A Wetland Mask for SARCalNet for Improved Radiometric Calibration over Natural Forest Targets

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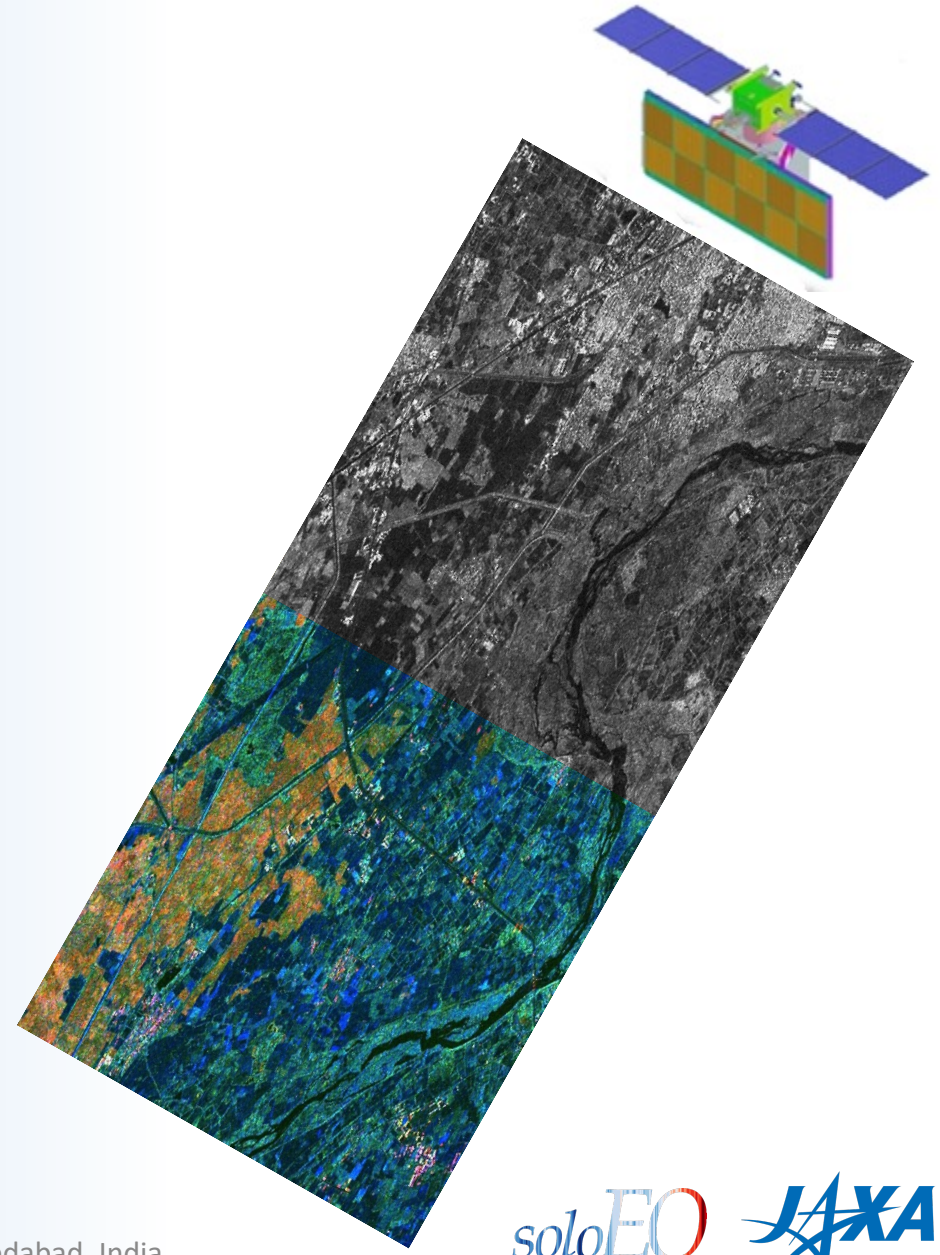
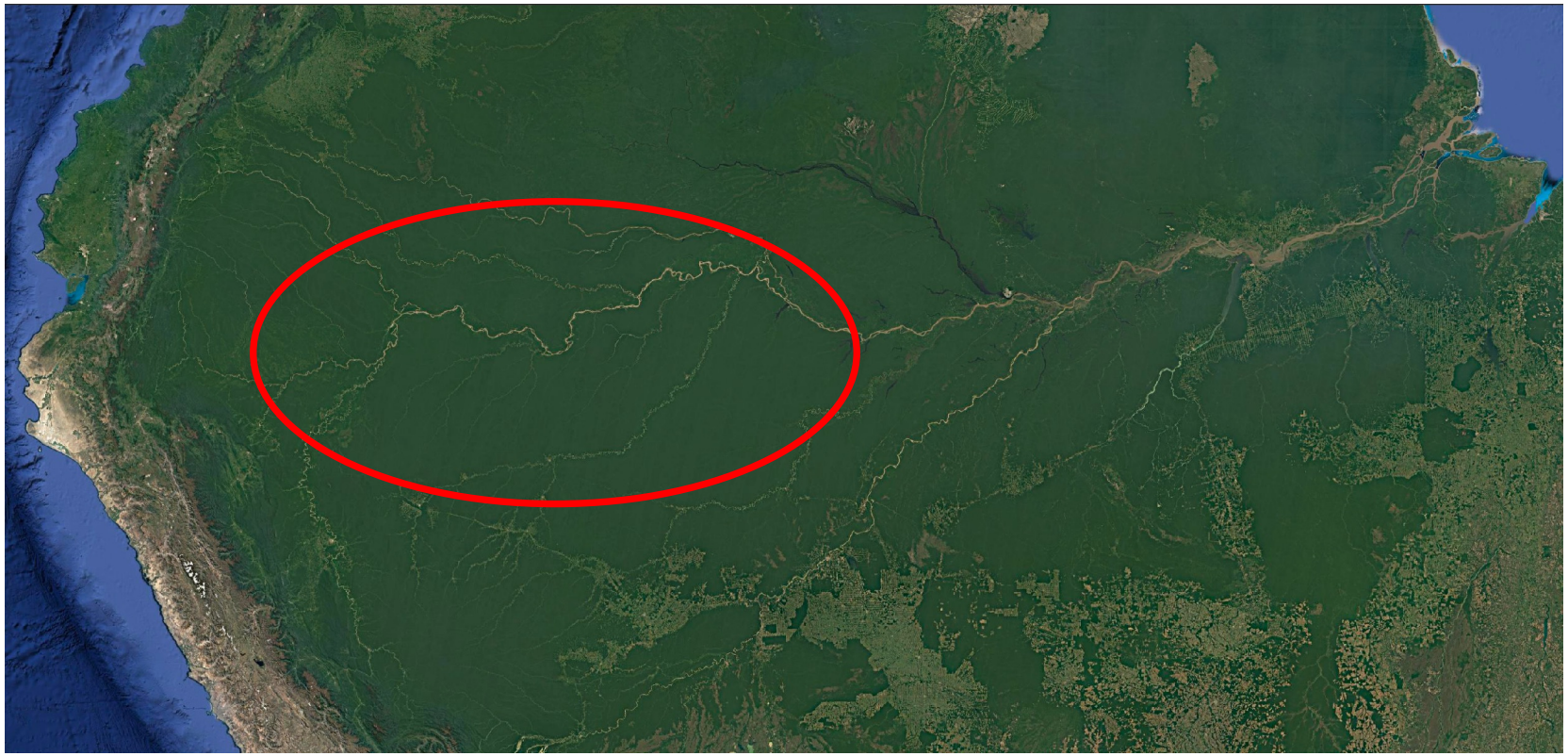
solo Earth Observation (soloEO)



A Wetland Mask for SARCalNet

- Amazon rainforest commonly used for SAR antenna calibration
- Based on the assumption that the forest is sufficiently homogeneous across the SAR range to allow for the detection of backscatter variations that can be attributed to the SAR antenna itself.



