ALOS Kyoto & Carbon Initiative - Science Team meeting #9

Assessment of Wetland Ecosystems and Flooding in the Lower Mekong River Basin using JERS-1 and PALSAR

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Ian Tapley, Horizon Geoscience Consulting, Perth, Australia.
and
Mekong River Commission, Vientanne, Laos.

Overview

- **Product name:** Flood extent, inundation pattern and duration mapping system for the Mekong River Basin (and the Alligator Rivers Region of Northern Australia).
- **Description:** Development of a flood mapping system using a time sequences of PALSAR data in scansar mode to map flood extent and capable of depicting the changes in the pattern of inundation over time within the wetlands of the Mekong River Basin. This involves mapping the extent of wetlands in the Lower Mekong Basin.
- **PALSAR mode:** Scansar and Ascending FB
- **Observation cycles:** 10-12 cycles Dec06-Jan09

Project Aims

Specific aims

- Location of all wetlands in LMB
- Type and distribution of wetlands
- Status, namely condition and disturbance
- Provide baseline dataset for comparisons
- Identify areas subject to disturbance by seasonality and human interference
- Ensure methodology to be repeatable.

Project Objectives

Specific objectives are to:

- Establish a baseline dataset of wetland extent and characteristics;
- Map spatial and temporal variations in hydrological conditions in LMB wetland ecosystems;
- Map inundation patterns and hydroperiod of LMB wetland ecosystems; and
- Establish a compatible and operational monitoring system for the mapping and continued evaluation of wetlands in the LMB (with consideration of existing MRC spatial information infrastructure and capabilities).

Study Areas

Local study areas ;

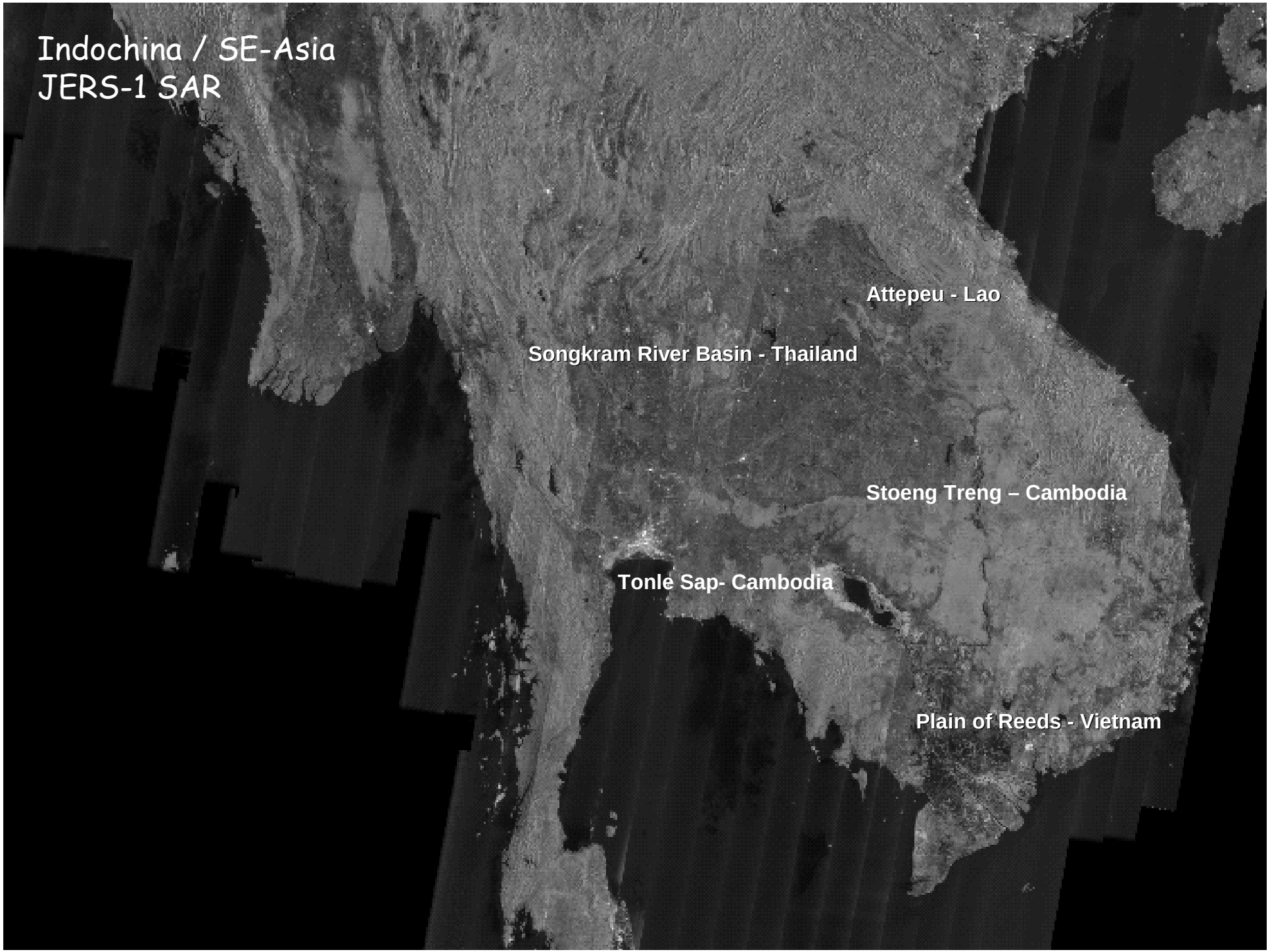
- **Tram Chim, Plain of Reeds,Vietnam**
- **Tonle Sap, Cambodia**
- **Songkram River Basin – Thailand**
- **Attepeu – Lao**
- **Stoeng Treng - Cambodia**
- **(Alligator Rivers – Northern Australia)**

Prototype Areas :

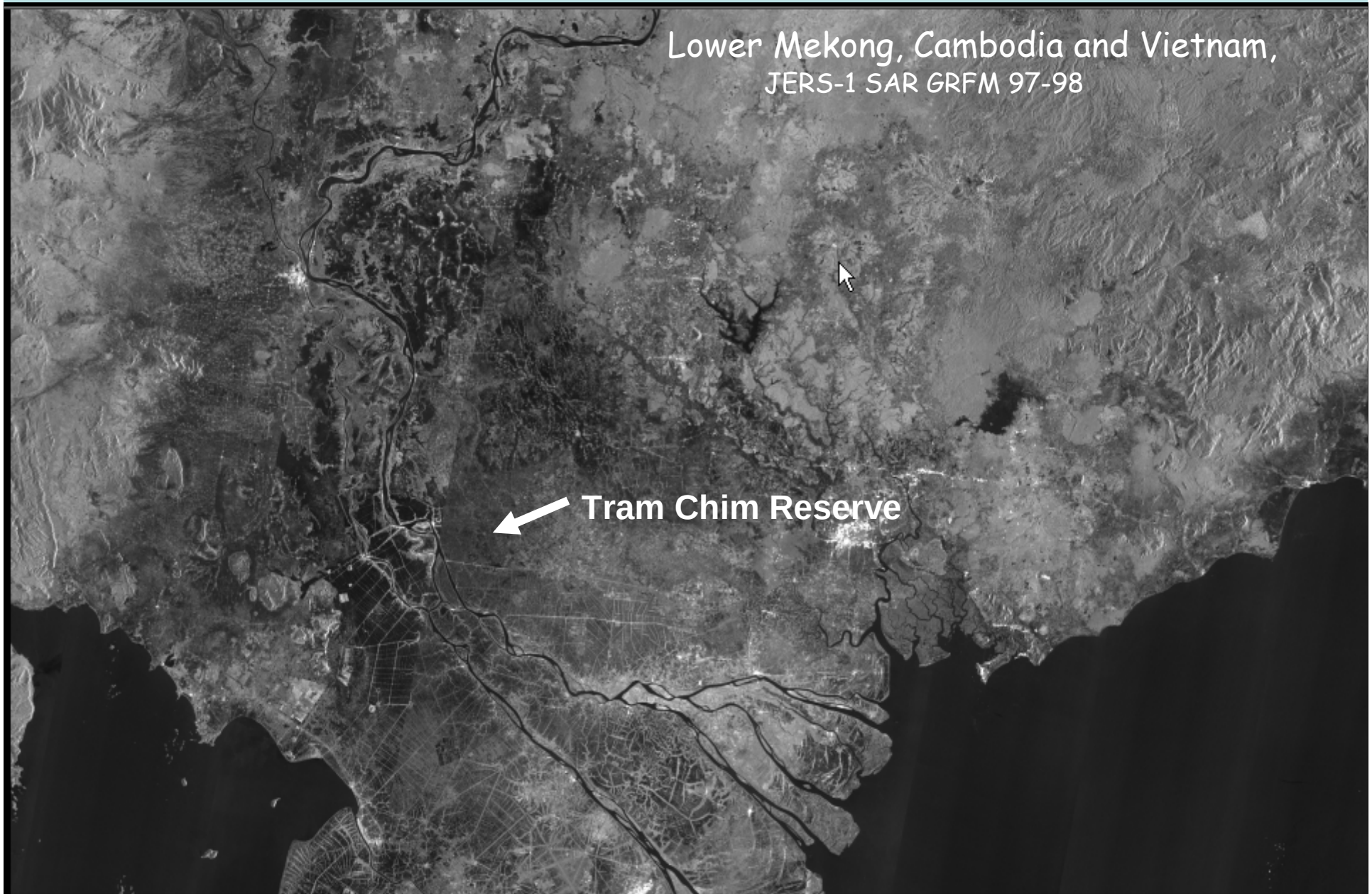
- **Lower Mekong Basin**
- **Kakadu World Heritage Region, Northern Australia)**

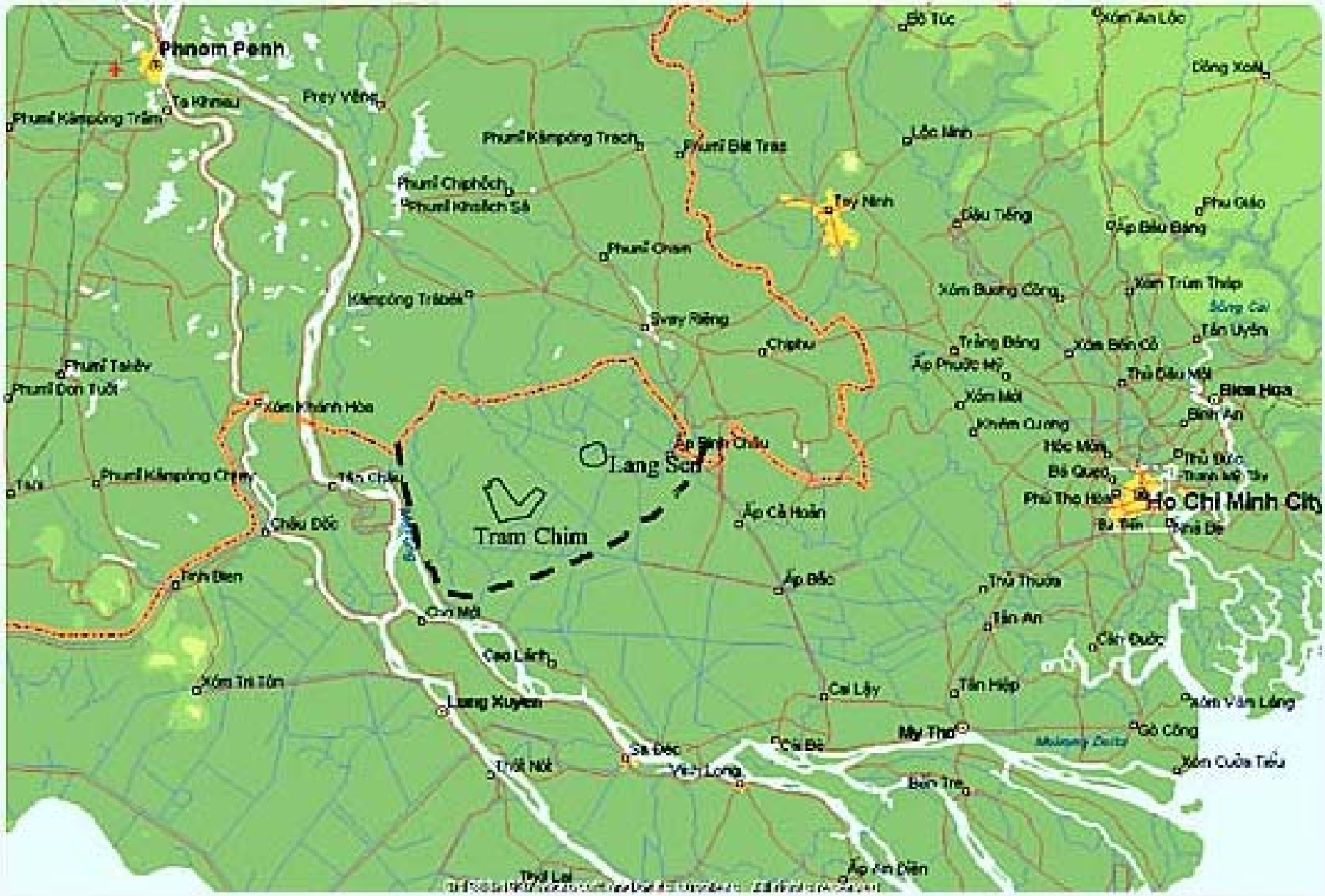
Product areas :

- **Greater Mekong Basin**
- **(Northern Australia)**


Indochina / SE-Asia
JERS-1 SAR
Attepeu - Lao
Songkram River Basin - Thailand
Stoeng Treng – Cambodia
Tonle Sap- Cambodia
Plain of Reeds - Vietnam

