K&C Phase 3 – Brief project essentials

The mapping and detection of inundated wetlands by ALOS PALSAR SCANSAR data

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Science Team meeting #18
RESTEC, Tokyo, November 7-9, 2012

Project area(s)

Wetland areas covered by ALOS PALSAR in SCANSAR mode.

SCANSAR processing

- This work is undertaken in conjunction with the NASA MEASURES task led by Kyle McDonald of CCNY to create an Earth Science Data Record for Inundated Wetlands.
- Terrain correction using SRTM DEM applied
- Data at incidence angles less than 29 degrees excluded
- Orthorectified to SRTM DEM by UTM tile
- Average of data spanning the time frame of each data set

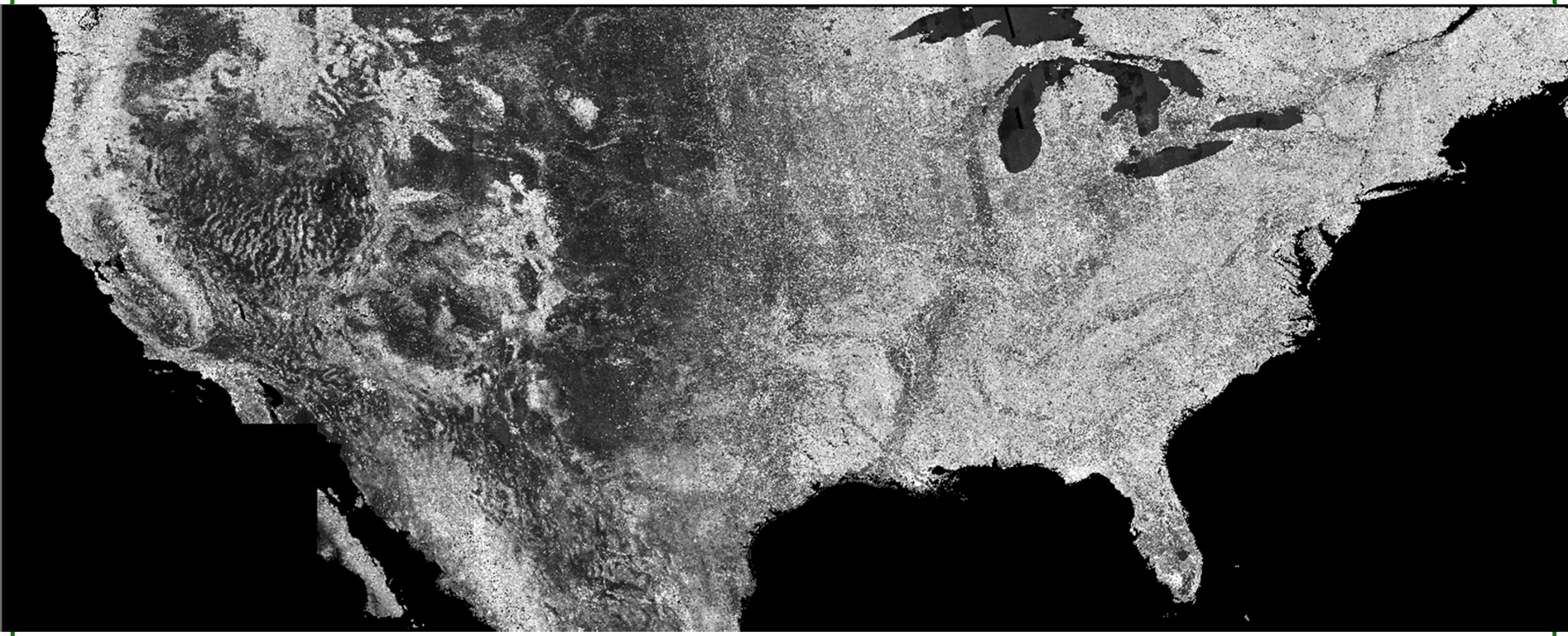
Data processed on Pleiades supercomputing facility at NASA Ames

- Almost 200,000 cpu's
- One of the largest supercomputing facilities in the world

Previous work

- Continental US
- Africa

HH image mosaic



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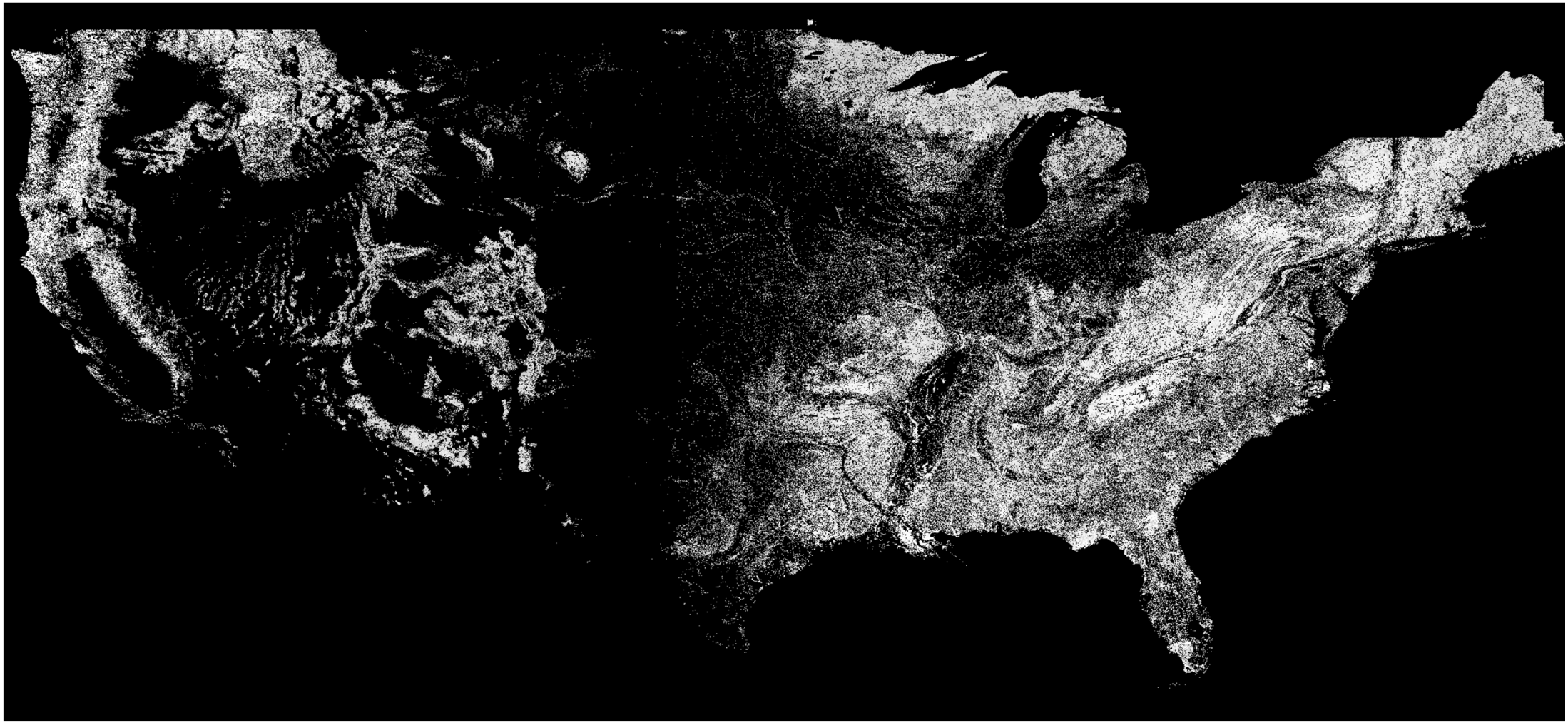
Continental US Biomass map

Derived from ALOS PALSAR, as well as other remote sensing data sets
(such as MODIS, SRTM) and Forest Inventory data from the US forest Service.



