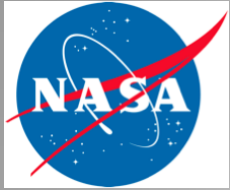


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# Mapping Floodplain Dynamics of the Amazon River Basin Using the Space-borne ALOS PALSAR Synthetic Aperture Radar



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## NASA Measures

The NASA “MEASURES” program has funded a task lead by Kyle McDonald to develop inundated wetlands products from ALOS PALSAR and other instruments

### Objectives:

#### 1) Regional inundated data sets

- ✓ from Synthetic Aperture Radar
- ✓ Spatial Coverage: Major Global Wetland Areas, 100m resolution
- ✓ temporal coverage: 1-2 year time series at 46 day intervals

#### 2) Global monthly inundation data sets

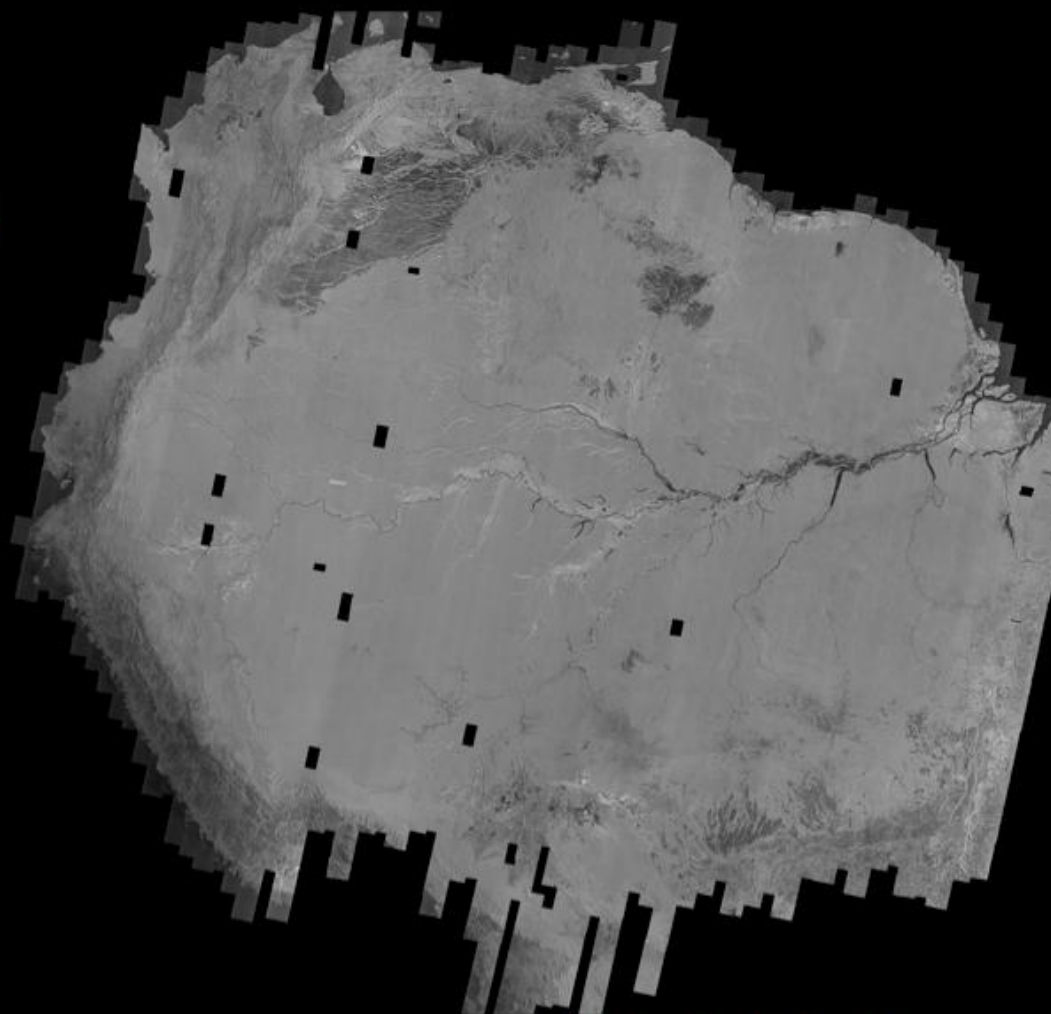
- ✓ derived from multiple satellite data sources
- ✓ Spatial coverage: Global, 25 km resolution
- ✓ Temporal Coverage: monthly monitoring with annual summaries

## ALOS SCANSAR and FBD data for mapping inundated wetlands

- The dual polarization “FBD” mode will be used to determine forest structure
  - ↓ One coverage
  - ↓ Non-vegetated, Herbaceous, Shrub, Woodland, Forest
- The “SCANSAR” mode data will be used to monitor inundation state
  - ↓ Inundated, not inundated
  - ↓ Coverage every 46 days
  - ↓ Focused on large wetland regions (Amazon basin, etc)
- Currently developing products for N/S America

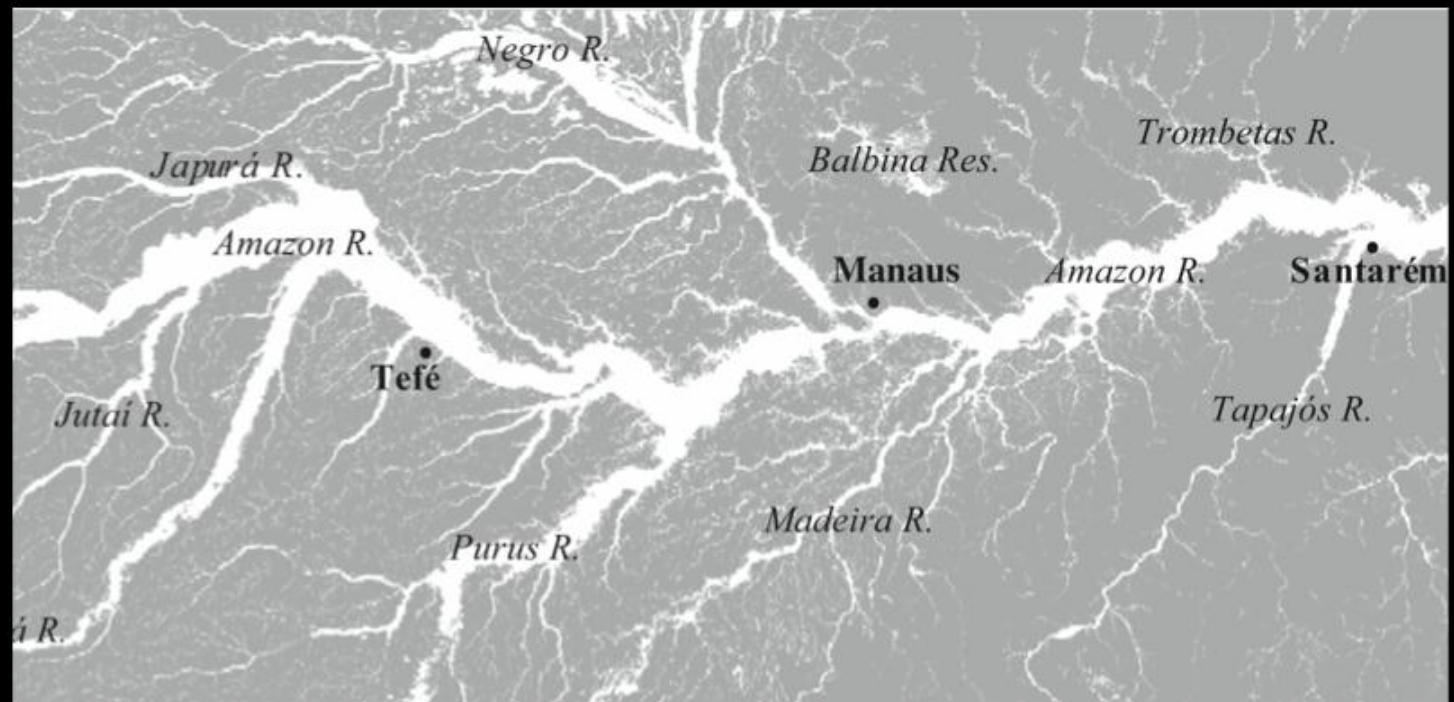
## Using SAR to image wetlands

In the late 1990s, the JERS-1 SAR was used to image the Amazon river at both high and low flood season



## Using SAR to image wetlands

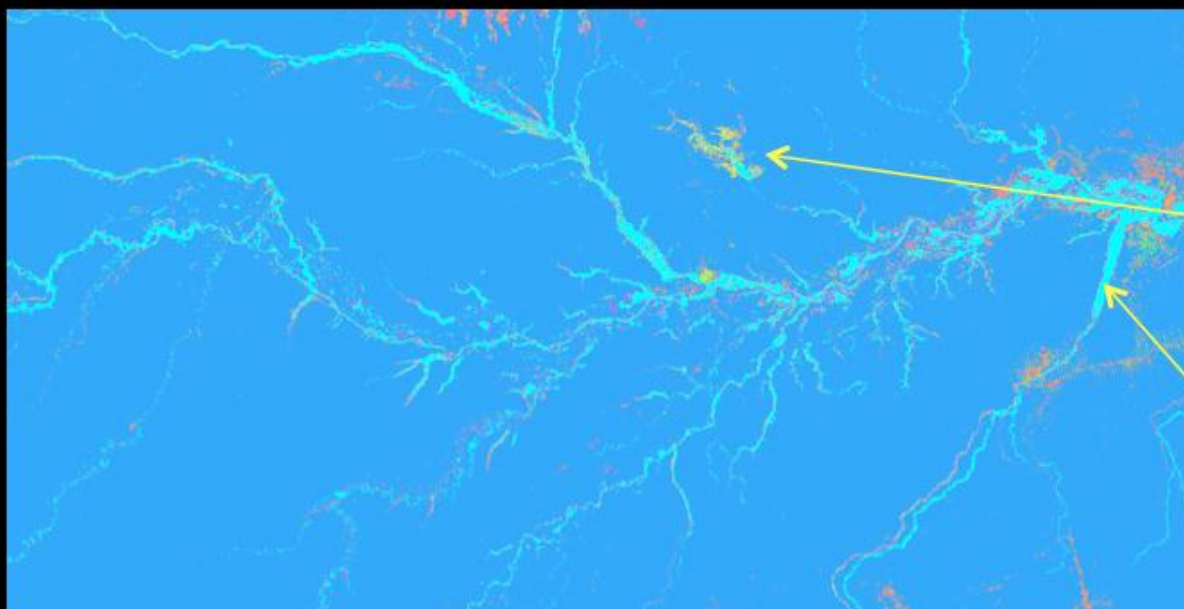
The JERS-1 SAR image was used to estimate maximum flood extent (17% of area shown).



