Kyoto & Carbon (K&C) Initiative

Wetlands Theme

Current Status of Projects

Mangroves

Overview

- Product name:
  - Mangrove maps (tropics and subtropics)
- Description:
  - Use of SAR (JERS-1 SAR, ALOS PALSAR) for mapping, characterising and monitoring mangroves.
- PALSAR mode:
  - Dual polarisation
- Observation cycles:
  - 13 (2007), 21 (2008), 29 (2009)
- Production schedule (estimated):
  - Test area demonstration (December 2007)
  - Regional demonstration (December 2008)
  - Generation of regional products (early 2009).
- Estimated date of delivery
  - As above

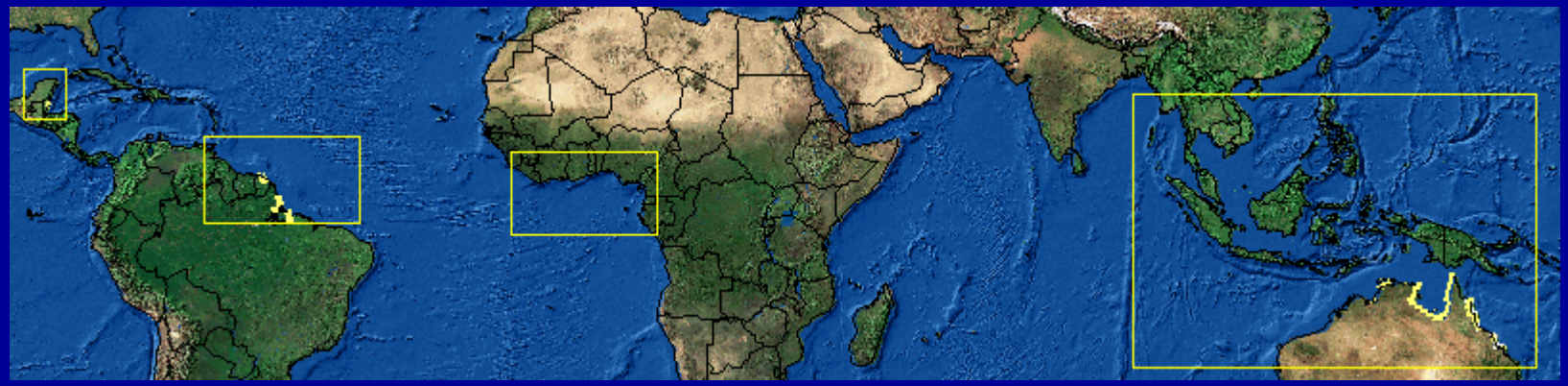
Project Aims

- To demonstrate the benefits of integrating ALOS PALSAR data for:
  - Characterising mangroves in terms of extent, structure, biomass & floristic composition – based on case studies for local regions
  - Mapping mangrove extent
  - Detecting and monitoring change in extent over decadal periods (through comparison with JERS-1 SAR data.
- To progressively generate maps of mangrove extent and change across the tropics and sub-tropics.

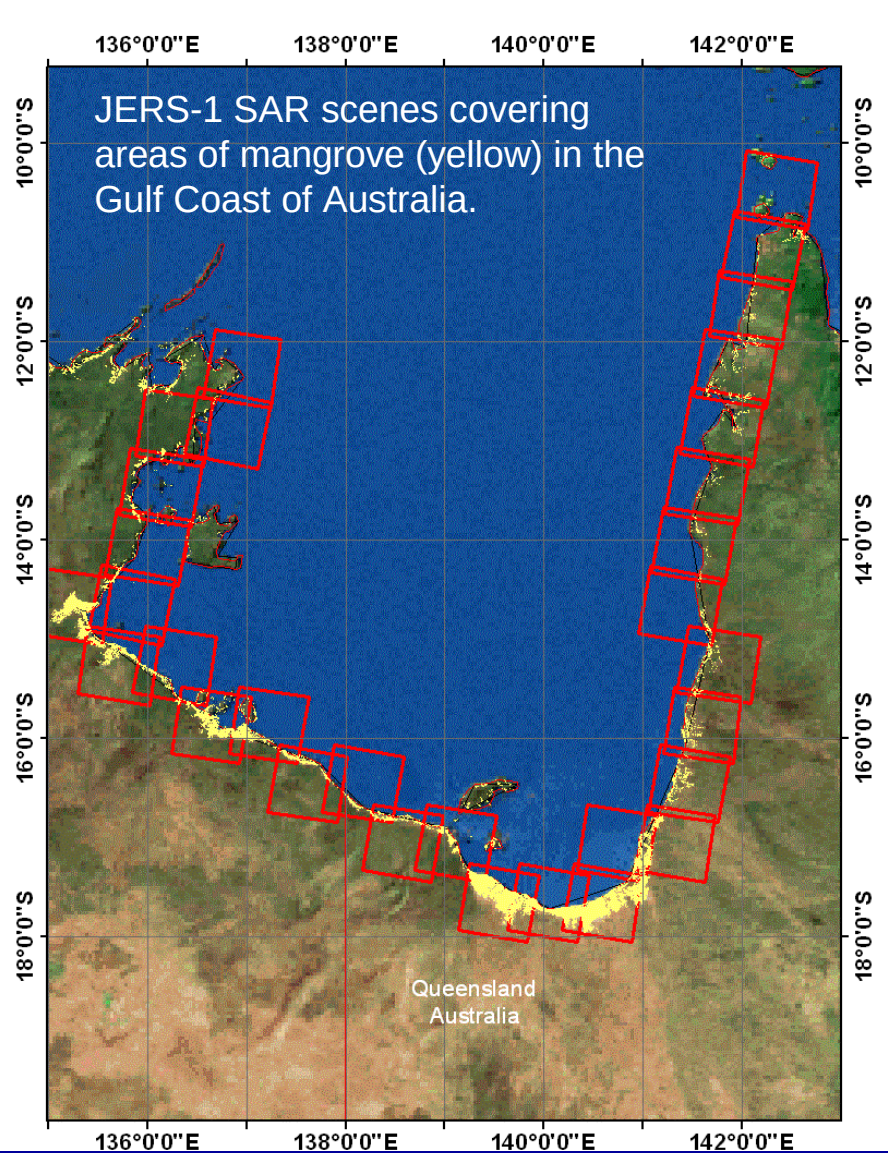
Study Areas

- Local study areas:
  - Australia
    - Kakadu National Park
    - Daintree River NP
  - Belize
  - French Guiana
  - Brazil
  - Malaysia
    - Perak
  - Central Africa
  - Indonesia

- Prototype areas:
  - Coasts of the regions above.
- Product areas:
  - Northern Australia
  - Amazon coast (Brazil to French Guiana)
  - Belize
  - South east Asia (selected regions)
  - Central Africa (selected regions)