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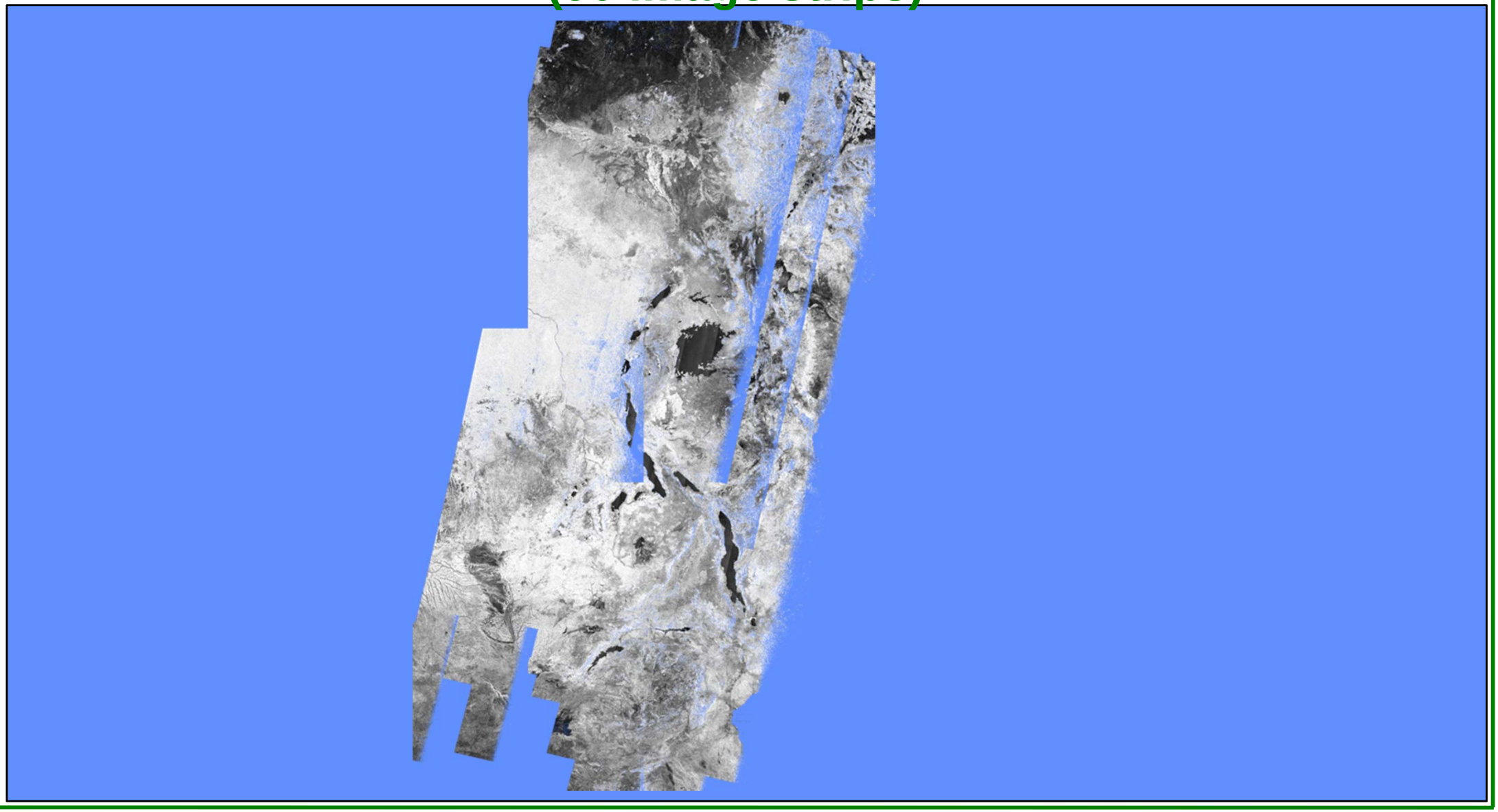
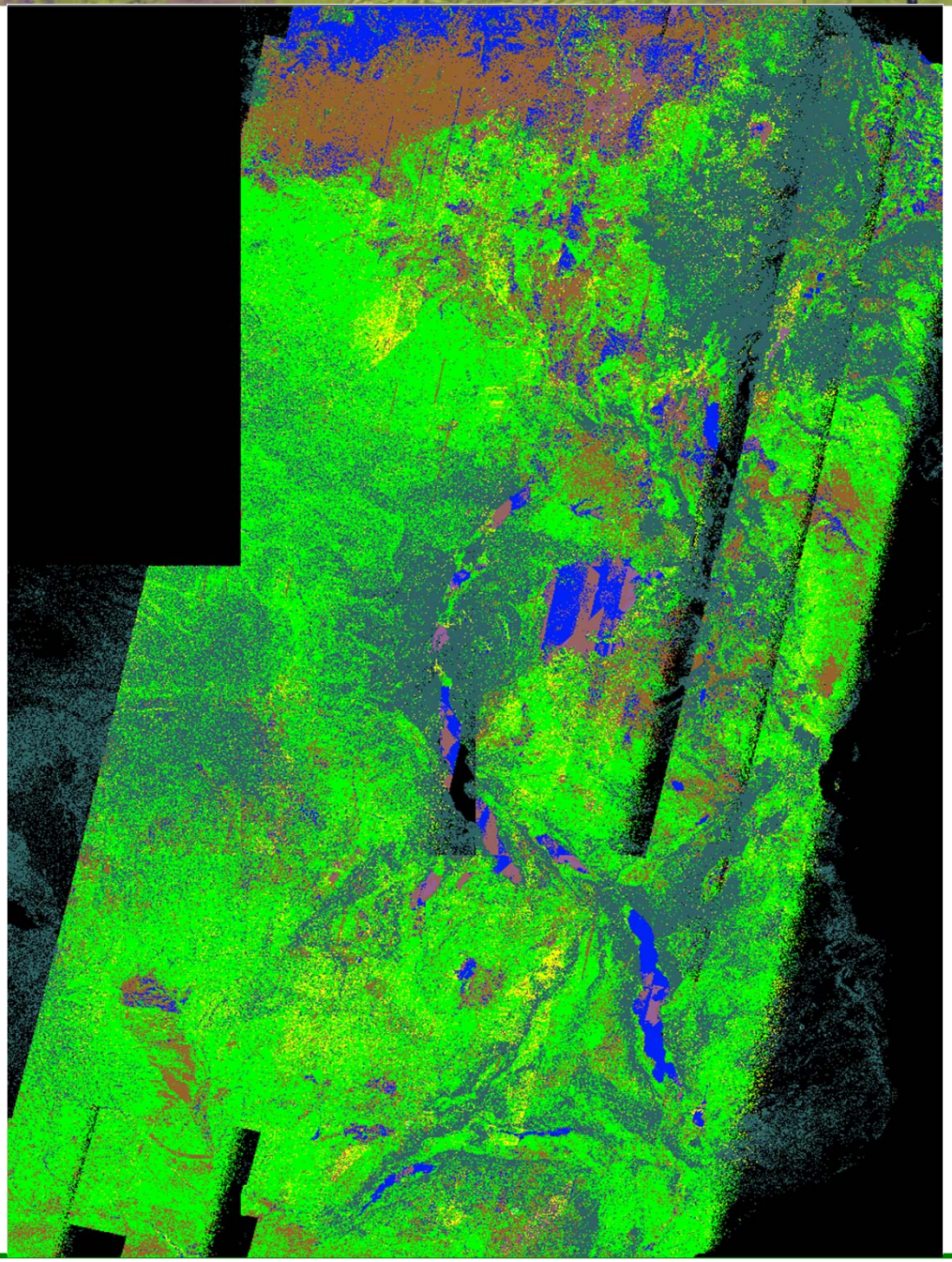
Africa image mosaic from ALOS PALSAR SCANSAR data (90 image strips)





We are currently validating this image classification with our collaborator, Lisa Rebelo

Similar classification legend as for South America

Classifying Inundated Wetlands

- **Biggest problems with using SCANSAR data:**
  - **Distinguishing grasslands and bare ground from open water**
  - **Distinguishing some high biomass forests from inundated vegetation**

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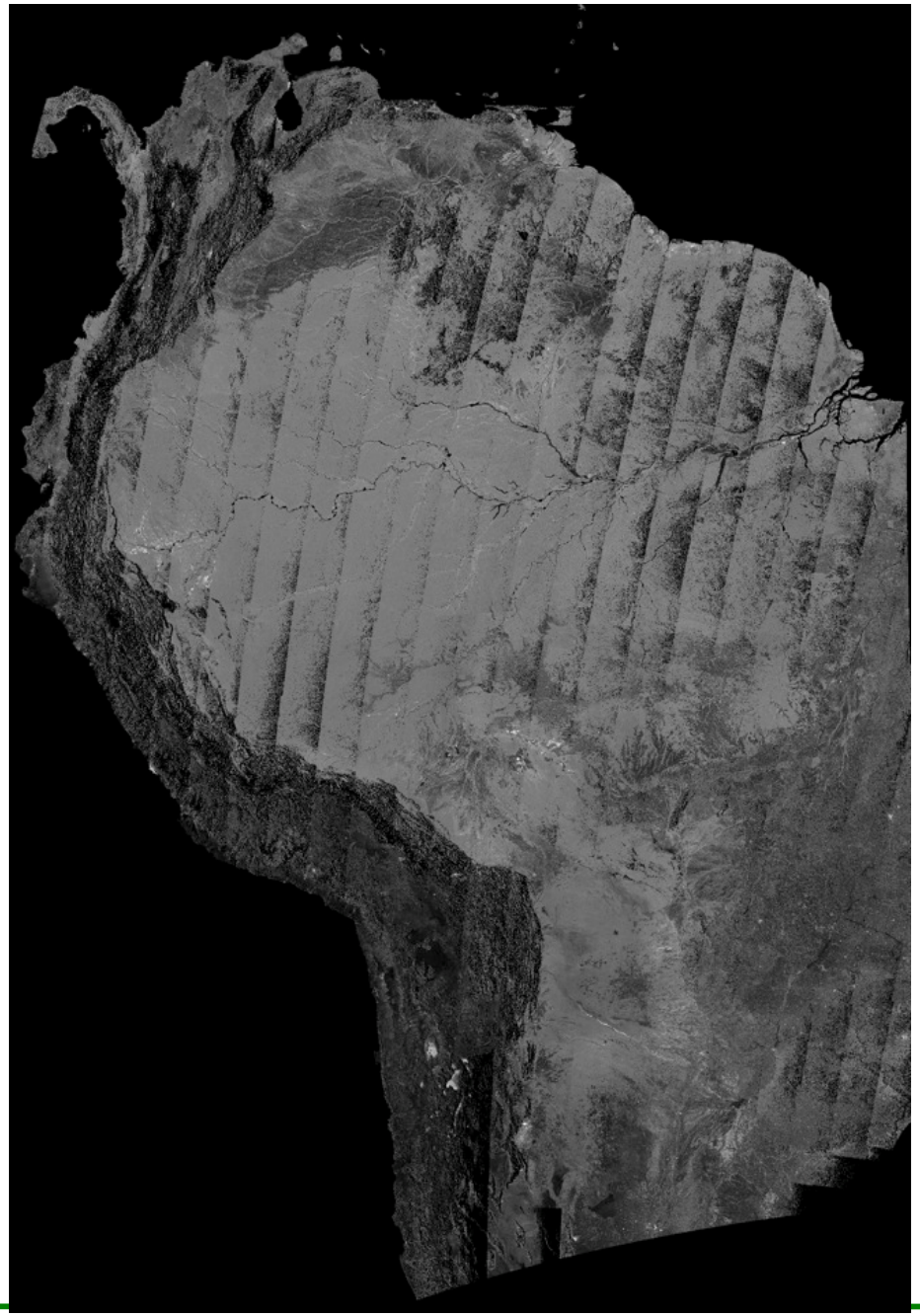