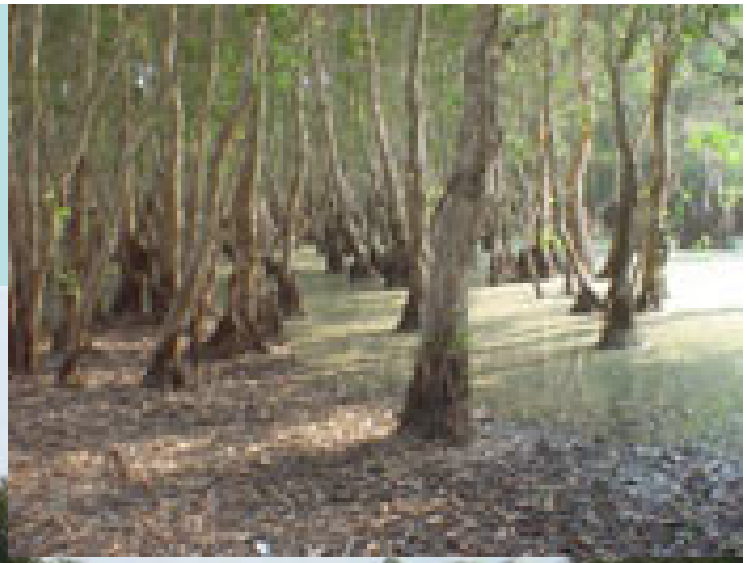
Plain of Reeds, Vietnam



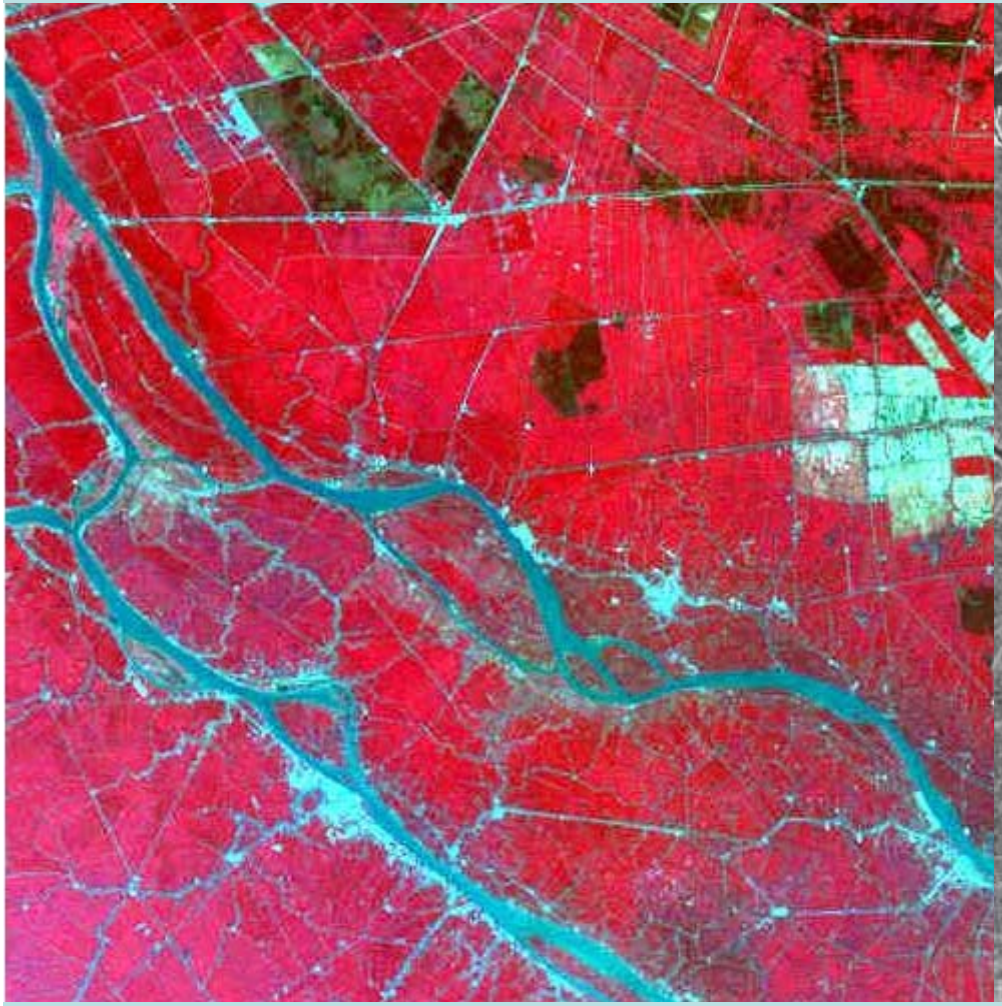


Tram Chim Reserve, Plain of Reeds, Vietnam


Tram Chim Reserve, Plain of Reeds, Vietnam
(Google)
© 2007 Europa Technologies
Image © 2007 TerraMetrics
©2006
Pointer 10°43'12.31" N 105°33'16.57" E elev 10 ft
Streaming 100%
Eye alt