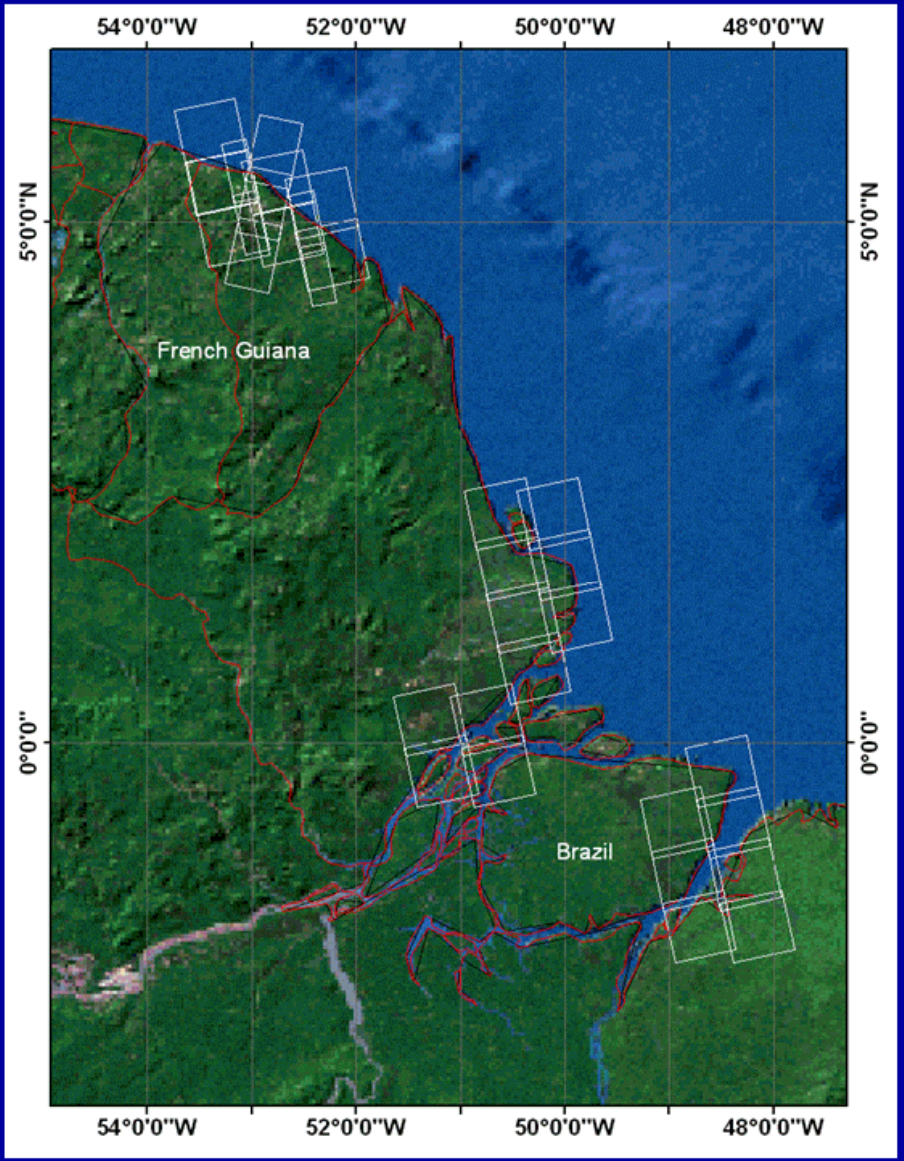


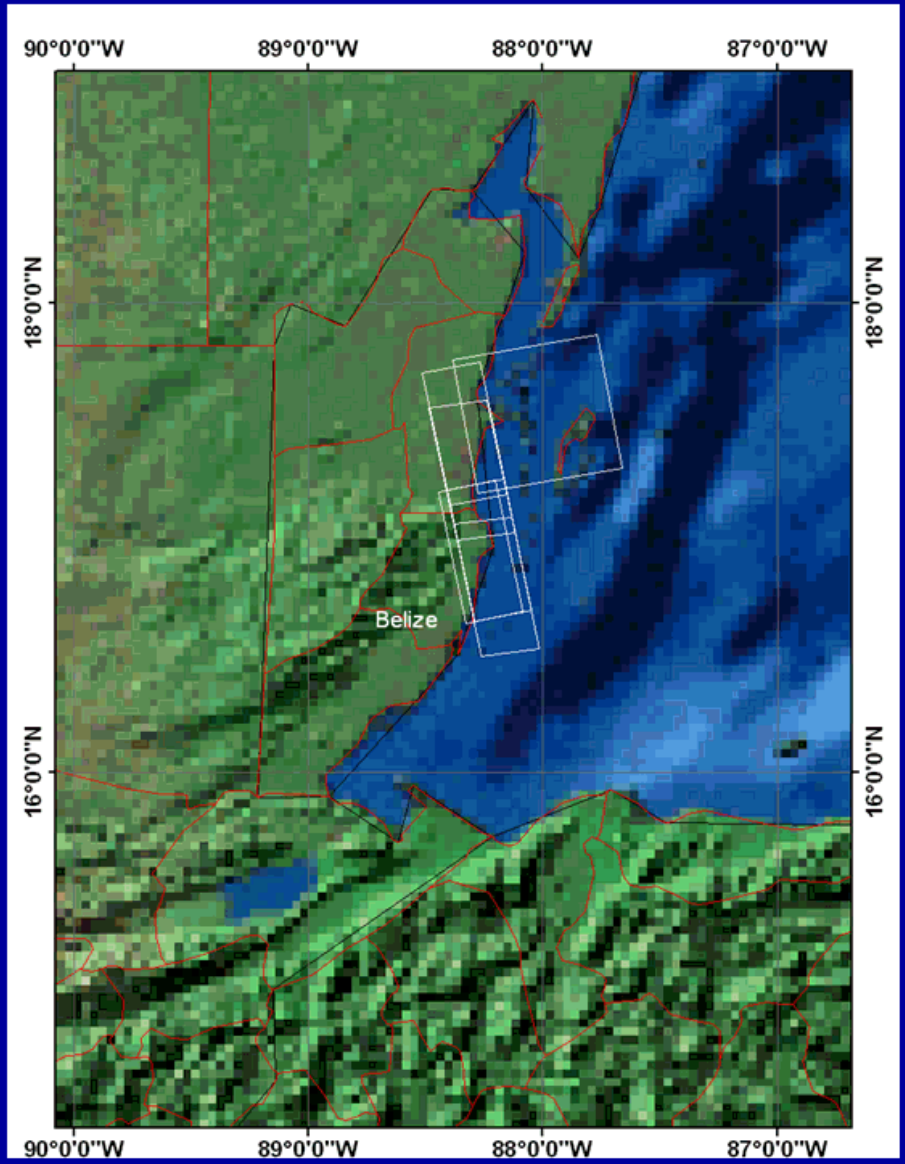
Future Scene Orders



- JERS-1 SAR scenes for change detection:
  - Amazon coast
  - Belize
- ALOS PALSAR Dual Polarisation data
  - All regions when acquired.
- Fully polarimetric data
  - All local study areas

