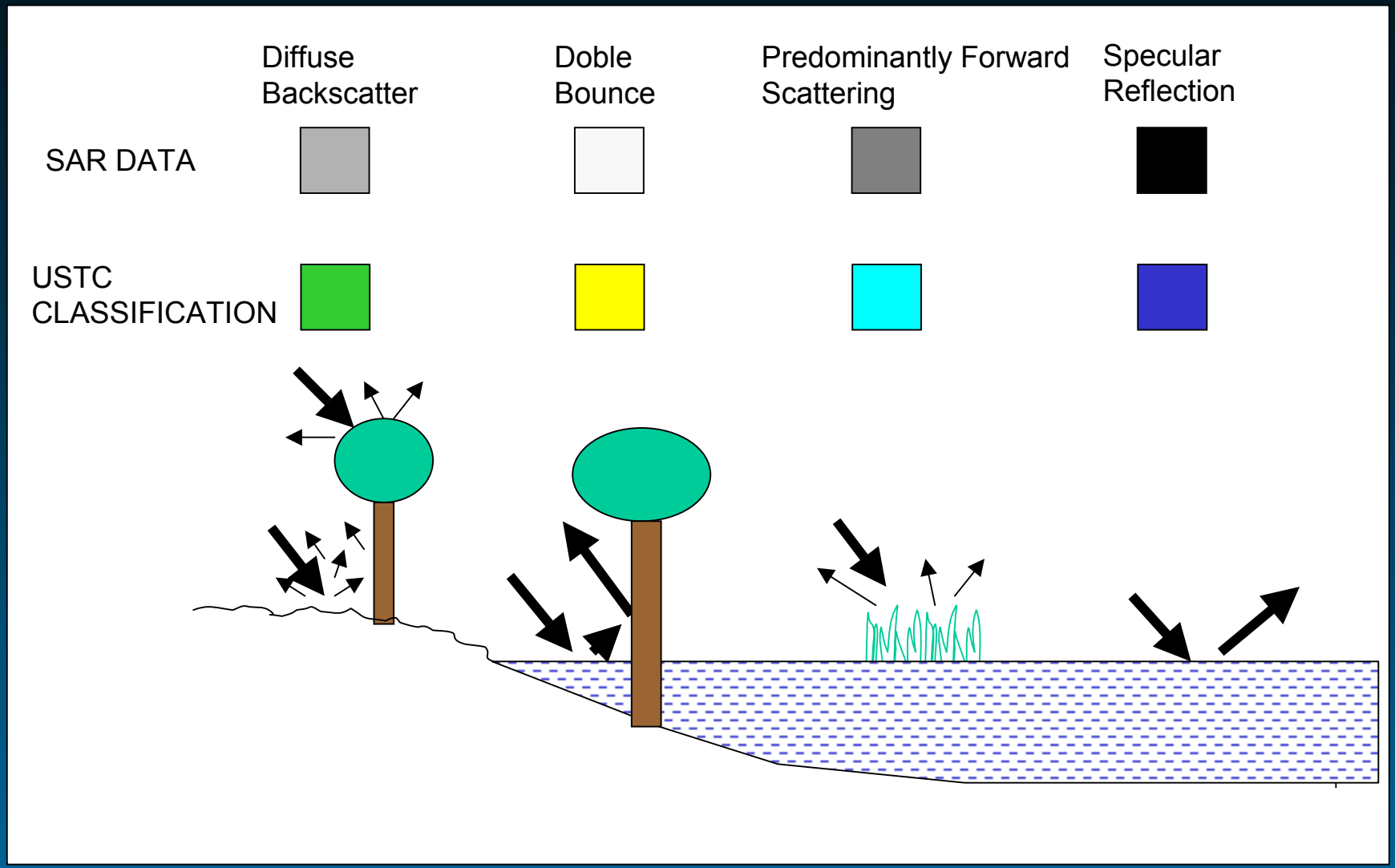
- BAND ACQUISITIONS
  - L Band - Quad-pol
  - X band – Single look

- INCIDENCE ANGLE
  (for each strip)
  - 39.57º (near range)
  - 70.99º (far range)