Tram Chim Reserve, Plain of Reeds, Vietnam



SPOT_01/02/07

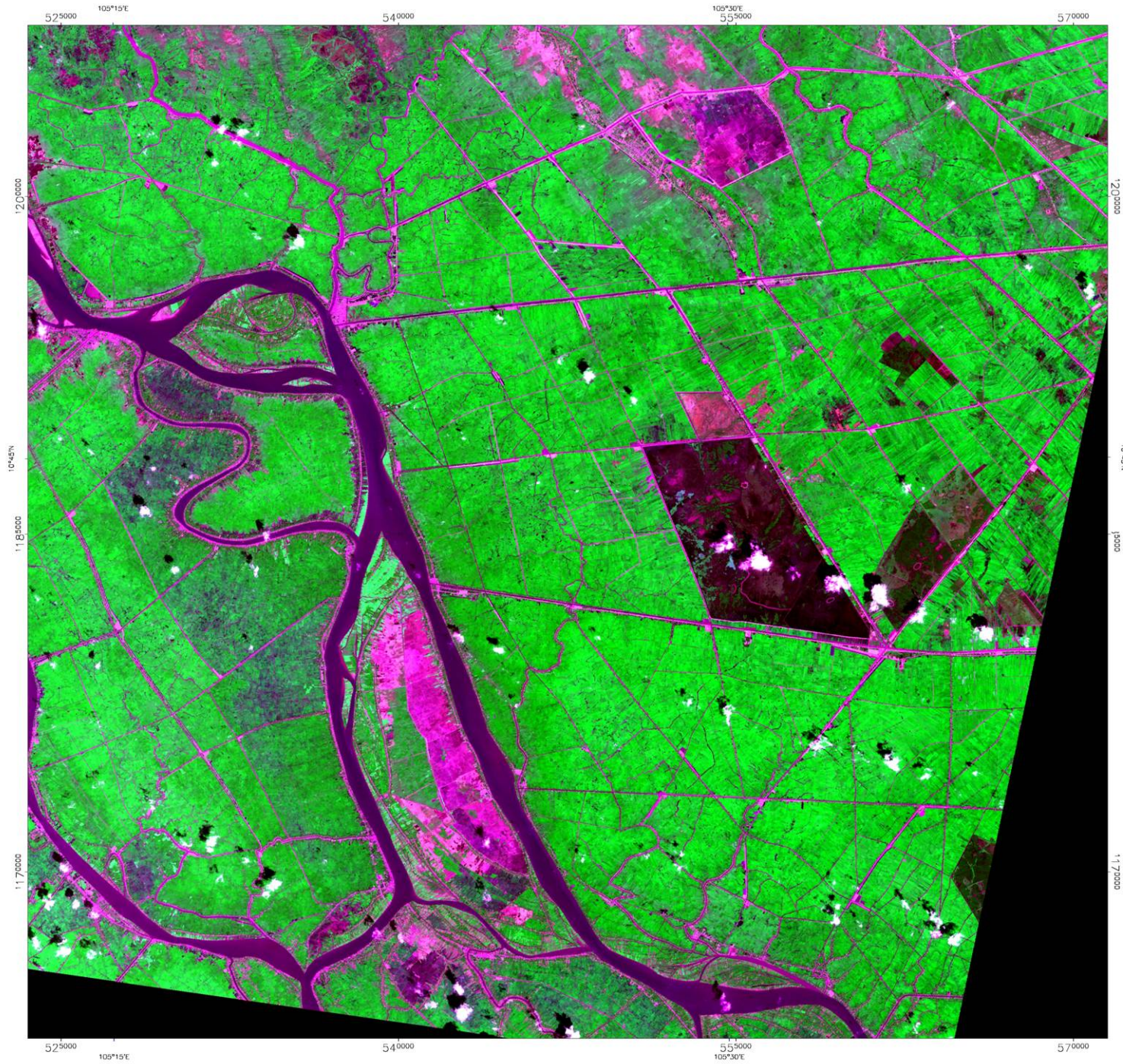
JERS1_February 1998

Tram Chim Reserve, Plain of Reeds, Vietnam

SPOT_22/12/06

JERS1_February 1998

Tram Chim Reserve, Plain of Reeds, Vietnam



Plain of Reeds, Vietnam

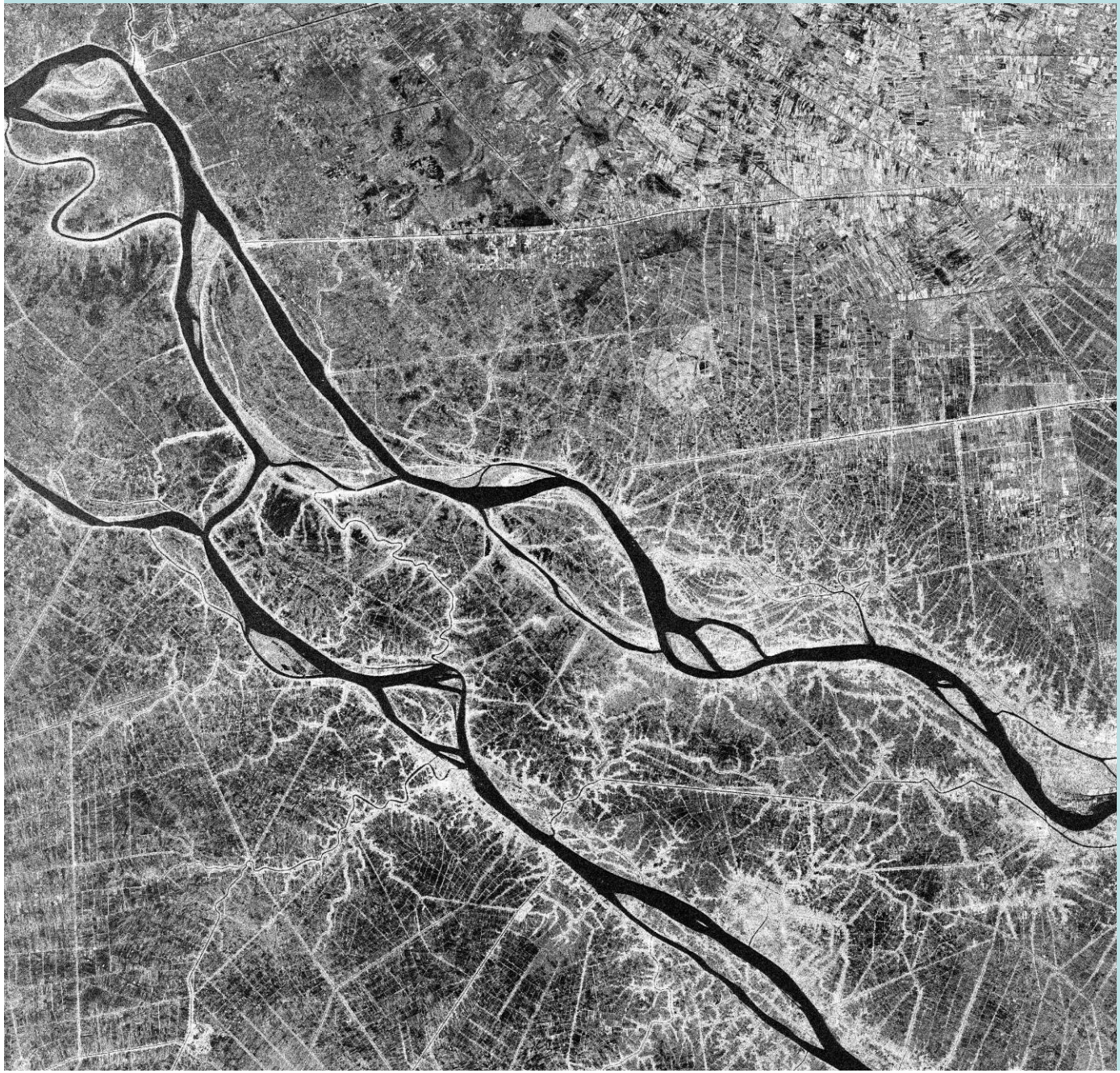
ASTER 2:3:1

18Jan2004

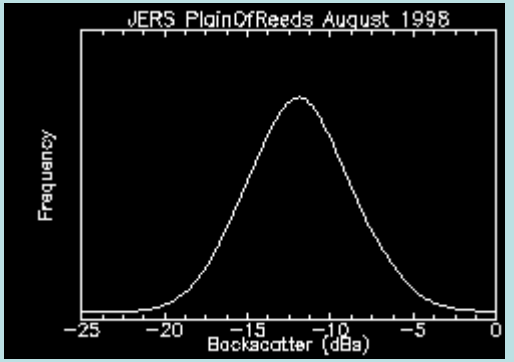
Plain of Reeds, Vietnam

3D perspective:
SRTM and ASTER 231

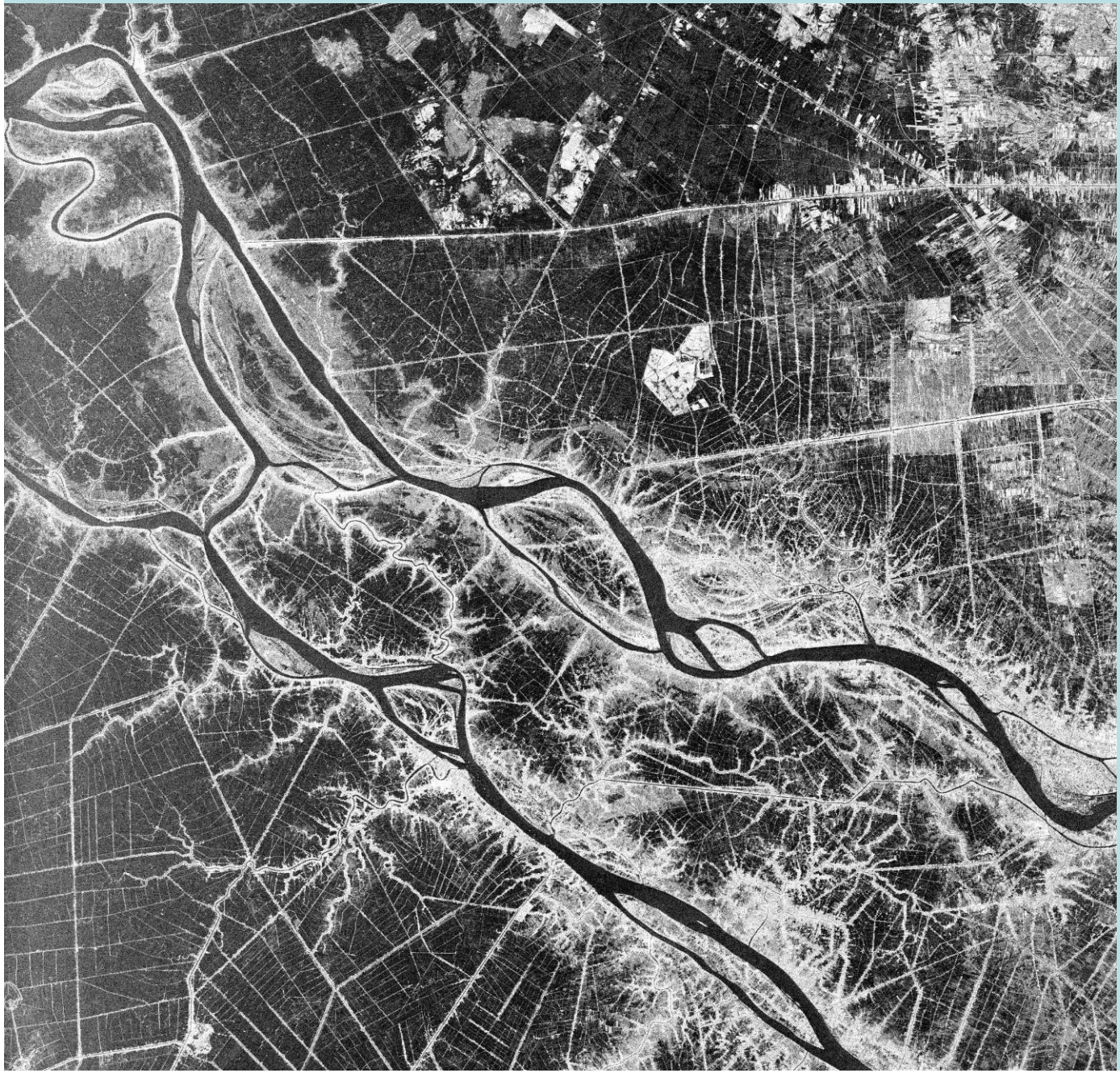
JERS-1 SAR Plain-of-Reeds, Vietnam



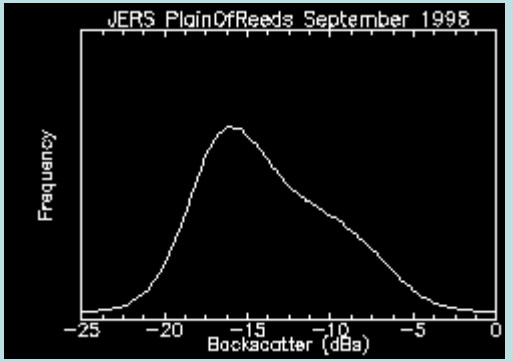
August 1998

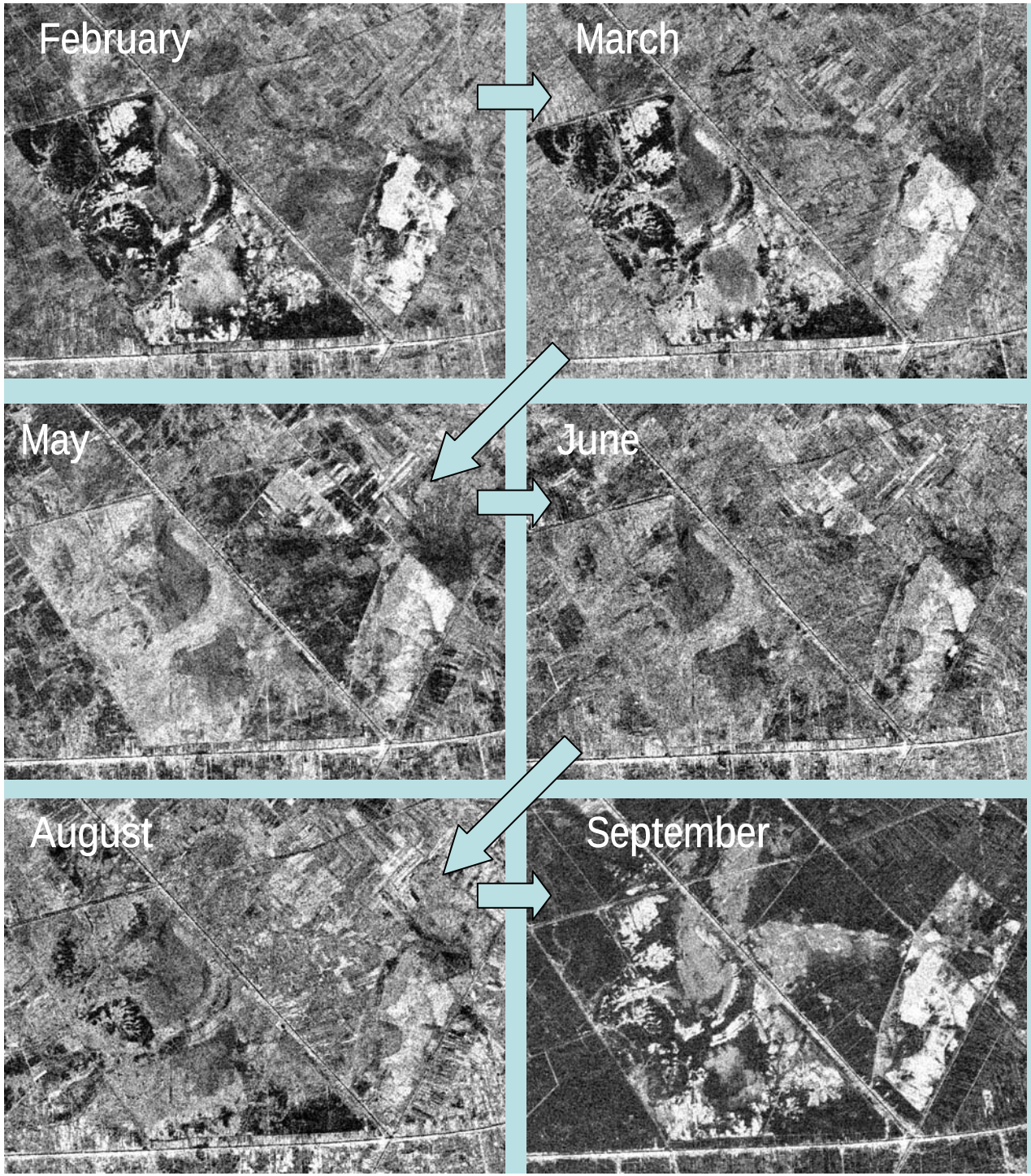


JERS-1 SAR Plain-of-Reeds, Vietnam



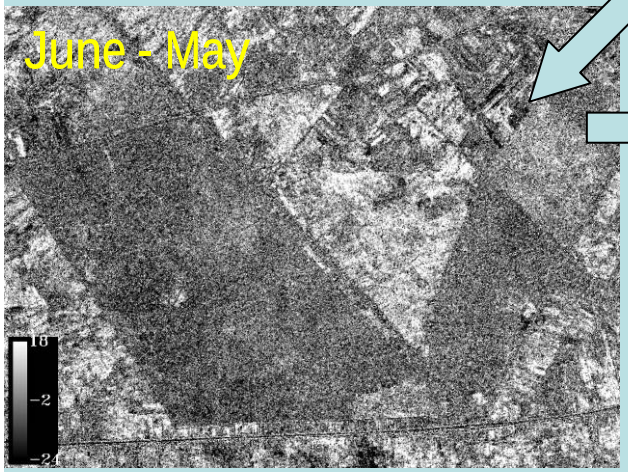
September 1998

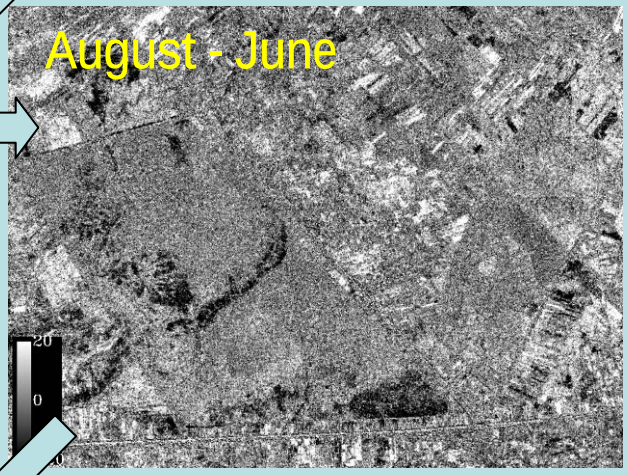


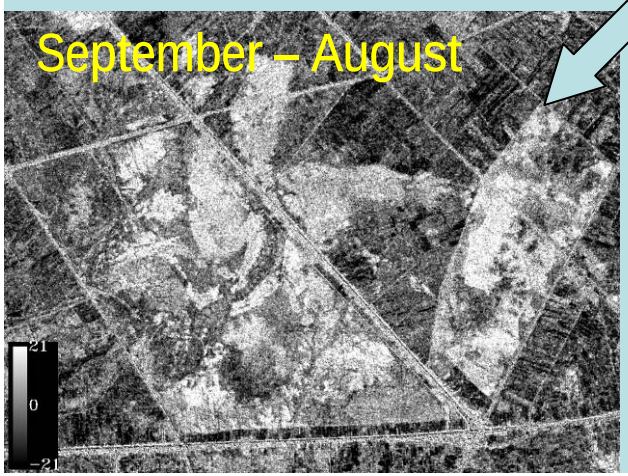


Tram Chim Reserve, Plain-of-Reeds

Time-series JERS SAR
February-September
1998

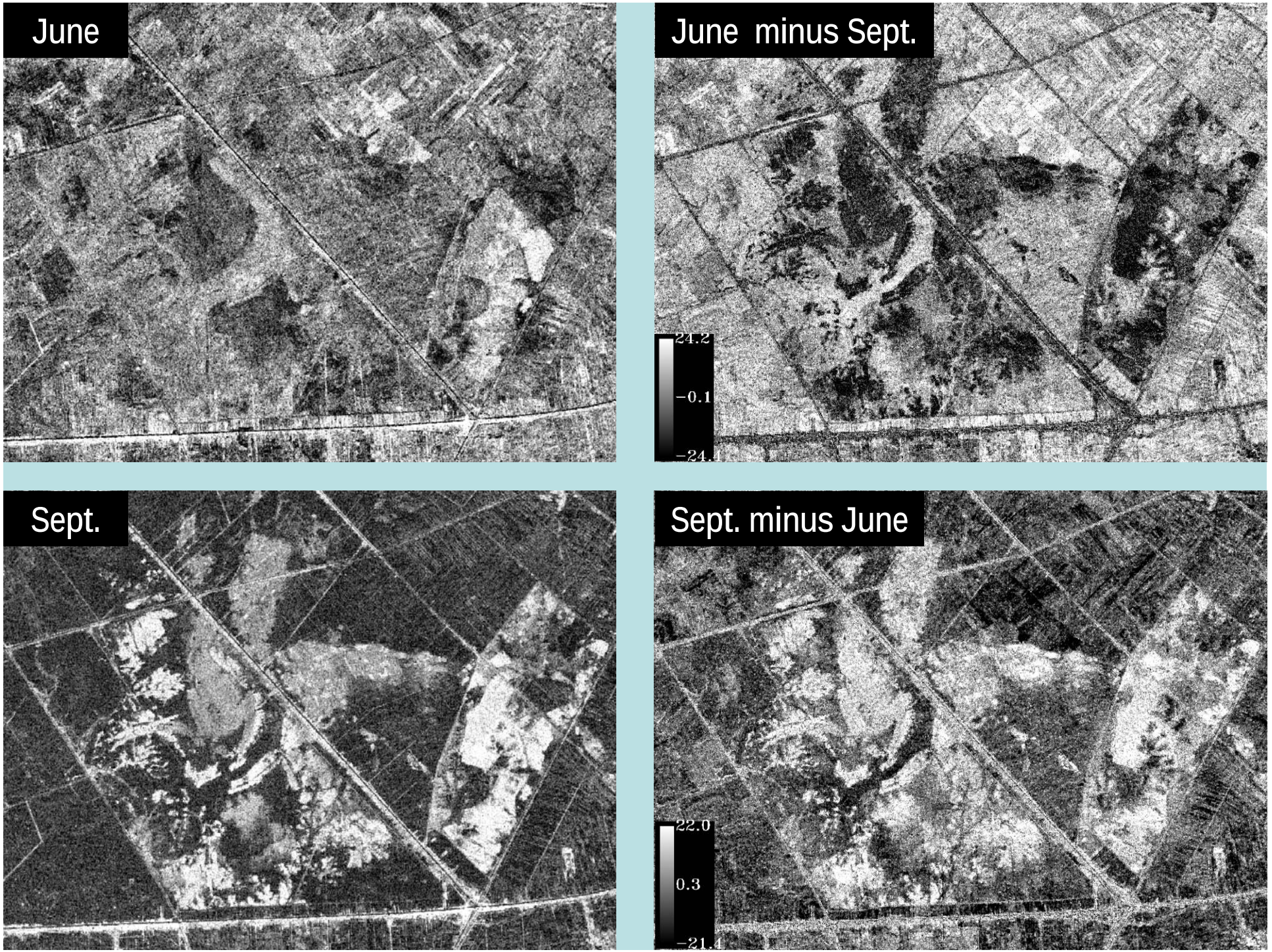


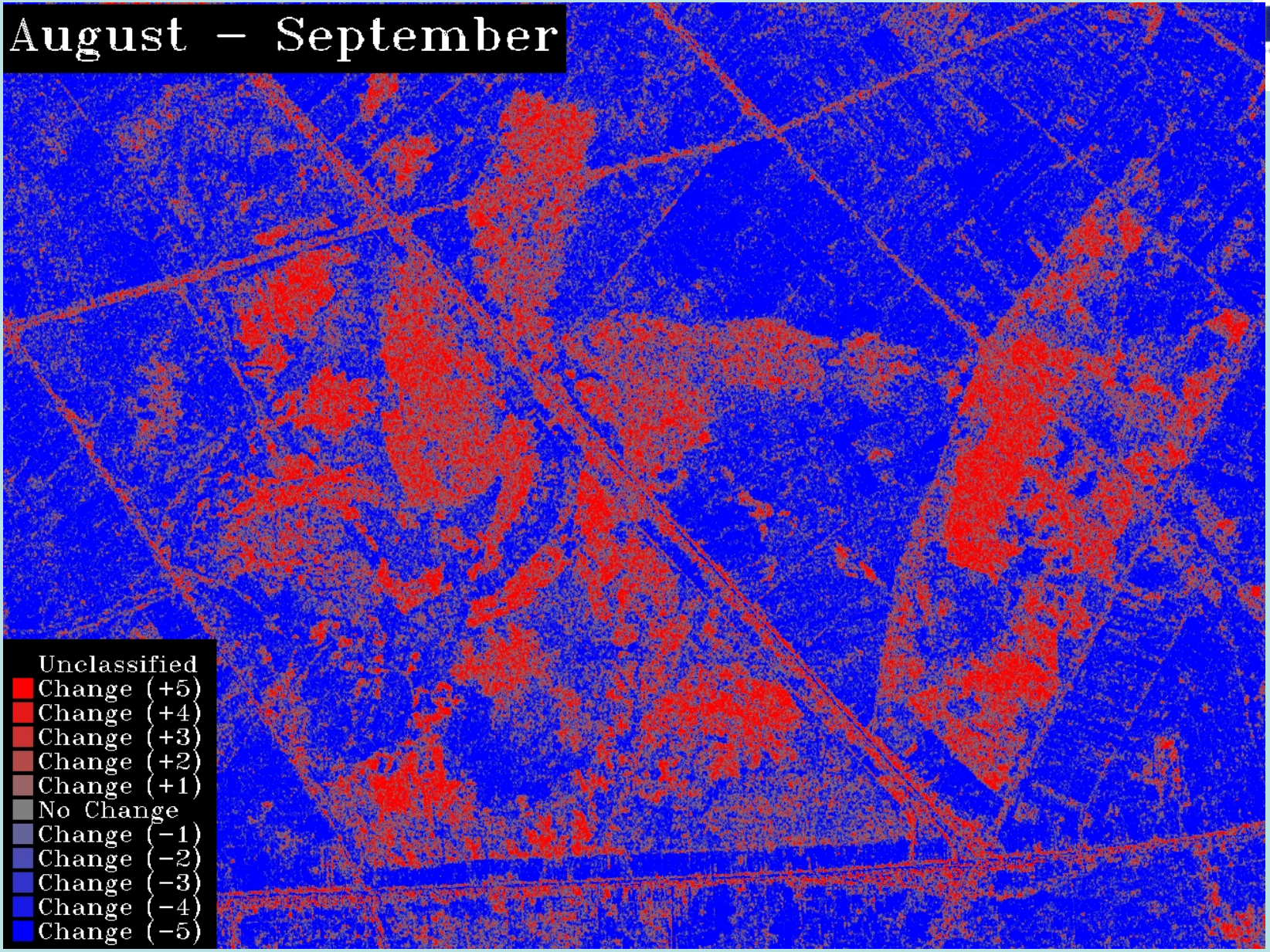




Difference images

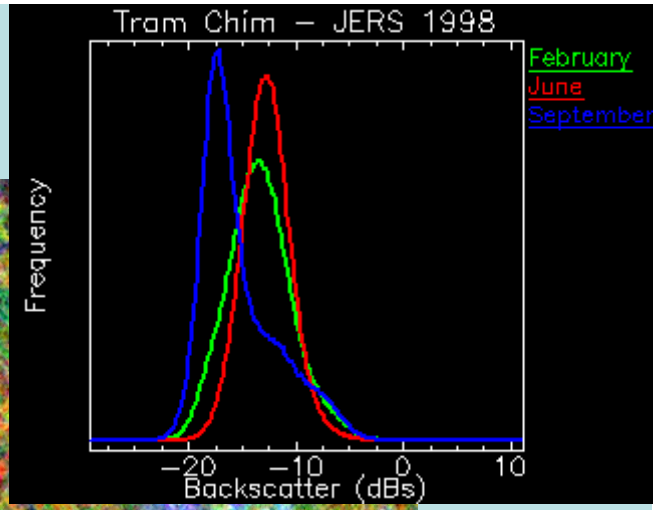
Tram Chim Reserve, Plain of Reeds, Vietnam