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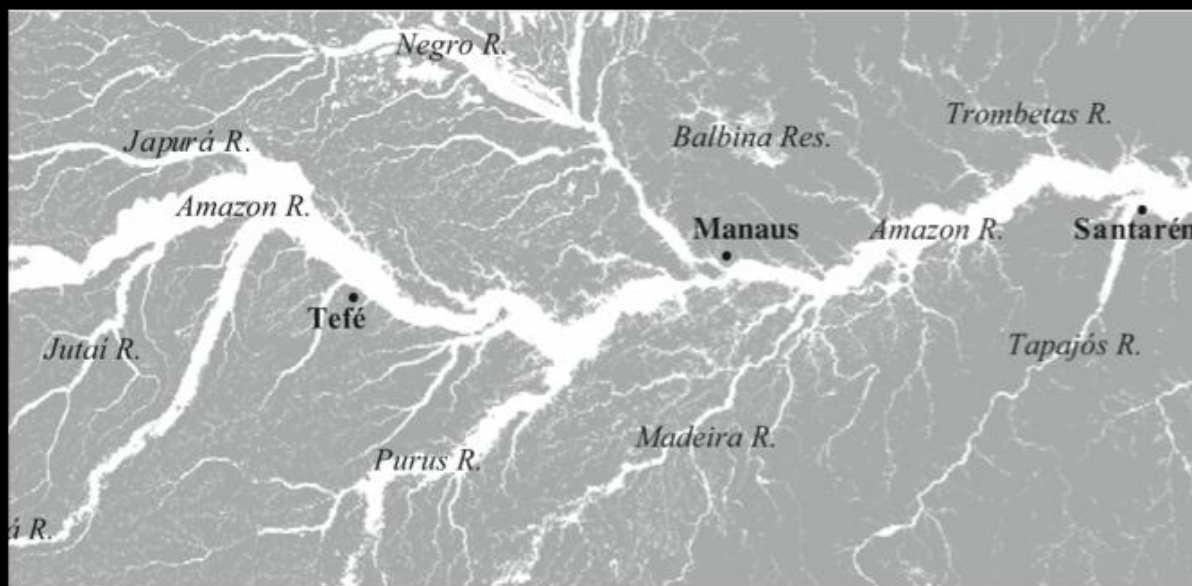
IGBP global land cover classification  
(17 land cover types including permanent wetlands)



Permanent wetlands

Open water

JERS-1 SAR based wetlands mask



## Optical imagery has drawbacks

**Difficult to get seasonal coverage due to clouds**

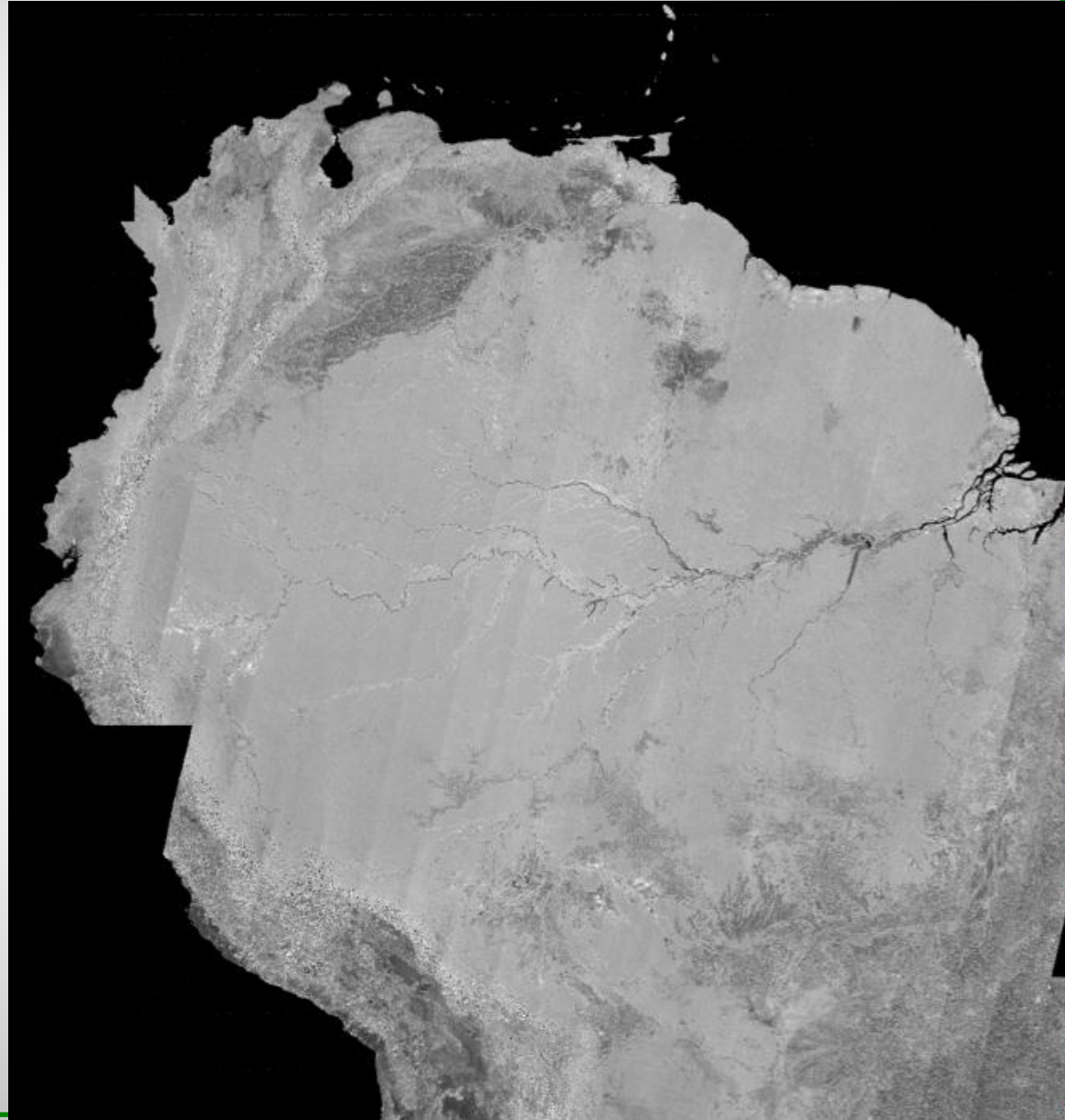
**Not very sensitive to below-canopy inundation**



## **SCANSAR mosaic 2007**

3 arcsecond postings (~90m)  
(same as SRTM)

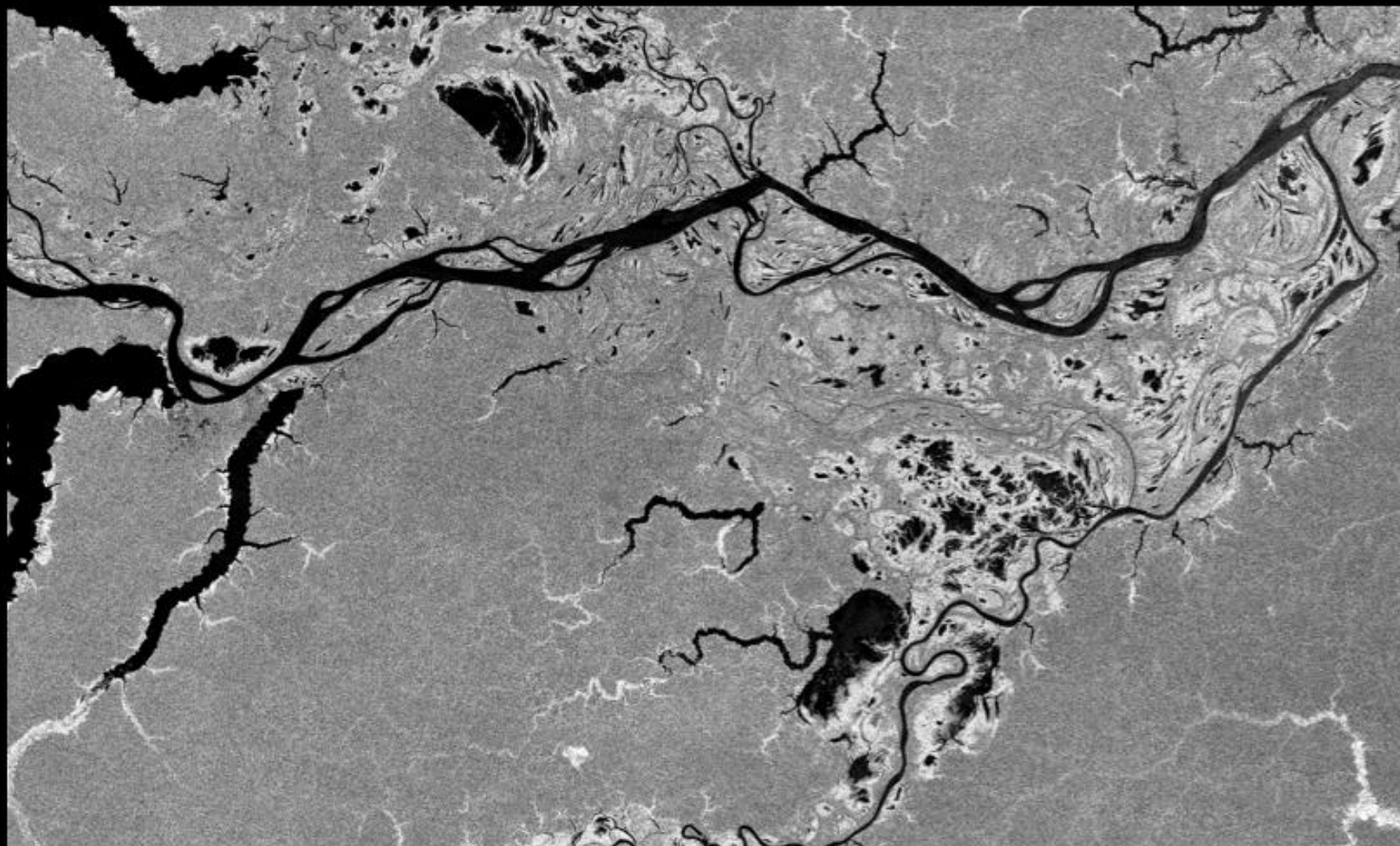
The Amazon river basin was imaged ~every 46 days by ALOS (2006-2011), so that inundation dynamics can be monitored