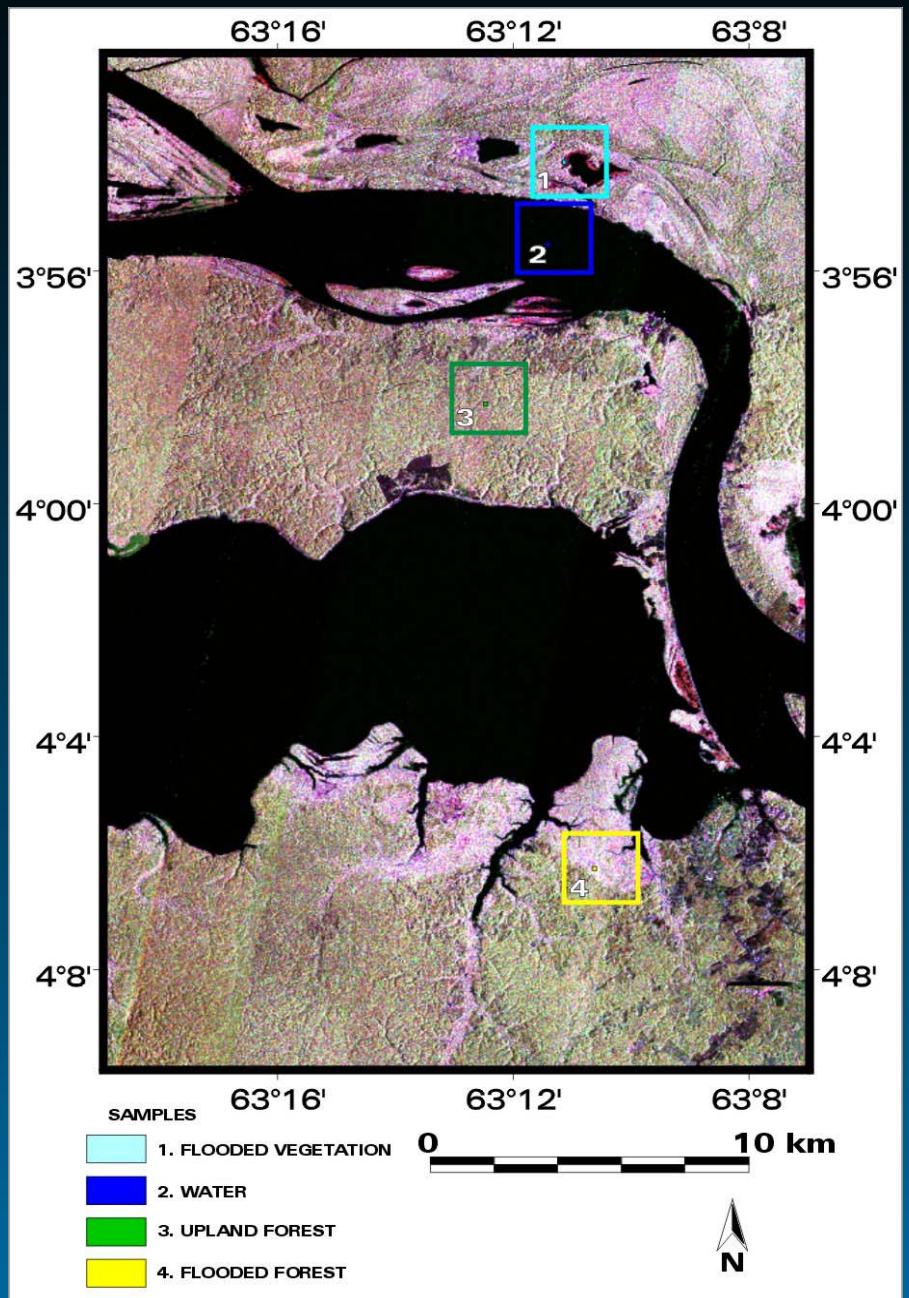
- SWATH WIDTH: 20 km

- GROUND RESOLUTION:
  5 m.

Radar signal interaction with different habitats



R99SAR L-band MOSAIC – SIPAM



- **Multi-polarized images used: R(HH) G(HV) B(VV)**

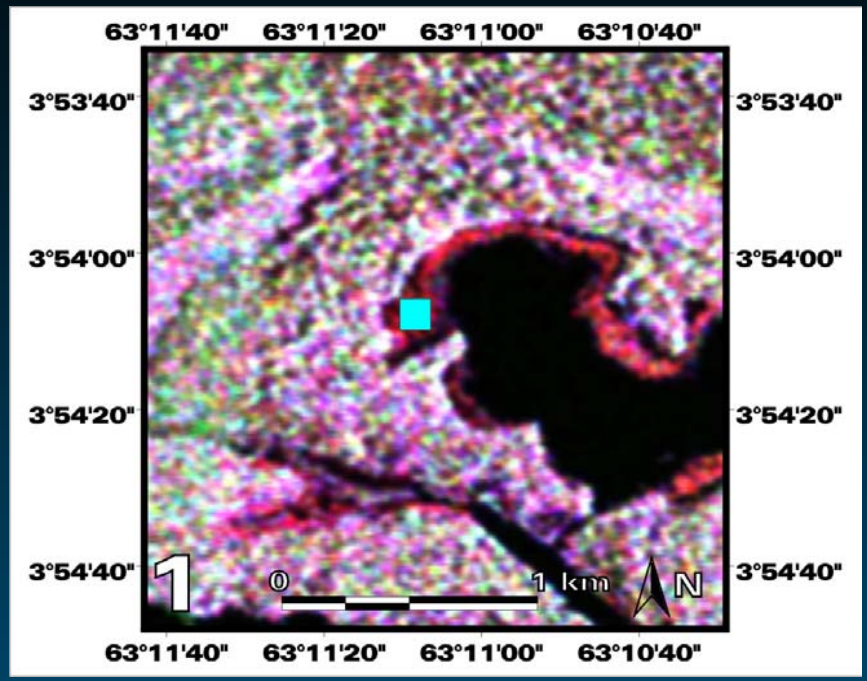
- Acquisition date: 01 JUNE 2005 (high flood)

- Incidence angle used interval of each strip:
  - 39.57º Near range
  - 45.00º Far Range

- This corresponds to an average of 4 km of each strip used to compose the mosaic;

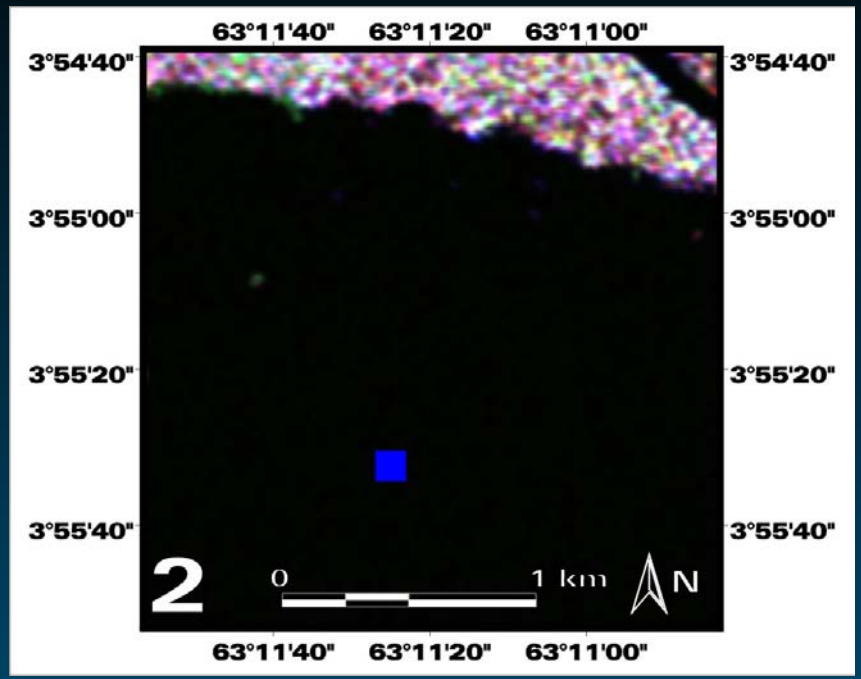
- Resolution resampled to 10 meters;