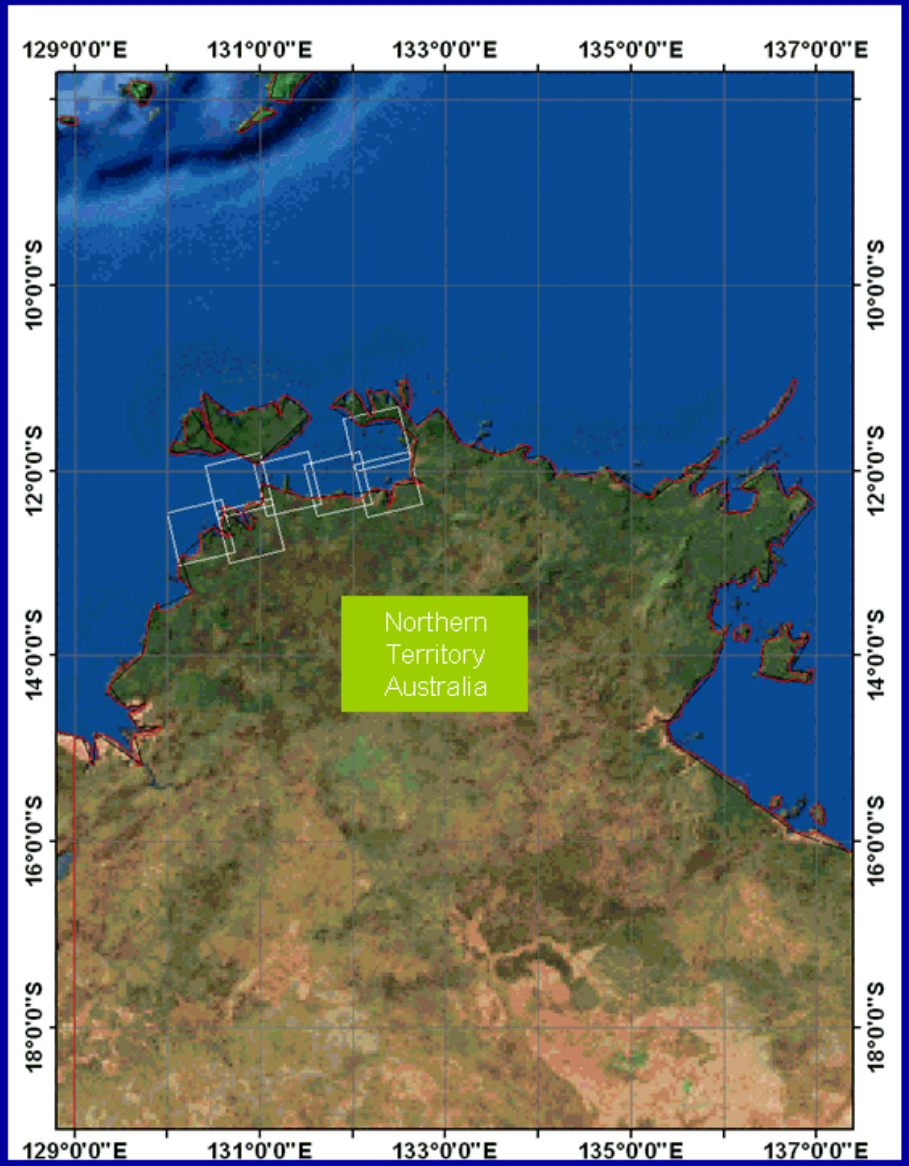
Scene requests to date: Amazon Coast & Belize

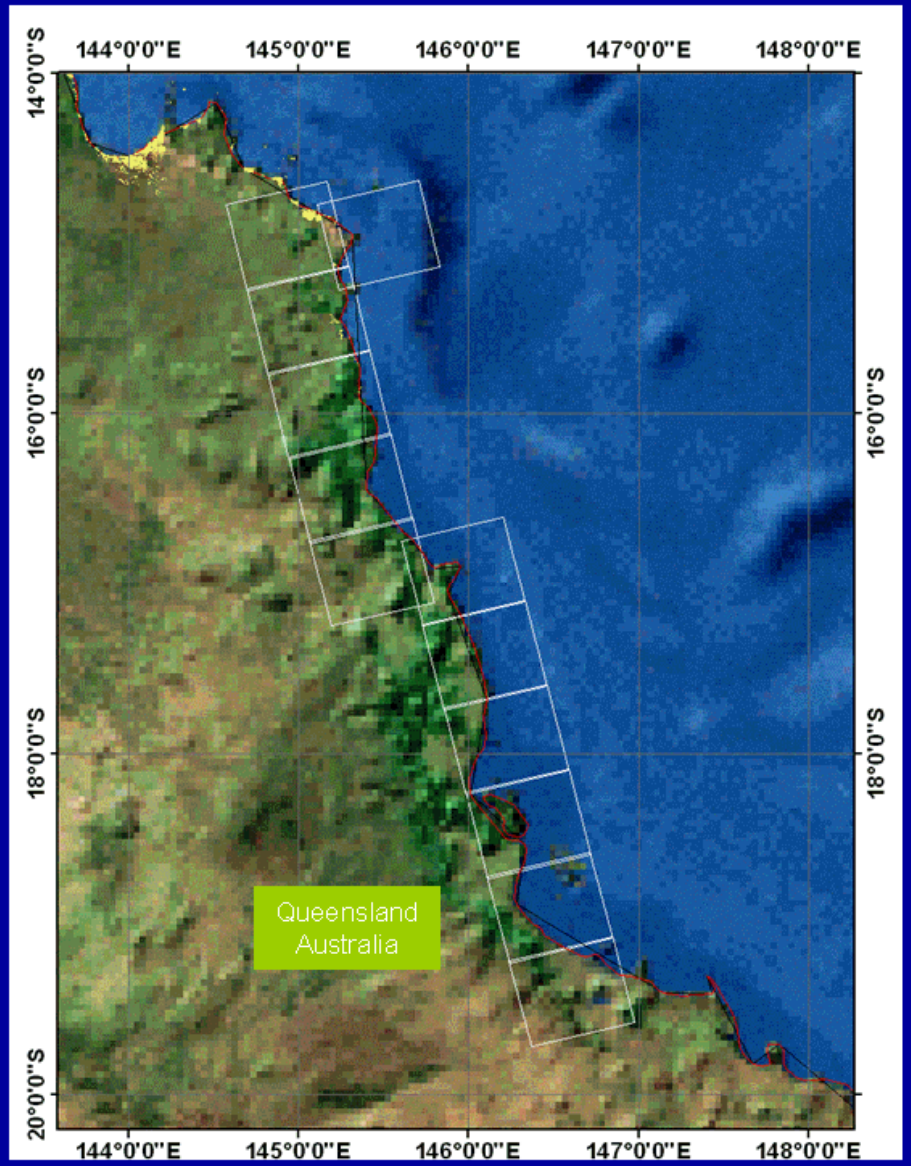




Includes fully polarimetric data (so far for Belize and French Guiana)