South America
ALOS SCANSAR multi-temporal image mosaic

Generated from 323 SCANSAR image strips*
Data from late 2006 to mid 2010.
Often 10 or more images per pixel

Orthorectified
Terrain calibrated
Imagery and products available as
KMZ (tiles exactly the same as SRTM)
GEOTIFF (tiles exactly the same as SRTM)
Binary with ENVI header

Black strip patches indicate no data at desired incidence angles

*Typically 400km x 3000km at 90 m resolution
1 million km^2 each

Classification thresholds based on

Allan S. Arnesen, Thiago S.F. Silva, Laura L. Hess, Evlyn M.L.M. Novo, Conrado M. Rudorff, Bruce D. Chapman, Kyle C. McDonald, Monitoring flood extent in the lower Amazon River floodplain using ALOS/PALSAR ScanSAR images, Remote Sensing of Environment, Volume 130, 15 March 2013, Pages 51-61, ISSN 0034-4257, 10.1016/j.rse.2012.10.035.

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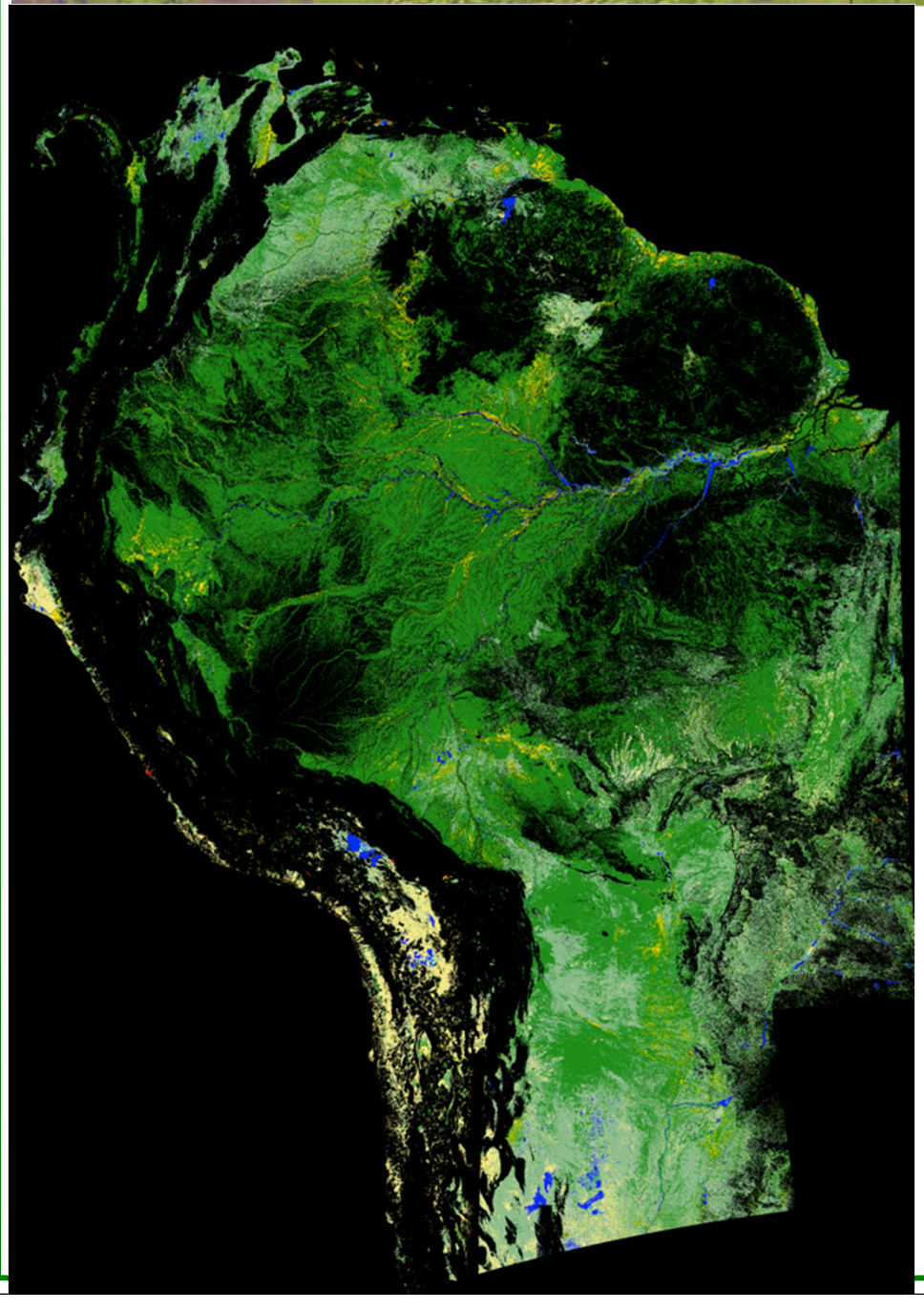

South America Inundation Classification From SCANSAR data

- Data mask (no data/ocean/high slope)
- Maximum inundated vegetation
- High vegetation
- Low vegetation
- Bare ground
- Maximum open water

13.4 million km^2 imaged by ALOS SCANSAR
248,000 km^2 maximum inundated vegetation
112,000 km^2 maximum open water

We are currently working with our collaborator, Bruce Forsberg of INPA, to validate and quantifying errors.

Sensitive to open water and inundated vegetation greater than 25 hectares in size.

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Fraction of 1° x1° area with inundated vegetation (seasonal maximum)

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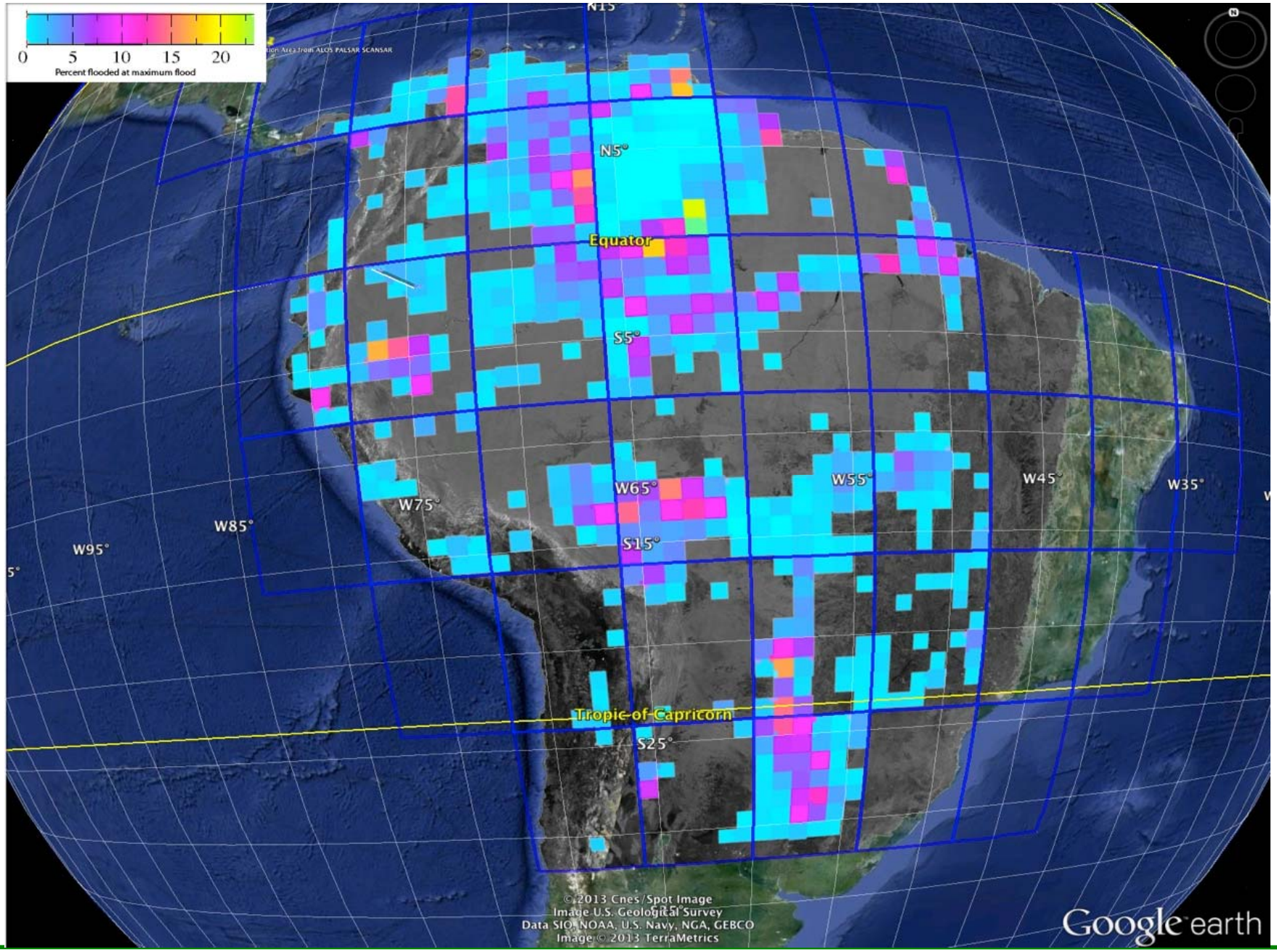