R99SAR L-band MOSAIC – SIPAM



- SAMPLE 01
11X11 PIXELS OF FLOODED VEGETATION OR LOW BIOMASS ABOVE WATER

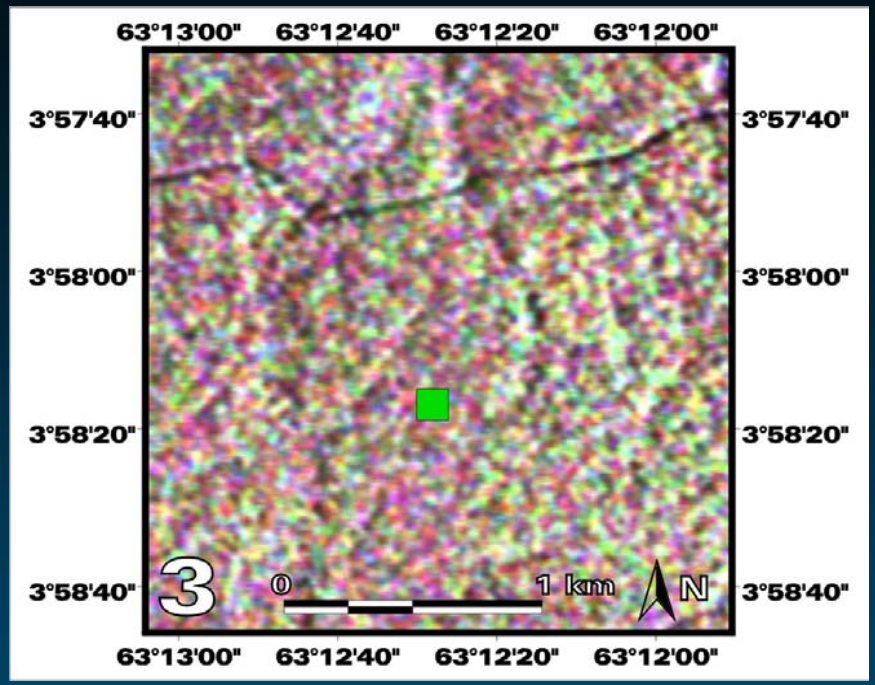
R99SAR L-band MOSAIC – SIPAM



- SAMPLE 02

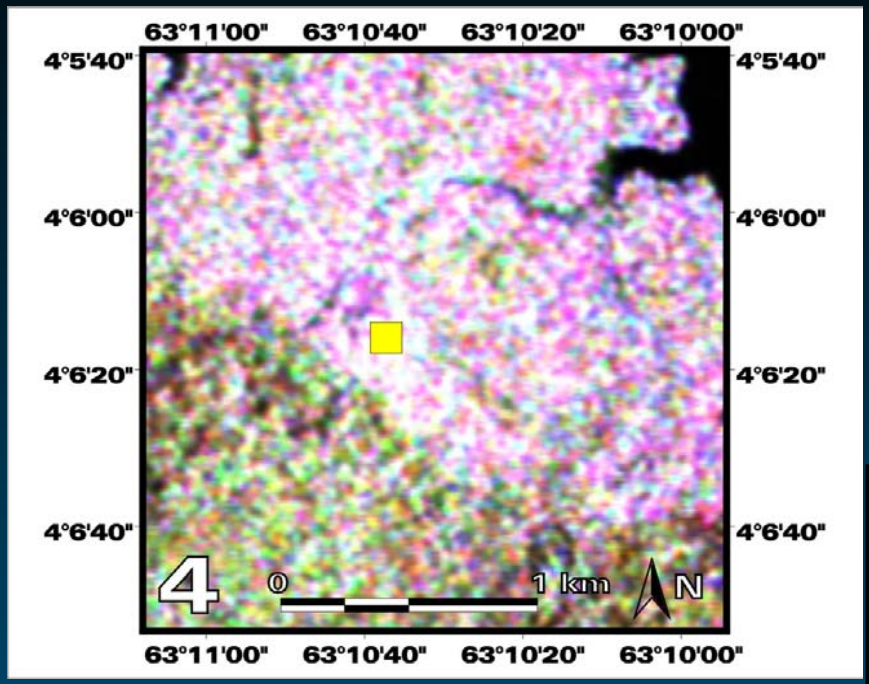
11X11 PIXELS OF WATER – COARI LAKE