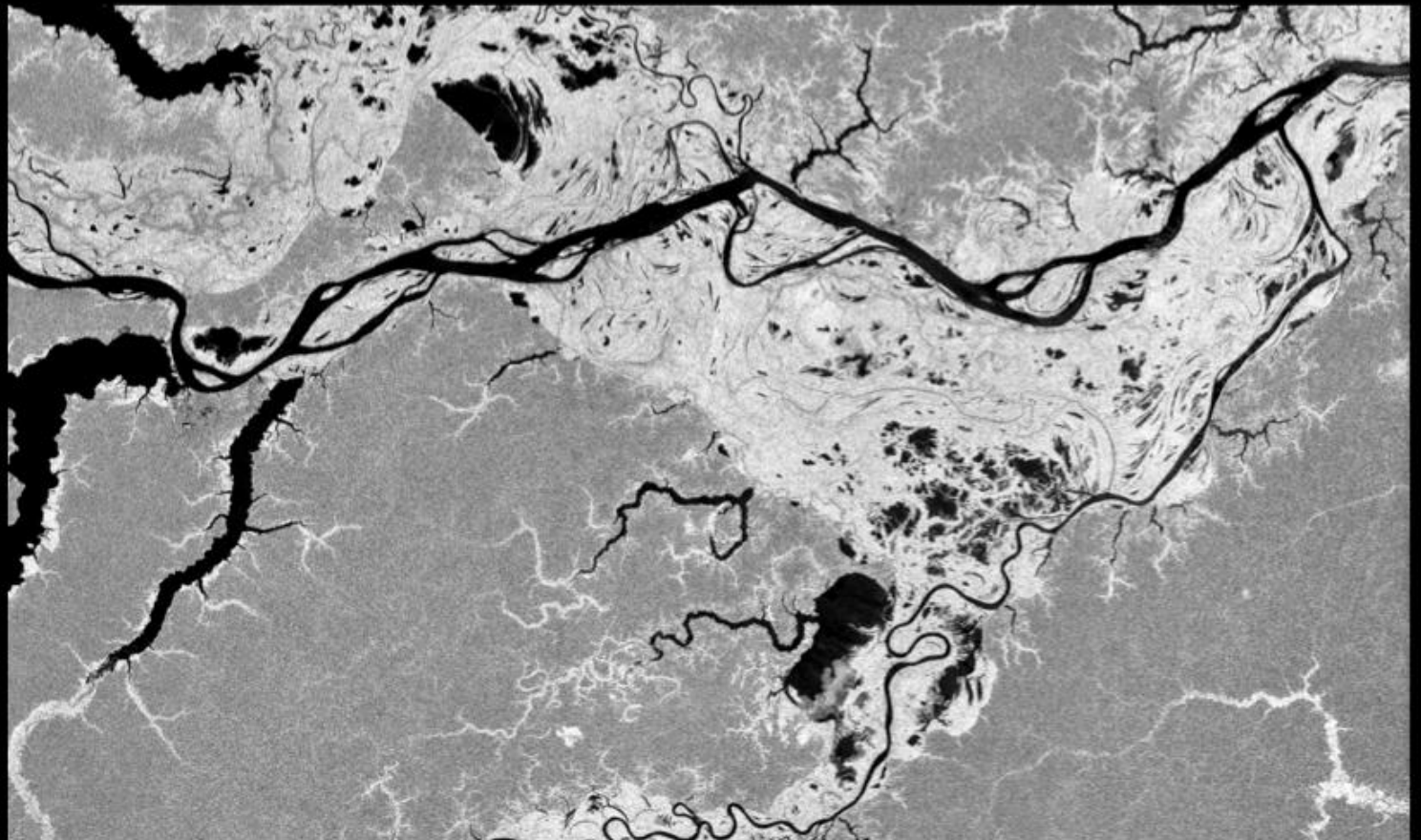
## SAR detection of inundated vegetation

Feb 4, 2007



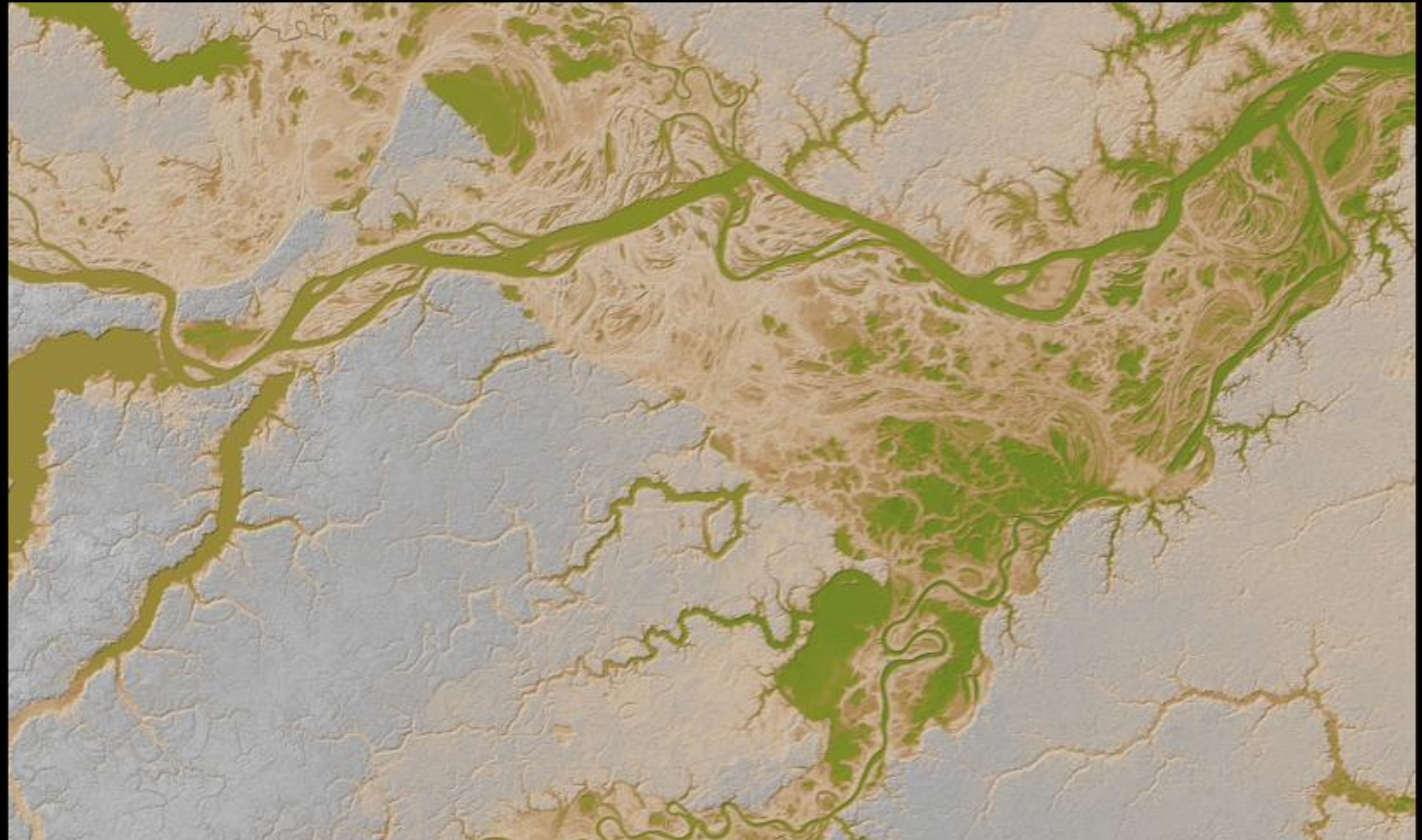
## SAR detection of inundated vegetation