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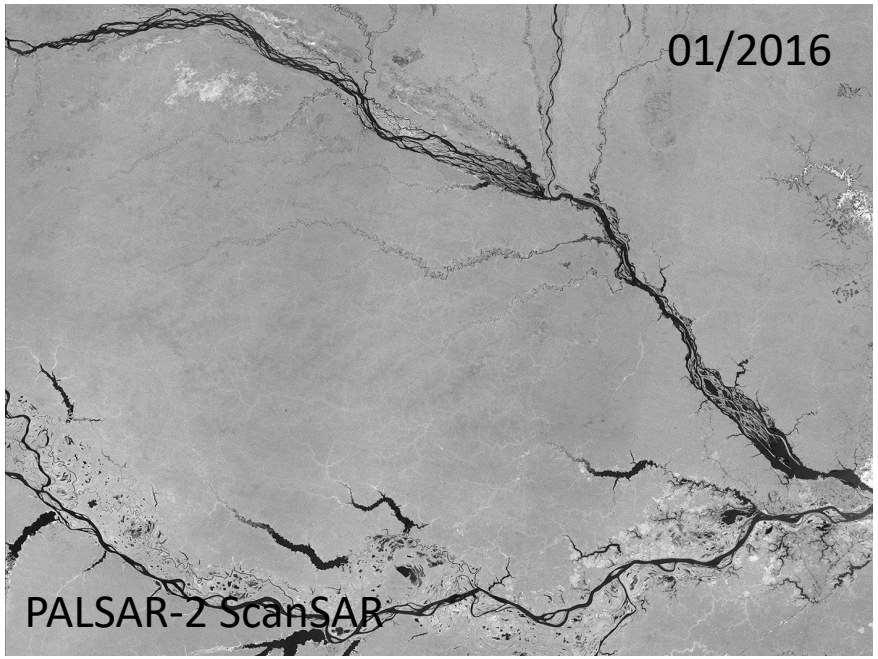
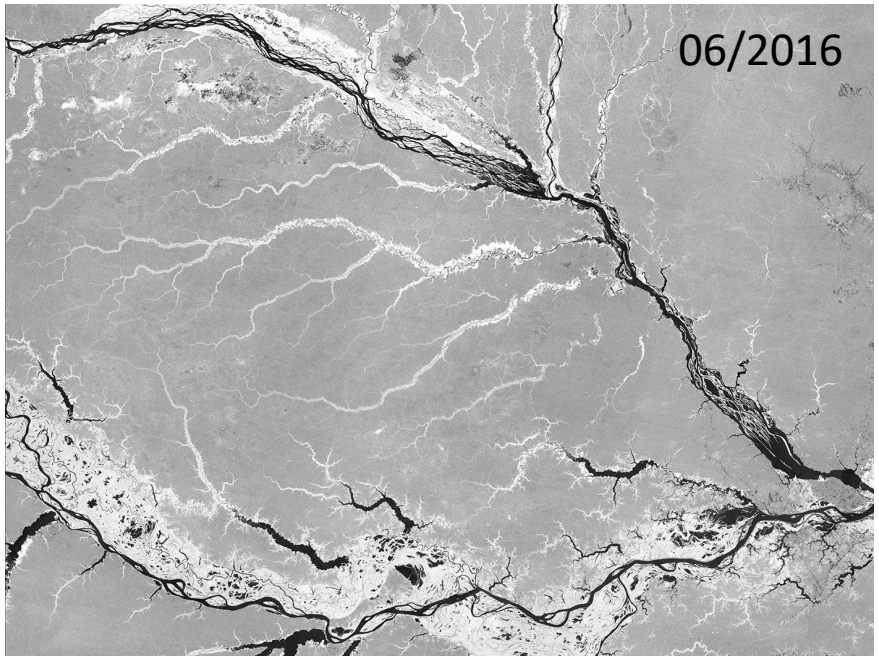
- The Amazon basin consists of both dryland (*terra firme*) forest and seasonally inundated *(varzea, igapó*) floodplain forest
- Strong co-pol dihedral backscatter, specifically at HH pol, from floodplain forest during high water season.
- Effect most prominent at longer λ (P, L), but present at all frequencies.





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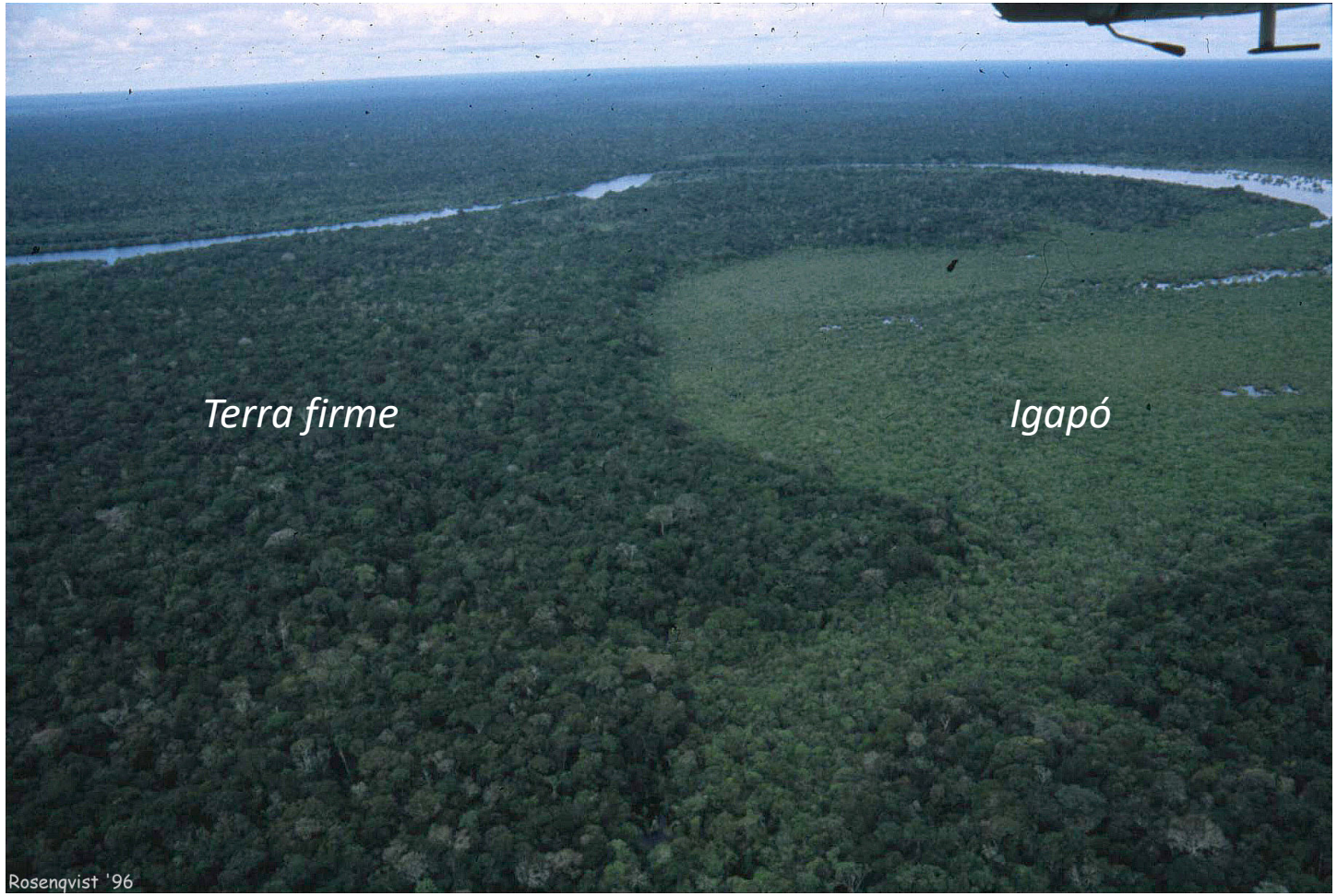
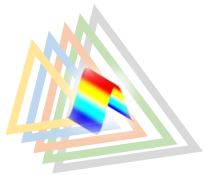
- Note that even during non-flooded conditions, the structure of *varzea/igapó* is different from that of *terra firme* forest.