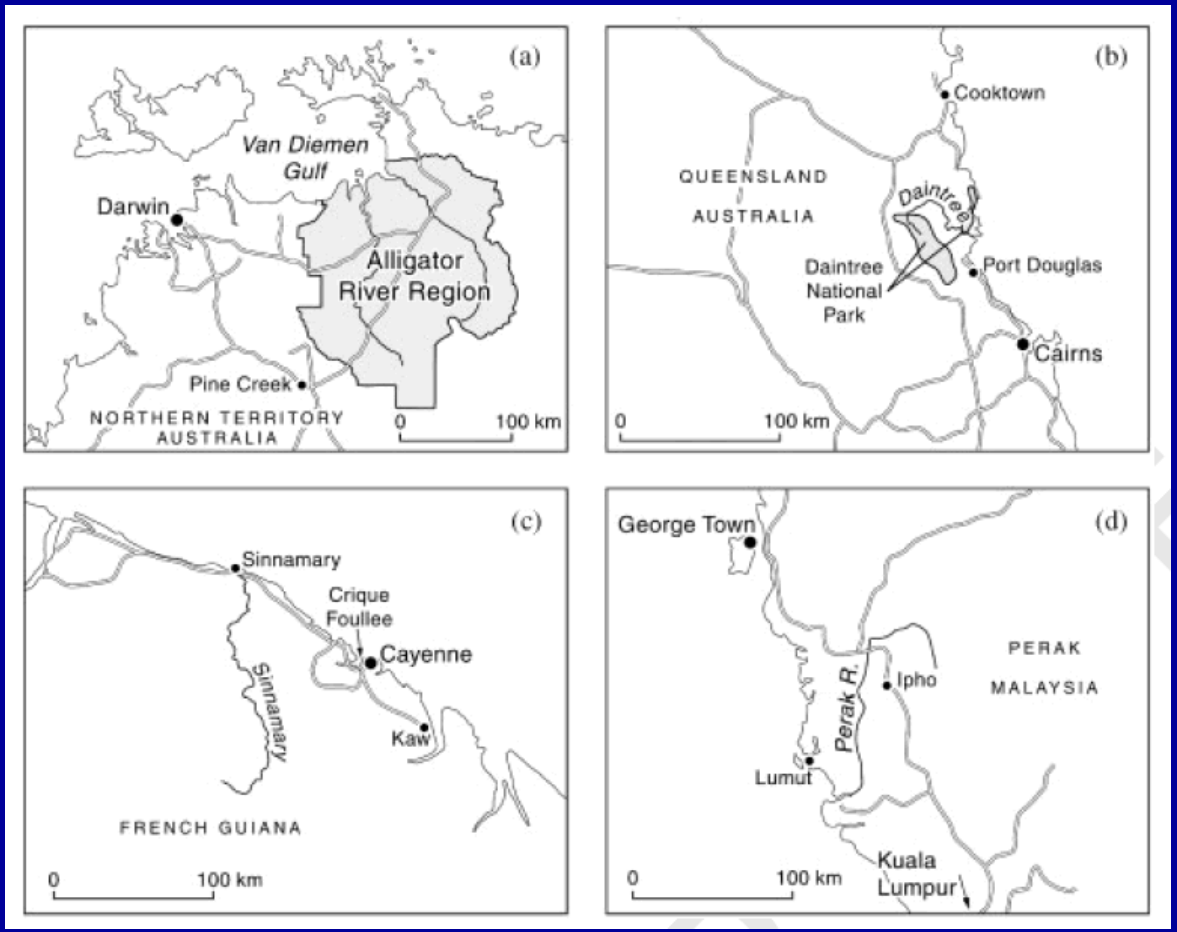
Australia


129°0'0"E
131°0'0"E
133°0'0"E
135°0'0"E
137°0'0"E
10°0'0"S
12°0'0"S
14°0'0"S
16°0'0"S
18°0'0"S
Northern
Territory
Australia

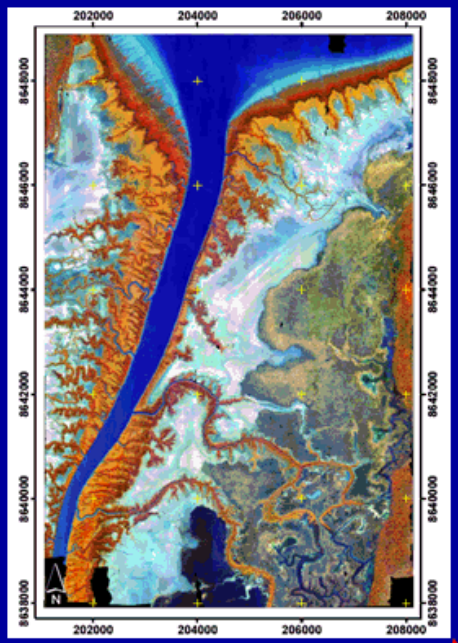

144°0'0"E
145°0'0"E
146°0'0"E
147°0'0"E
148°0'0"E
14°0'0"S
16°0'0"S
18°0'0"S
20°0'0"S
Queensland
Australia

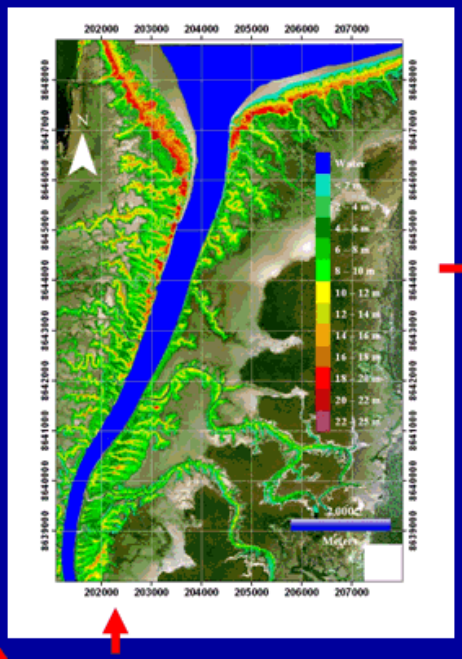
Local study areas: examples

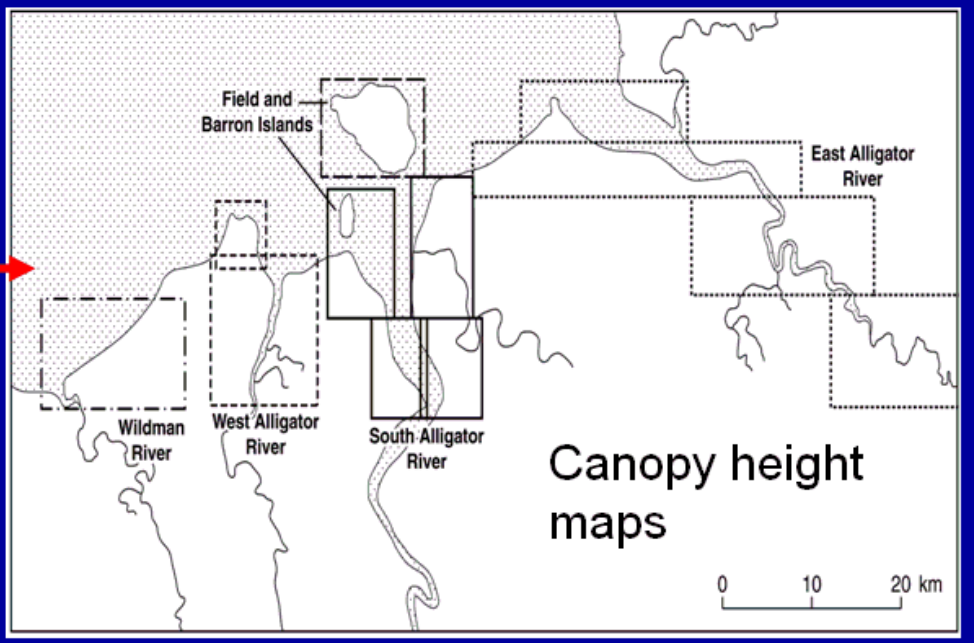
- Australia
  - Kakadu National Park (Alligator Rivers)
  - Daintree National Park.
- French Guiana
  - Sinnamary
  - Crique Foullee
- Malaysia
  - Perak