R99SAR L-band MOSAIC – SIPAM

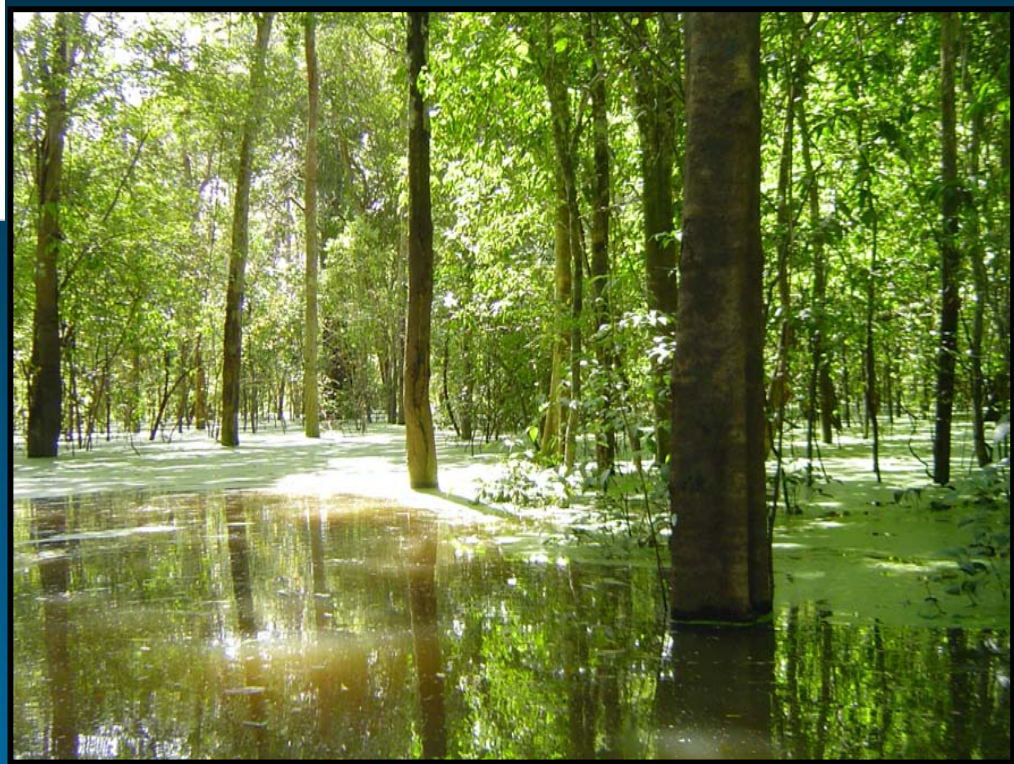


- SAMPLE 03
11X11 PIXELS OF UPLAND FOREST

R99SAR L-band MOSAIC – SIPAM

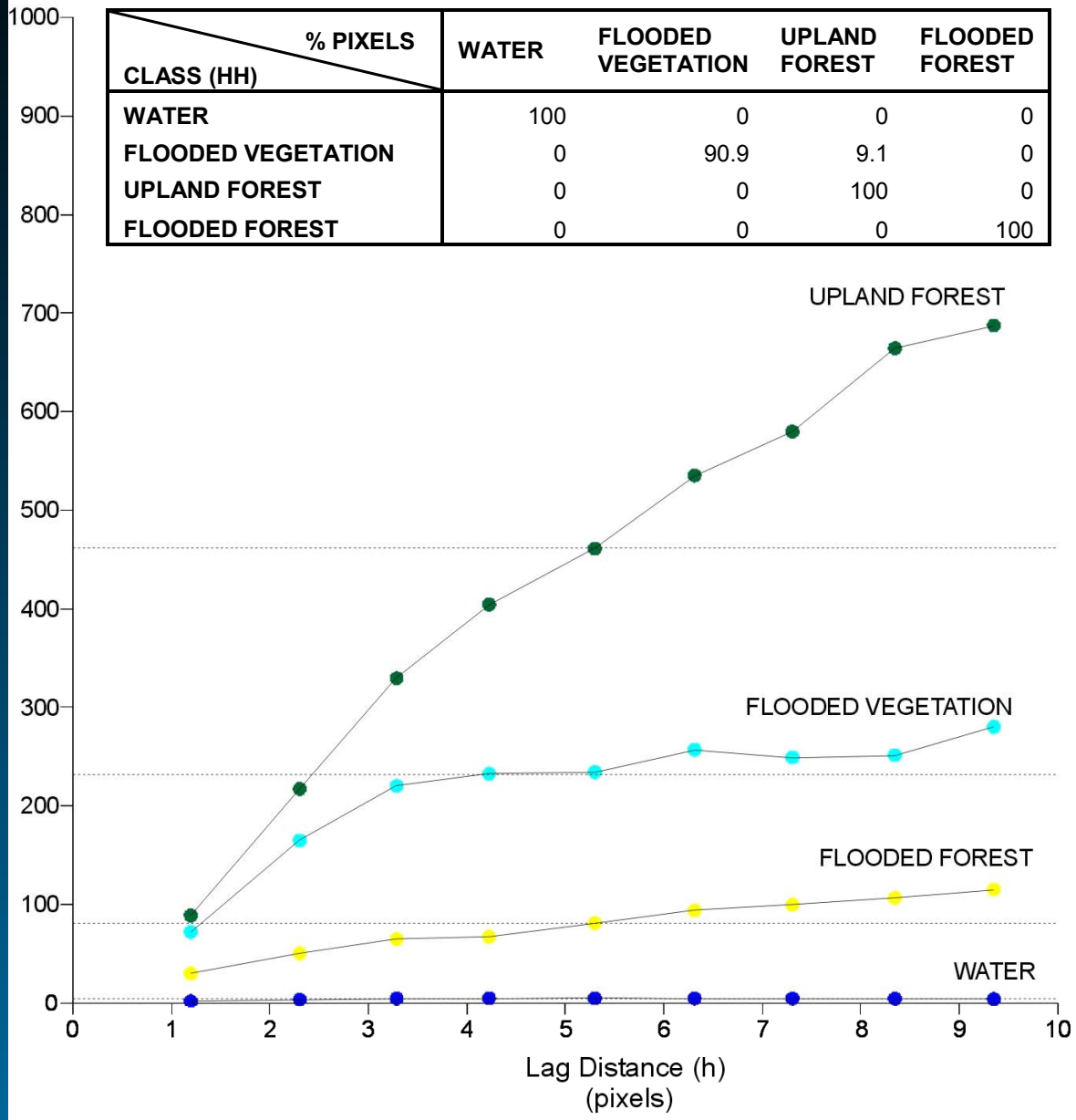


- SAMPLE 04
11X11 PIXELS OF FLOODED FOREST WITH HIGH BIOMASS ABOVE WATER