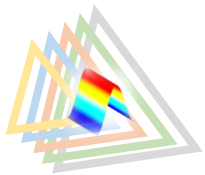
A Wetland Mask for SARCalNet

- To avoid contamination of backscatter from pixels from non-dryland forest areas, such areas need to be masked out in order for the data to be useful for calibration.
- The masks currently used are often coarse, and cover larger regions than perhaps necessary in order to safely avoid contamination from wetland pixels. Many useful dryland forest pixels may be excluded in the process.
- The use of different masks for different SAR missions also inhibits potential cross-calibration efforts between missions.



Wetland mapping at JAXA EORC

- Wetland mapping project by JAXA (EORC), soloEO and Aberystwyth University (UK), under the ALOS Kyoto & Carbon (K&C) Initiative
- Use of ALOS-2 PALSAR-2 ScanSAR time-series (2014-2024) to map Amazon and Congo river basin inundation spatial and temporal dynamics 2014-present.
- 9 pantropical ScanSAR coverages (42-day repeat) per year.
- Wetland datasets developed for other purposes (wetland conservation, climate change impacts, carbon emission estimates, etc.) but may be useful for SAR calibration.
- Simplified (binary) version generated for SARCalNet.



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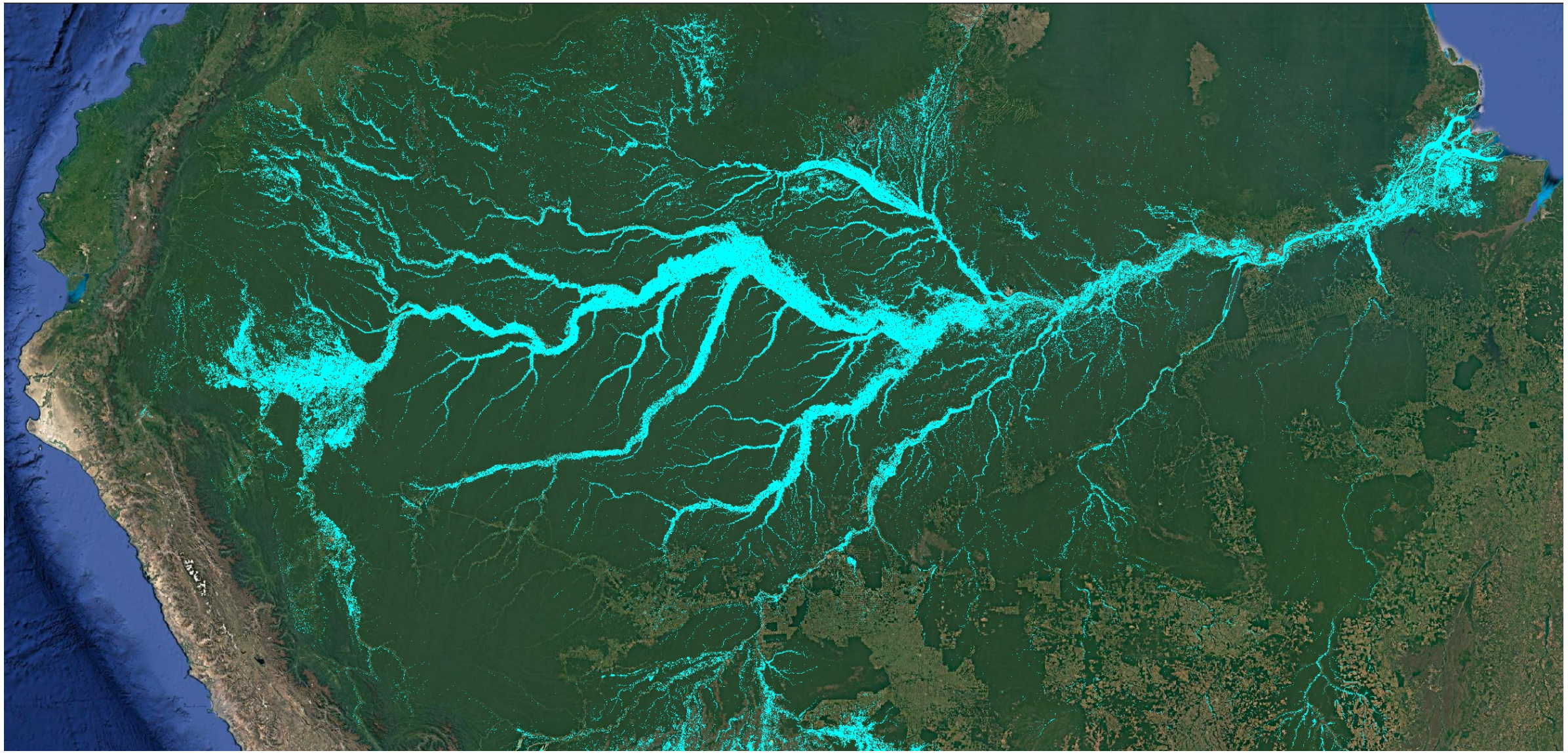
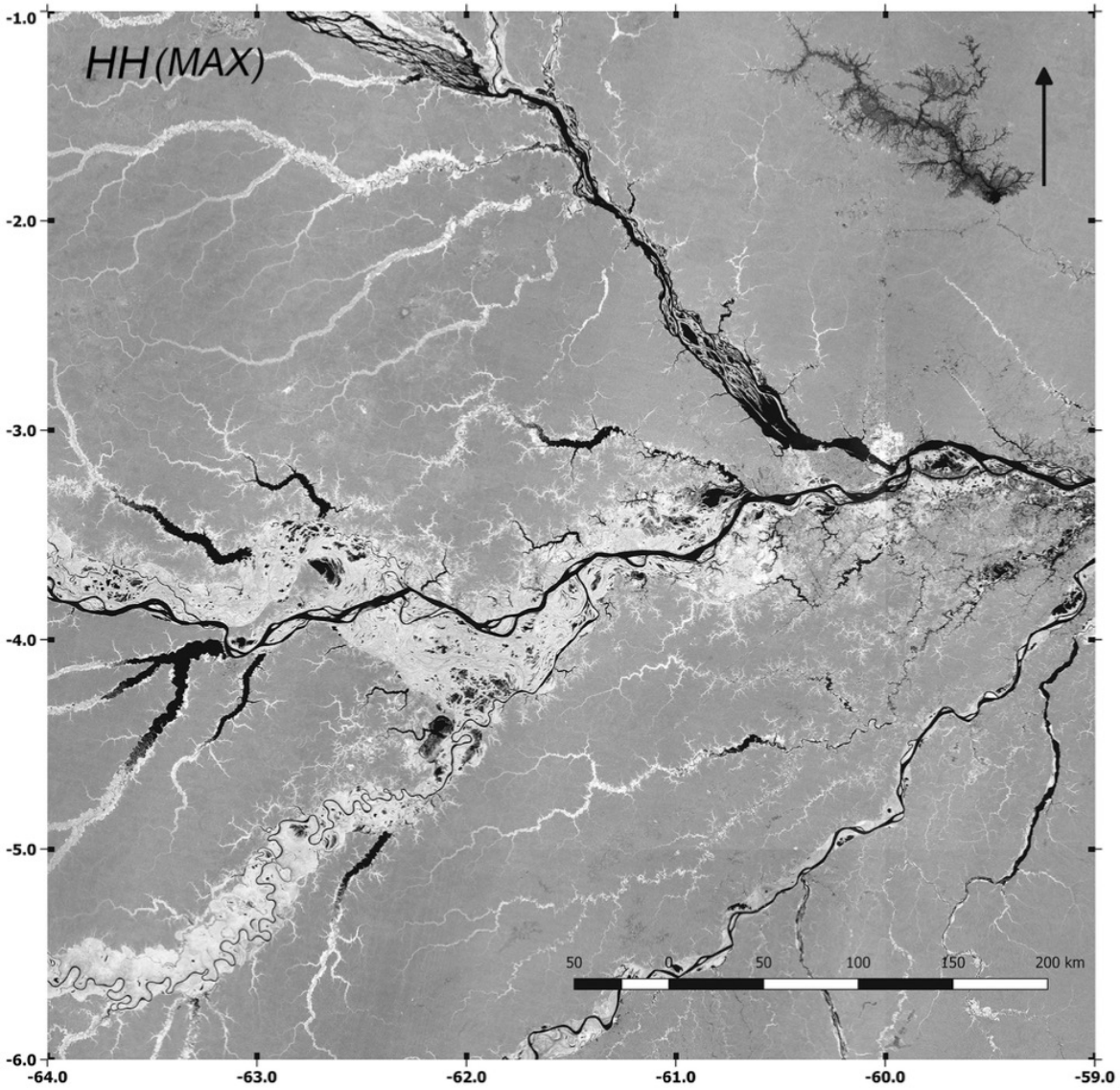
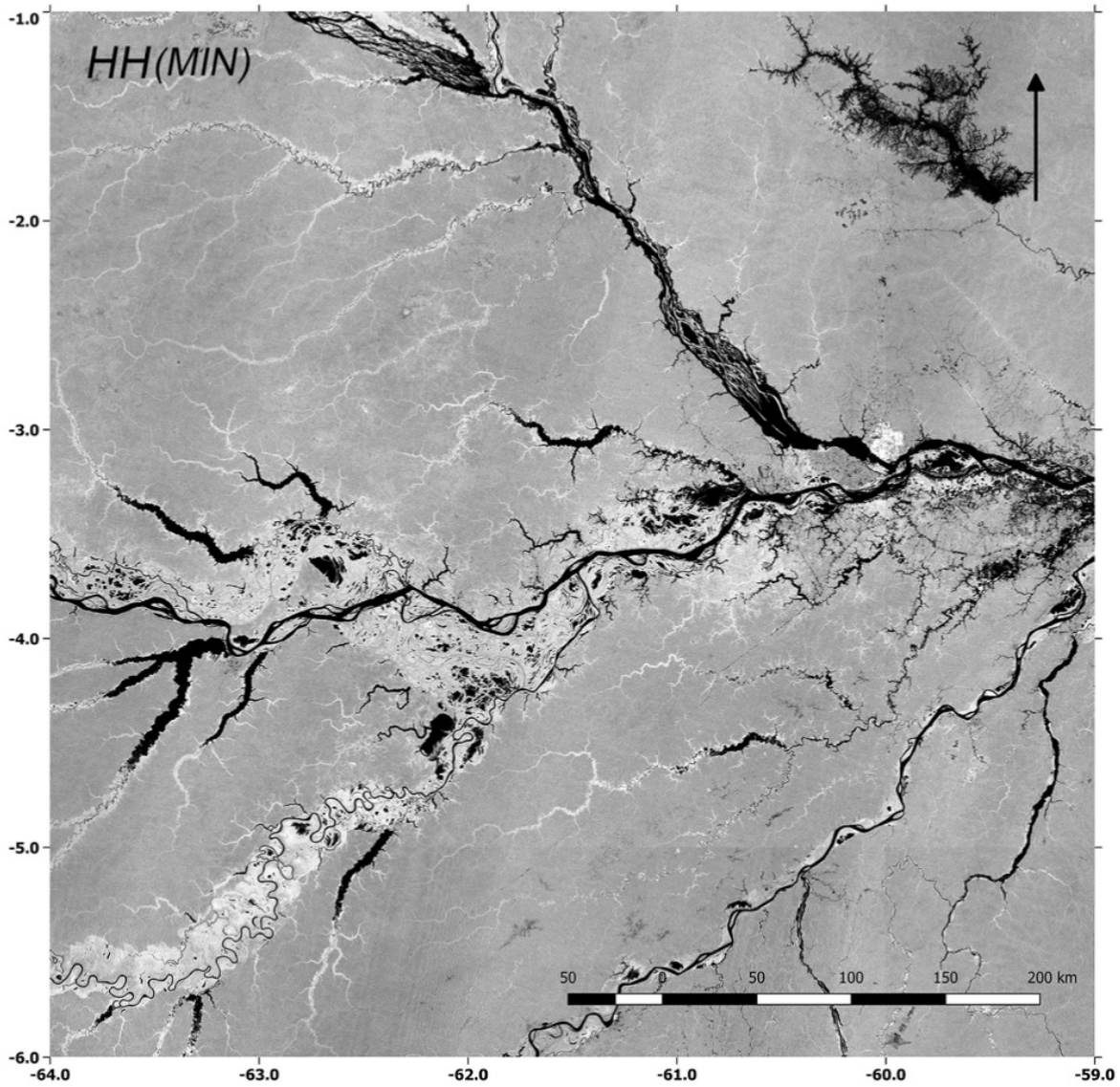