Fraction of 1° x1° area with open water (seasonal maximum)

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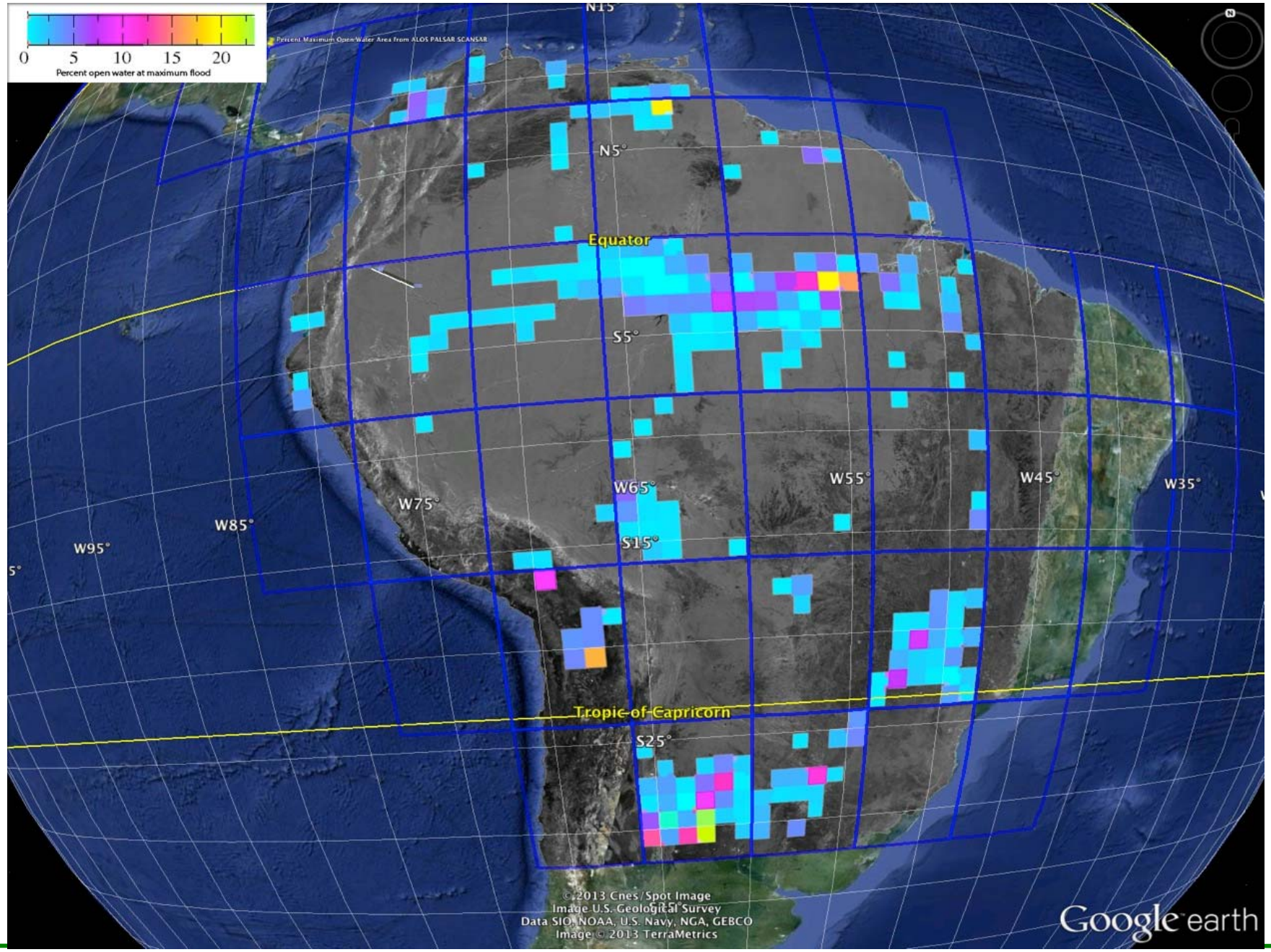

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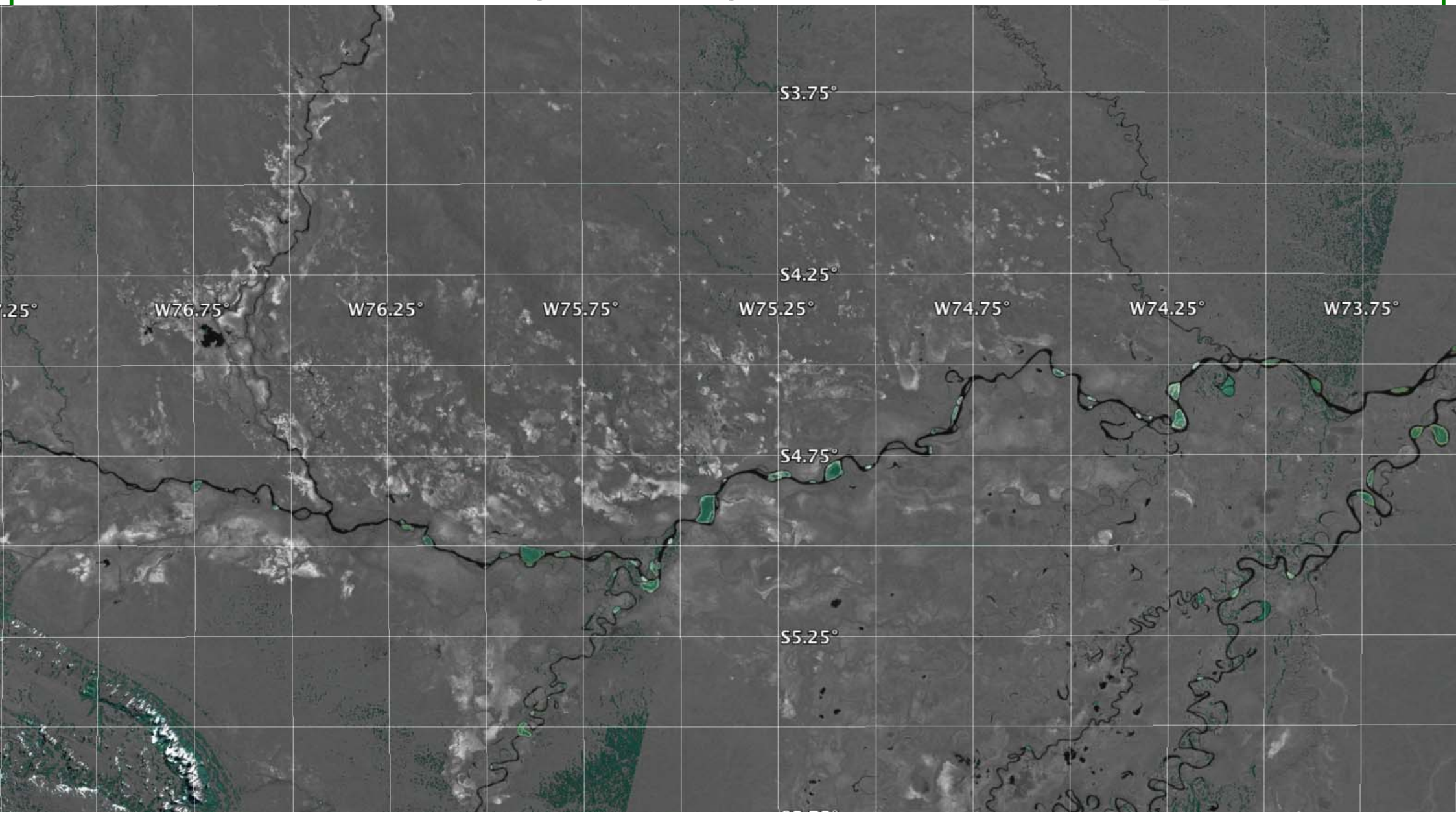
SCANSAR image (in Google Earth) – Palm Swamps