Jun 22, 2007



## SAR detection of inundated vegetation

Shaded relief  
from SRTM

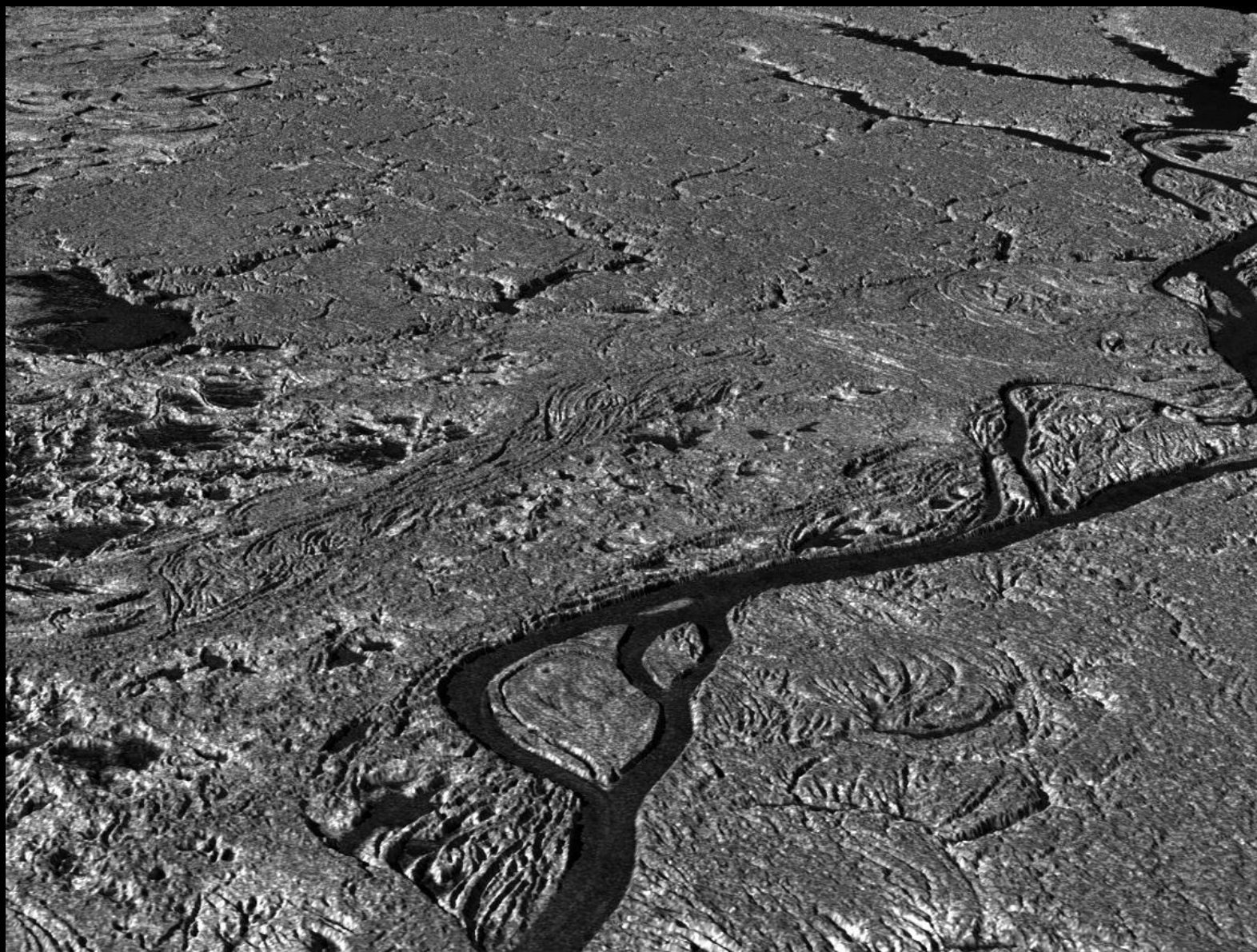


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3D visualization

Feb 4, 2007

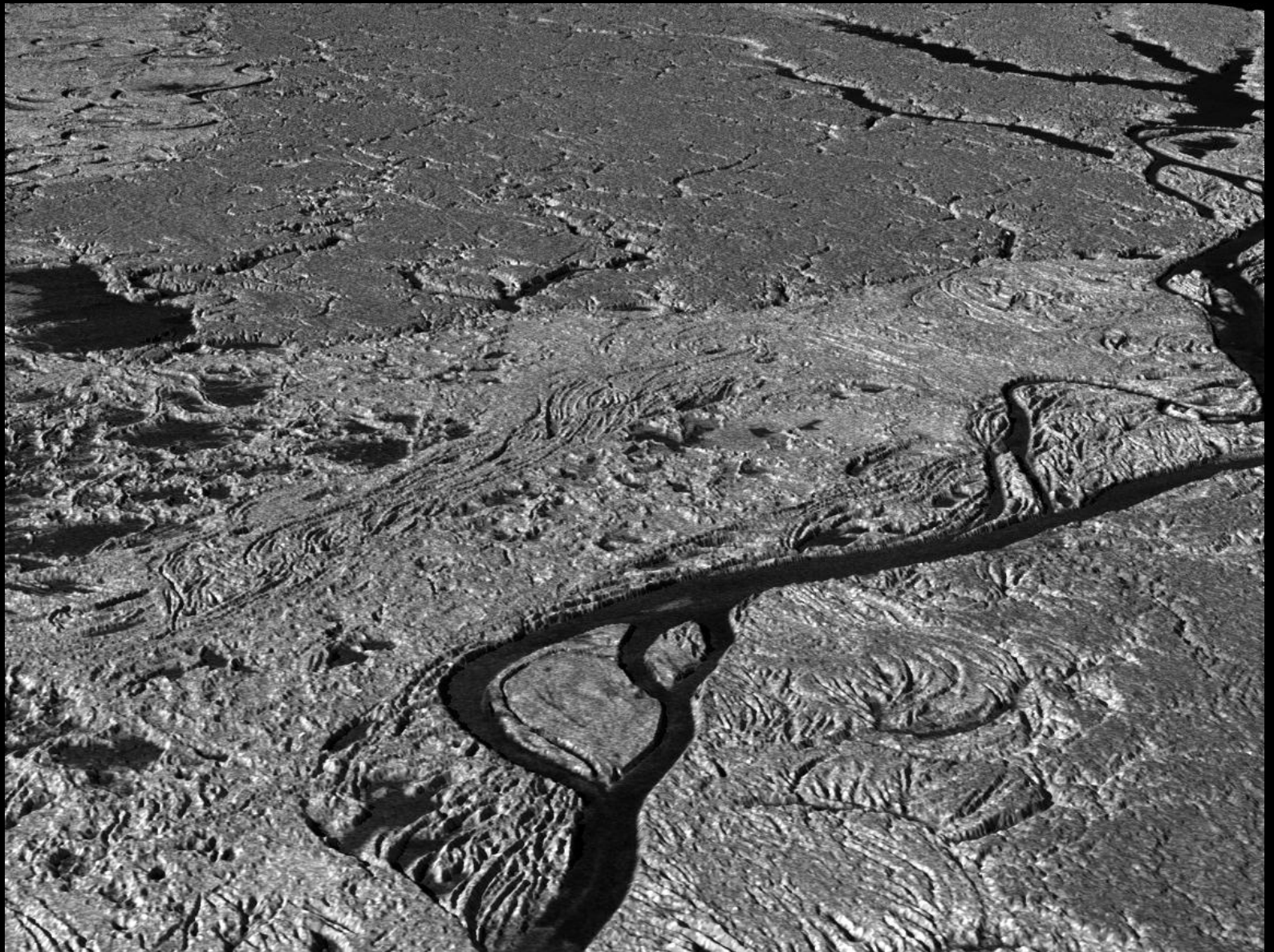


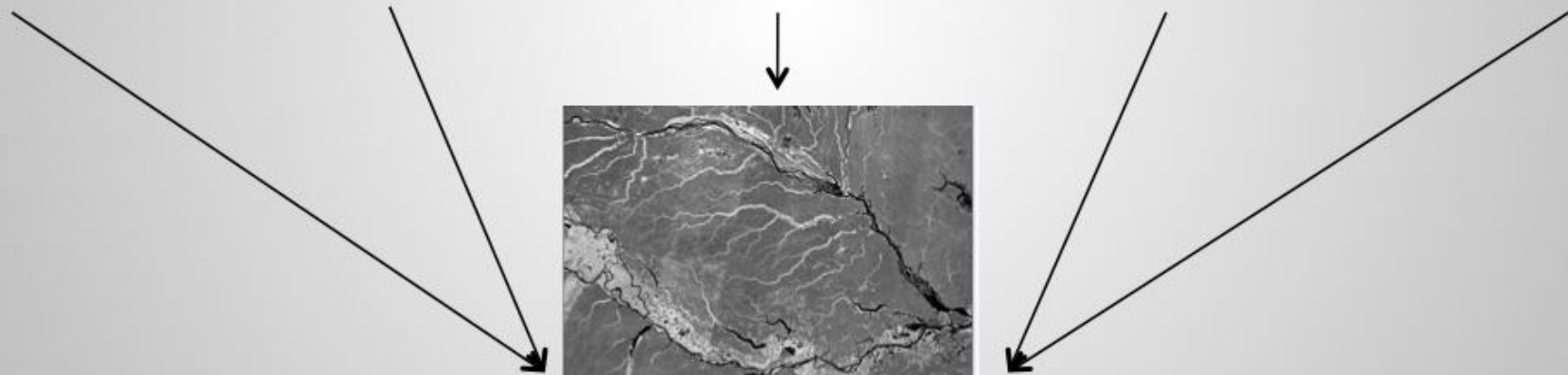
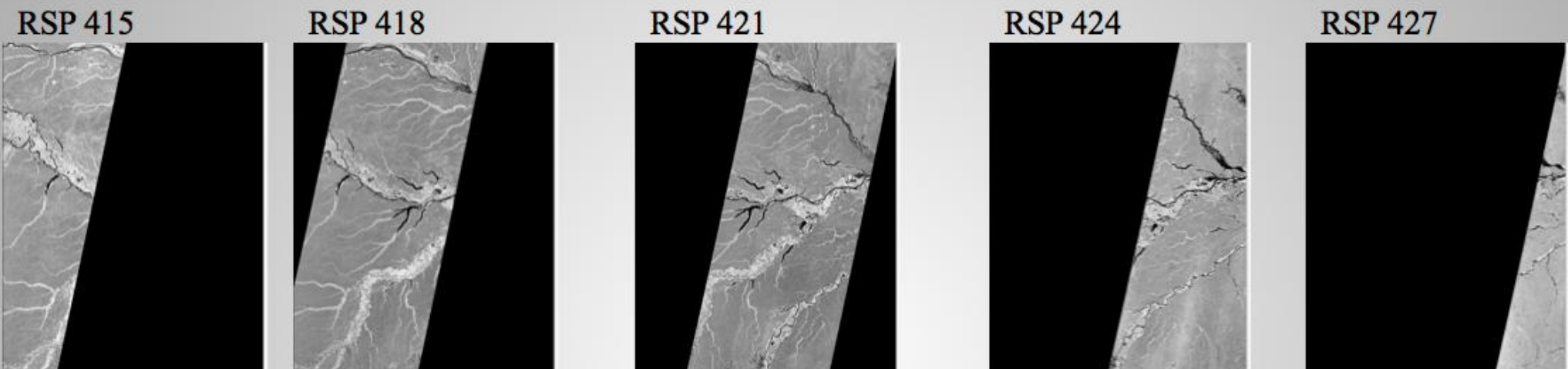
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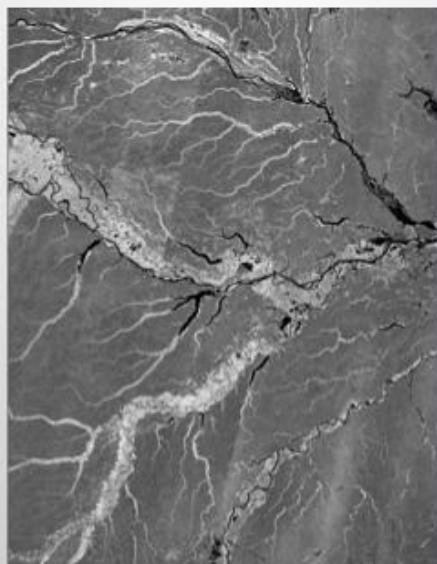
3D visualization

Jun 22, 2007





**Mosaicking eliminates overlapping coverage**



**UTM tile 20M**

**ALOS**

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**Amazon River  
Peru**

Iquitos

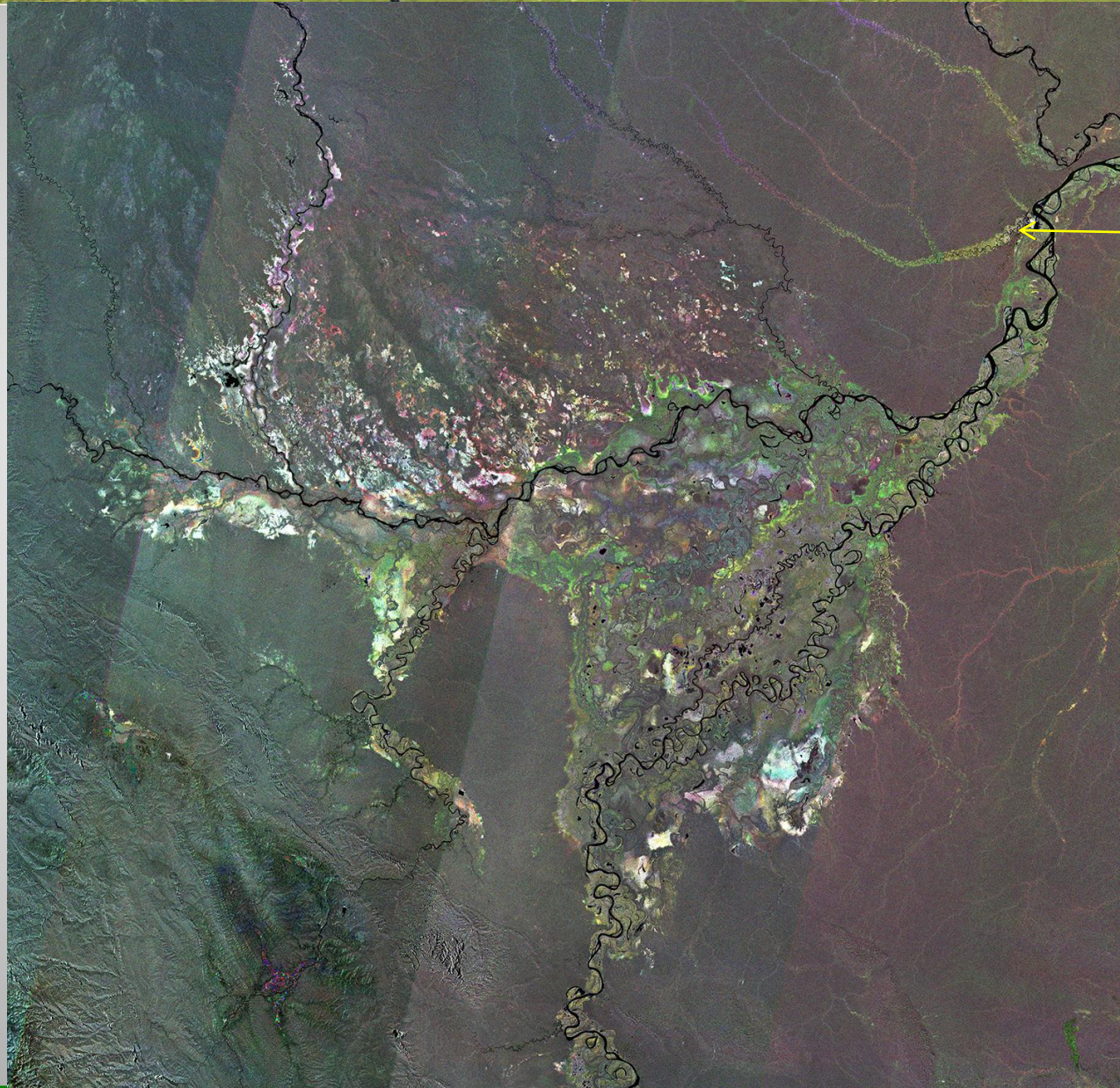


Image composite:

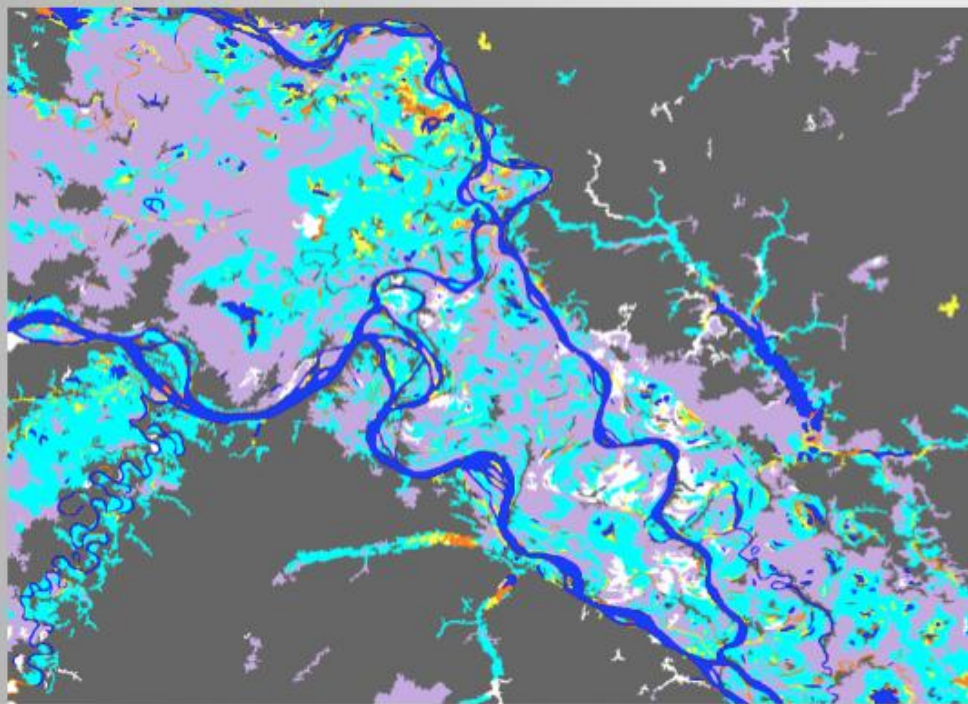
Jan-March, 2007

April-May 2007

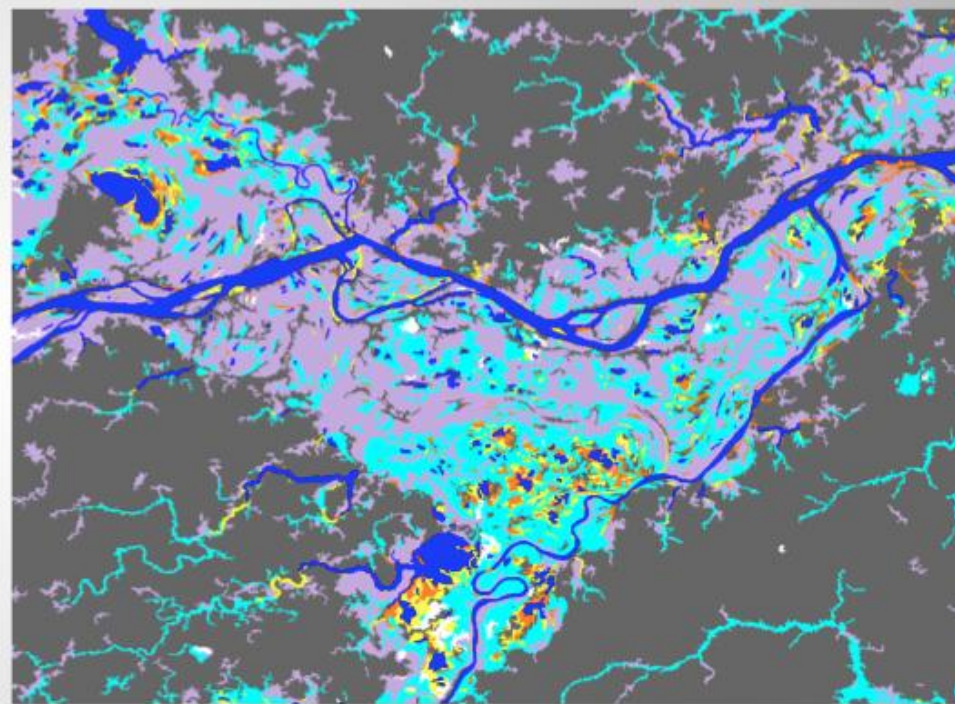
June 2007

## Wetland Habitat Mapping for Várzea Sustainable Development Reserves

## Mamirauá

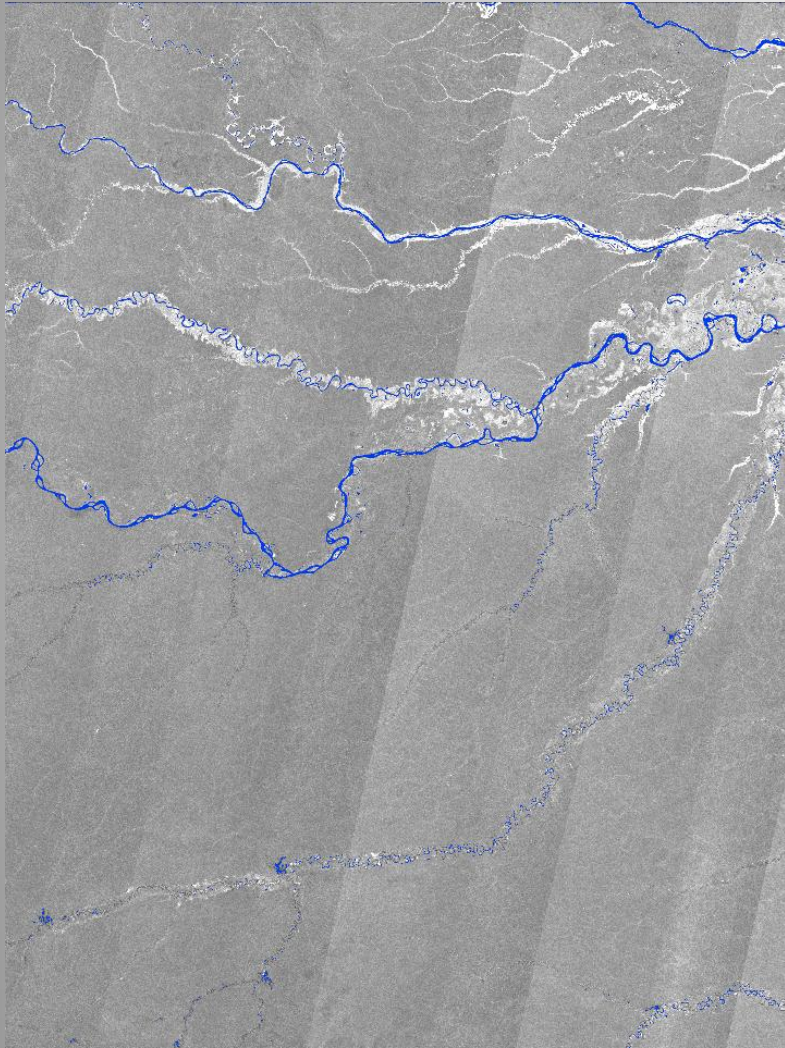


## Piagaçu-Purus



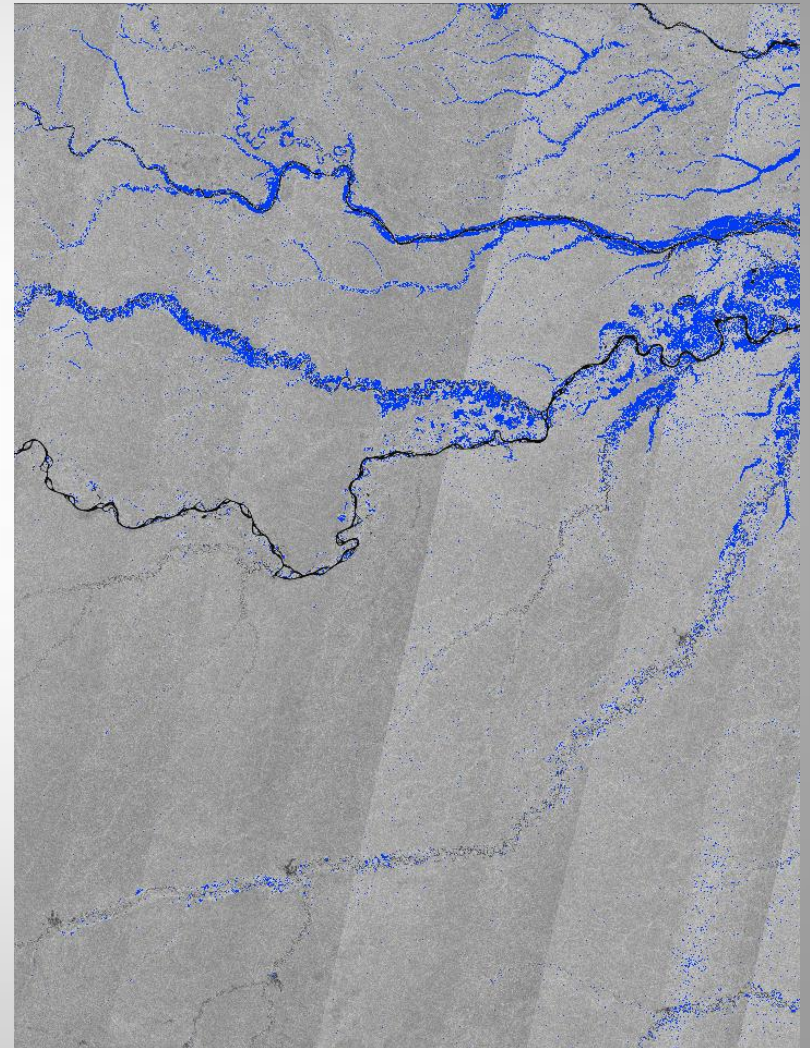


## Simple thresholds for identifying open water and