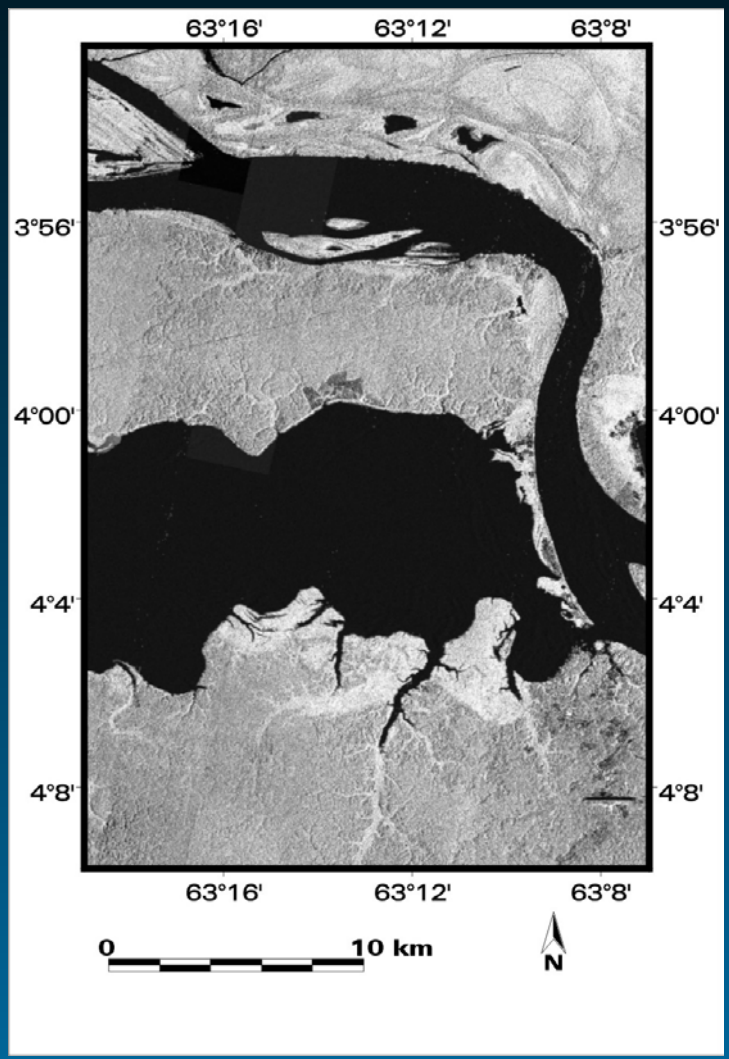
HH Polarization

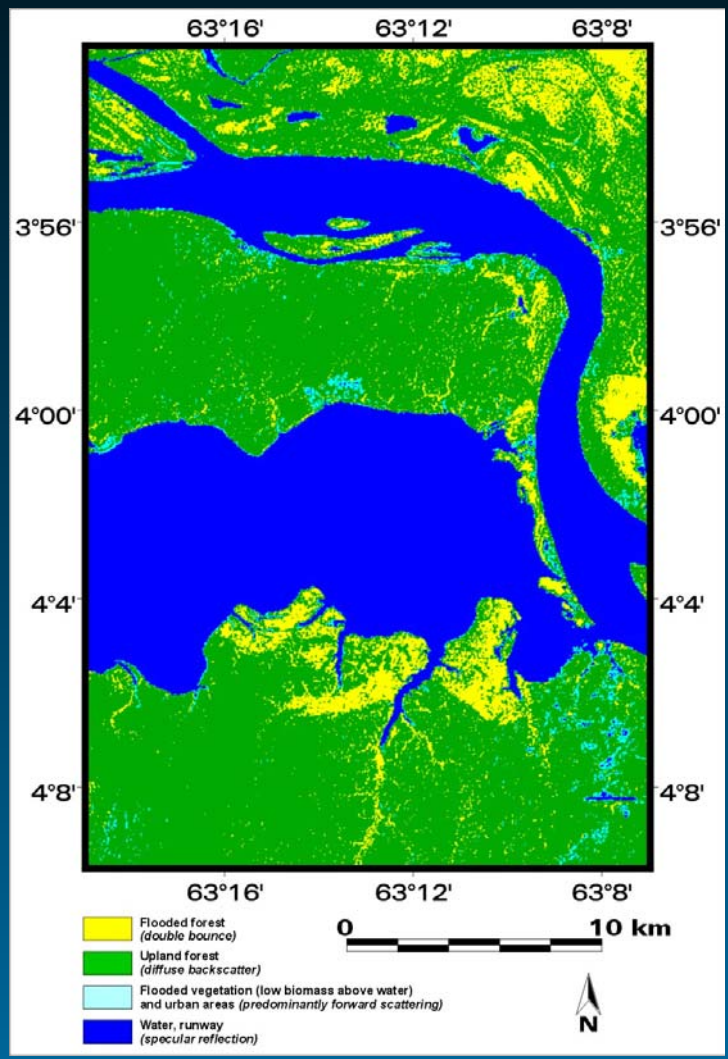
% PIXELS / CLASS (HH)	WATER	FLOODED VEGETATION	UPLAND FOREST	FLOODED FOREST
WATER	100	0	0	0
FLOODED VEGETATION	0	90.9	9.1	0
UPLAND FOREST	0	0	100	0
FLOODED FOREST	0	0	0	100