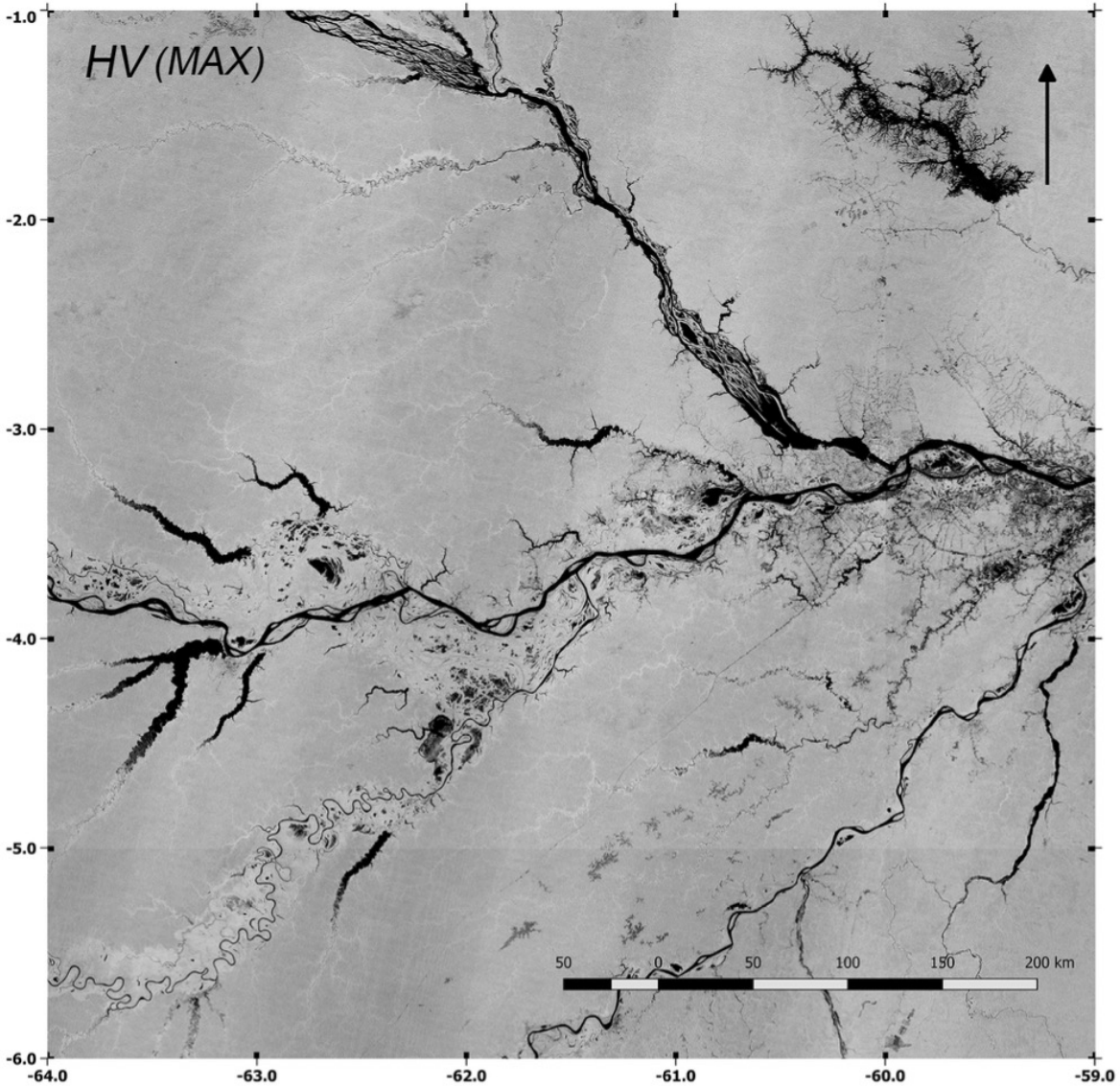
MAX and MIN inundation images generated for each hydrological year