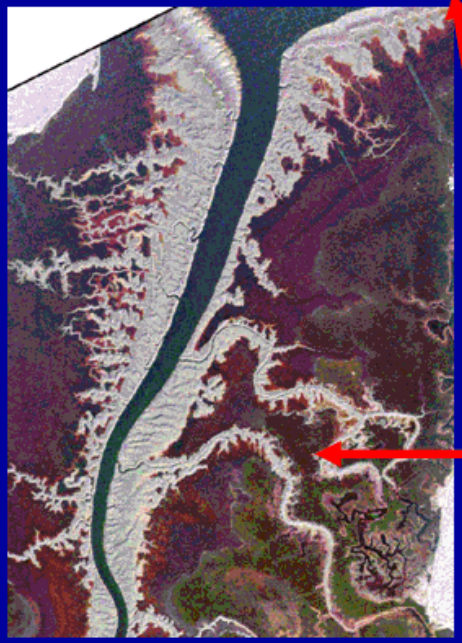


Supportive Datasets: Australia









a) Stereo aerial photography

Canopy height

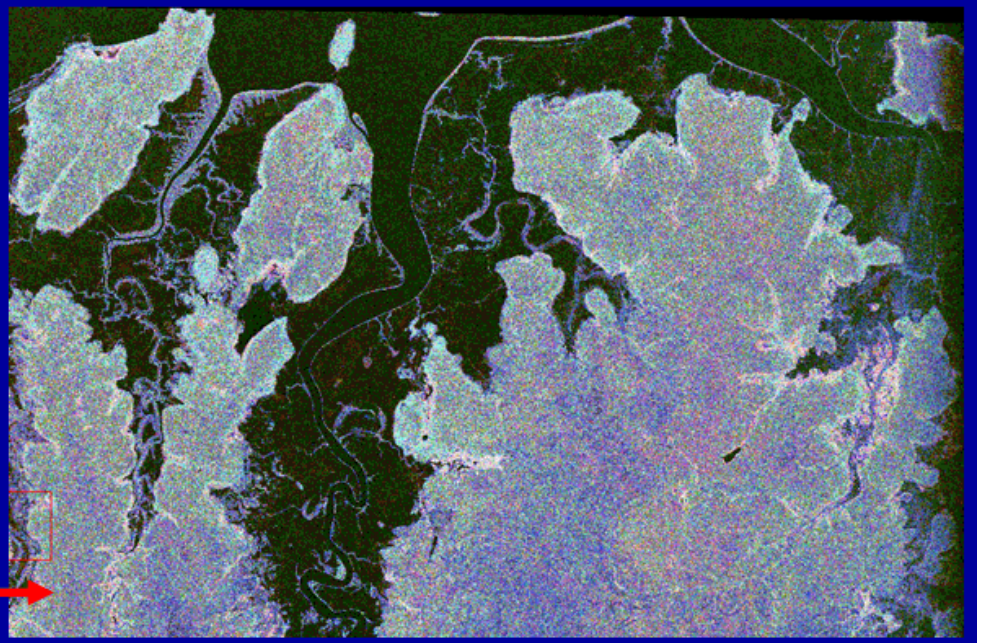
b) Compact Airborne Spectrographic Image (CASI) data

Species distributions

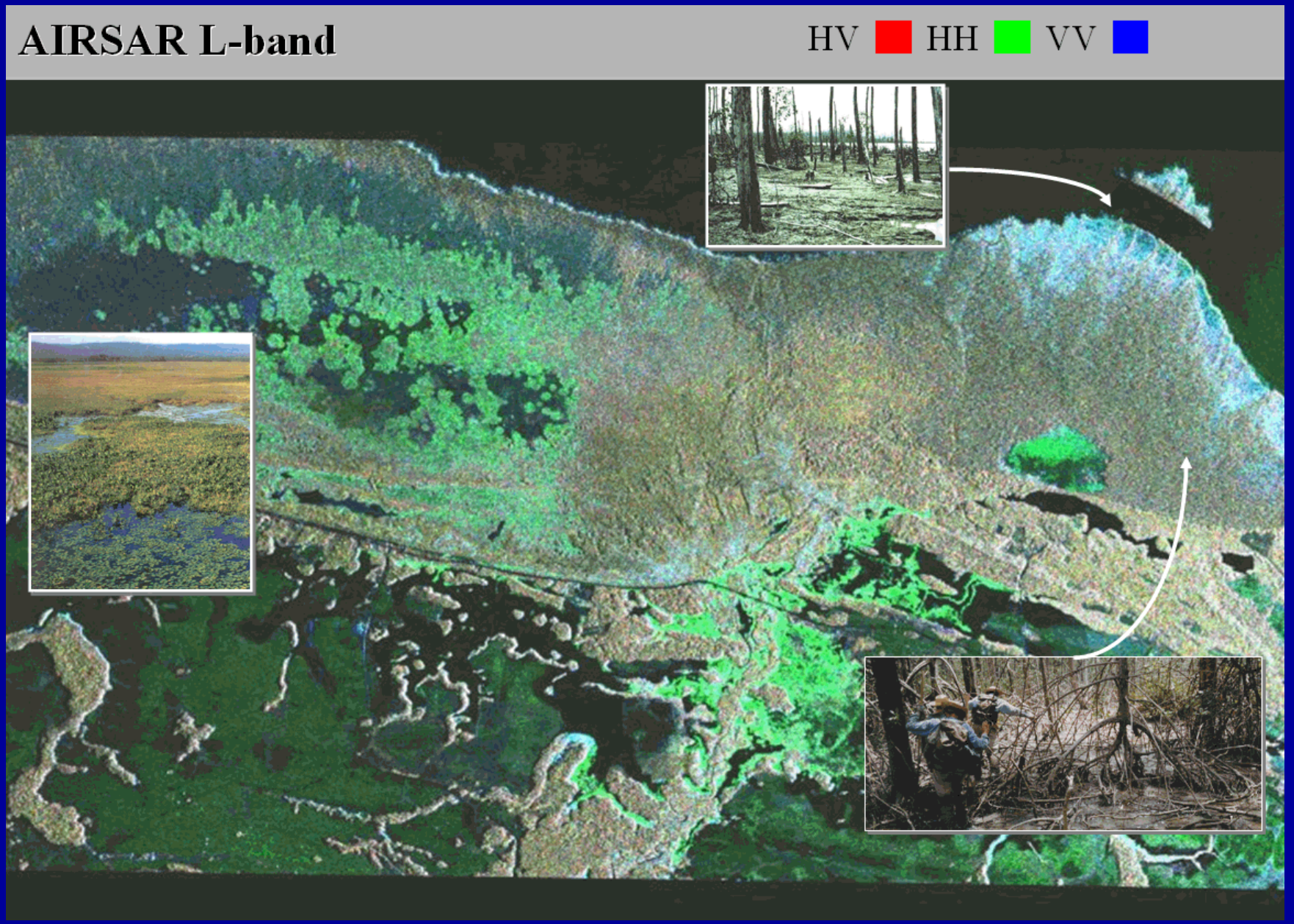
c) AIRSAR

Structure & biomass.