inundated vegetation



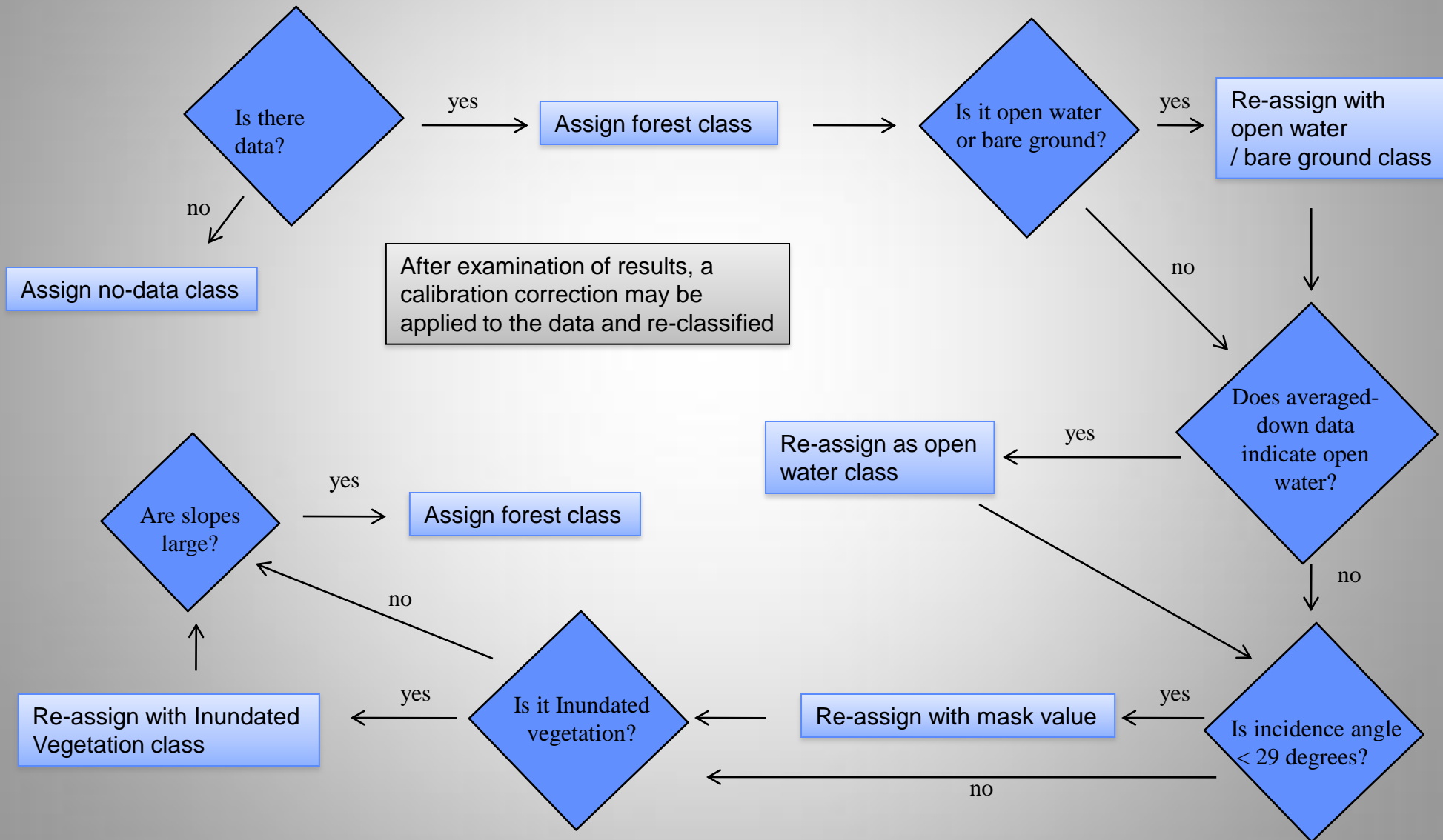
Open water → less than -10dB

19M



Inundated Vegetation → greater than -6 dB

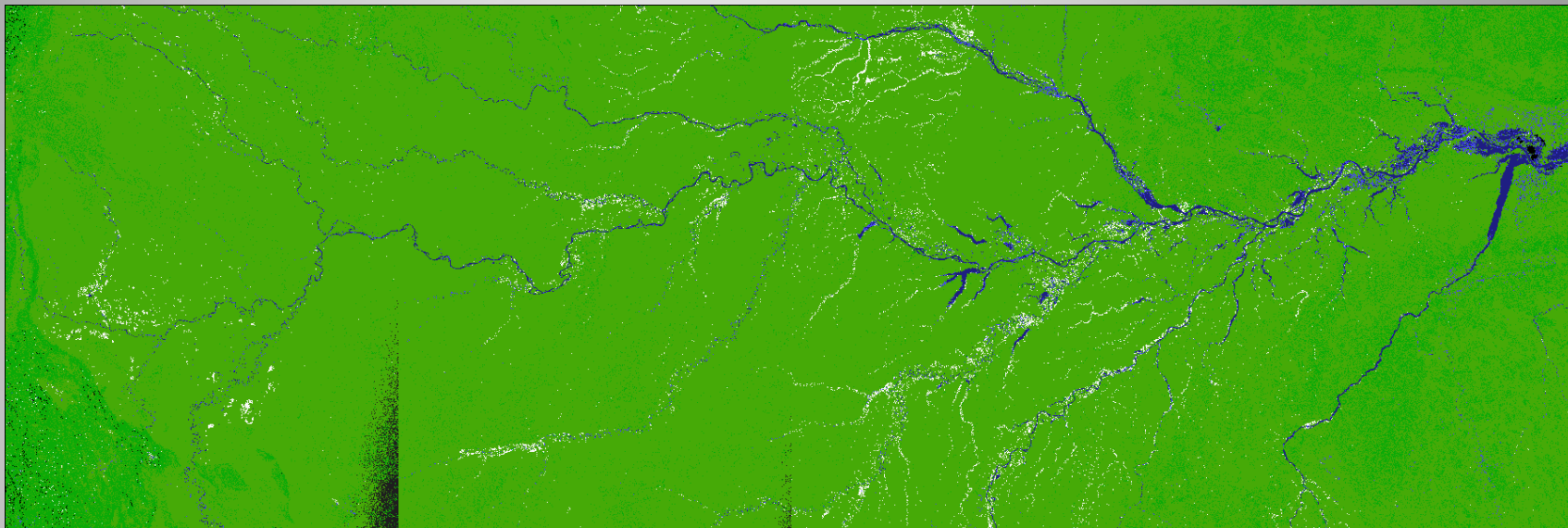
## Simple threshold-based classification



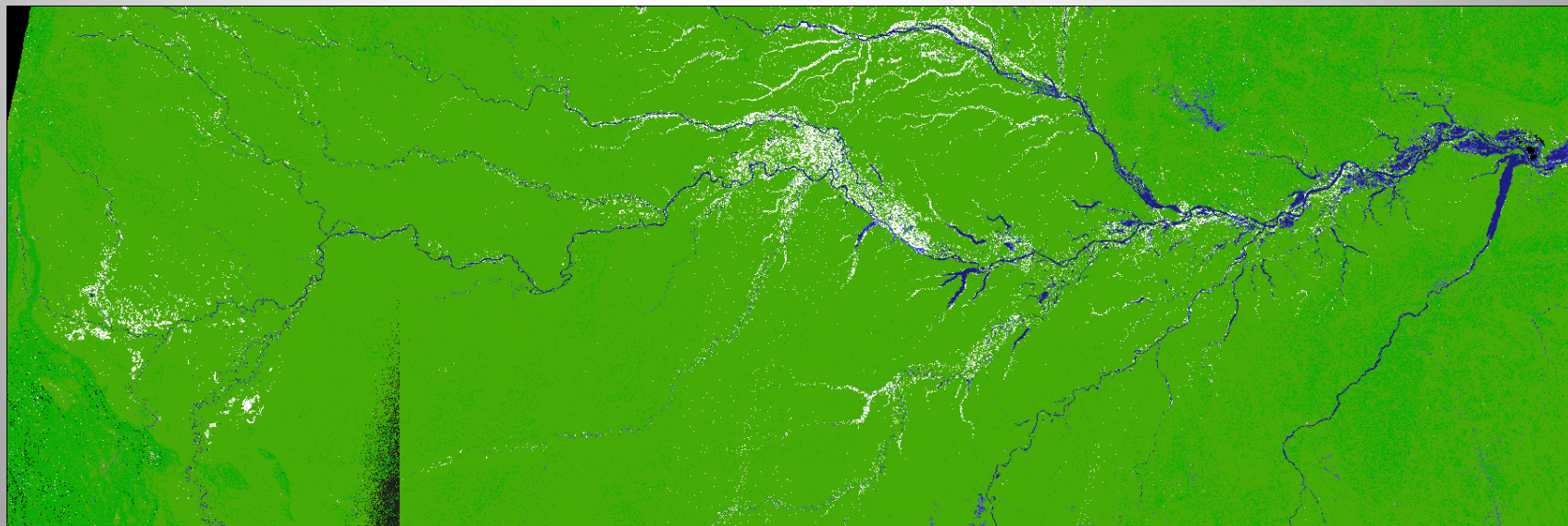
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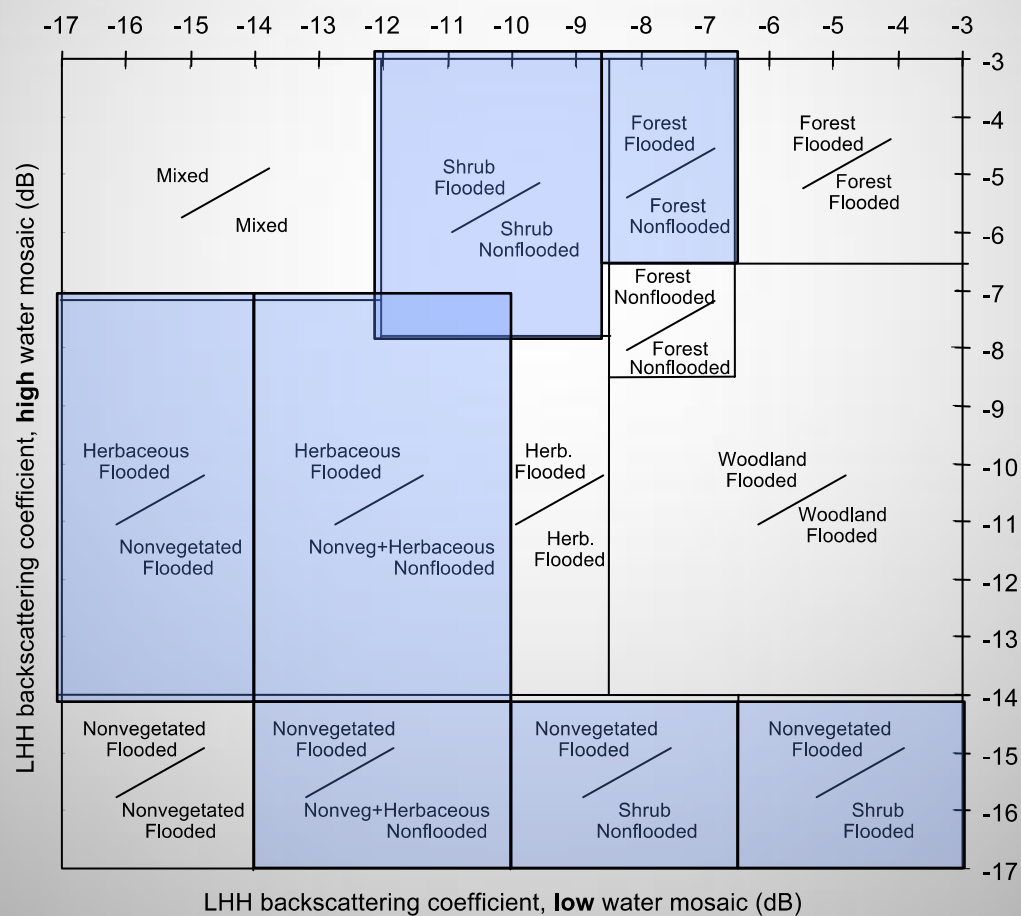
Early 2007