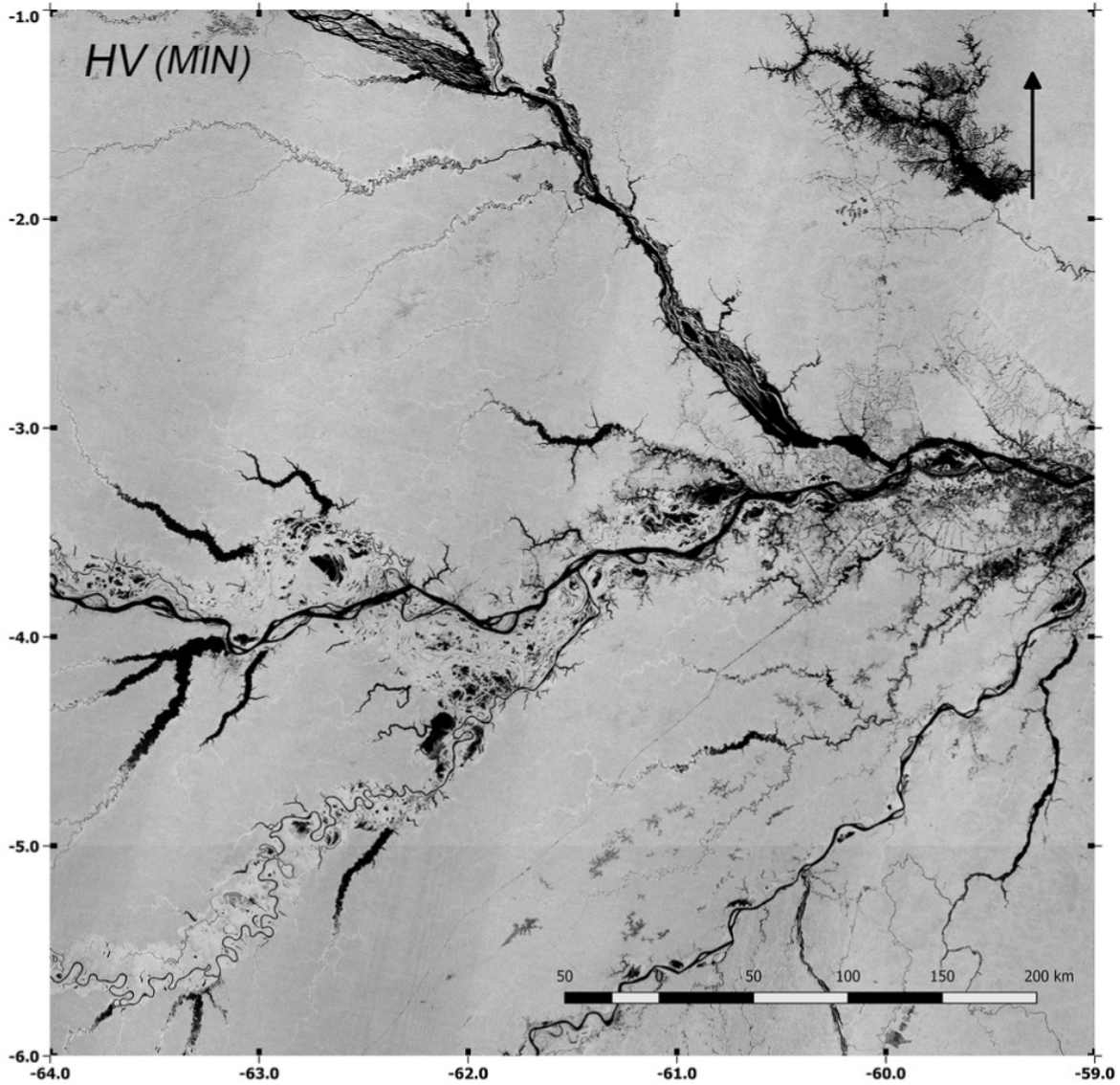




PALSAR-2 ScanSAR HH pol. Nov 2015 – Oct 2016

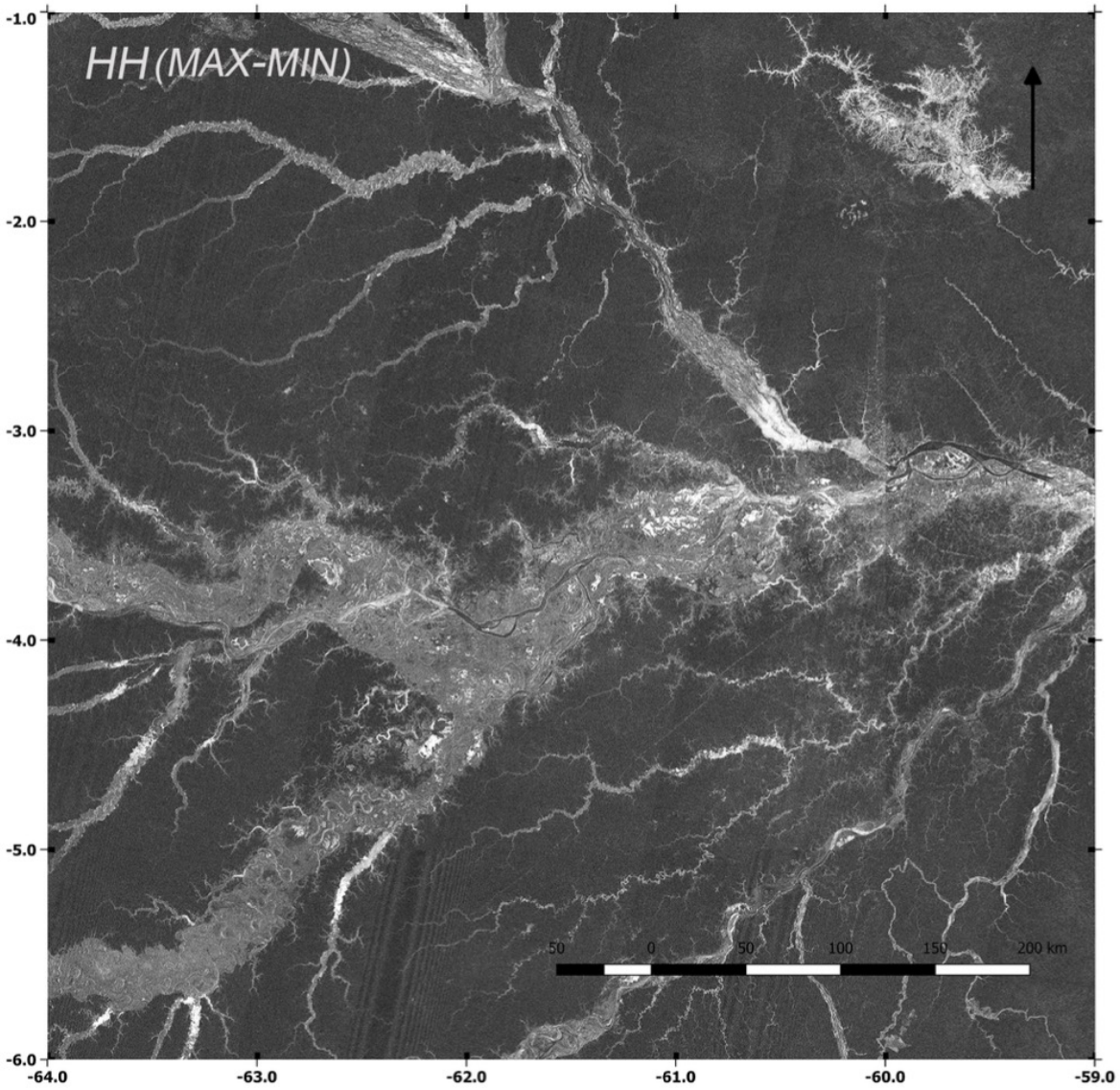
MAX and MIN inundation images generated for each hydrological year