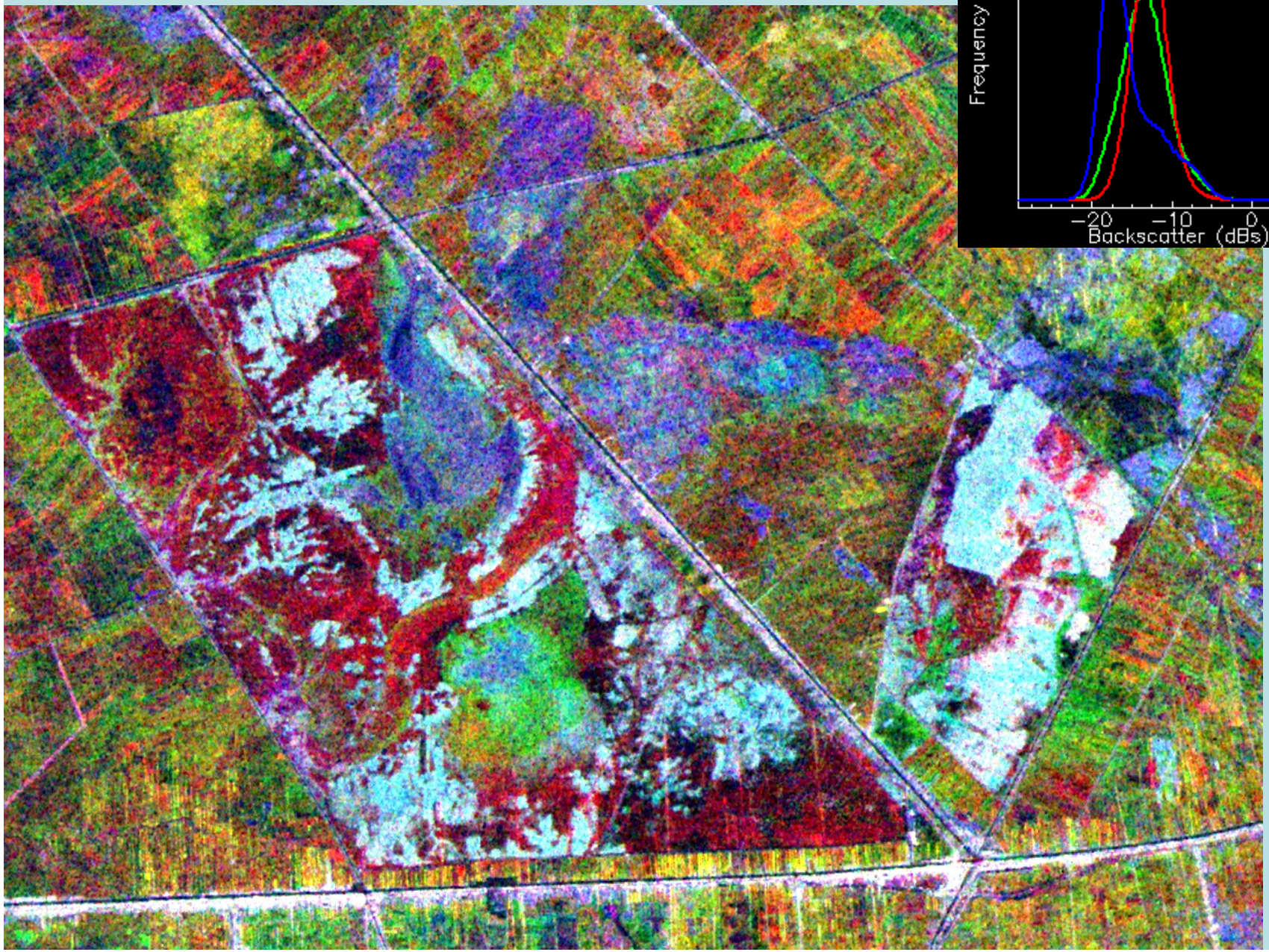

June
June minus Sept.
24.2
−0.1
−24.4
Sept.
Sept. minus June
22.0
0.3
−21.4



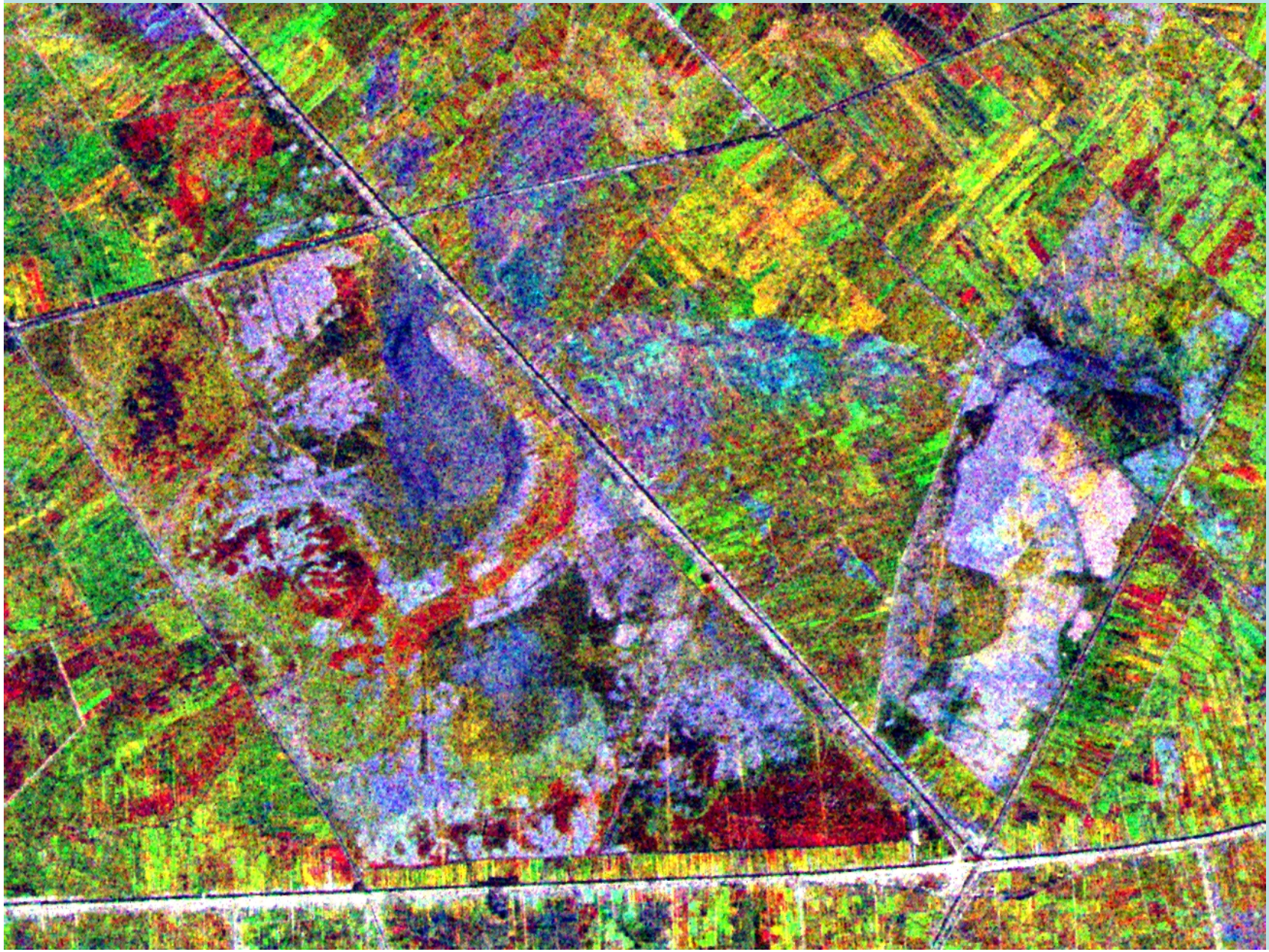
Change Image - Tram Chim Reserve, Plain of Reeds, Vietnam

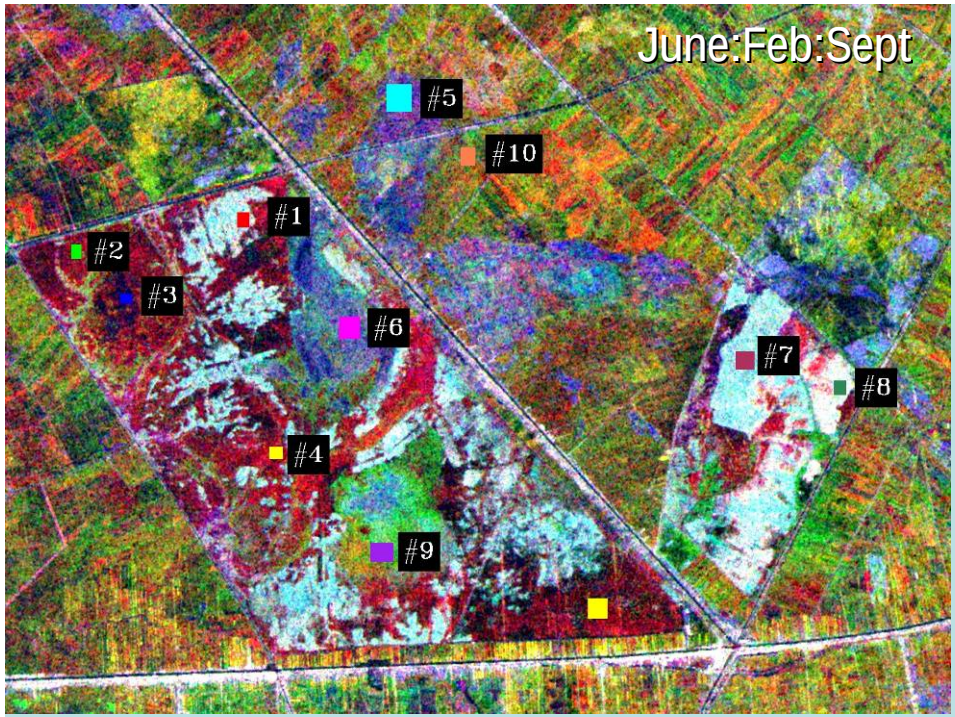
Tram Chim Reserve – JERS-1 SAR 1998
June / Feb / Sept (RGB)

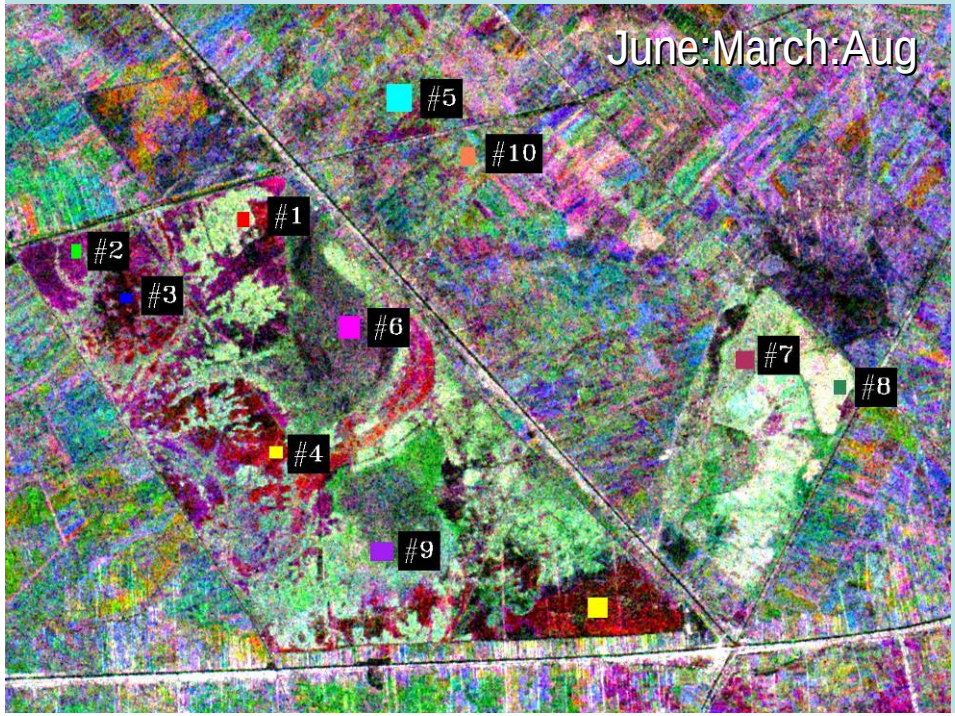


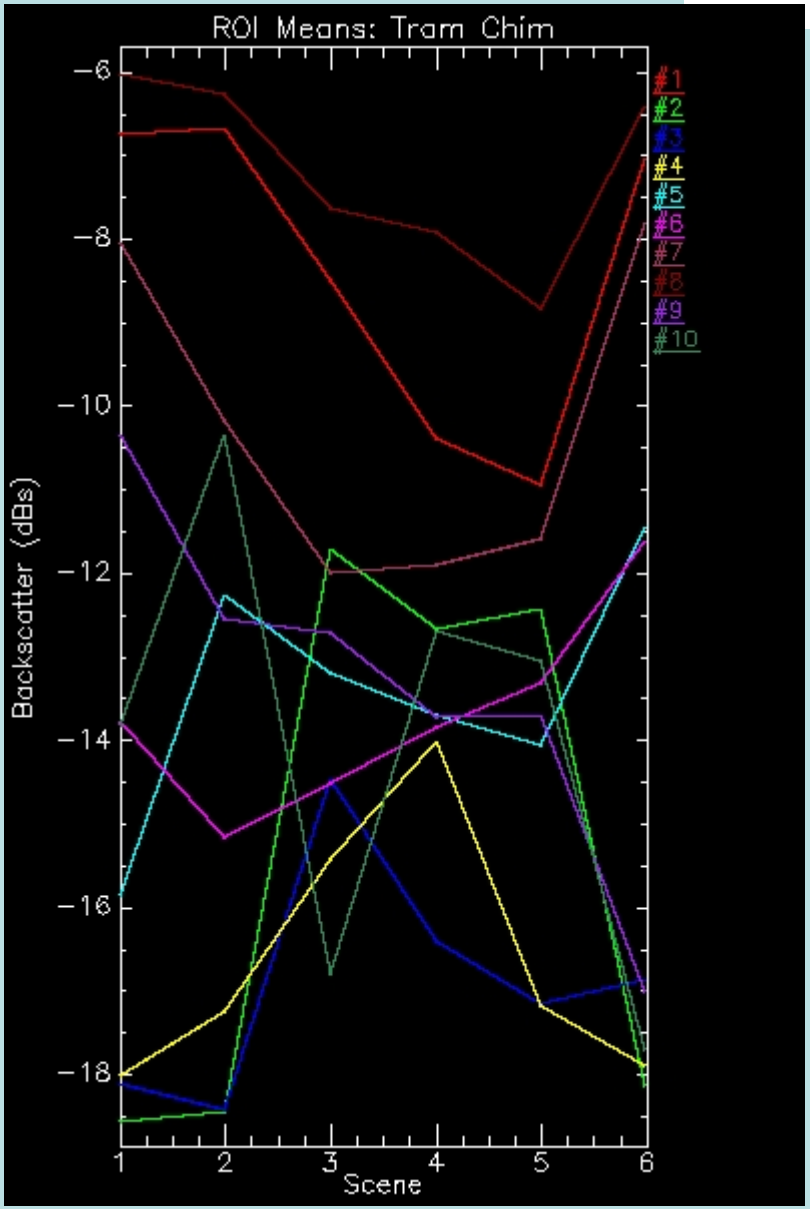


Tram Chim Reserve – JERS-1 SAR 1998
June / Aug / Sept (RGB)