Mid 2007



## Decision Matrix Approach (modified from Hess et al. 2003)



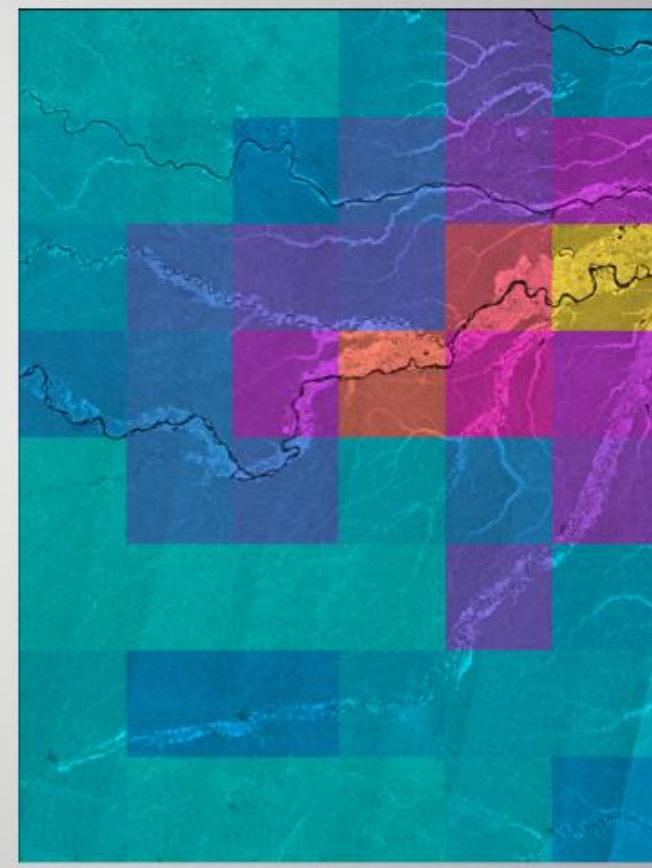
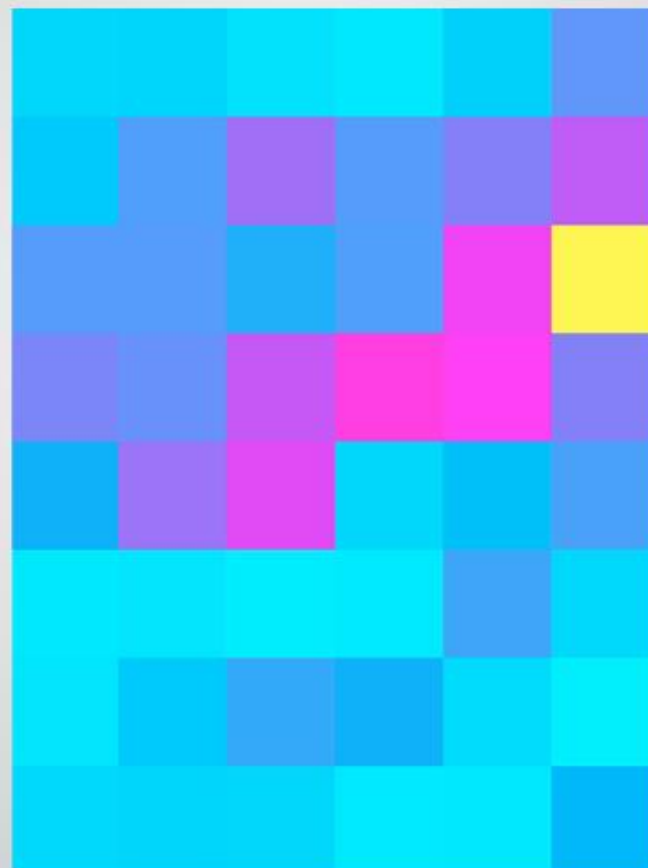
## Fraction for each 1deg x 1deg cell