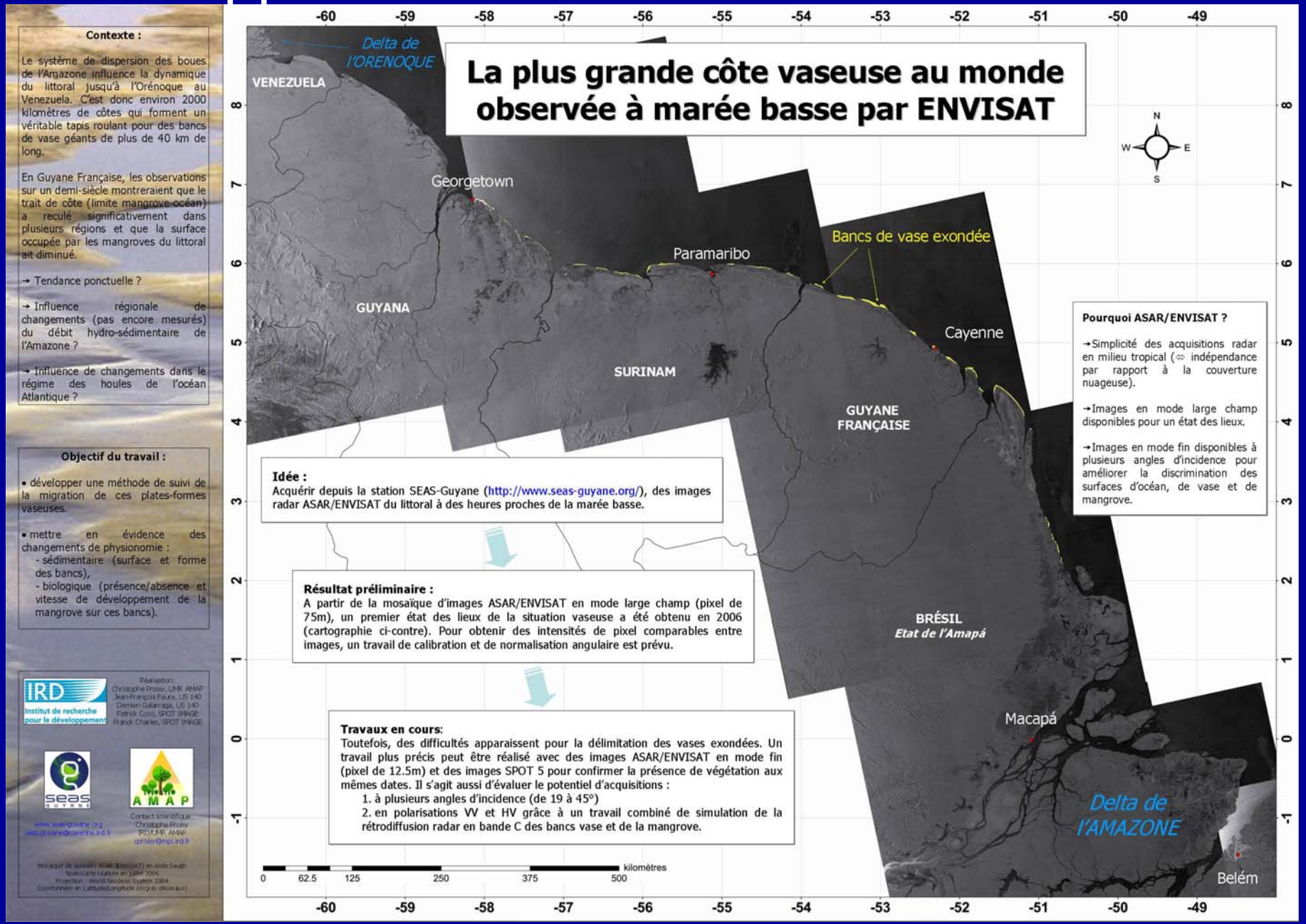
d) ALOS PALSAR



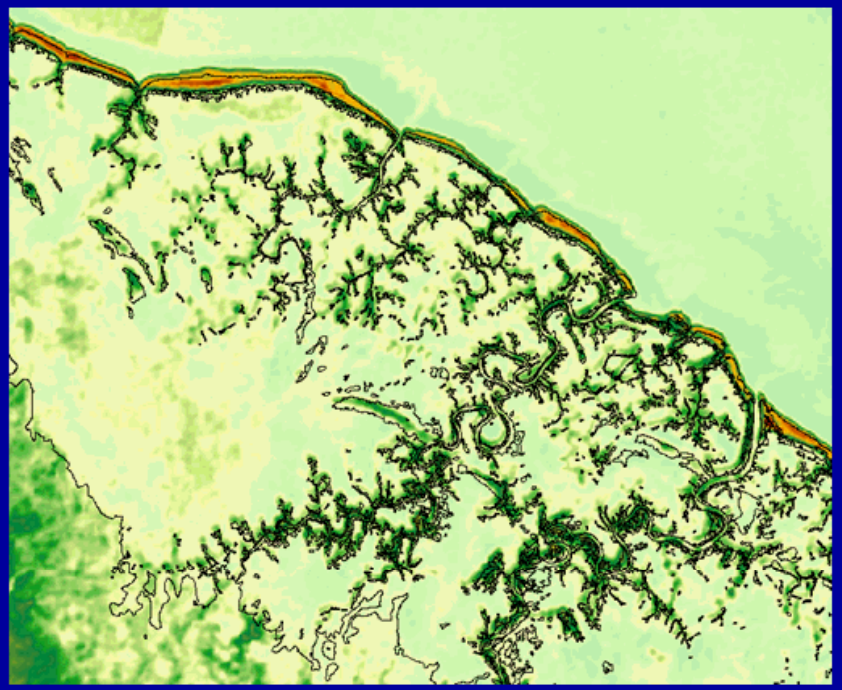
Supportive Datasets: French Guiana

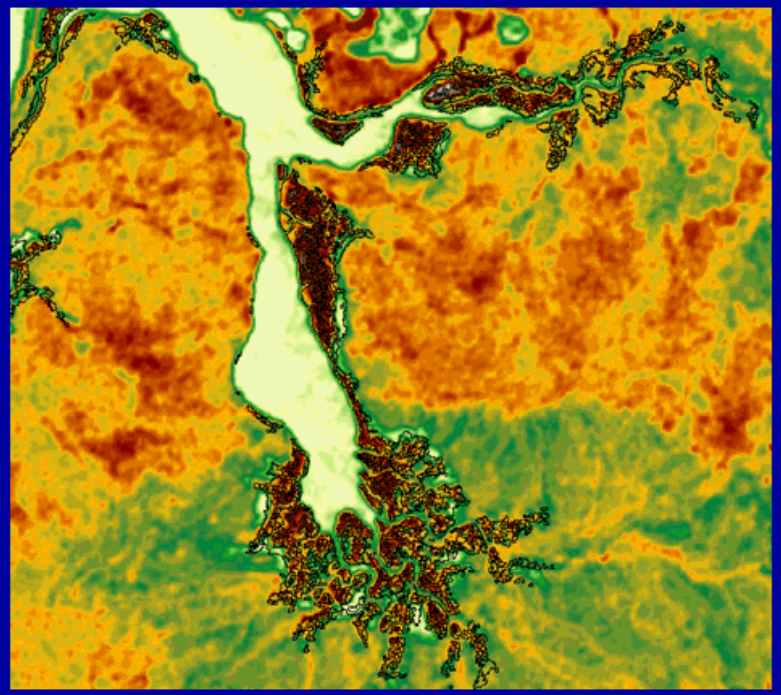


Supportive Datasets: Amazon Mouth



JERS-1 SAR Observations of Mangroves

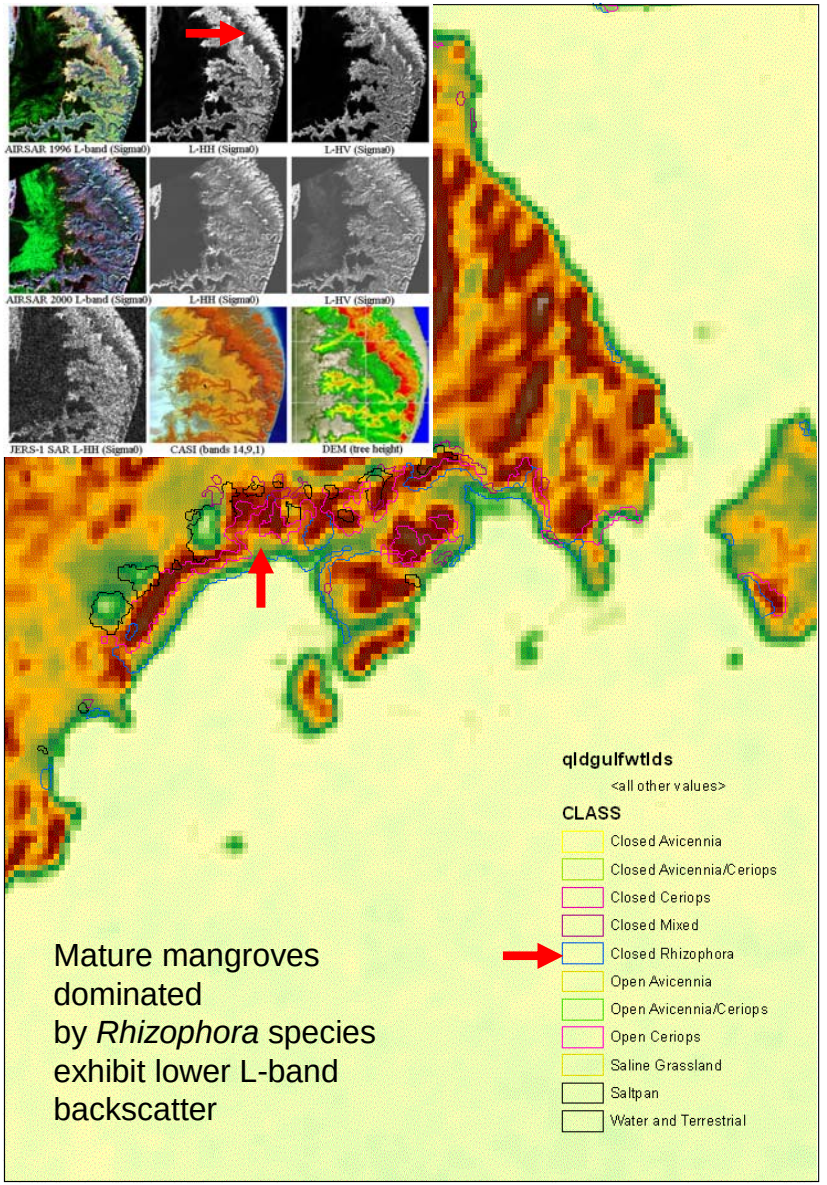




- The extent of mangroves has already been mapped in northern Australia using Landsat sensor data and aerial photography (Queensland Government; outlined).
- Using JERS-1 SAR (backdrop), Landsat-derived Foliage Projected Cover (FPC) and SRTM height information, options for