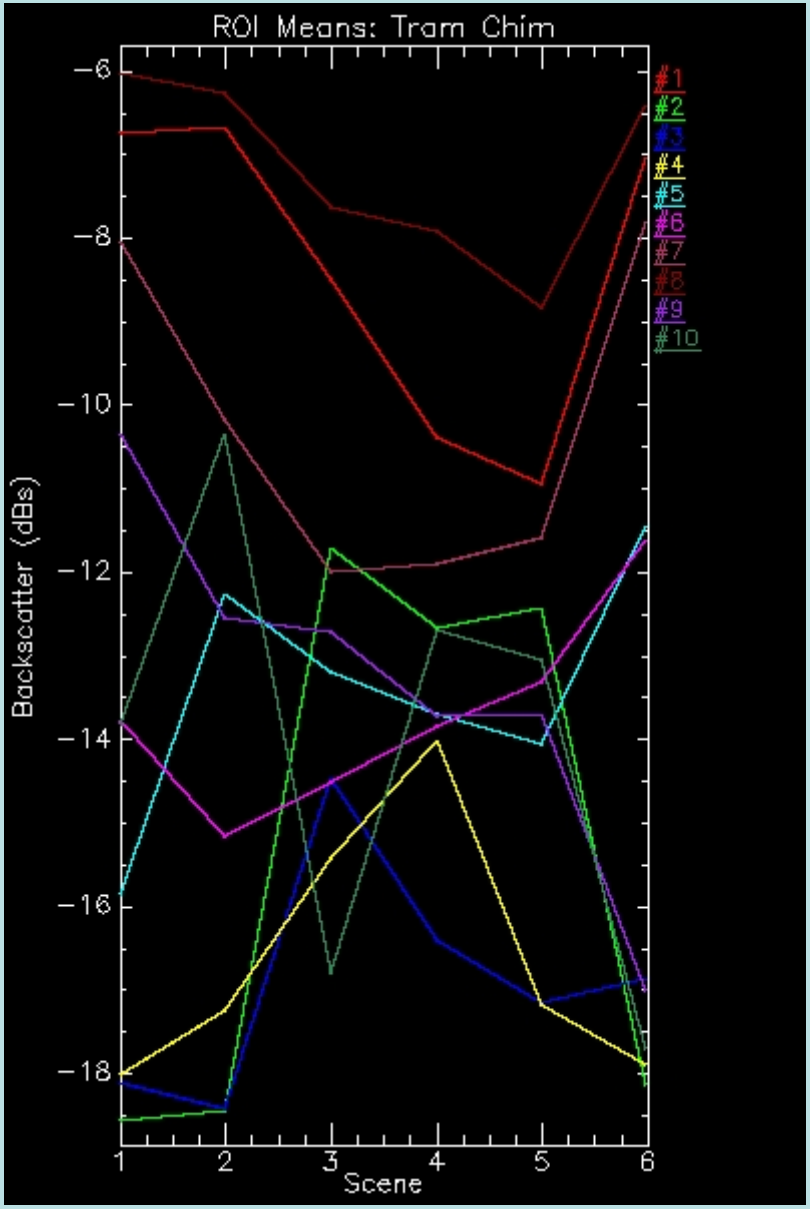




Regions of Interest

Spectral separability between selected ROI pairs. Both the Jeffries-Matusita and Transformed Divergence separability measures are reported. These values range from 0 to 2.0 and indicate how well the selected ROI pairs are statistically separate. Values greater than 1.9 indicate that the ROI pairs have good separability.

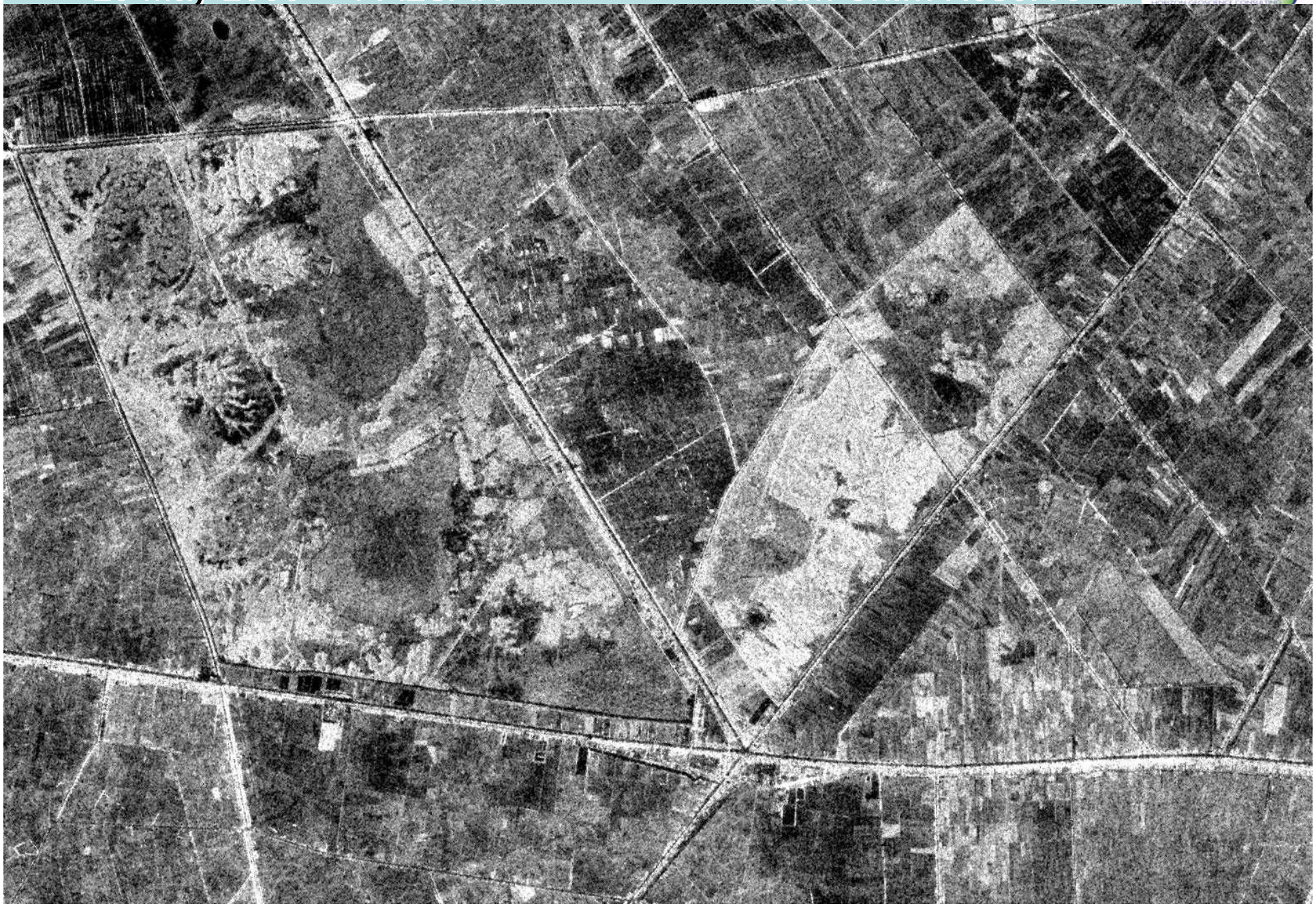
Regions of Interest



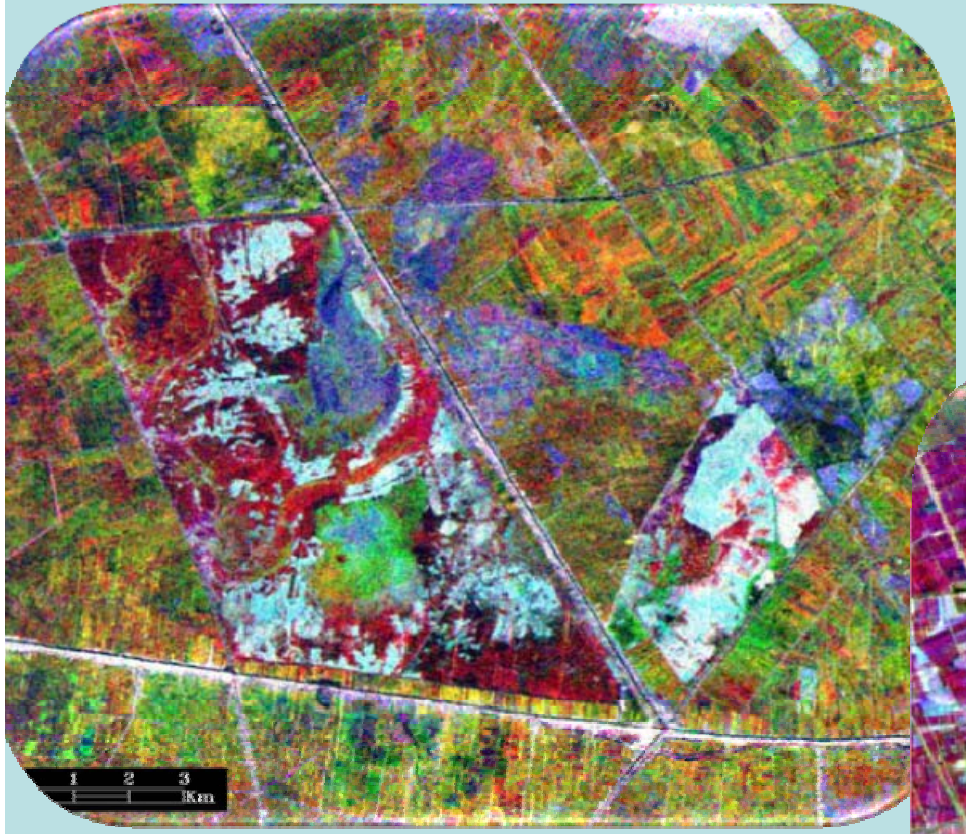
Pair Separation (least to most):

Region #1 and Region #8	1.02495064
Region #5 and Region #6	1.23472027
Region #3 and Region #4	1.27475011
Region #1 and Region #7	1.45279074
Region #9 and Region #10	1.75637739
Region #2 and Region #4	1.82570509
Region #7 and Region #8	1.88894688
Region #8 and Region #10	1.90432373
Region #6 and Region #9	1.92509872
Region #2 and Region #3	1.92739602
Region #5 and Region #9	1.93675462
Region #6 and Region #7	1.95677206
Region #4 and Region #5	1.96191273
Region #6 and Region #10	1.96670706
Region #4 and Region #10	1.96679632
Region #4 and Region #6	1.96946121
Region #5 and Region #7	1.97619123
Region #3 and Region #6	1.99000232
Region #3 and Region #5	1.99209143
Region #4 and Region #9	1.99257905
Region #7 and Region #9	1.99688694
Region #2 and Region #5	1.99770774
Region #2 and Region #6	1.99780736
Region #1 and Region #5	1.99788407
Region #7 and Region #10	1.99872860
Region #1 and Region #6	1.99886648
Region #2 and Region #9	1.99895295
Region #1 and Region #9	1.99896333
Region #2 and Region #10	1.99967603
Region #3 and Region #10	1.99968129
Region #1 and Region #10	1.99980817
Region #5 and Region #8	1.99994194
Region #3 and Region #9	1.99995328
Region #6 and Region #8	1.99997156
Region #4 and Region #7	1.99999776
Region #8 and Region #10	1.99999903
Region #8 and Region #9	1.99999928
Region #1 and Region #4	1.99999982
Region #2 and Region #7	1.99999998
Region #1 and Region #2	1.99999999
Region #3 and Region #7	2.00000000
Region #4 and Region #8	2.00000000
Region #1 and Region #3	2.00000000
Region #2 and Region #8	2.00000000
Region #3 and Region #8	2.00000000