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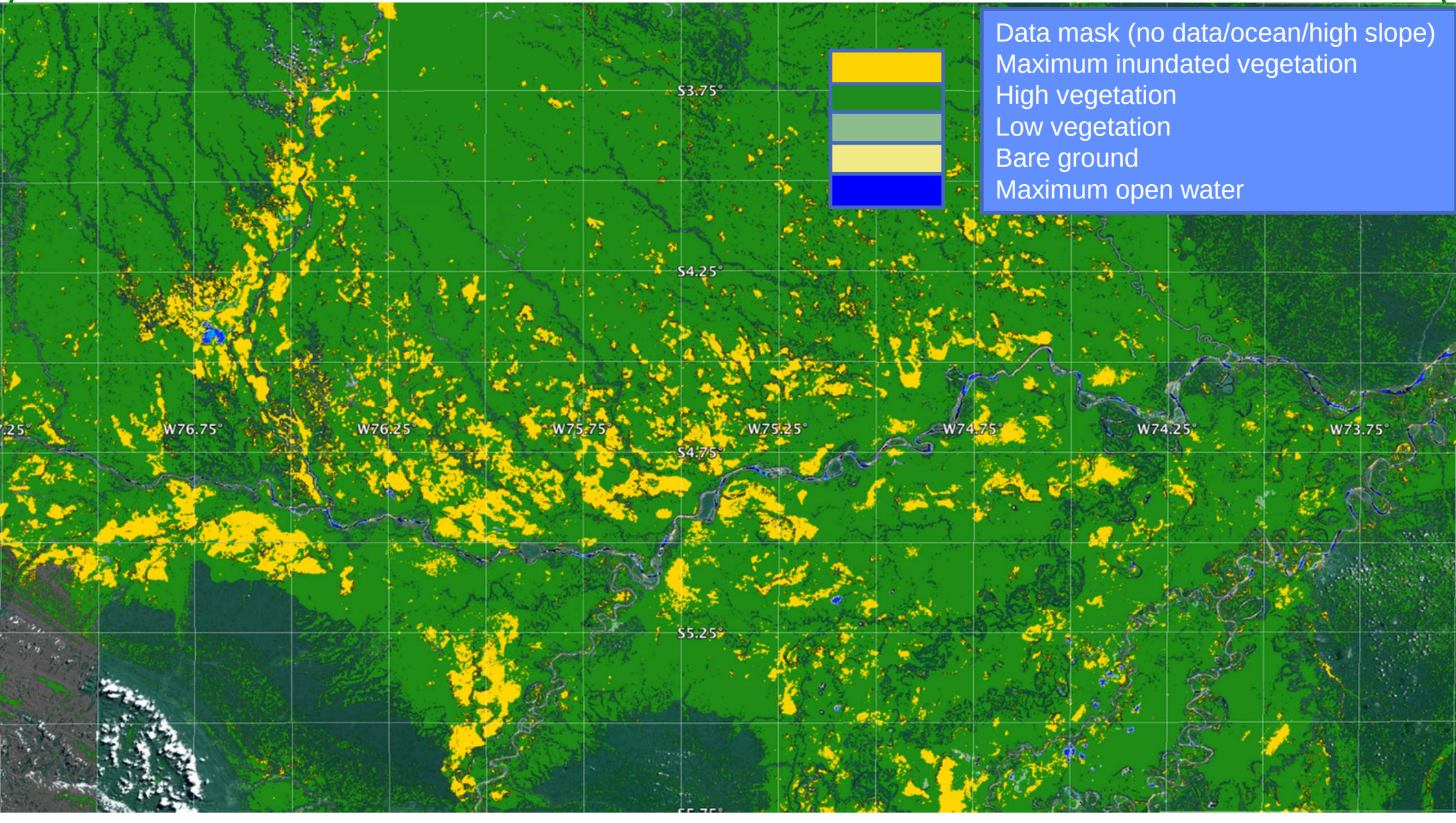
Inundation classes (in Google Earth) – Palm Swamps



ALOS SCANSAR image (in Google Earth)
- zoom to full resolution

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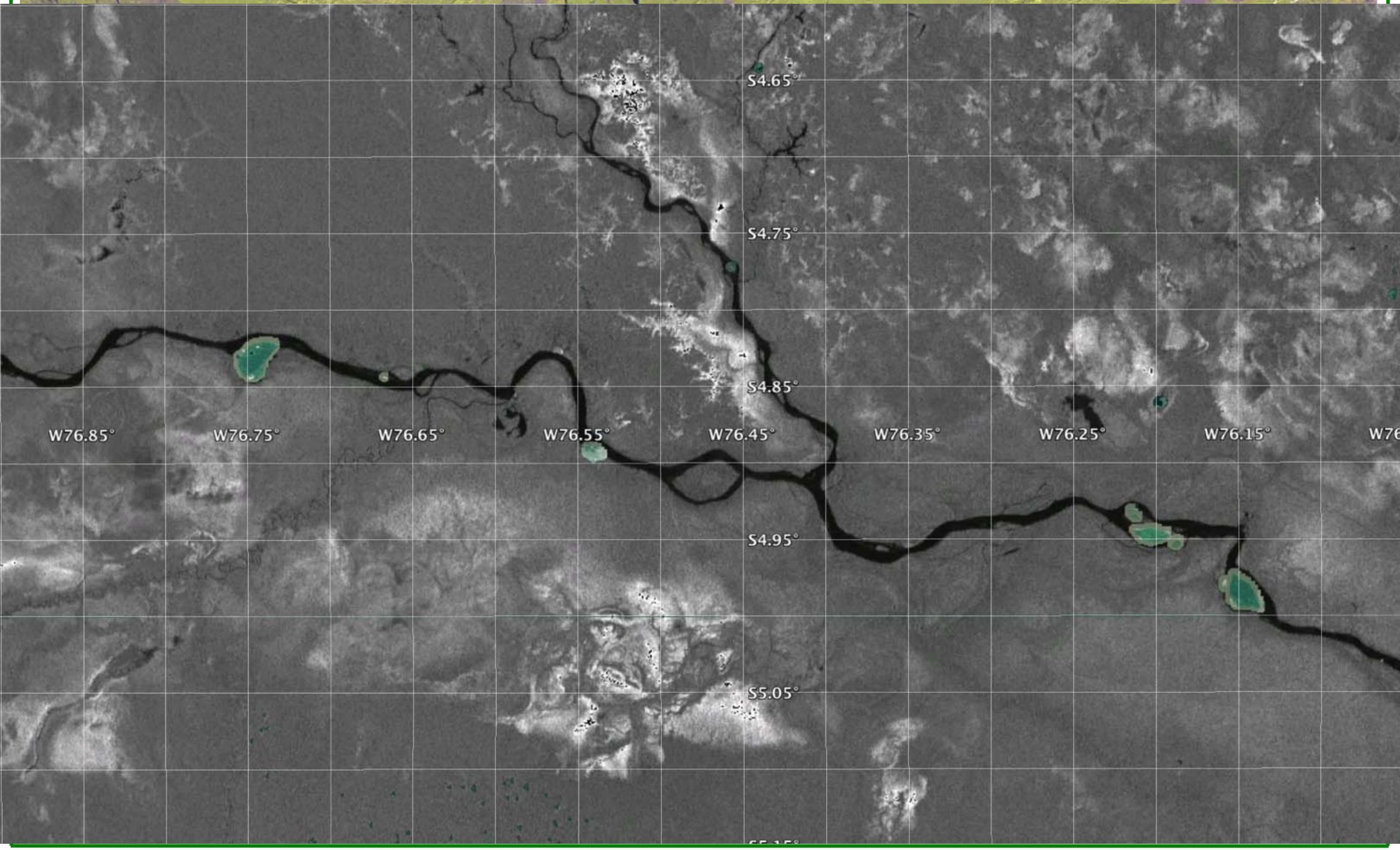

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SCANSAR image (in Google Earth) – zoom to full resolution

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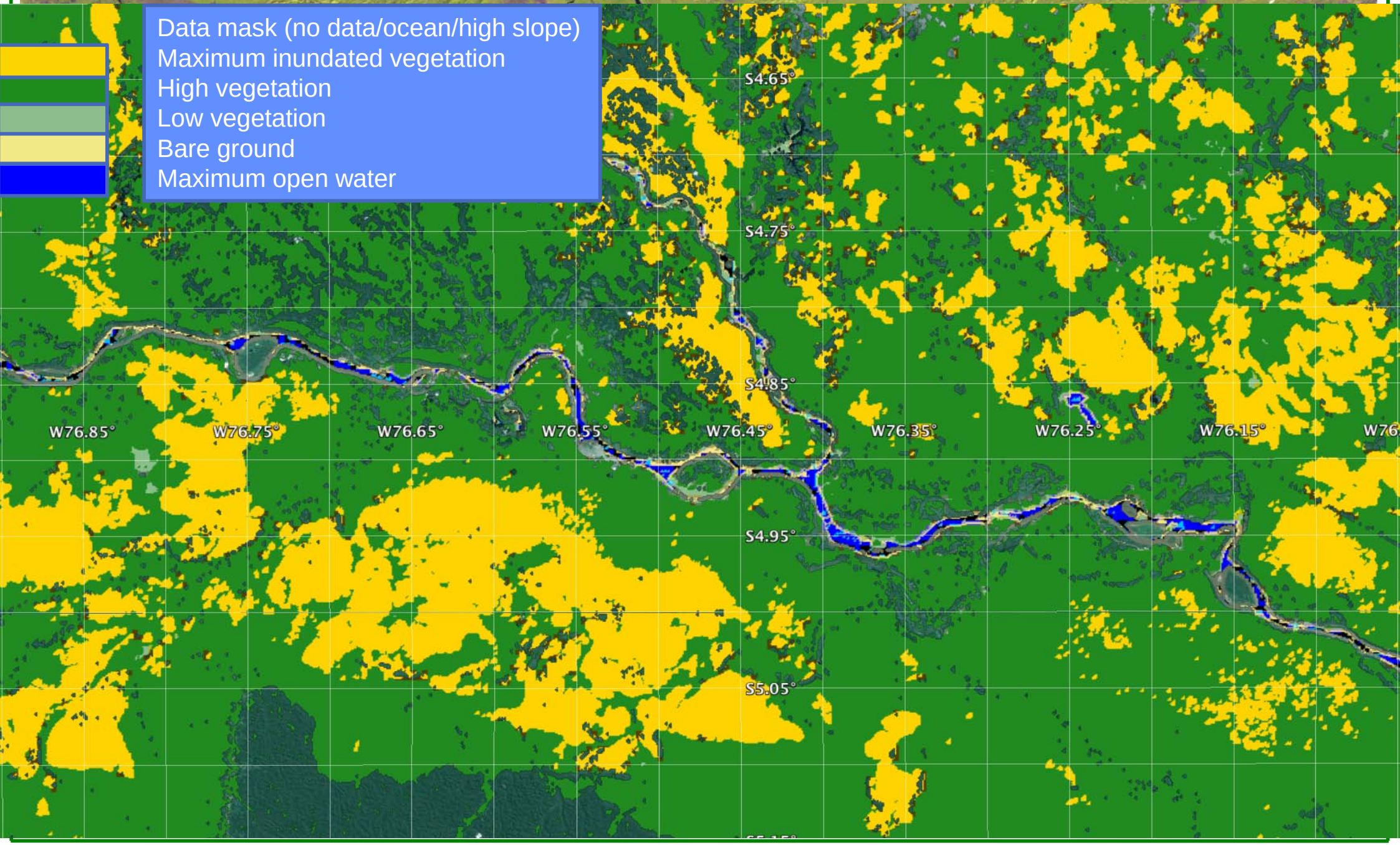