better describing/mapping the structure, biomass and floristic composition of mangroves are provided.
- The ALOS PALSAR data are expected to provide better opportunities for characterisation and mapping of mangroves.
- Integration with JERS-1 SAR data is expected to allow better detection of change in an area vulnerable to sea level fluctuations.

Mapped distribution
Of mangroves,
Gulf Region

Examples: Mangrove Community Discrimination



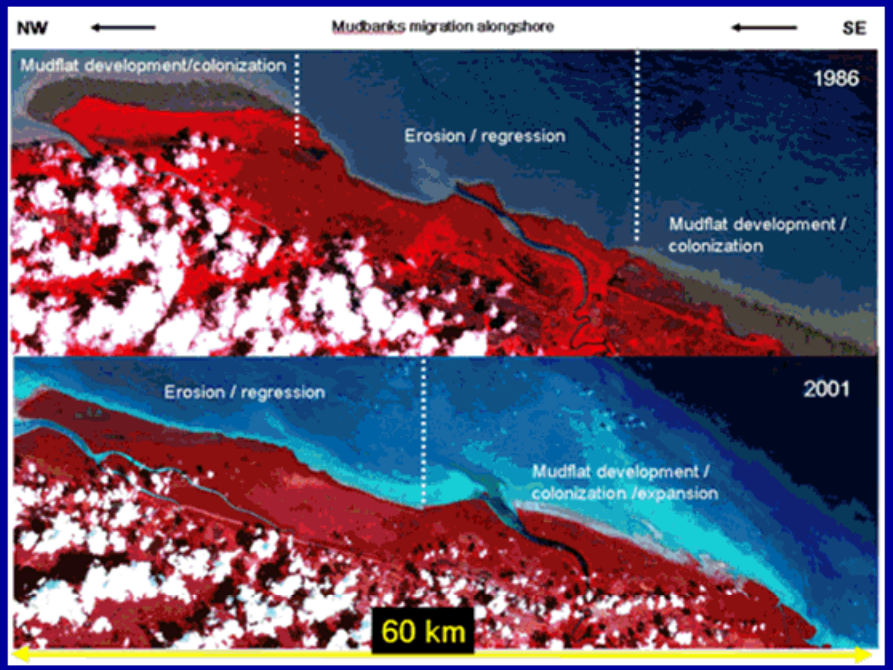
Mature mangroves dominated by *Rhizophora* species exhibit lower L-band backscatter