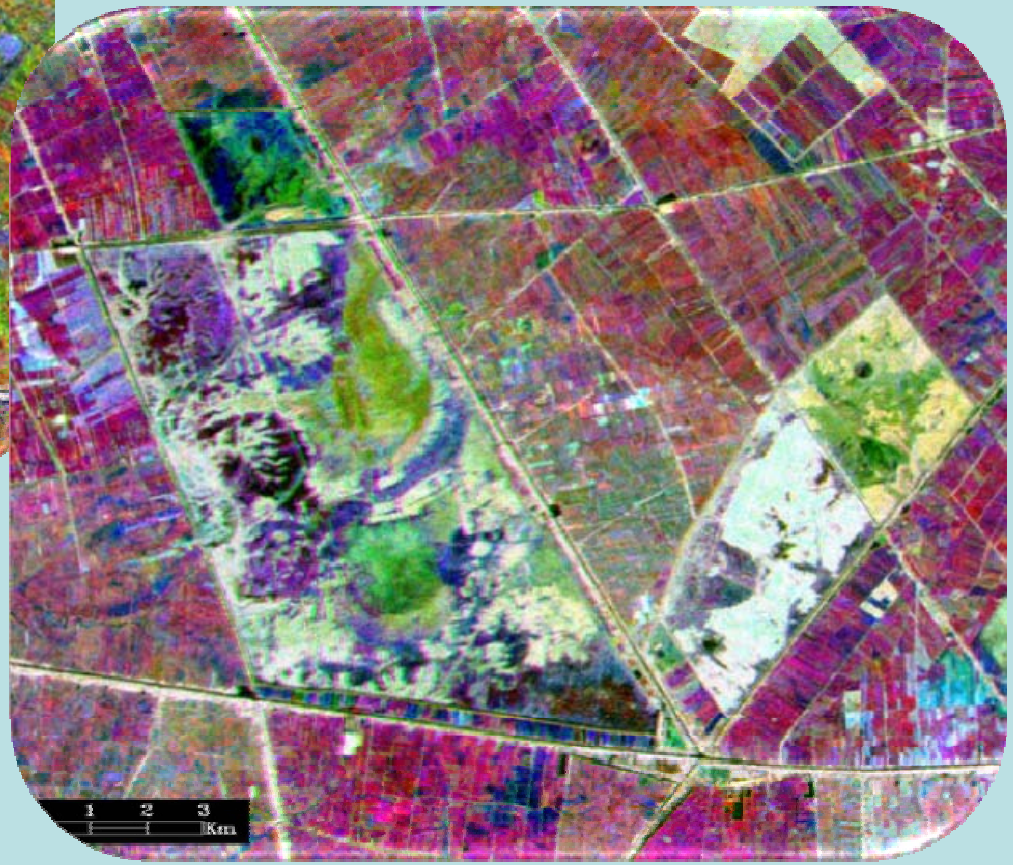
29 May 2006 PALSAR Tram Chim Reserve



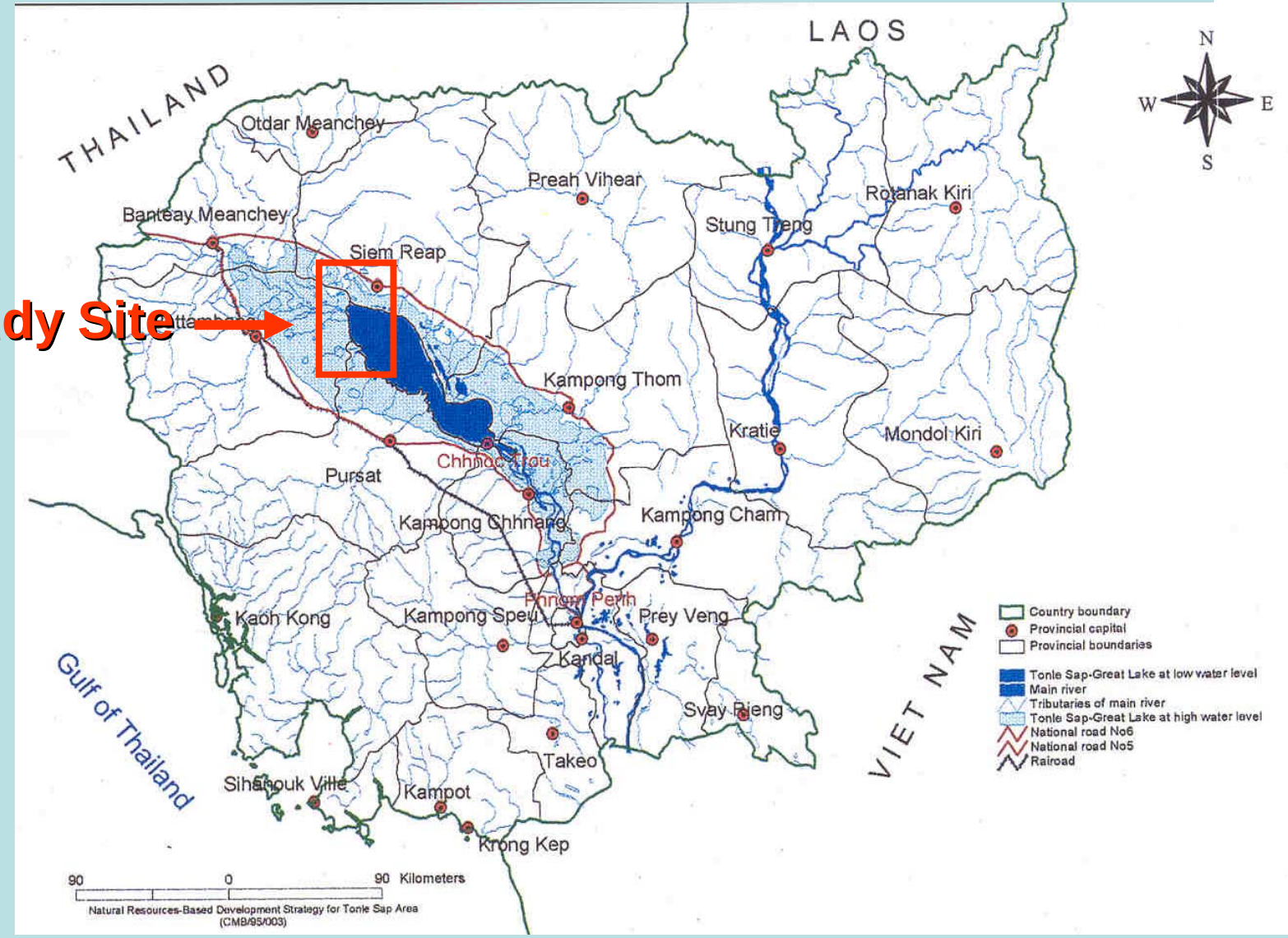
14 July 2006 PALSAR Tram Chim Reserve



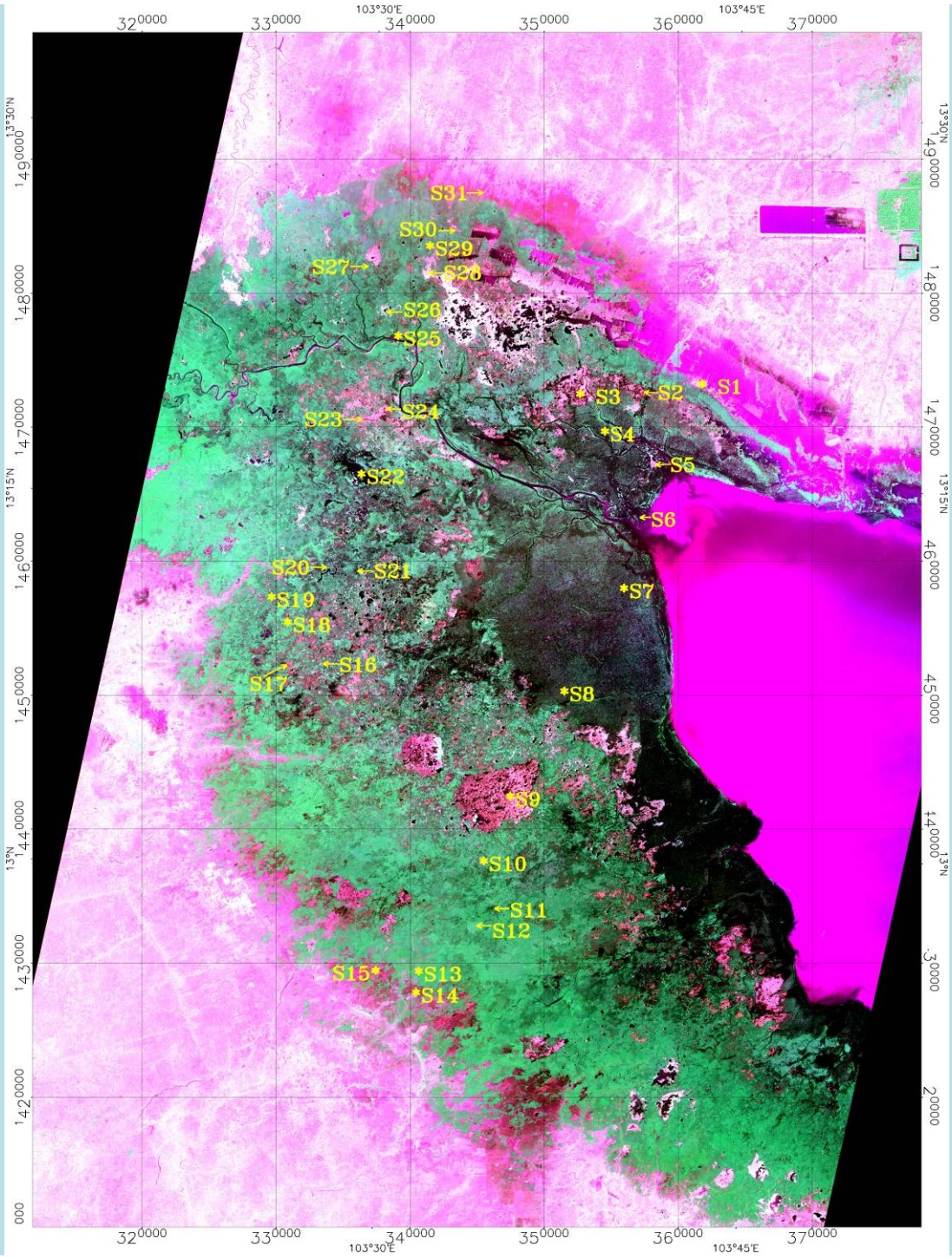
JERS-1:
1998 June/Feb/Sept
(RGB)



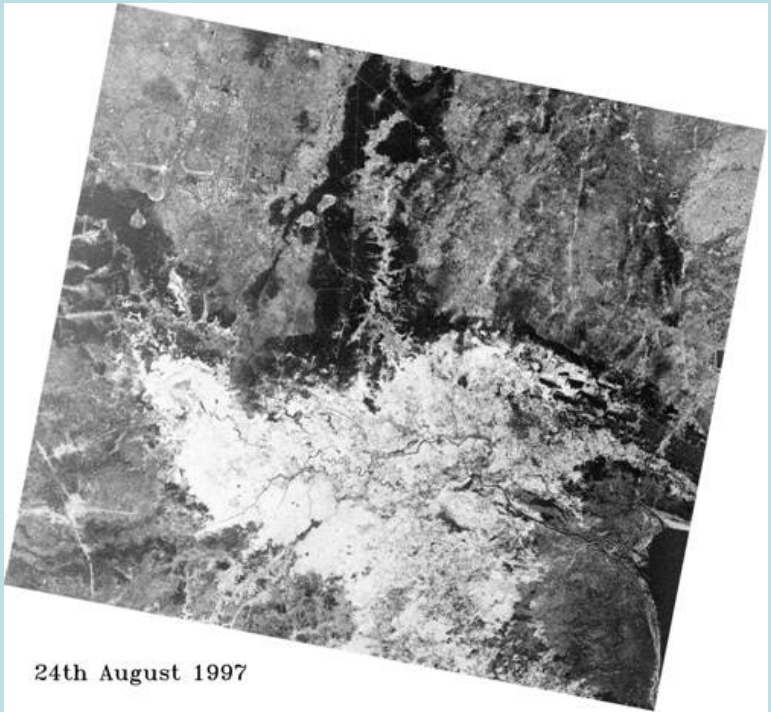
PALSAR:
Jul'06/Jan'07/Feb'07
(RGB)



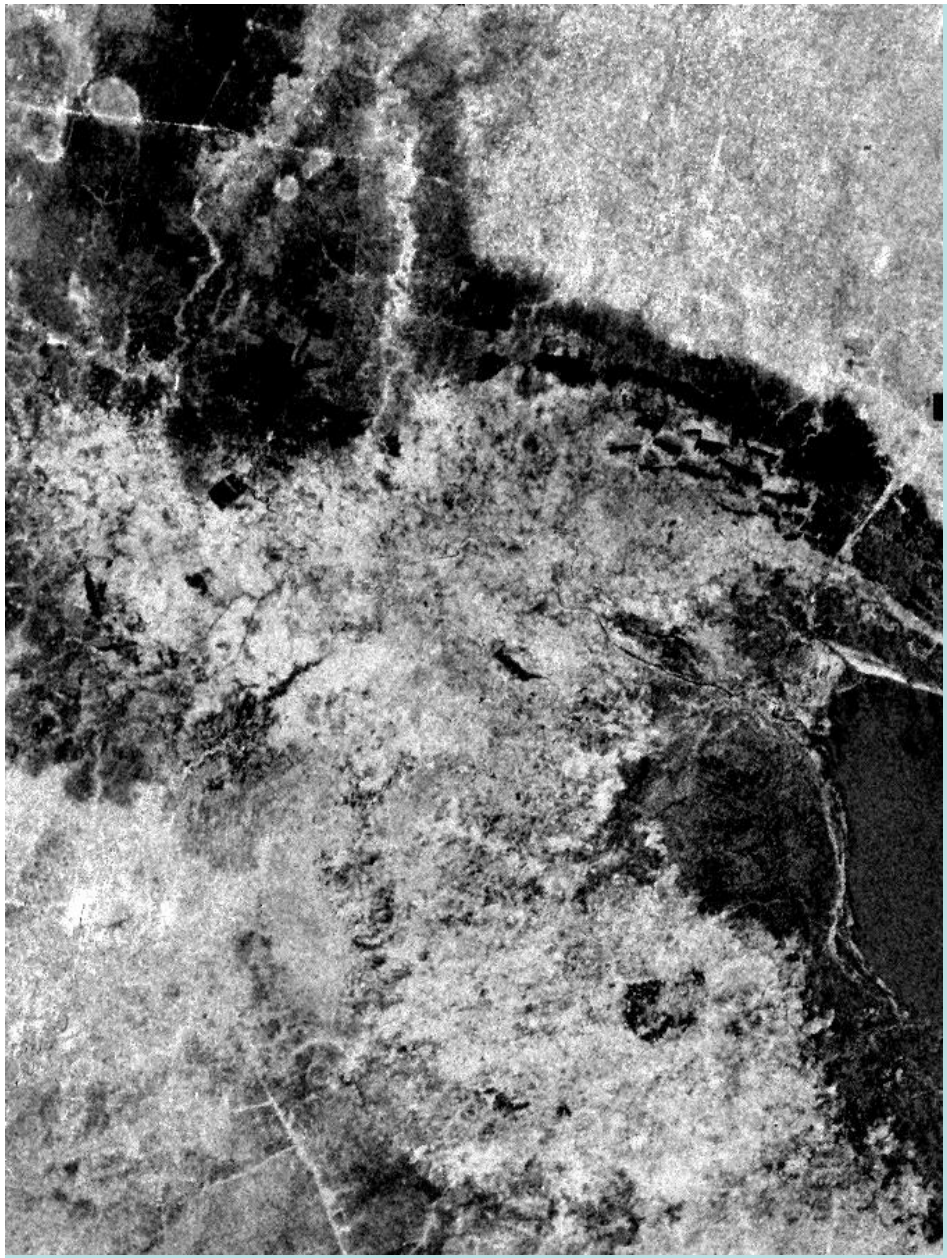
Tonle Sap Great Lake



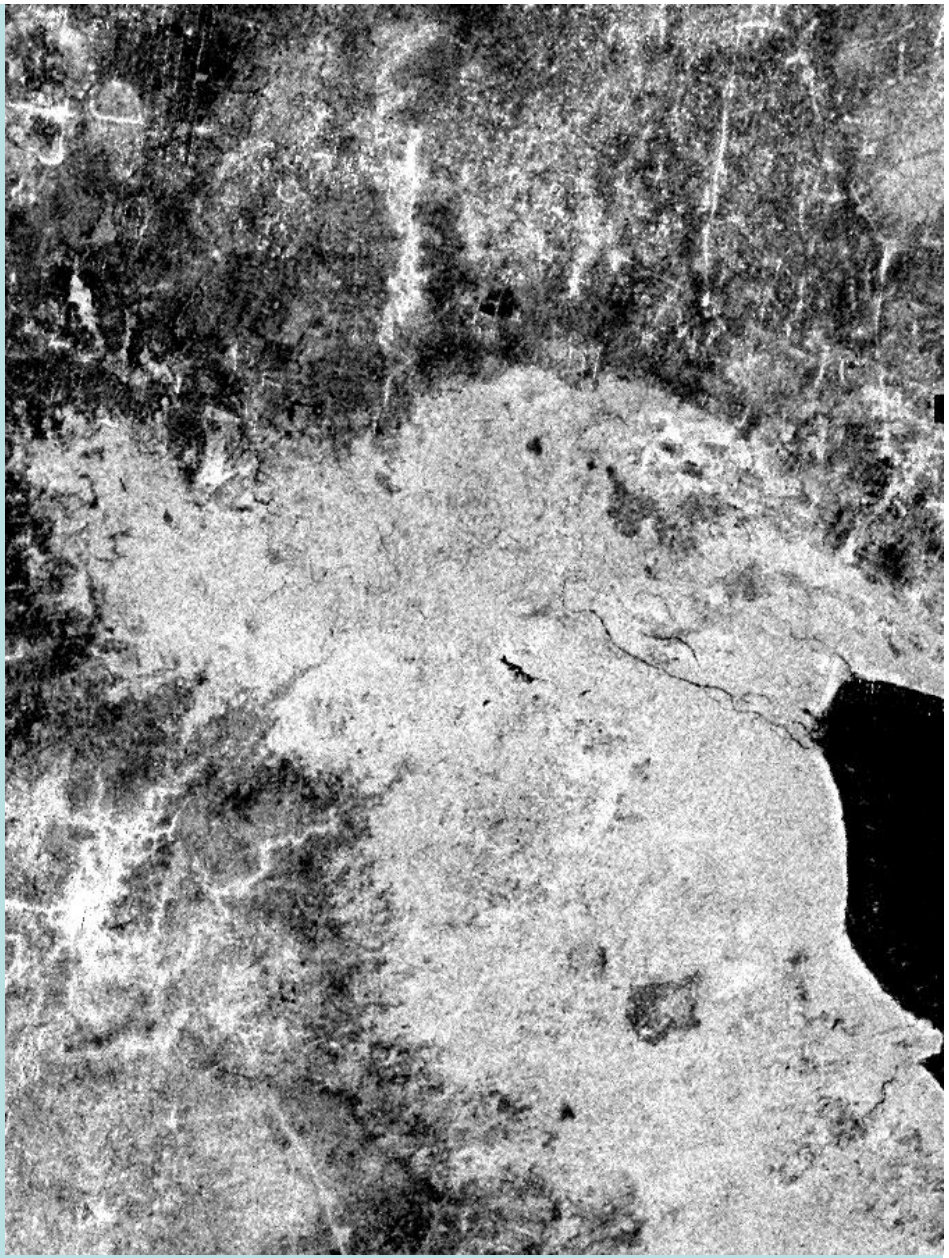
ASTER coverage (Bands 2:3:1 RGB) of wetland site adjacent to Lake Tonle Sap, with the locations of AIRSAR field sites discussed in this study. These ASTER data were collected on 10th January 2002.



Multi-date JERS-1 SAR images of Tonle Sap wetlands highlighting the variability in radar backscatter in response to an increase in surface run-off from river systems originating in highlands north of the site.