R99SAR L-band MOSAIC SIPAM

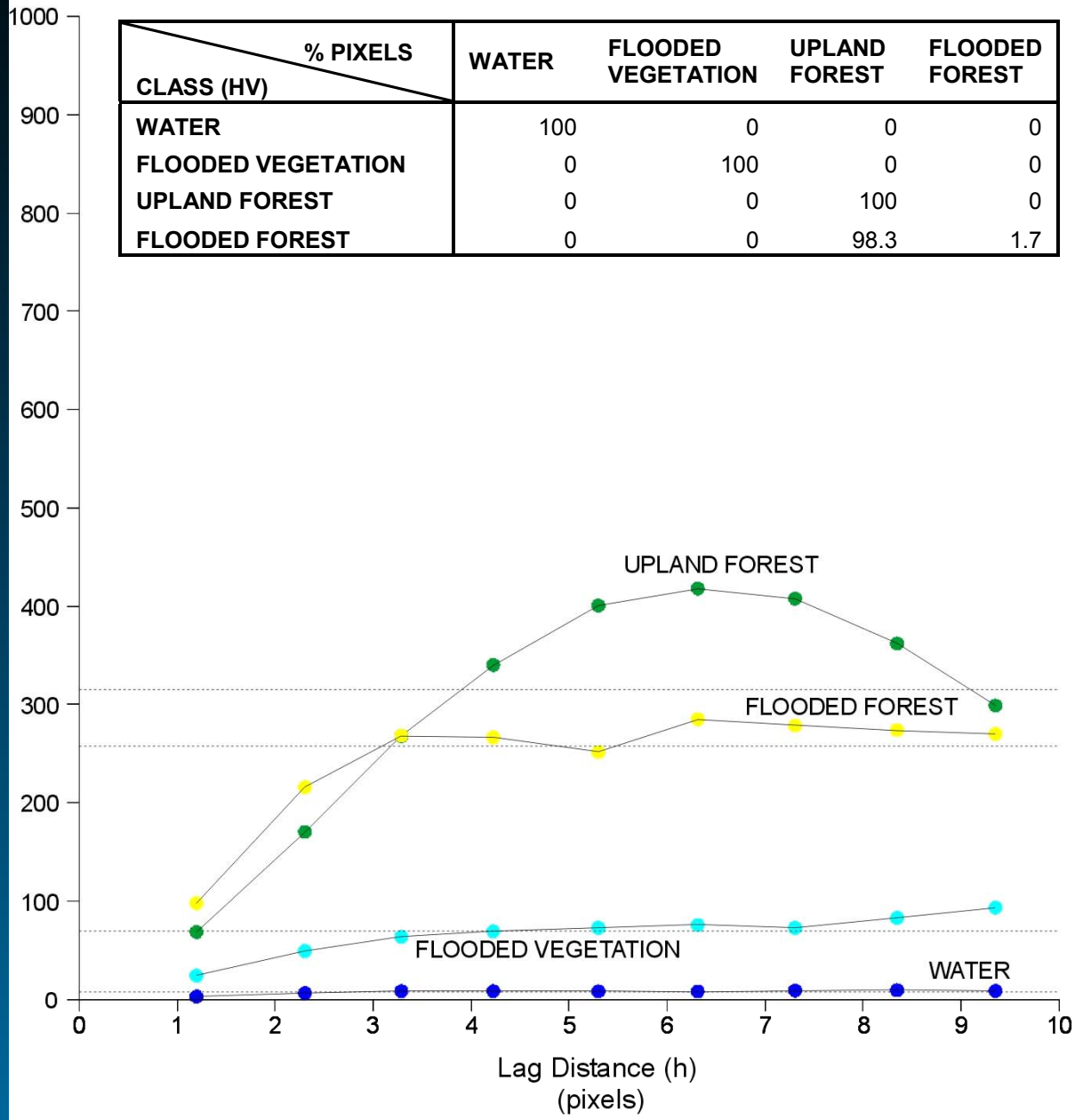
HH Polarization





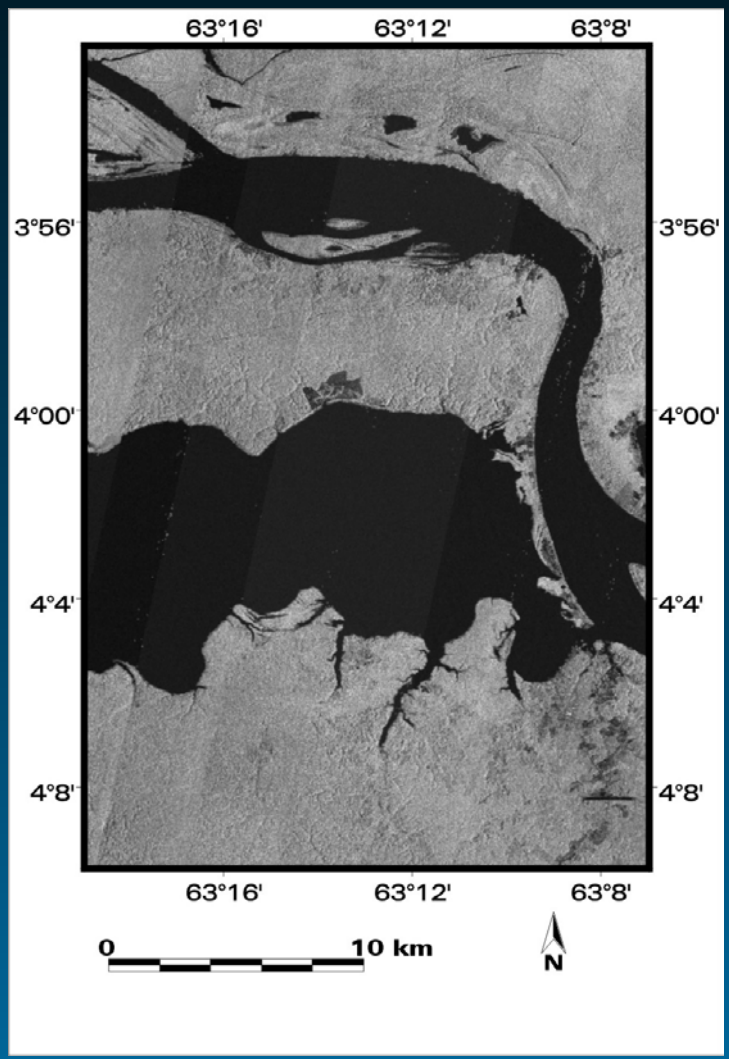
HV Polarization

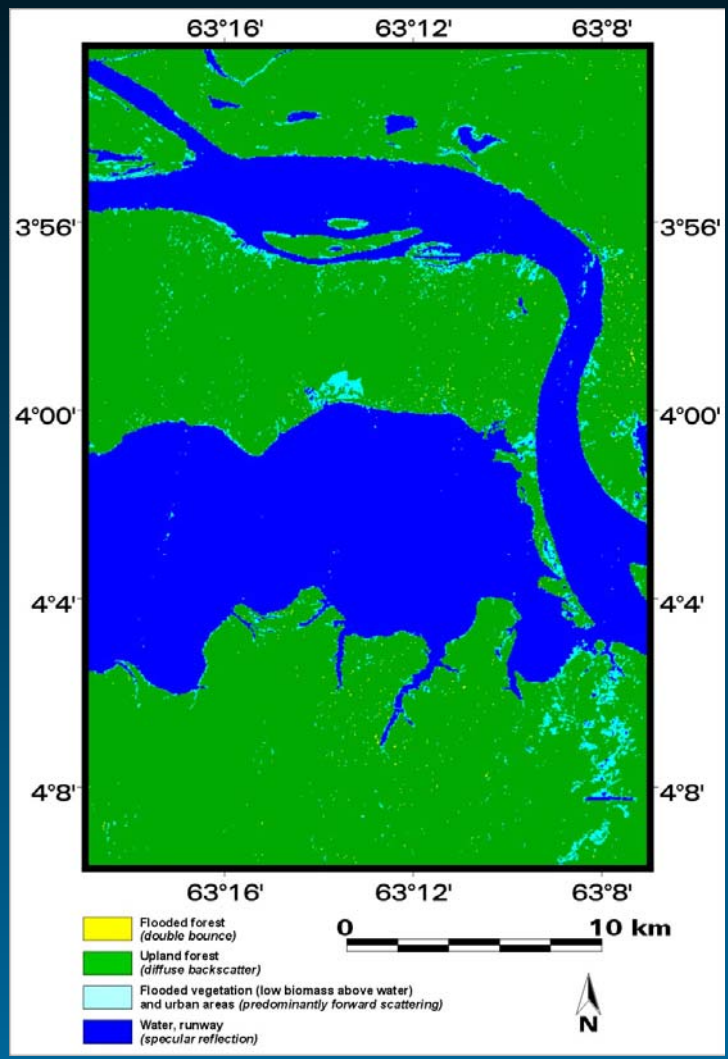
% PIXELS / CLASS (HV)	WATER	FLOODED VEGETATION	UPLAND FOREST	FLOODED FOREST
WATER	100	0	0	0
FLOODED VEGETATION	0	100	0	0
UPLAND FOREST	0	0	100	0
FLOODED FOREST	0	0	98.3	1.7