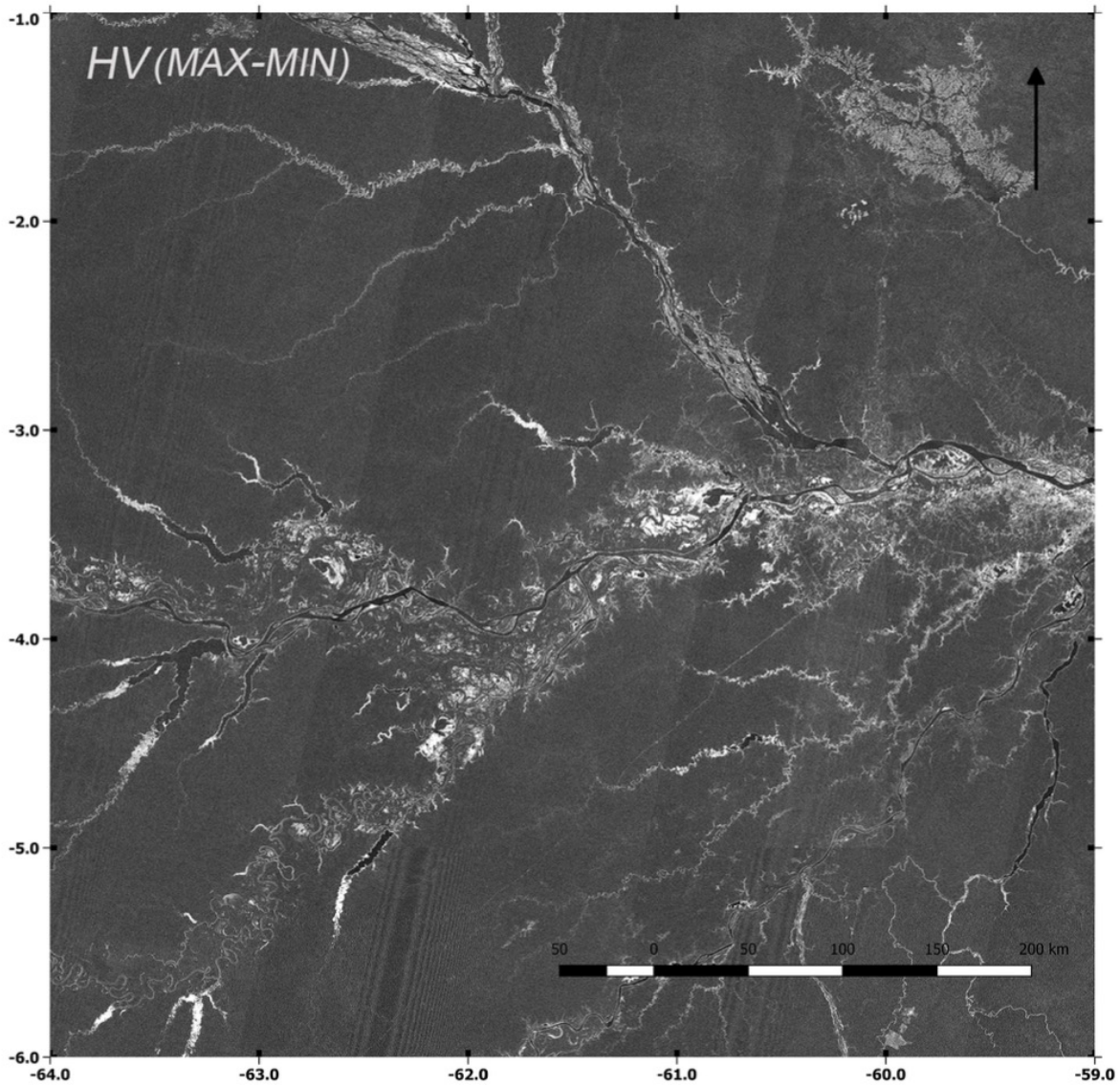




PALSAR-2 ScanSAR HV pol. Nov 2015 – Oct 2016

MAX and MIN inundation images generated for each hydrological year



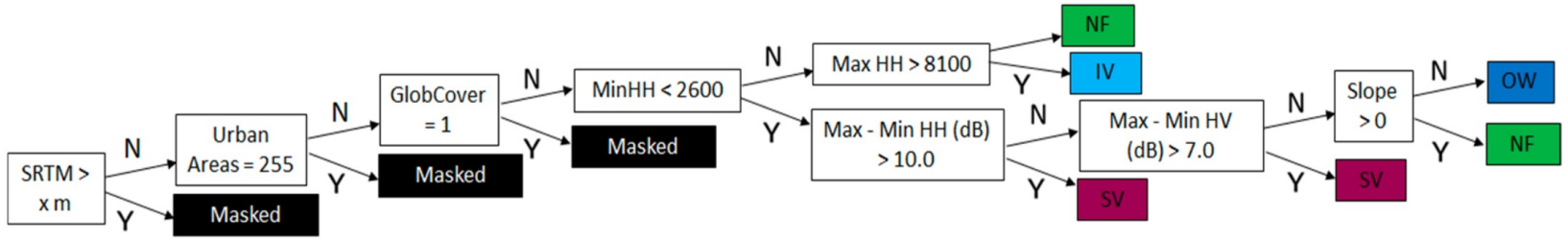


MAX-MIN diff. Nov 2015 – Oct 2016

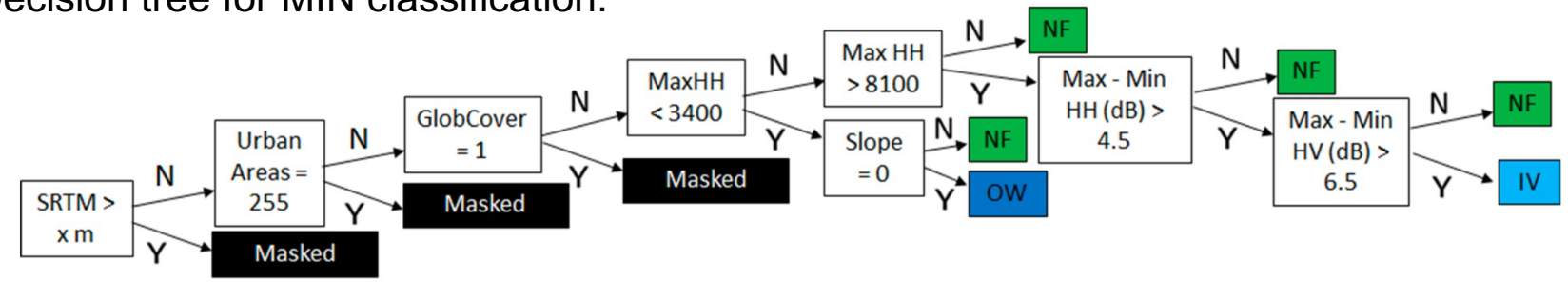
Classification approach

Decision tree classification applied for each annual dataset

Decision tree for MAX classification:



Decision tree for MIN classification:



IV: Inundated Vegetation
SV: Seasonally Submerged Veg.
OW: Open Water
NF: Non-Flooded / Other Land Cover

A Wetland Mask for SARCalNet

remote sensing

MDPI

Article

Mapping of Maximum and Minimum Inundation Extents in the Amazon Basin 2014–2017 with ALOS-2 PALSAR-2 ScanSAR Time-Series Data

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check for updates

Abstract: Seasonal inundation is an important effect that governs the distribution of ecosystems in the tropics. In the Amazon Basin, the seasonal flood pulse causes a difference in high and low water levels that can exceed 15 m. The associated flood duration and extent play an important role in land-atmosphere carbon exchange and affect the ecosystem's carbon pool that originates from organic matter transported from upland and flooded forests. Studies of wetlands inundation across the Amazon Basin have utilized dual season mosaics from JERS-1 and wide-swath ScanSAR data from ALOS PALSAR to characterize inundation across the basin. This study builds upon past efforts with JERS-1 and ALOS PALSAR and uses ALOS-2 PALSAR-2 ScanSAR data to generate annual maximum and minimum inundation extent maps over the full Amazon Basin for the period spanning November 2014–October 2017. The study uses decision tree classification to create a maximum and a minimum inundation extent map for each year over this time period. The results show that a generalized algorithm that fits the entire basin has an 86% overall accuracy compared with a classification made for a local region from the same PALSAR-2 datasets. Comparisons with previous full-basin inundation maps by other L-band radars shows similar results for inundated areas during maximum inundation. The maps derived previously from JERS-1 and ALOS PALSAR show 7.3% and 6.9% inundated vegetation, respectively, and this study using PALSAR-2 shows values ranging between 5.5% and 7.0% across the three study years. Comparisons between the stage data across the basin and acquisition dates/periods for JERS-1 and PALSAR-2 show that the sensors capture the nature of the maximum and minimum flooding across the basins but have not successfully captured the exact maximum and minimum flood levels that have been recorded in the stage data. The inundation maps are publicly available under a Creative Commons (CC BY 4.0) licenses from the Alaska Satellite Facility.

Keywords: SAR; inundation; decision tree classification; Amazon; wetlands

1. Introduction

The Amazon Basin covers an area of approximately six million km^2 and is a host to vast wetlands, complexes and biodiversity richness with the meandering of rivers creating a mosaic of habitats. River meandering and its effects on flood regimes and water and soil qualities result in varying distributions of species and habitat composition. The biotic interactions in river-floodplain systems within the basin are driven primarily by the seasonal flood pulse phenomenon [1,2]. This annual pulse moves from the west in the Andes eastward to the Amazon delta over the course of several months and results in

https://doi.org/10.3390/rs12081326

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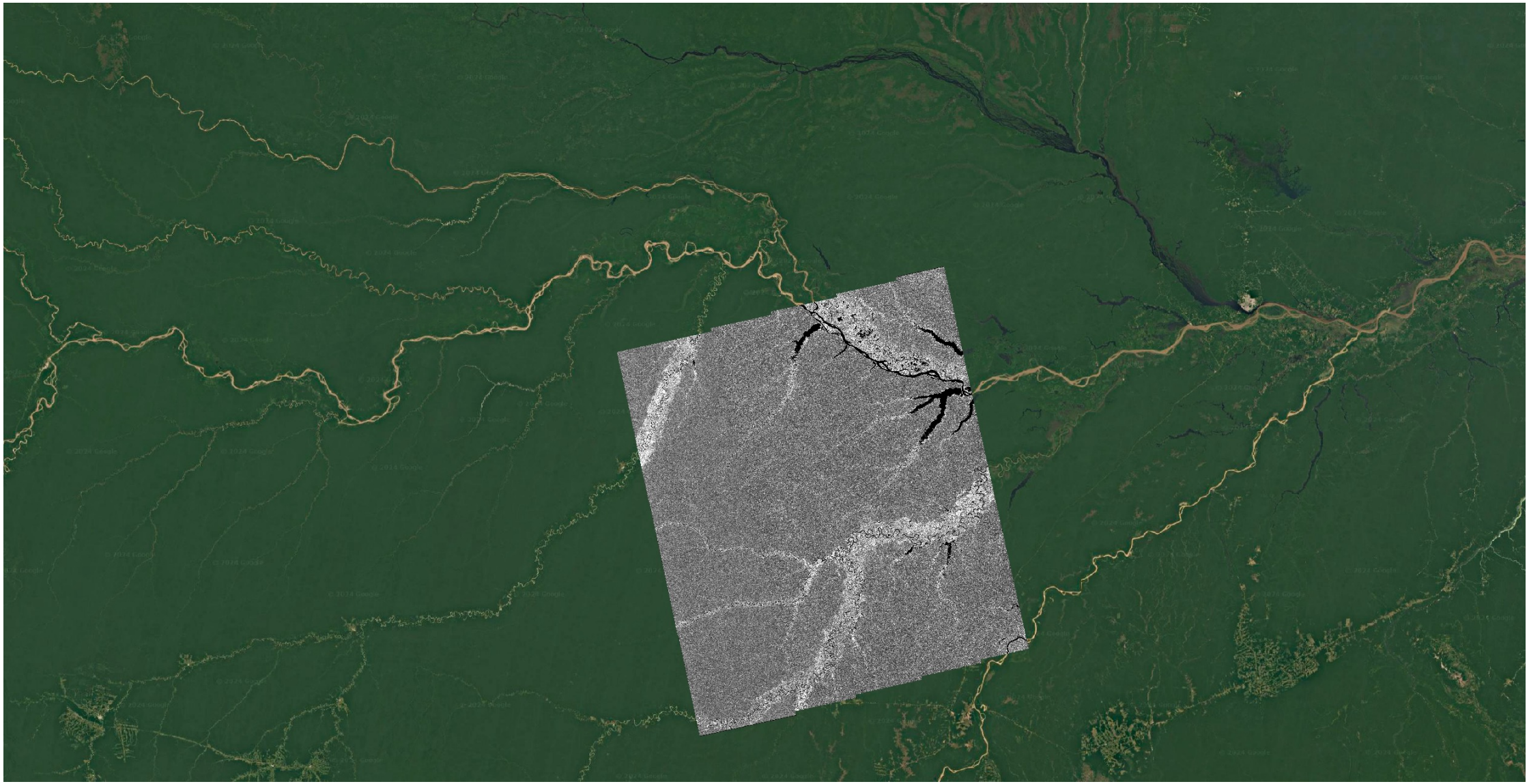