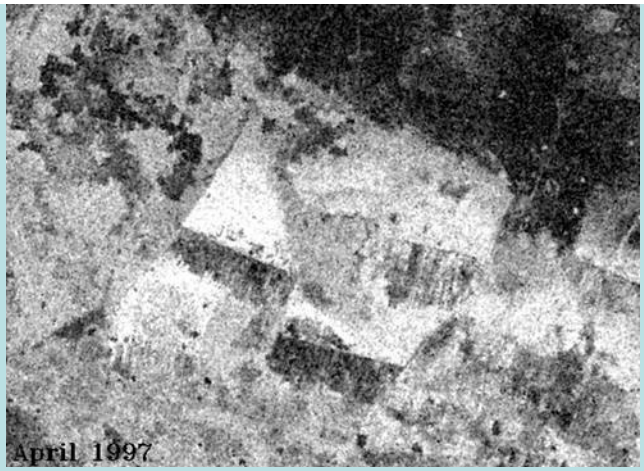


PALSAR WB1 – 05 November 2006



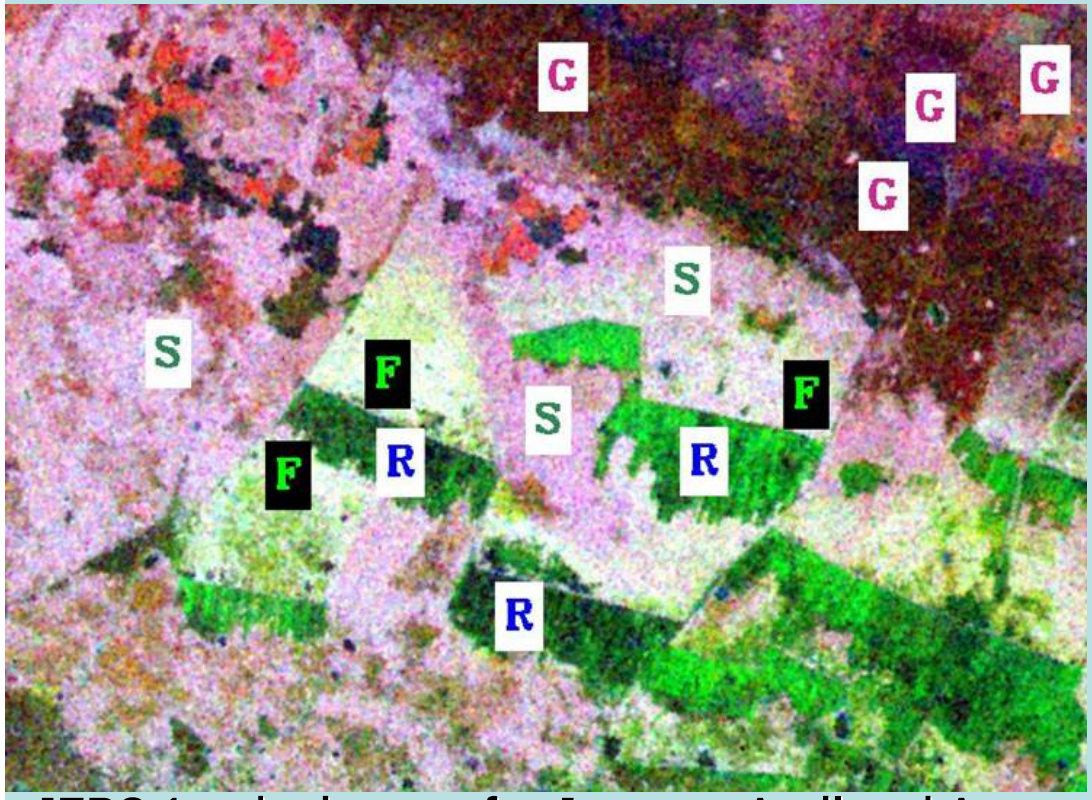
PALSAR WB1 – 23 March 2007

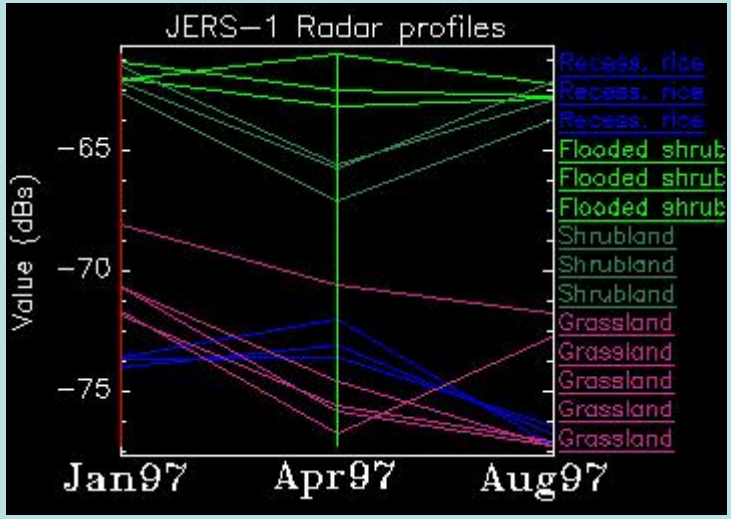
January 1997



April 1997

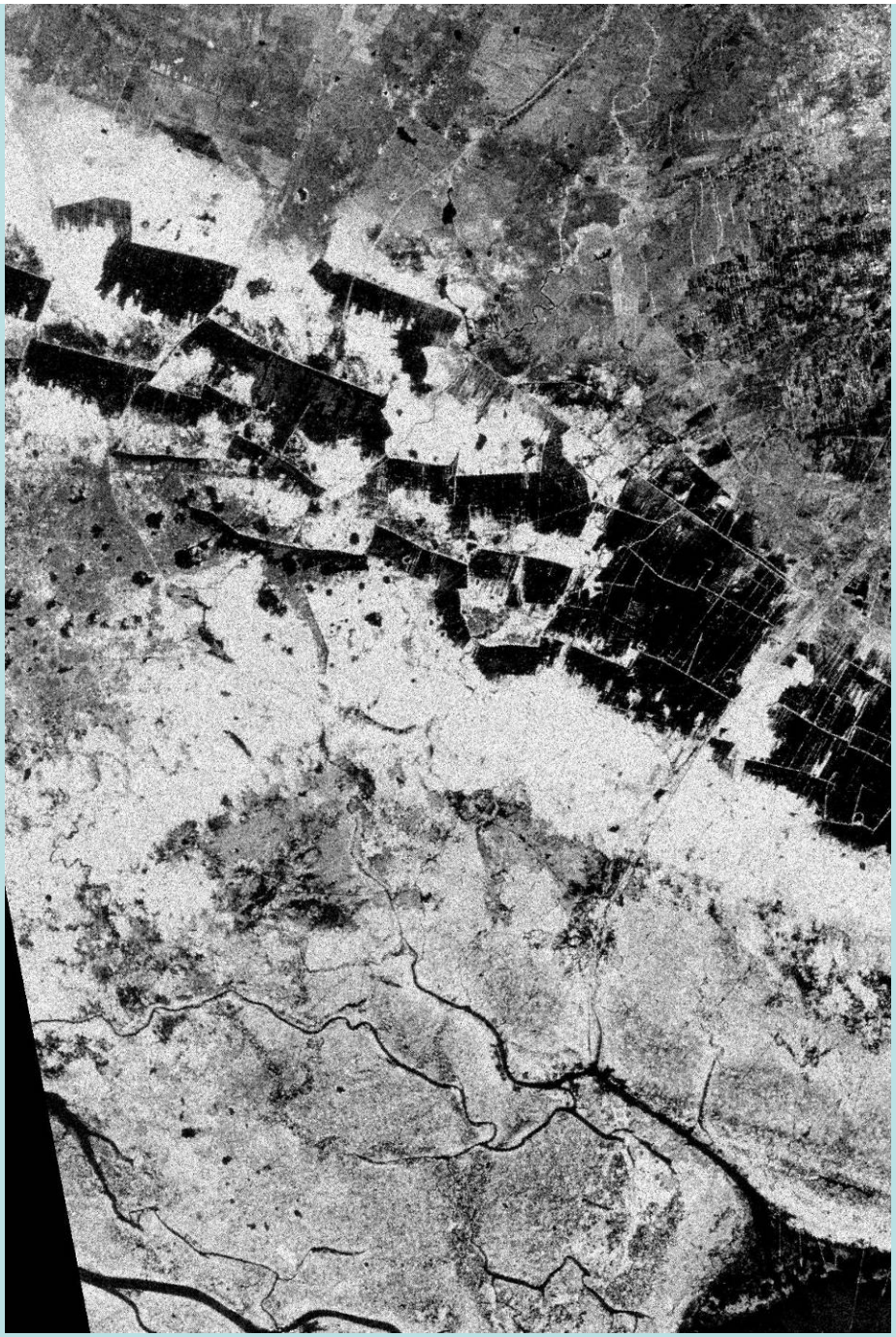
August 1997



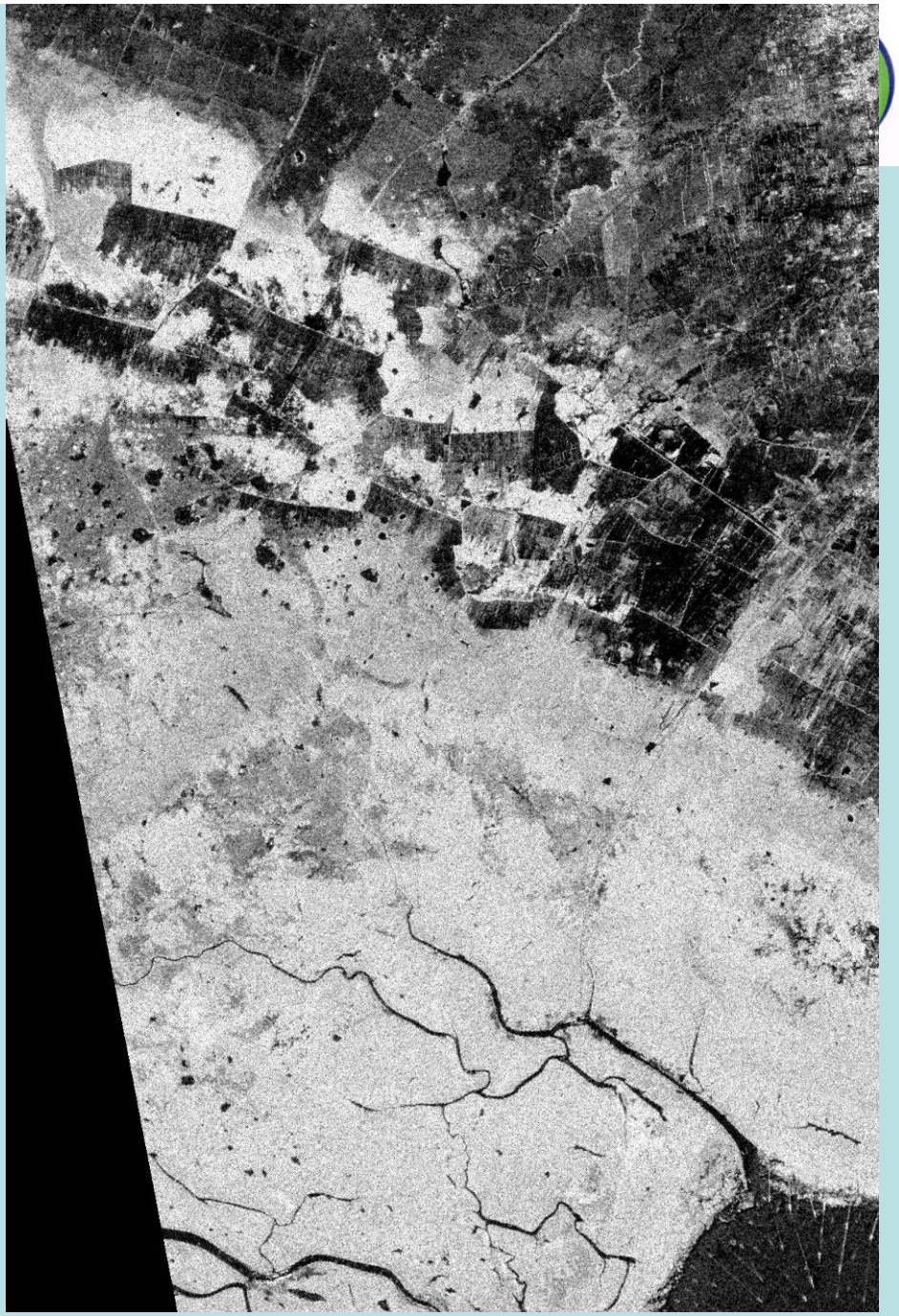


Sample sites and spectra for recession rice, flooded shrublands, shrubland and grasslands growing on abandoned rice-fields

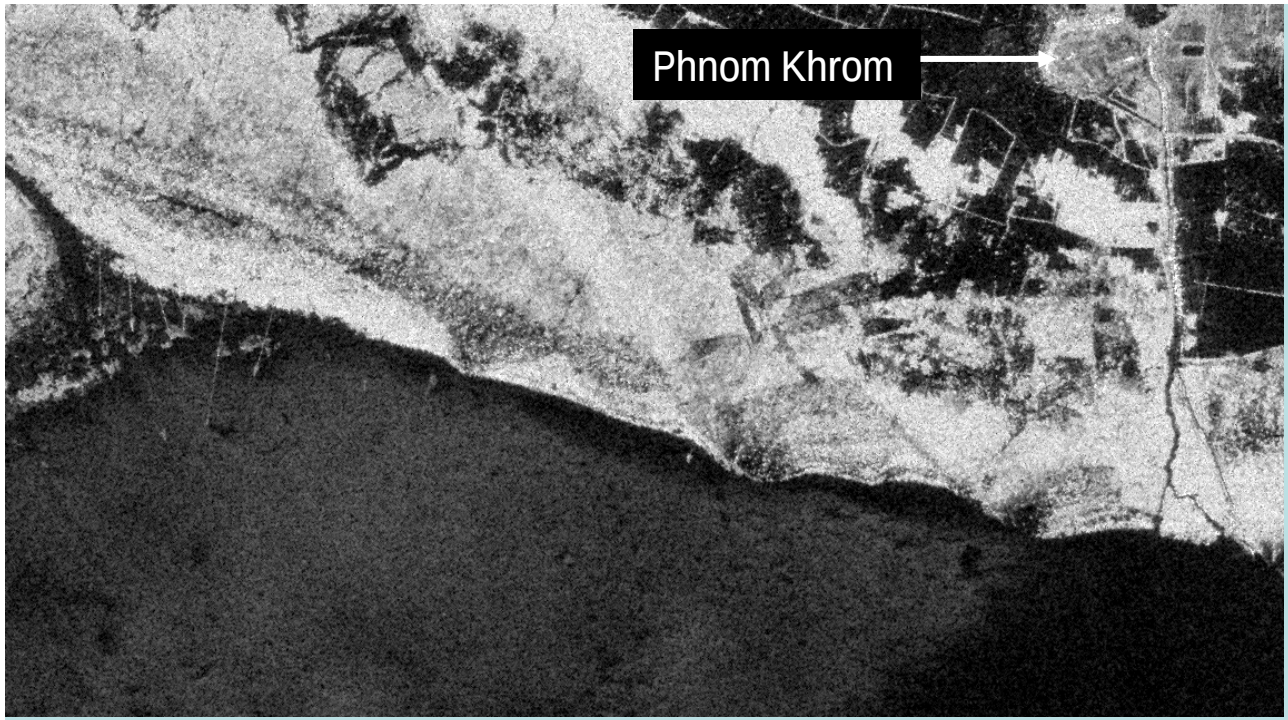
JERS-1 radar images for January, April and August 1997, and RGB colour-composite image