R99SAR L-band MOSAIC SIPAM

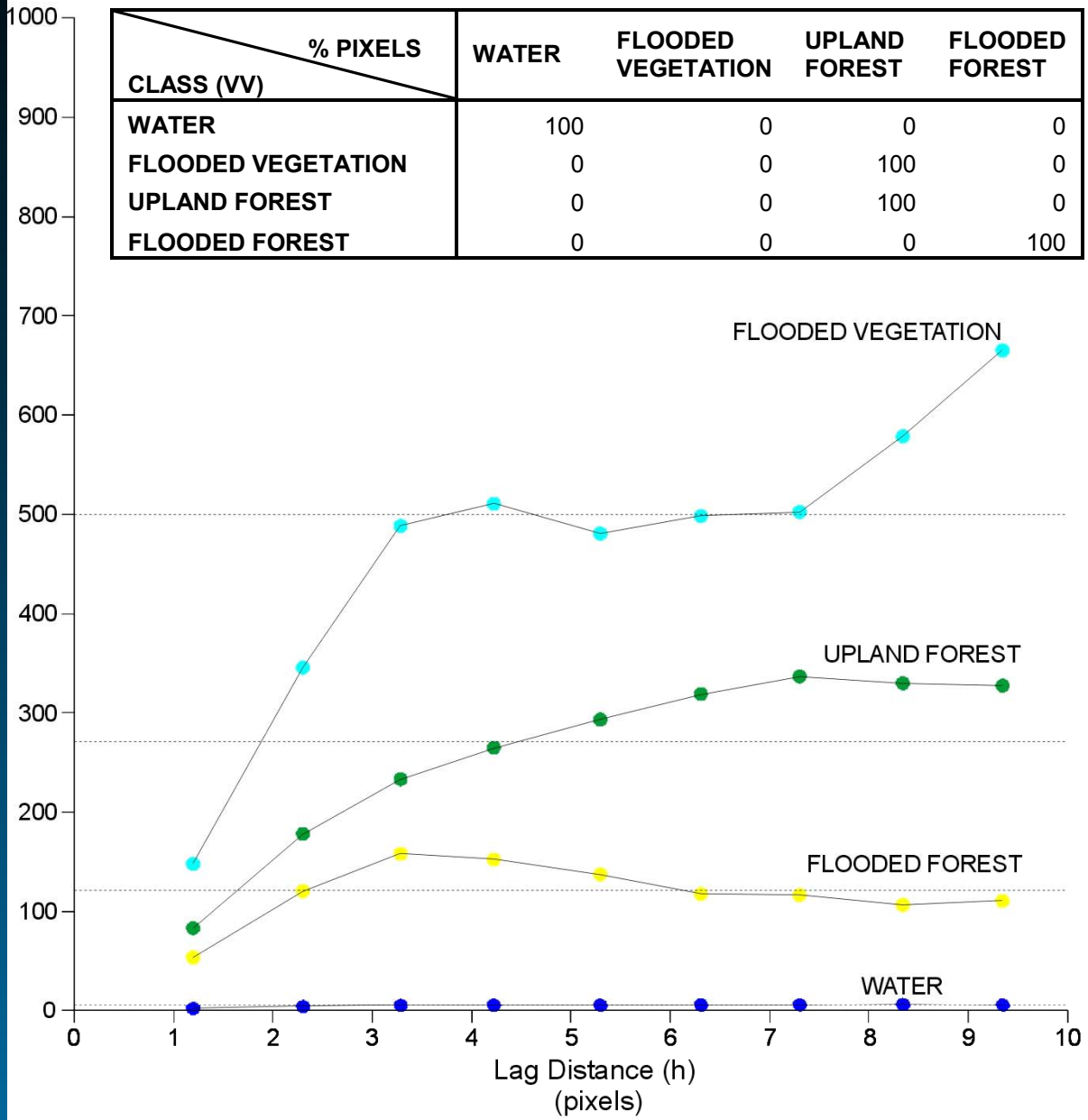
HV Polarization





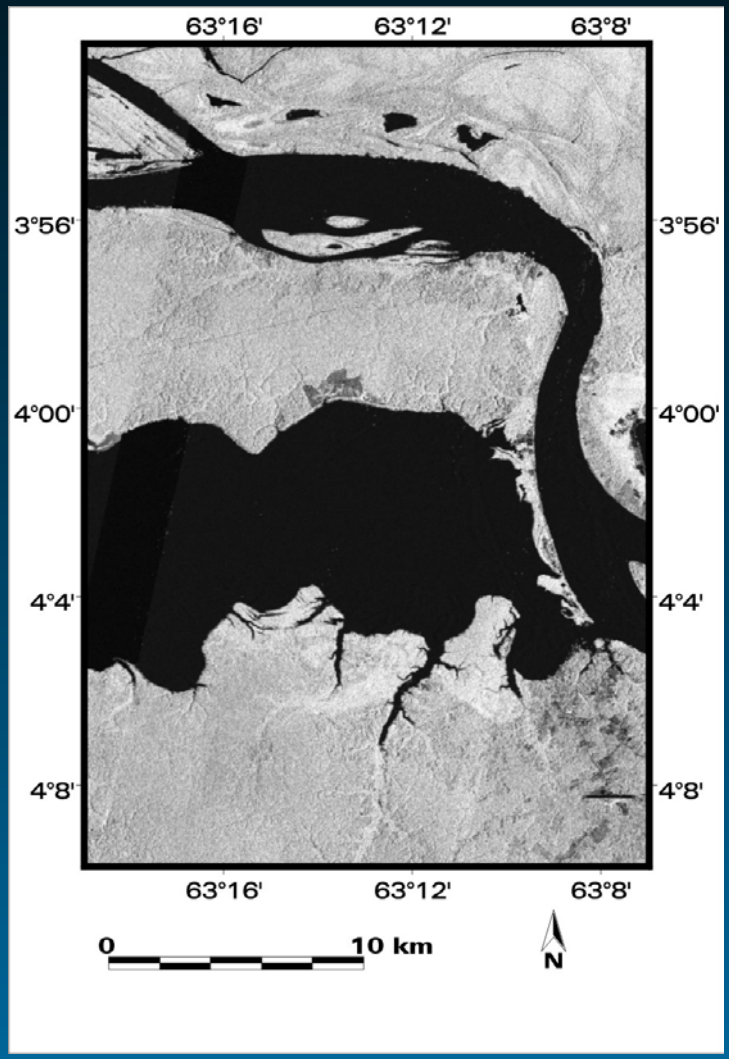
VV Polarization

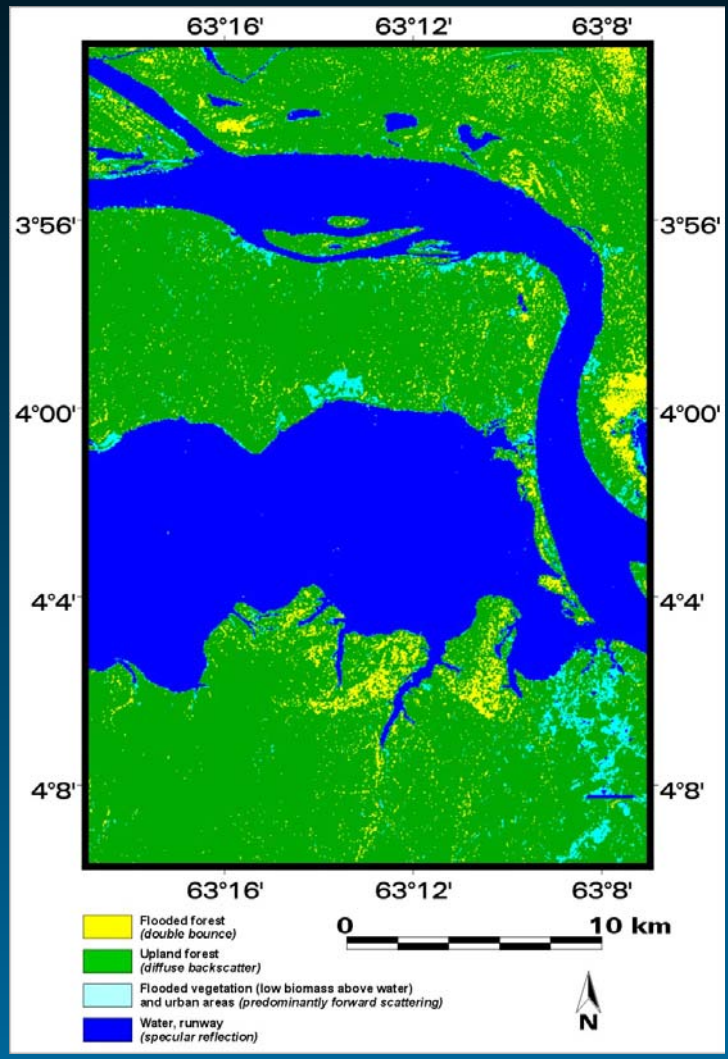
% PIXELS / CLASS (VV)	WATER	FLOODED VEGETATION	UPLAND FOREST	FLOODED FOREST
WATER	100	0	0	0
FLOODED VEGETATION	0	0	100	0
UPLAND FOREST	0	0	100	0
FLOODED FOREST	0	0	0	100