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Inundated wetlands in Rondonia

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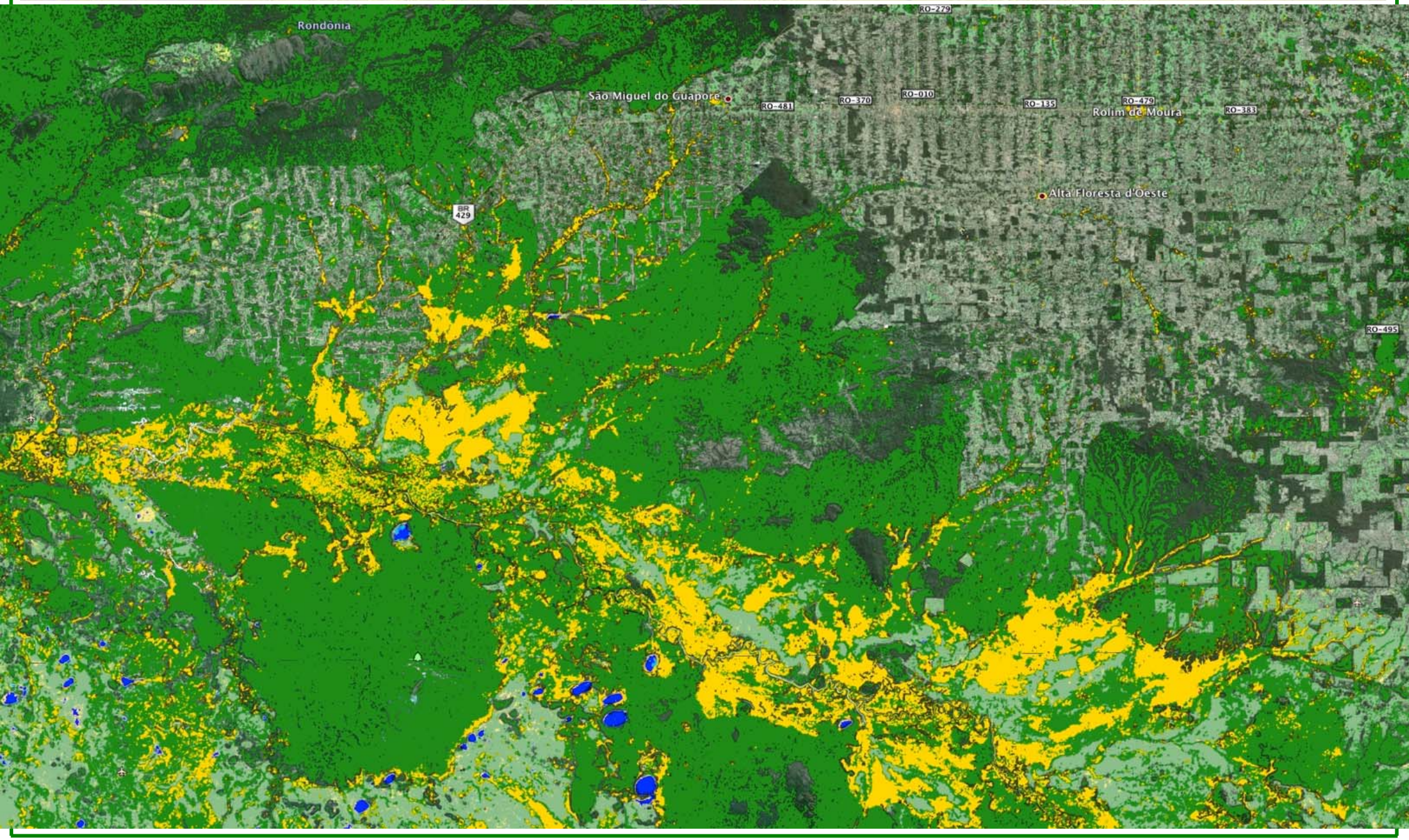
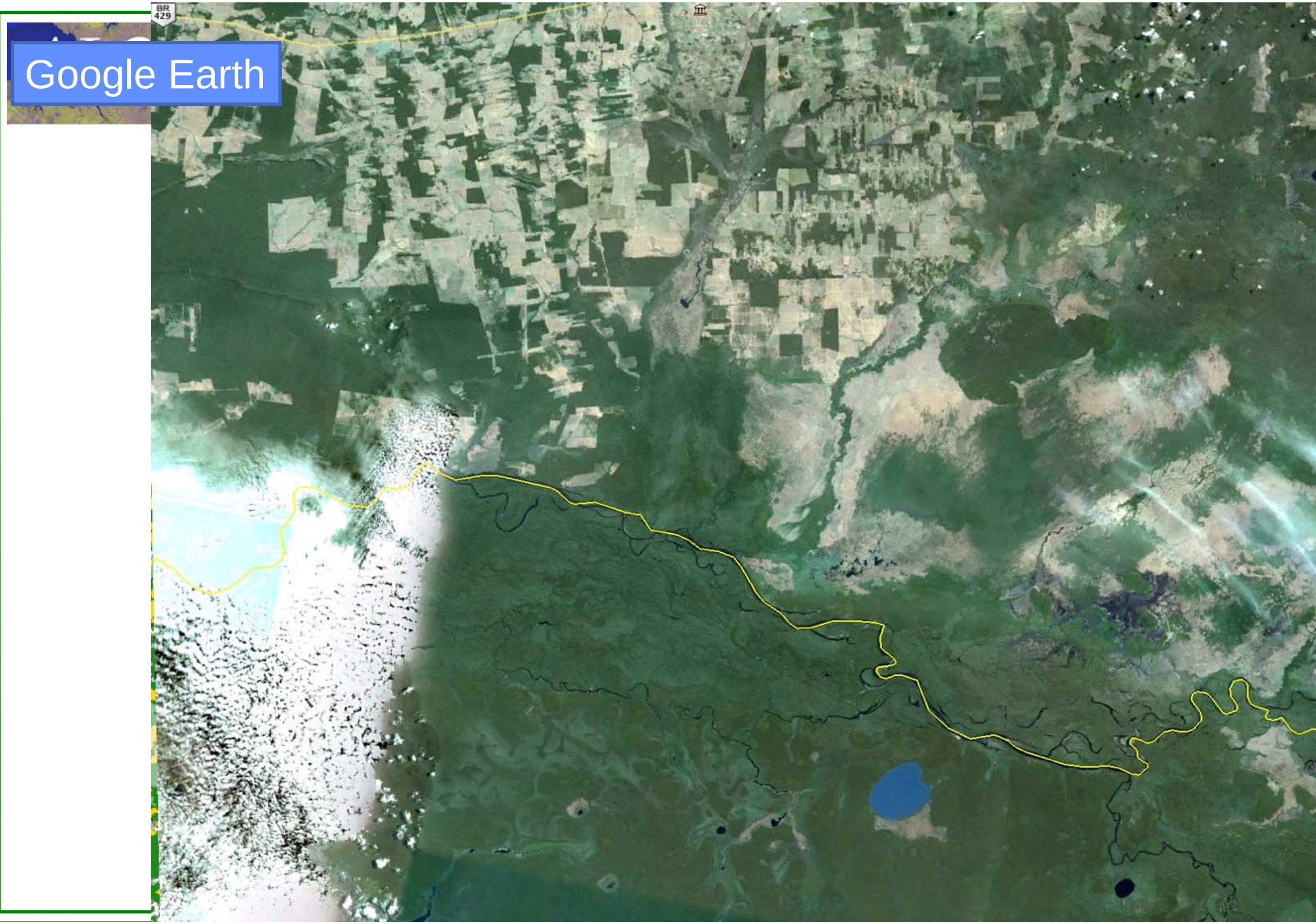
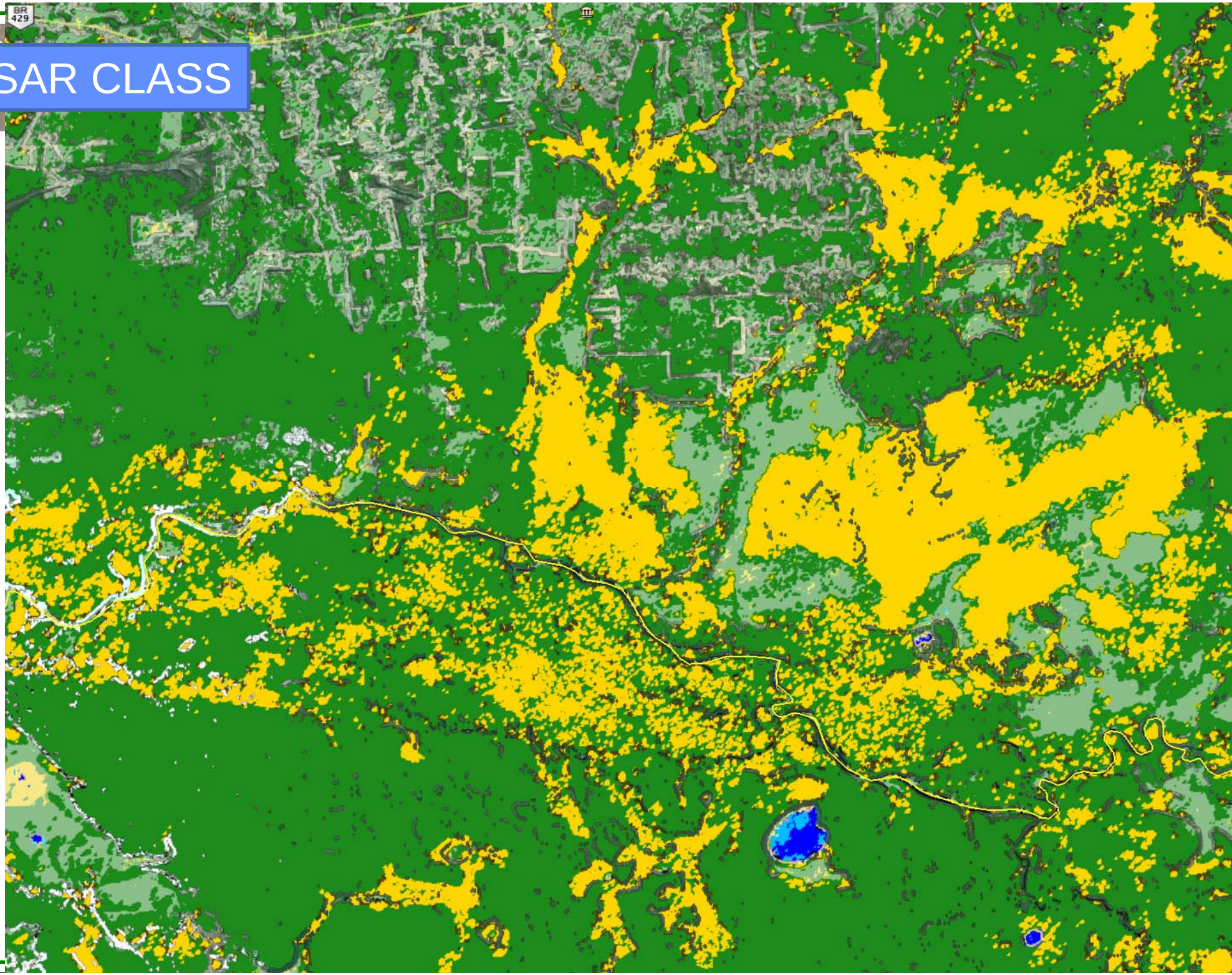