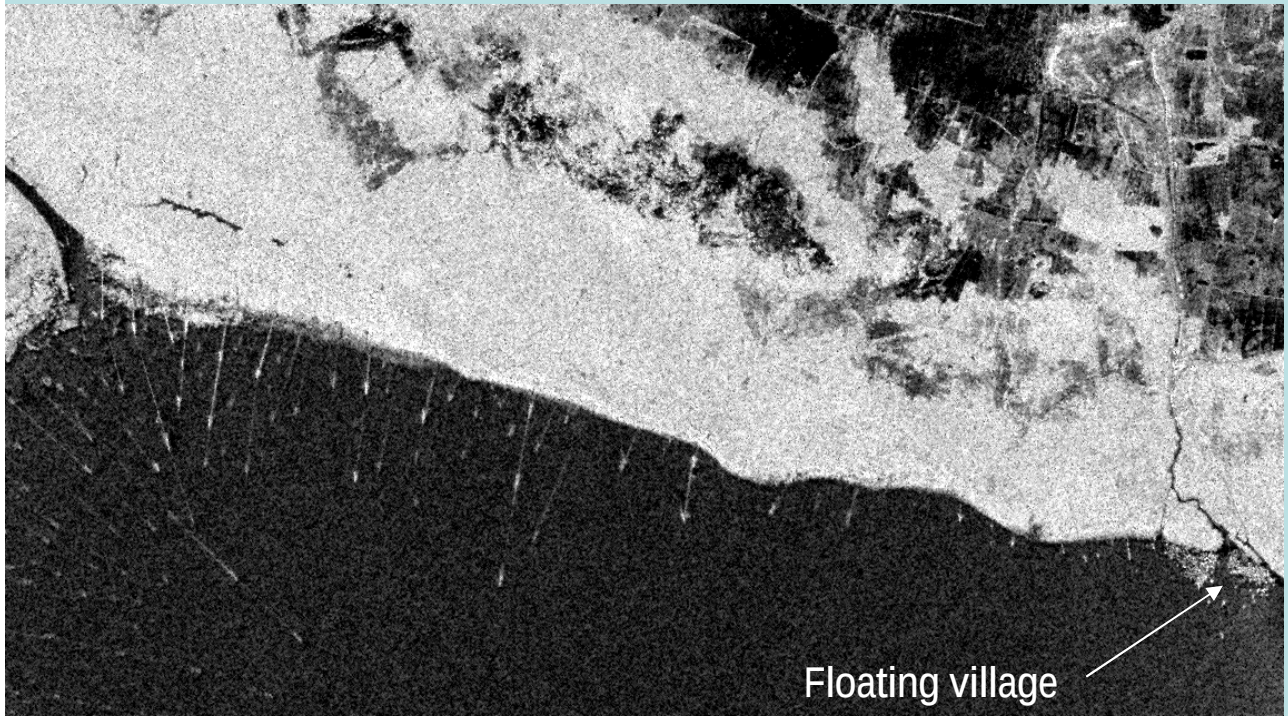
PALSAR FBS – 28 December 2006



PALSAR FBS – 12 February 2007

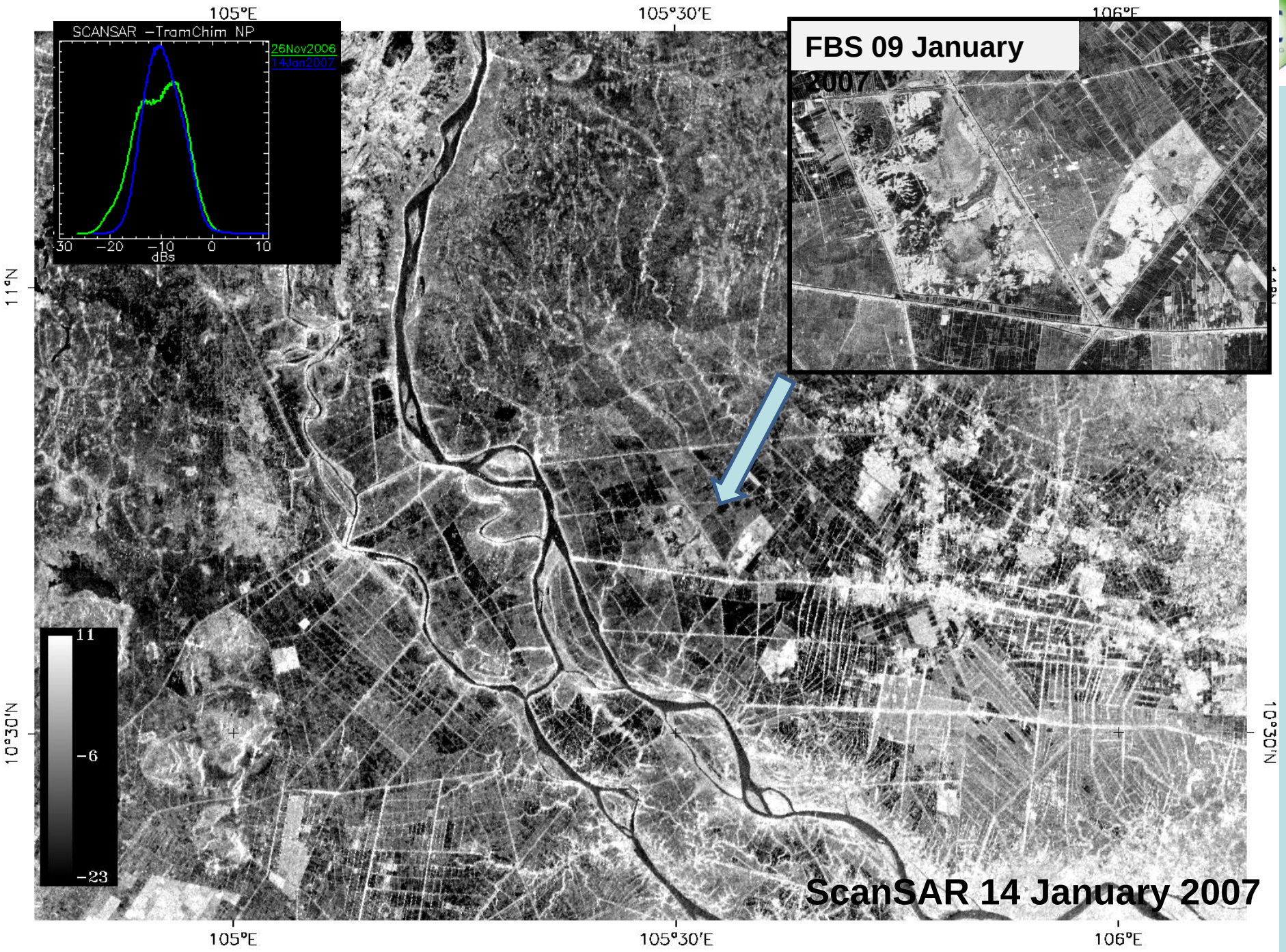


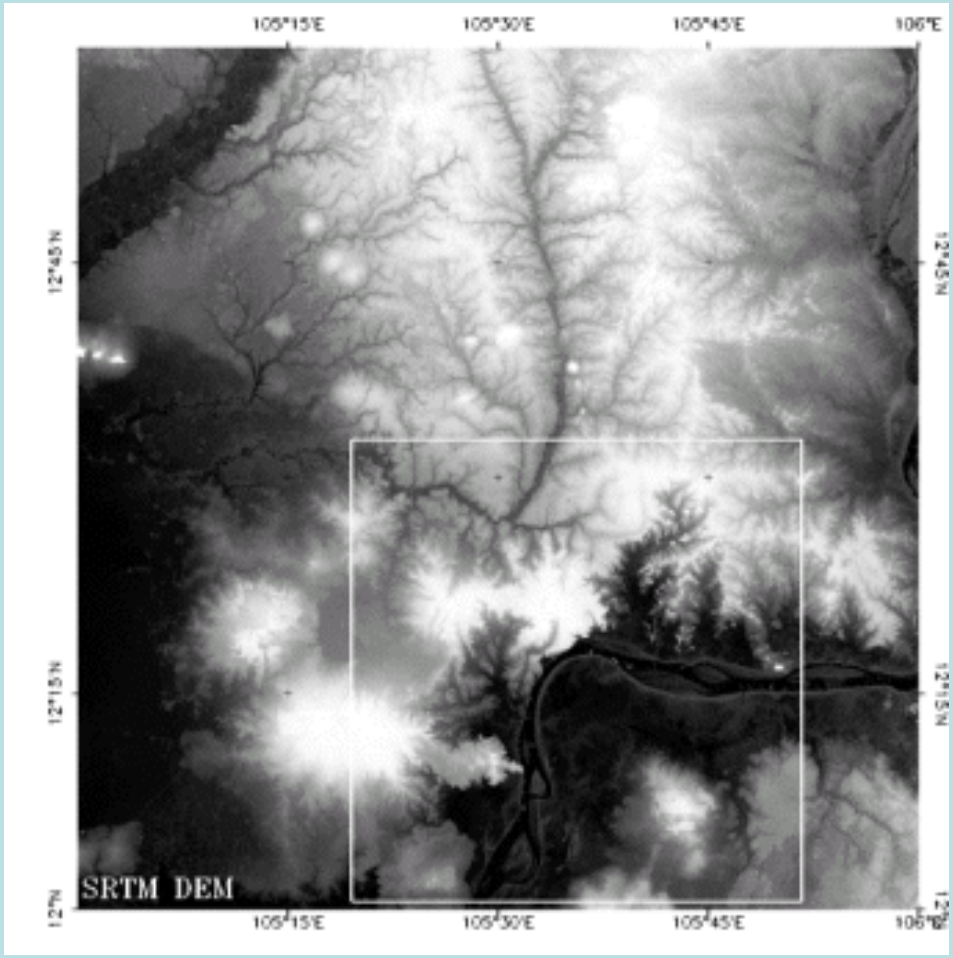
PALSAR FBS – 28 December 2006

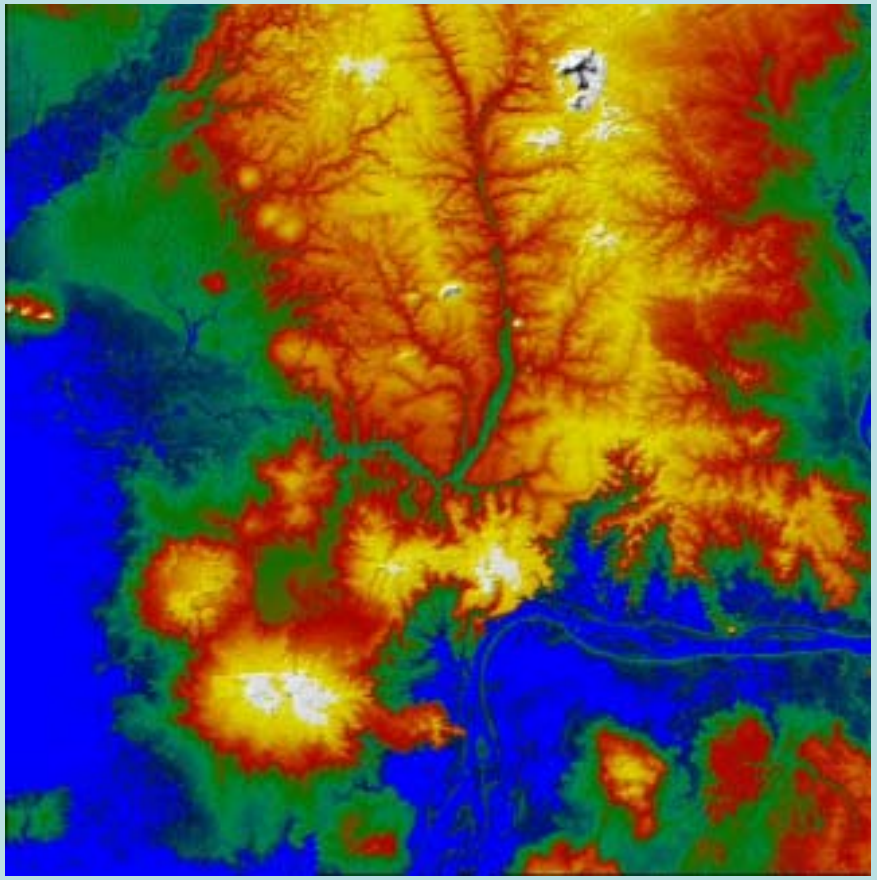


PALSARFBS – 12 February 2007

ScanSAR 26 November 2006


105°E
105°30'E
106°E
11°N
10°30'N
SCANSAR –TramChim_NP
26Nov2006
14Jan2007
30
−20
−10
0
10
dBs
FBS 09 January 2007
11
−6
−23
ScanSAR 14 January 2007





SRTM Tile Of Mekong River Upstream
From Phnom Penh

Problems and Bottle Necks

- Some geo-registration problems in the early stages.
- Due to staff changes yet to get Mekong River Commission to finally commit resources to the project. This has prevented any field verification.
- Holding over basin-wide analysis until resources become available from MRC.
- Availability of regional mosaics??

ALOS KYOTO & CARBON INITIATIVE

The IBA comprises Tram Chim National Park and adjacent areas of natural habitat, located in the Mekong Delta, 25 km to the north of Cao Lanh, the capital of Dong Thap province. The site supports one of the last remnants of the Plain of Reeds wetland ecosystem, which previously covered some 700,000 ha of the Mekong Delta in Vietnam1. The topography of the site is a shallow basin, which slopes to the south-east, parallel to the Mekong River, to the north-east, perpendicular to the Mekong River, and to the south-west, perpendicular to the Vai Co river2. The vegetation of the site includes large areas of seasonally inundated grassland, regenerating *Melaleuca* forest and open swamp. *Melaleuca* forest is distributed throughout the site, both as plantations and as scattered, natural patches in areas of grassland or open swamp. Large populations of waterbirds are found at the site, particularly in the dry season, when thousands of waterfowl visit1.

To access a web site, Left click on site address, Right click and select "Open Hyperlink"

http://www.mekongwetlands.org/Demonstration/Vietnam/photos.htm

http://www.birdlifeindochina.org/iba/english/pdf/VN006_Tram_Chim.pdf

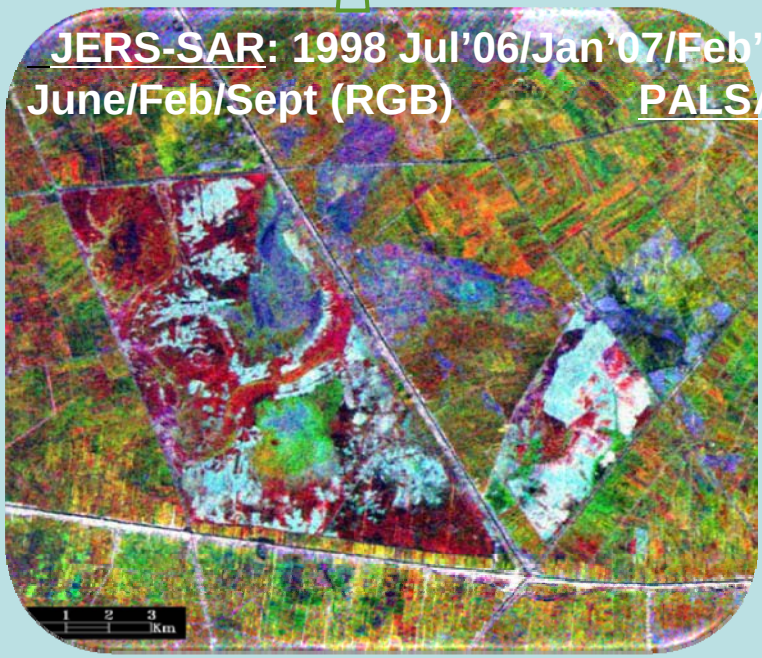
http://www.birdlifeindochina.org/source_book/pdf/4%20Mekong%20Delta/Tram%20Chim.pdf

http://horticulture.coafes.umn.edu/vd/h5015/01papers/pacovsky2.htm

Wetland extent, inundation patterns and vegetation change in the Lower Mekong River Basin

Using archival JERS (1992 -'98) and PALSAR (2006 -) datasets:

1. Establish a baseline wetland inventory;
2. Apply change-detection, multi-variate analysis, segmentation and classification techniques to:
   - Map spatial / temporal variations in wetland ecosystems;
   - Map inundation patterns and hydro-period;
   - Identify areas subject to disturbance by seasonality and human interference.



Tram Chim NP

A remnant of P-of-R wetland ecosystem.

Mixture of seasonally inundated grassland, open swamp and regenerating *Melaleuca* forest (compare images)

Under threat from land-use activities, pollutant discharge and alteration of natural water levels