Processing Sequences

- Sequences
  - Processing Level: 1.0
    - Requires SRTM-derived DEM or better.
  - Processing software: Gamma

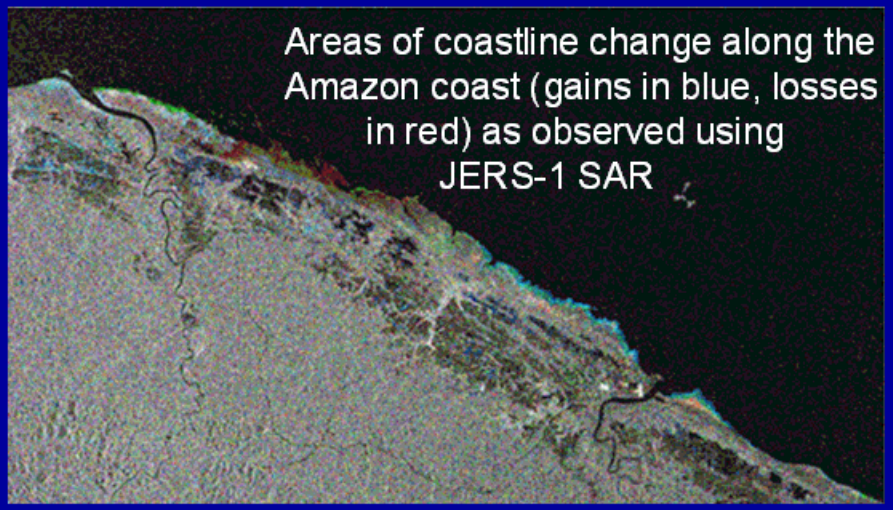
- Issues
  - Software for scene location display
  - Orthorectification procedures
  - Links with K&C mosaics
  - Ease of ordering

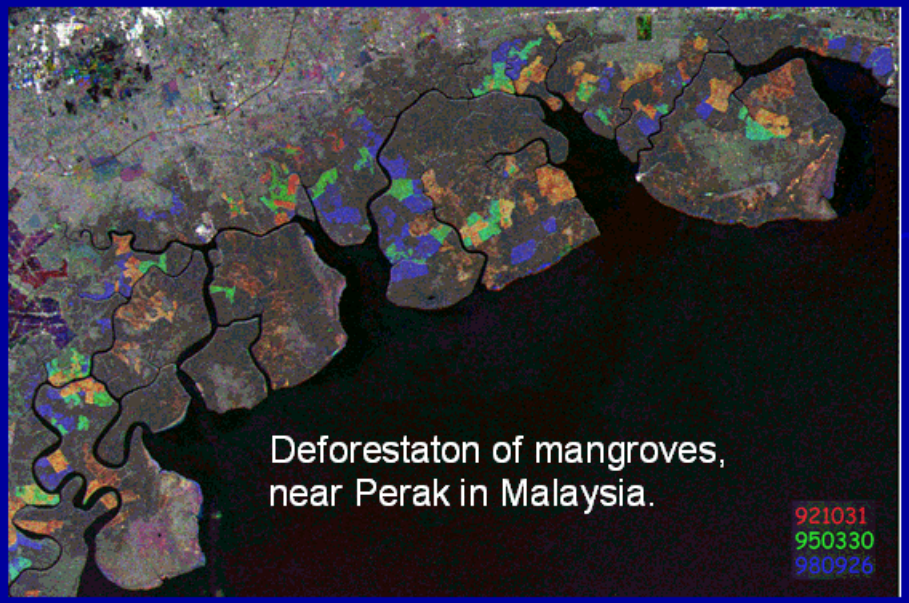
Mangroves: Change Detection



Multi-temporal datasets used to detect:

- 'Natural' change (e.g., Amazon coast)
- Deforestation (e.g., Malaysia)





Future actions:

- Establish closer links with other K&C projects namely:
  - Joint Research Centre (African mosaics)
  - University of Wageningen (Southeast Asia mosaics).

- Enhance collaborative network
  - Joint meetings in IGARSS, Brazil (C. Proisy), Australia and UK.
  - Implementation of wiki site to enhance coordination of activities.
  - Funding bids

Key publications relating to ALOS

- Fromard, F., Vega, C., Proisy, C., 2004. Half a century of dynamic coastal change affecting mangrove shorelines of French Guiana. A case study based on remote sensing data analyses and field surveys. *Marine Geology*, 208 (2-4), 265-280.
- Lucas R.M., Mitchell, A., Donnelly, B., Milne, A.K., Ellison, J. and Finlaysson, M. (2002). Use of Stereo Aerial Photography for Assessing Changes in the Extent and Height of Mangrove Canopies in Tropical Australia. *Wetlands Ecology and Management*, 10, 161-175.
- Lucas, R. M., Mitchell, A. L., Rosenqvist, A., Proisy, C., Melius A., Ticehurst, C., 2007. The potential of L-band SAR for quantifying mangrove characteristics and change: Case studies from the Tropics. Special issue “Satellite-based radar – developing tools for wetlands management". *Aquatic Conservation: Marine and Freshwater Ecosystems*, 17(3): 245-264. DOI: 10.1002/aqc.833.
- Mougin, E., Proisy, C., Marty, G., Fromard, F., Puig, H., Bétoulle, J. L., Rudant, J.P., 1999. Multifrequency and multipolarization radar backscattering from mangrove forests, *IEEE Transactions on Geoscience and Remote Sensing*, 37(1): 94-102.
- Proisy, C., Couteron, P., Fromard, F., 2007. Predicting and mapping mangrove biomass from canopy grain analysis using Fourier-based textural ordination of IKONOS images. *Remote Sensing of Environment*. DOI:10.1016/j.rse.2007.01.009.
- Proisy, C., Mougin, E., Fromard, F., Trichon, V., Karam, M. A., 2002. On the influence of canopy structure on the polarimetric radar response from mangrove forest. *International Journal of Remote Sensing*, 23(20): 4197-4210.
- Proisy, C., Mougin, E., Dufrêne, E., Le Dantec, V., 2000a. Monitoring seasonal changes of a mixed temperate forest using ERS SAR observations, *IEEE Transactions on Geoscience and Remote Sensing*, 38(1): 540-552.
- Proisy, C., Mougin, E., Fromard, F., Karam, M. A., 2000b. Interpretation of polarimetric signatures of mangrove forests, *Remote Sensing of Environment*, 71: 56-66.
- Souza-Filho, P.W.M. and Paradella, W.R. 2002. Recognition of the main geobotanical features along the Braganca mangrove coast (Brazilian Amazon Region) from Landsat TM and RADARSAT-1 data. *Wetlands Ecology and Management*, 10: 123-132.
- Souza-Filho, P.W.M. and Paradella, W.R. 2003. Use of synthetic aperture radar for recognition of coastal geomorphological features, land-use assessment and shoreline changes in Braganca coast, Para, Northern Brazil. *Annals of the Brazilian Academy of Sciences*, 75, 3: 341-356.