Google Earth
BR 429

SCANSAR CLASS



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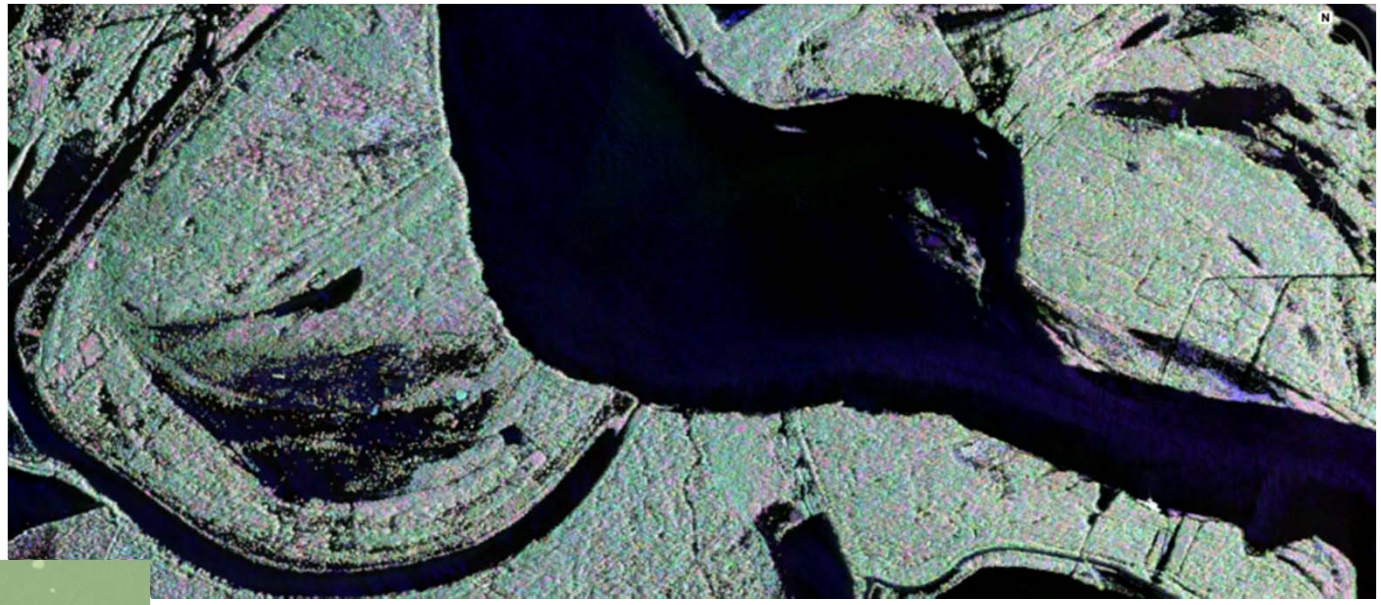
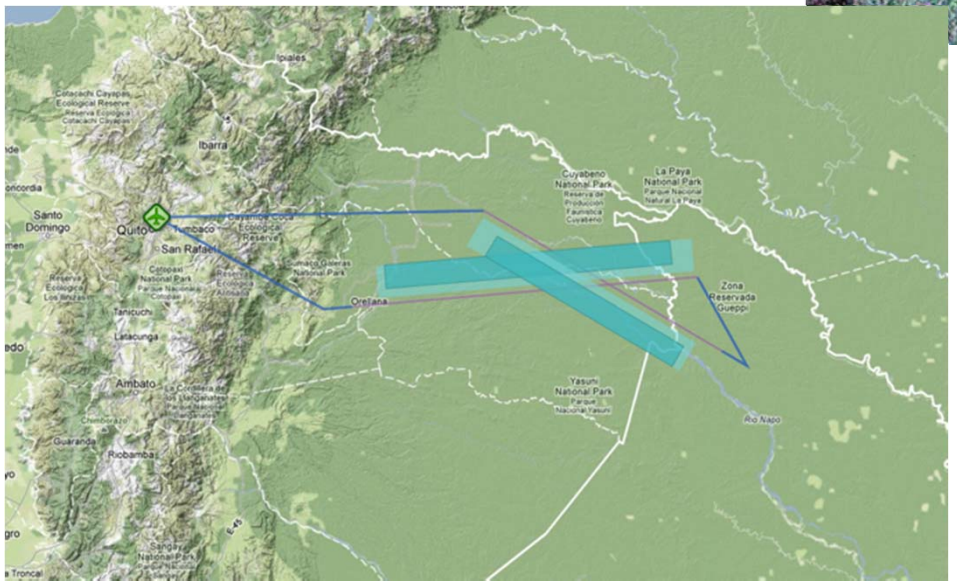
UAVSAR validation experiment

In March 2013, we conducted an experiment in Ecuador and Peru, by imaging the Napo river (which experiences very variable flooding) using UAVSAR, NASA's airborne quad pol L-band SAR.





Steve Hamilton and Jorge Celi of Michigan State will lead the field campaign simultaneous with UAVSAR observations.