May-June 2007

ALOS Open Water

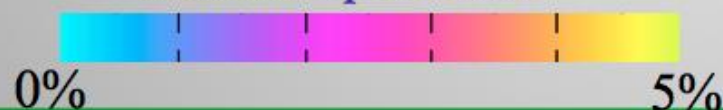
AMSR-E/QSCAT Open Water

ALOS Inundated Vegetation



19M

Fraction open water



Fraction inundated vegetation



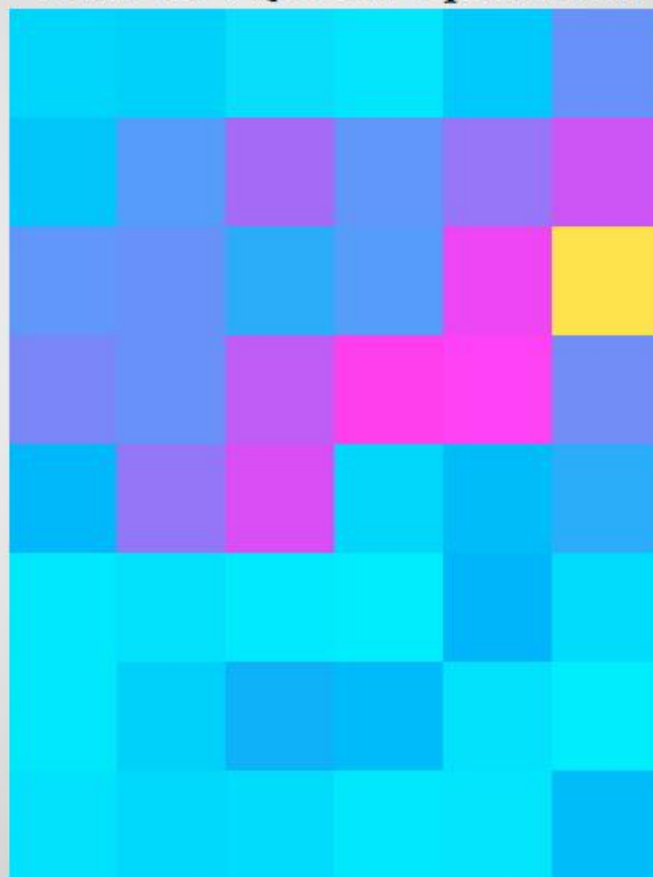
## Fraction for each 1deg x 1deg cell

July 2007

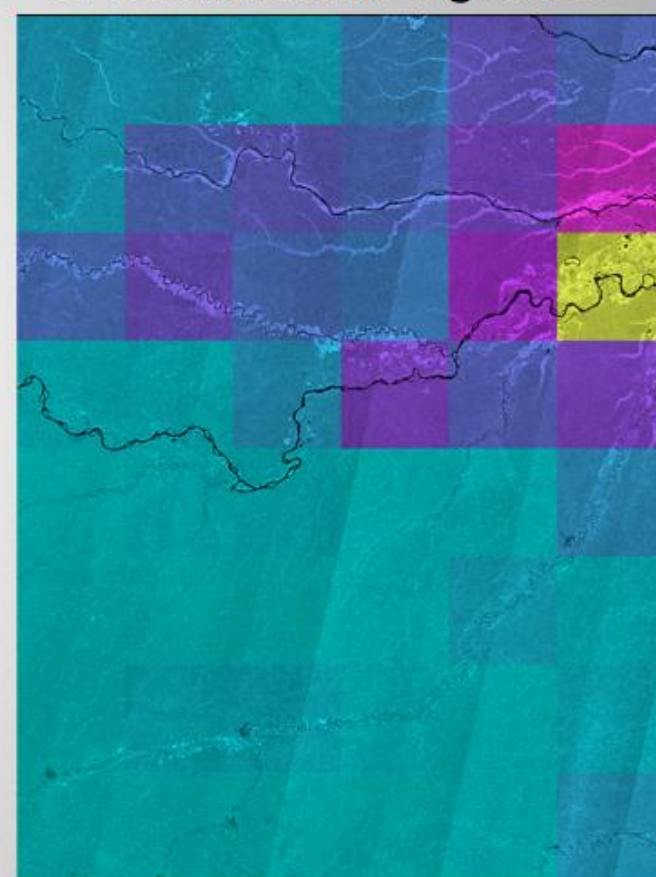
ALOS Open Water



AMSR-E/QSCAT Open Water



ALOS Inundated Vegetation



Fraction open water



Fraction inundated vegetation



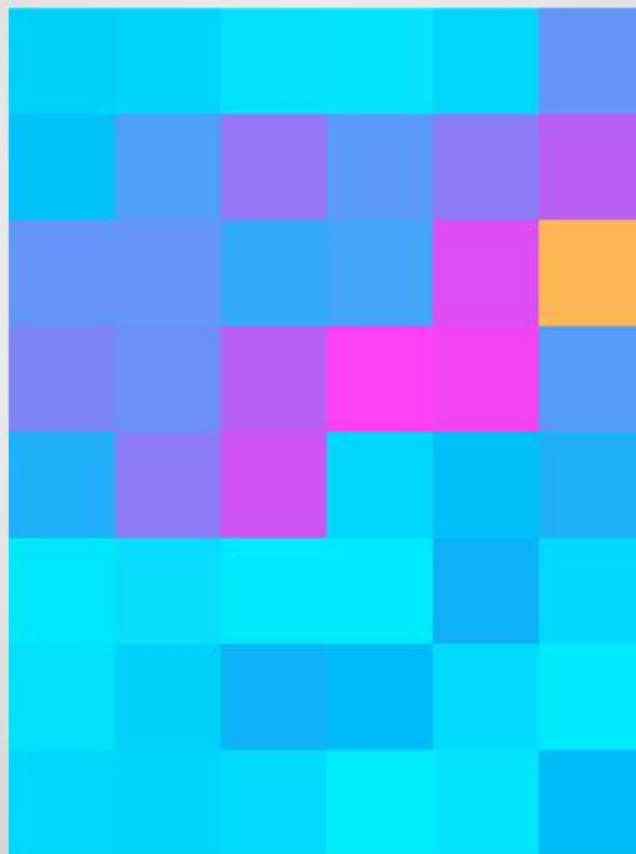
## Fraction for each 1deg x 1deg cell

Aug-Sept 2007

ALOS Open Water



AMSR-E/QSCAT Open Water



ALOS Inundated Vegetation



Fraction open water



19M

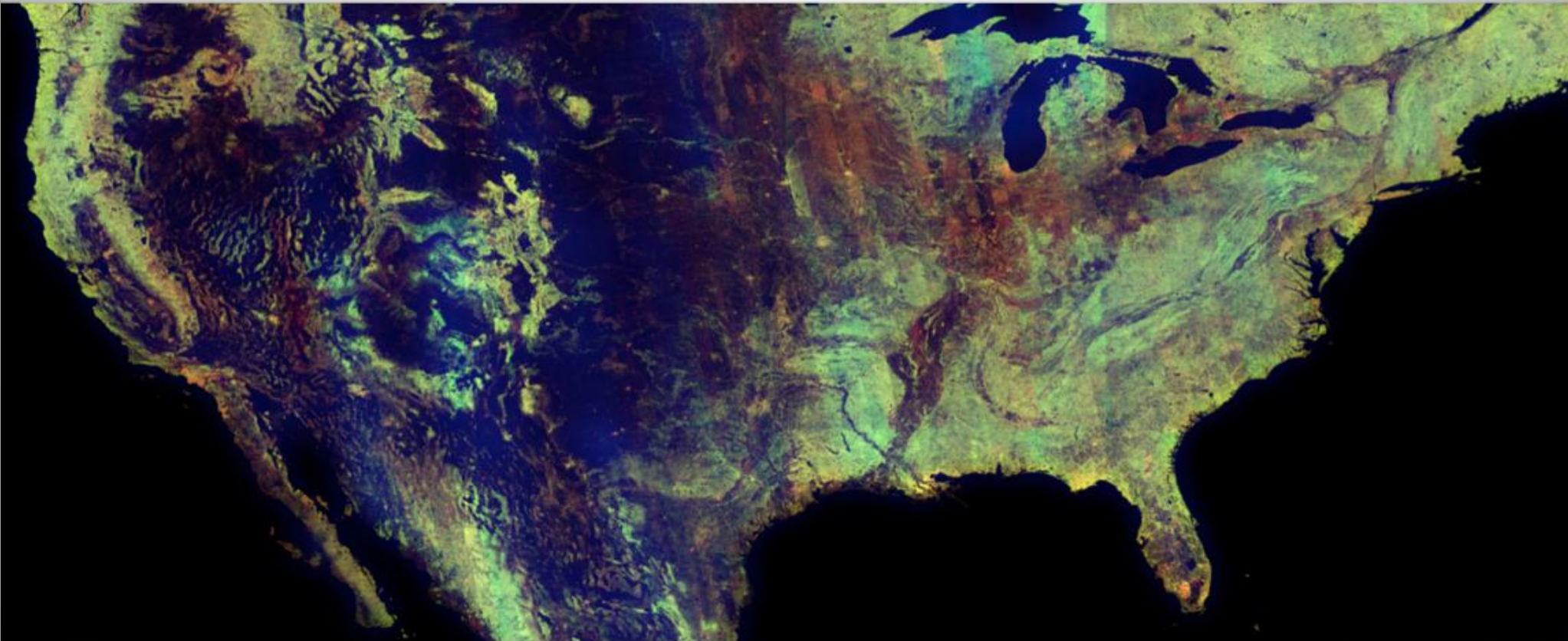
Fraction inundated vegetation



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## Dual Polarization Data



HH HV HV/HH

Summer 2007



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Dual Polarization  
Florida



HH HV HV/HH

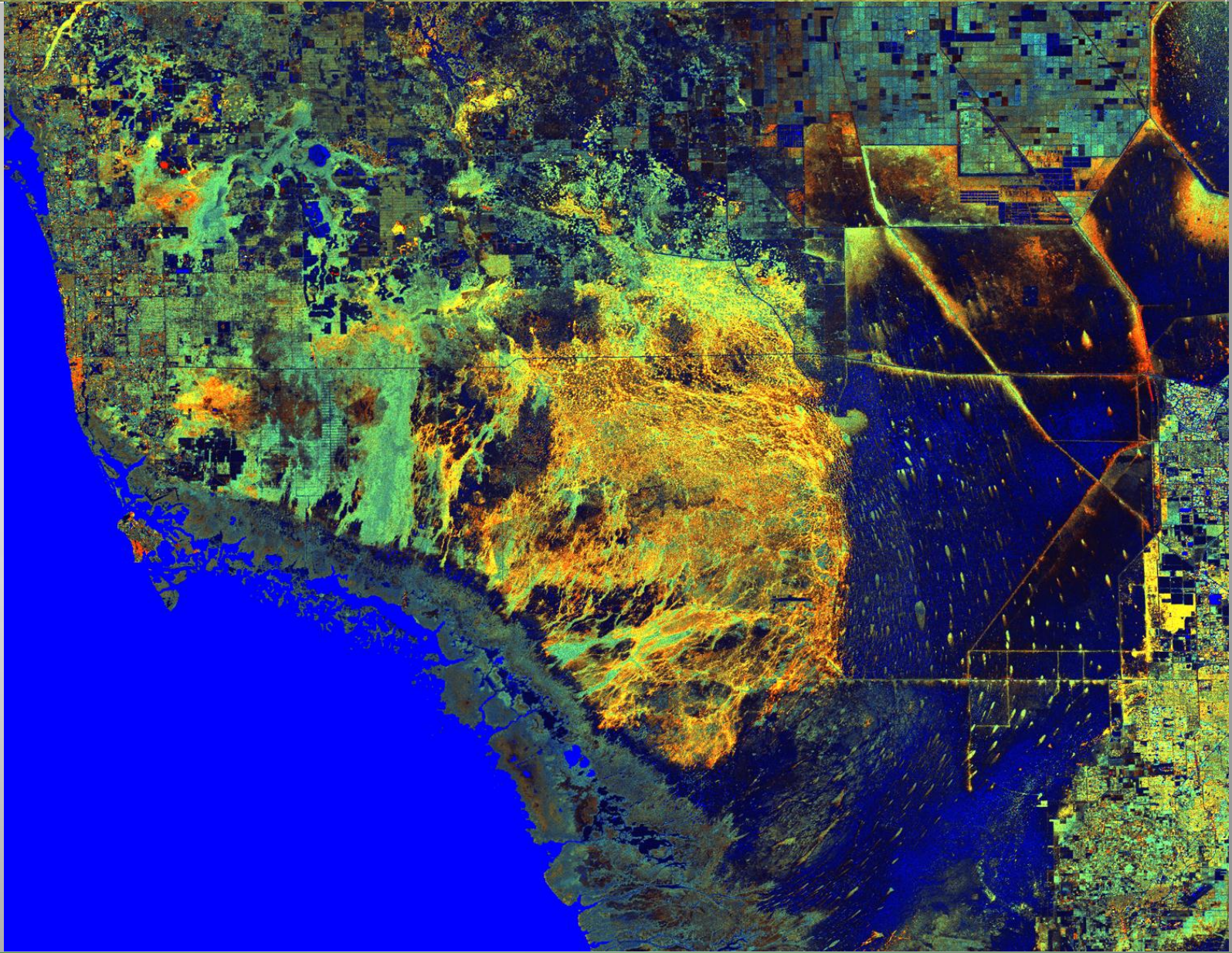
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Everglades

90 m resolution

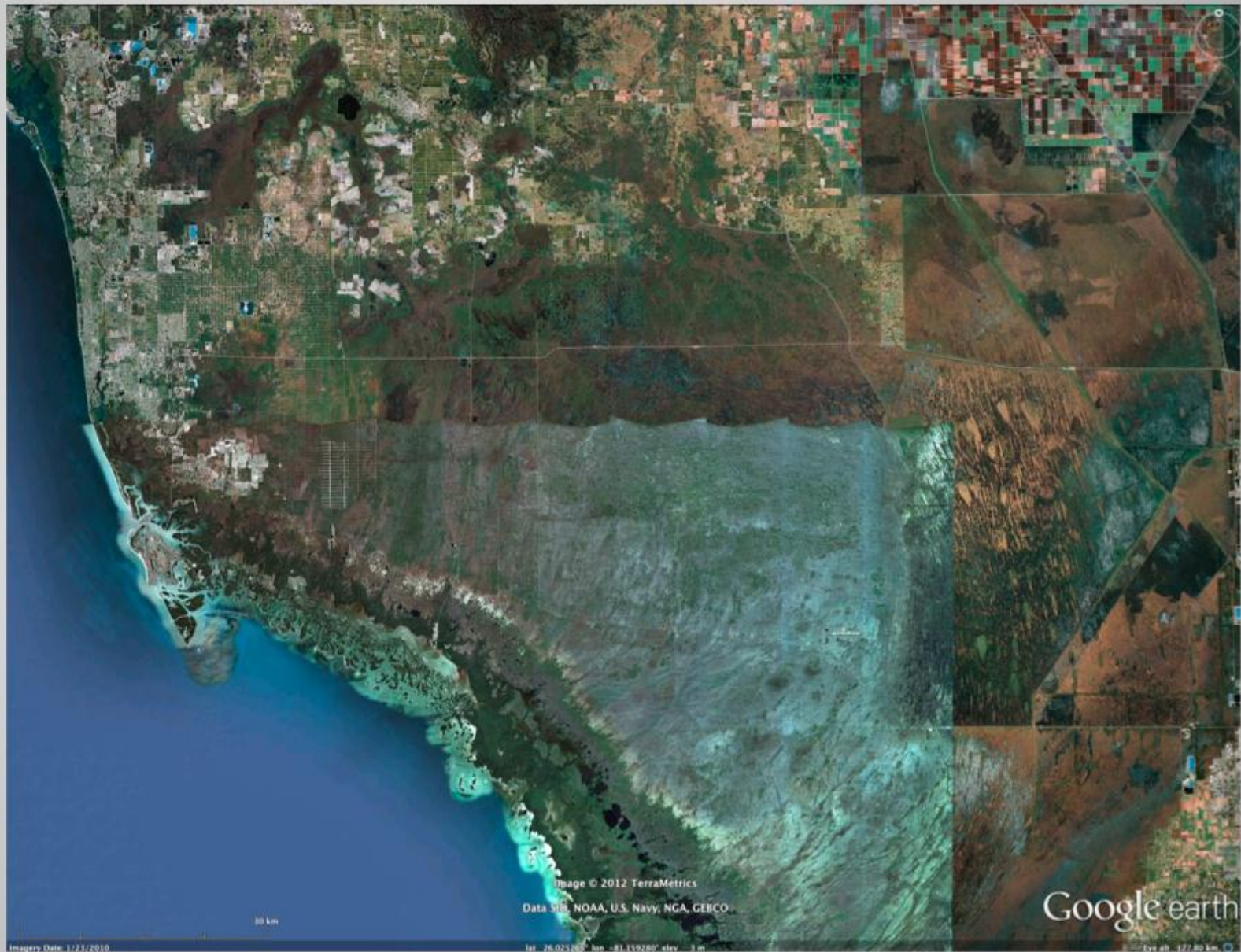
HH HV HV/HH



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For  
comparison,  
Google Earth  
image



**This research is undertaken within the framework of the ALOS Kyoto & Carbon Initiative. The ALOS data were provided by JAXA EORC.**

***Resources supporting this work were provided by the NASA High-End Computing (HEC) Program through the NASA Advanced Supercomputing (NAS) Division at Ames Research Center.***

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