R99SAR L-band MOSAIC SIPAM

VV Polarization





R99SAR L-band MOSAIC SIPAM

HH+HV USTC

L-BAND POLARIZATION	MEAN	STANDARD DEVIATION
HH	120.8349	78.1614
HV	101.1349	57.5408
VV	128.3939	83.2249

(A) COVARIANCE MATRIX			
	HH	HV	VV
HH	6109.21		
HV	4257.20	3310.94	
VV	6275.12	4583.54	6926.38

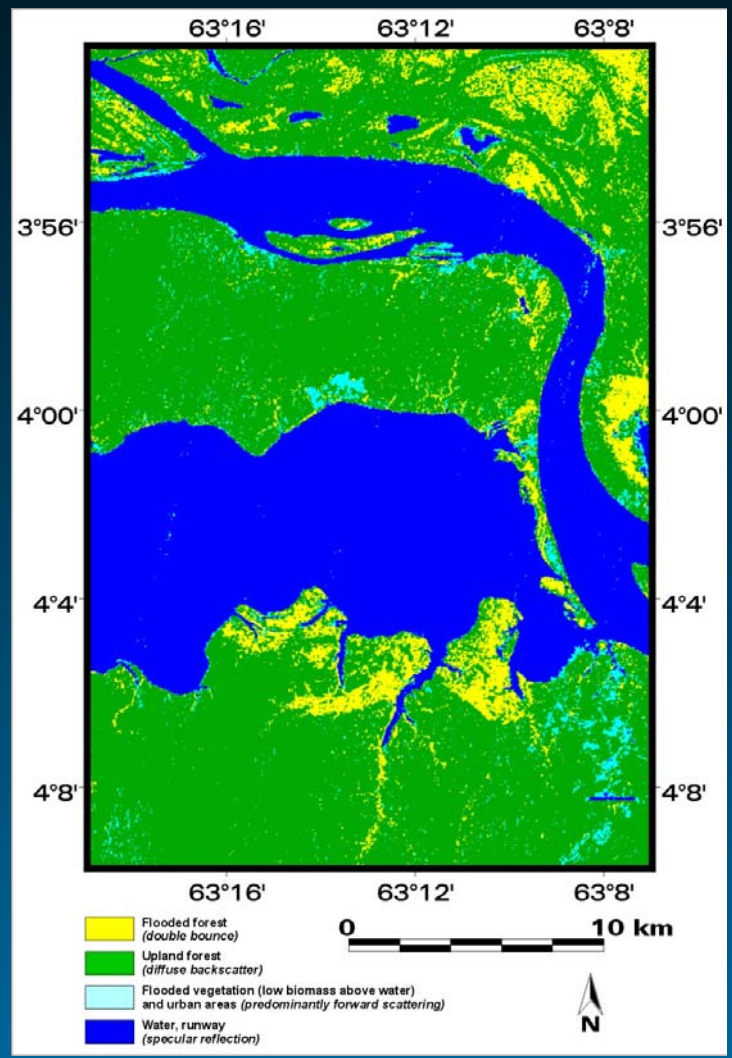
Element of Correlation Matrix

$$q_{ij} = \frac{v_{ij}}{\sqrt{v_{ii} \times v_{jj}}}$$

Element of Covariance Matrix

Variances of the *i*th and *j*th bands of data

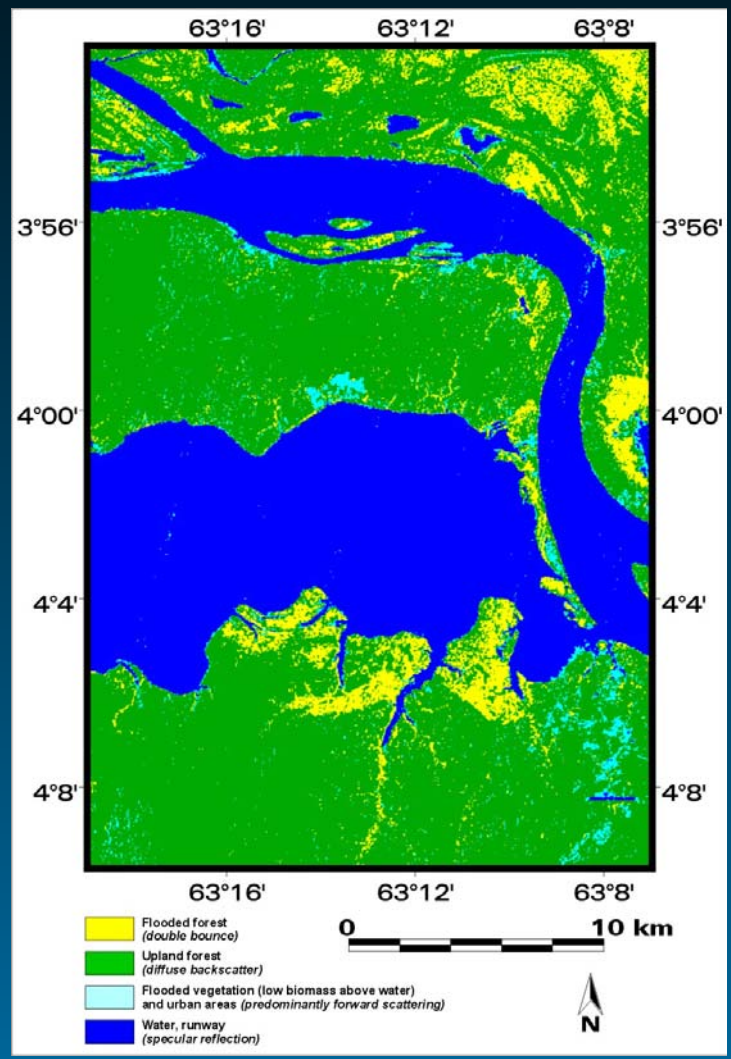
(B) CORRELATION MATRIX			
	HH	HV	VV
HH	1.0000		
HV	0.9466	1.0000	
VV	0.9646	0.9571	1.0000



R99SAR L-band MOSAIC SIPAM

HH+HV USTC

% PIXELS / CLASS (HH+HV)	WATER	FLOODED VEGETATION	UPLAND FOREST	FLOODED FOREST
WATER	100	0	0	0
FLOODED VEGETATION	0	98.3	1.7	0
UPLAND FOREST	0	0	100	0
FLOODED FOREST	0	0	0	100



Conclusions

- R99SAR data were processed in order to generate co-registered, uncalibrated multipolarization image mosaics (LHH, LHV, LVV).
- Sample sites of arbitrary size (11 by 11 pixels) were then chosen for selected surface cover types (flooded vegetation, water, upland forest and flooded forest) at each polarization configuration.
- Calculated semivariograms presented distinct signatures, thus justifying the use of the USTC classifier.

Conclusions

- The observation of confusion matrixes for LHH, LHV and LVV USTC classification demonstrated that the LHH configuration yielded the best results for the individual mosaics.
- The least correlated mosaics (LHH and LHV) were jointly processed. The resulting confusion matrix presented better results if compared with the ones corresponding to the individual mosaics.
- Information derived from R99SAR data is easy to interpret and constitutes a powerful high resolution representation of areas with high oil sensitivity in the Amazon rain forest.