- **Quantitatively verify sensitivity to inundation**

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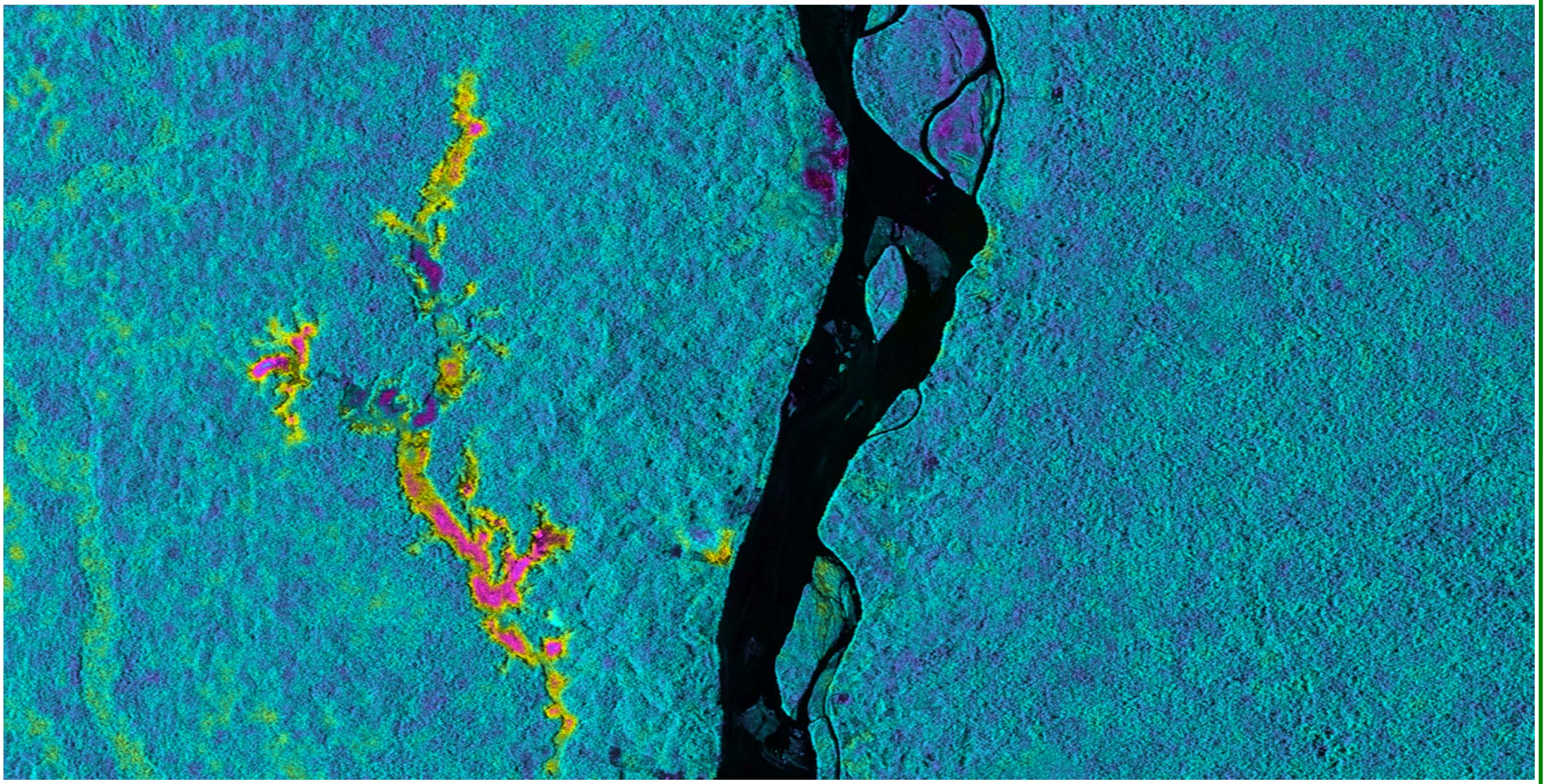
UAVSAR data collect: March 17, 2013



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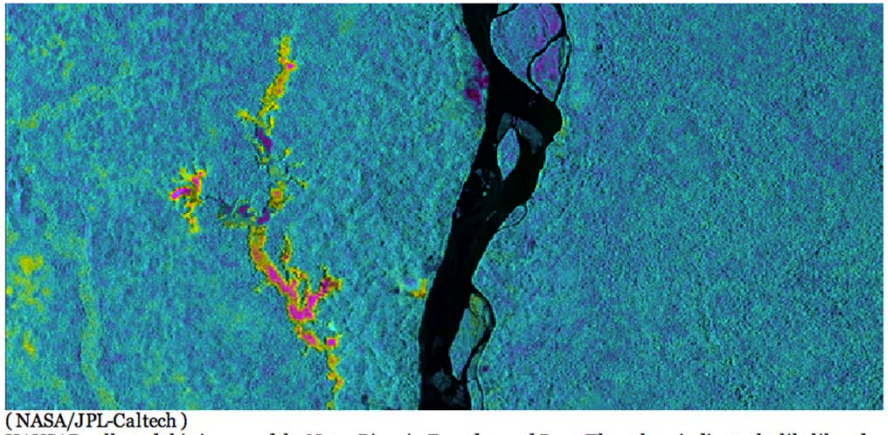
UAVSAR



(NASA/JPL-Caltech)
UAVSAR collected this image of the Napo River in Ecuador and Peru. The colors indicate the likelihood of flooding beneath the forest canopy. Red and yellow indicate areas that are likely to flood, while blue and green show areas less likely to be inundated. Black indicates the river itself.

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Project objectives and schedule

The objectives of this project is to an inundated wetland product for ALOS PALSAR SCANSAR regions with the following classes identified:

Open water

Open water/bare ground

Inundated vegetation

High slope areas masked (slope greater than 5%)

Other

Validate percentages with fractional inundation measured by lower resolution sensors.

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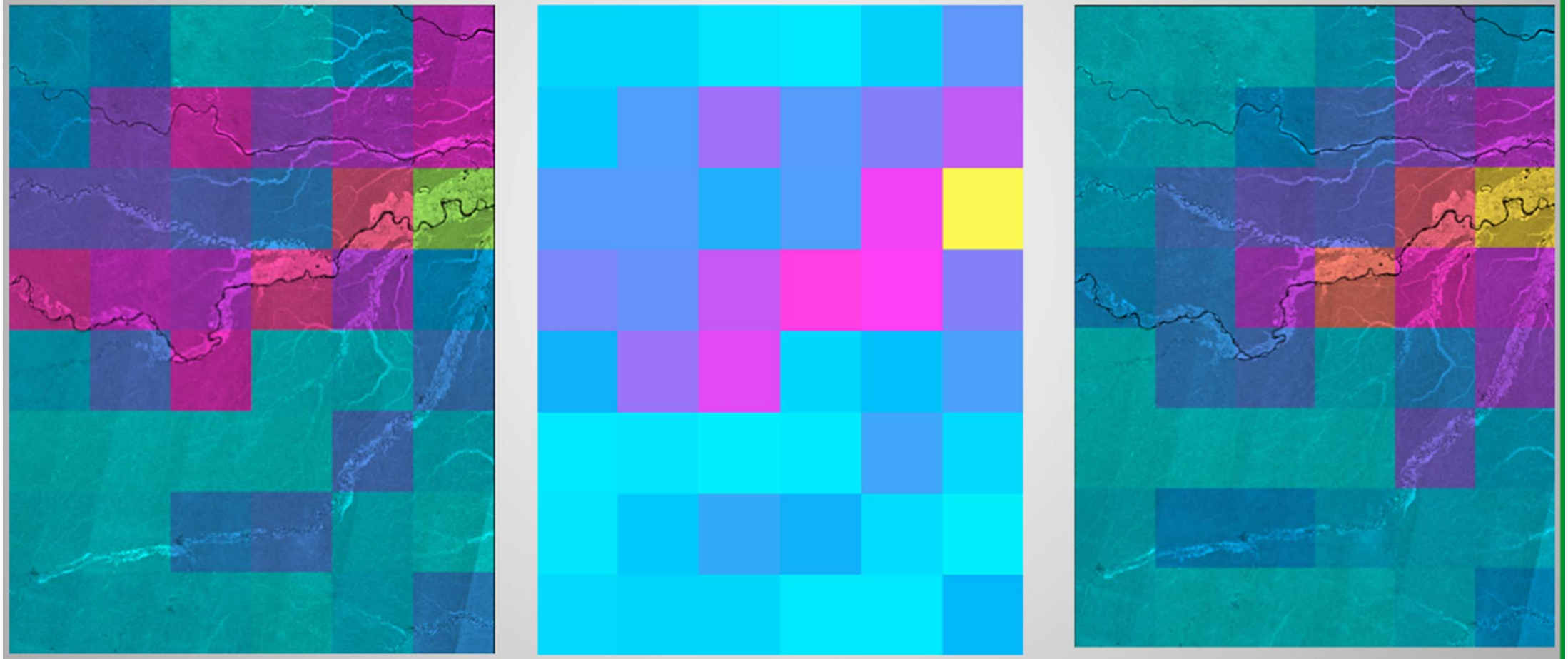
Fraction for each 1deg x 1deg cell

May-June 2007

ALOS Open Water

AMSR-E/QSCAT Open Water

ALOS Inundated Vegetation



19M

Fraction open water

0% 5%

Fraction inundated vegetation

0% 40%

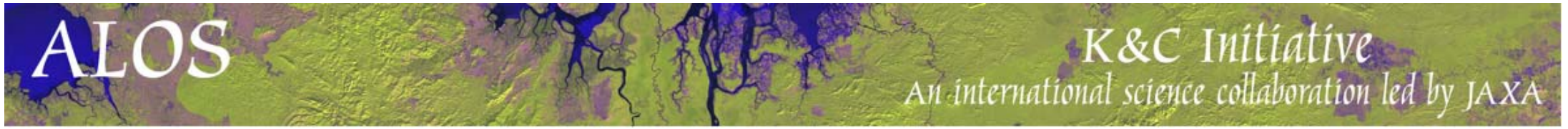
Support to JAXA's global forest mapping effort

Identification of inundated forests is a special subcategory of the global forests for which ALOS PALSAR is uniquely capable of discriminating

Deliverables

- ALOS PALSAR image mosaics
- Inundation classification
- Publication describing methods
- Biomass map delivered from co-I Saatchi.
- Field data over Napo river coincident with UAVSAR overflight has been collected, and will be delivered by the next meeting.
- Please visit our website at http://wetlands.jpl.nasa.gov to download the wetland products as they are made available.

I hope that we can work with JAXA in making these types of products with ALOS-2 data.



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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