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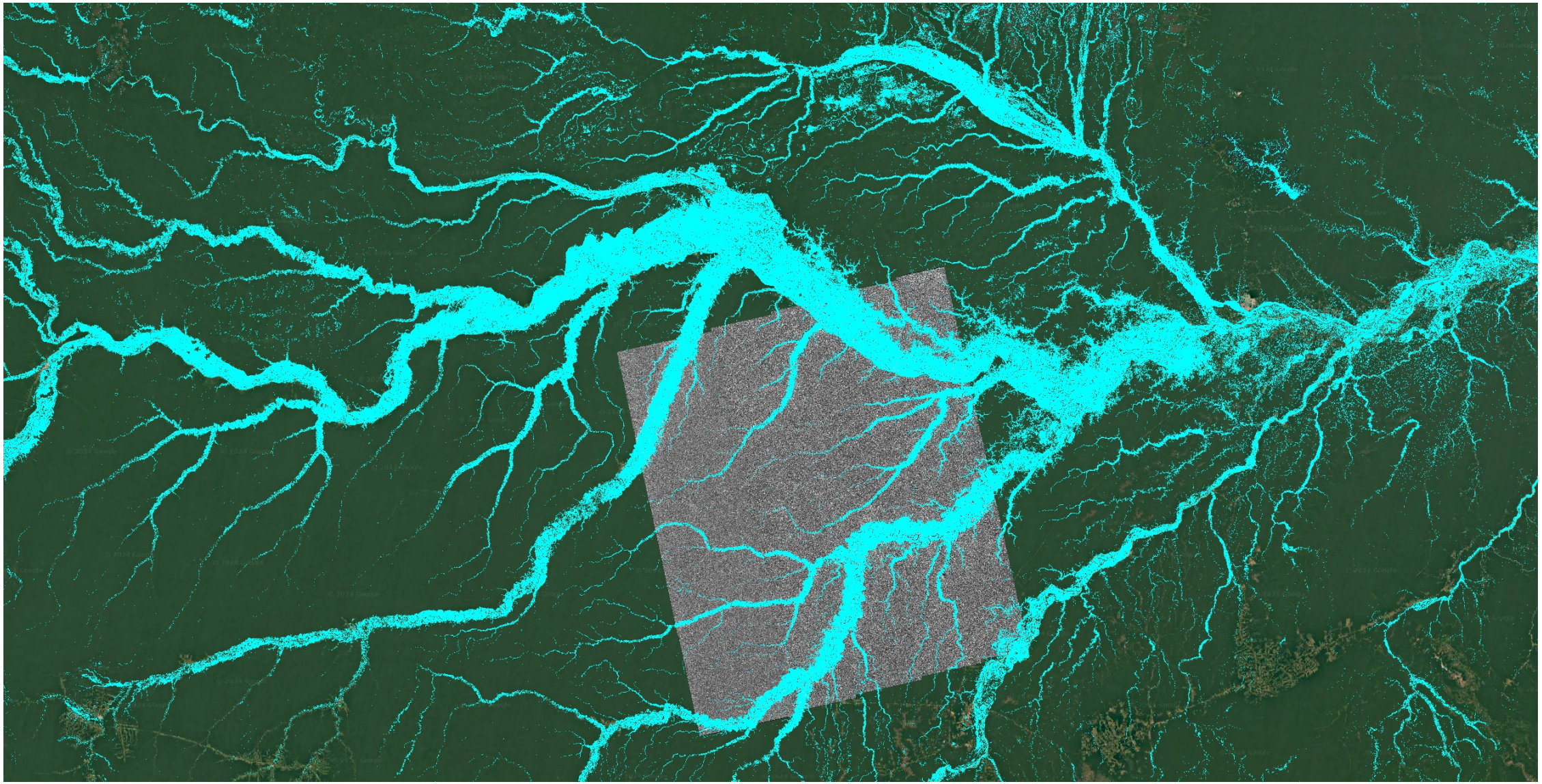

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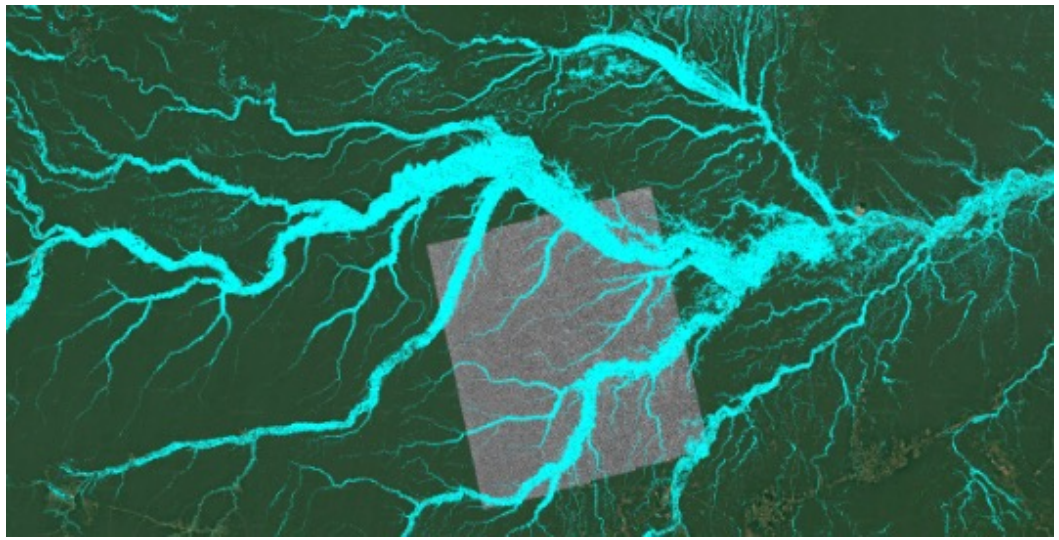
Dataset description:

- Name: Amazon MAX Wetland Mask 2014-2017
- Geographical coverage: Amazon river drainage basin (Brazil, Colombia, Ecuador, Peru, Bolivia)
- Input data: PALSAR-2 ScanSAR, Nov 2014 – Oct 2017 (3x9 obs. coverages)
- Projection: Geographical coordinates, WGS84 (EPSG 4326)
- Pixel spacing: 50 m (1.6 arcsec)
- File format: GeoTiff, binary
  - 1 – seasonally inundated wetlands; [pixel classified as inundated in at least one PALSAR-2 observation in the time-series]
  - 0 – Any other land cover
- File size: 4 GB (35 MB zipped)



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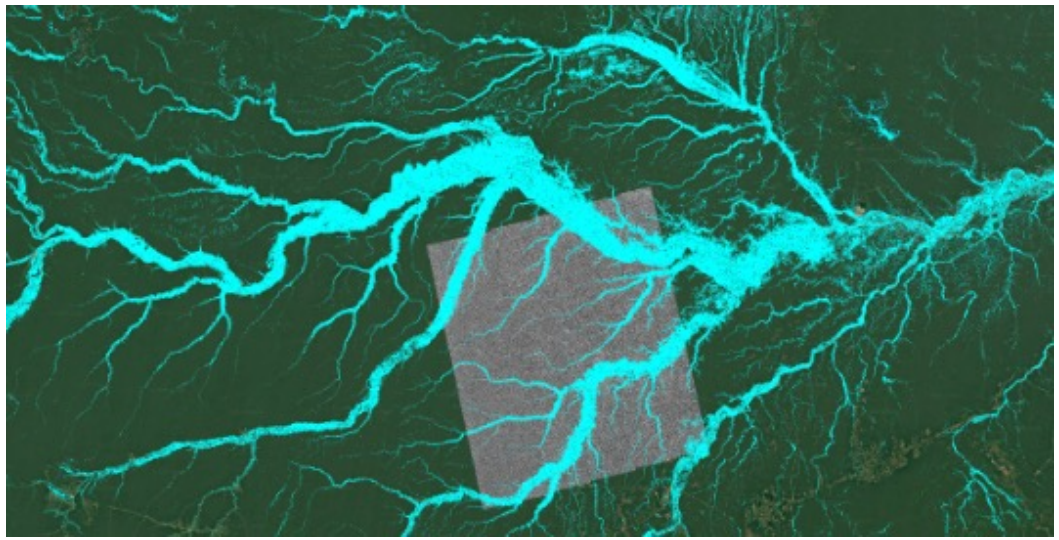
Ongoing developments

- Application to full 2014 - 2024 archive; ALOS-4 PALSAR-3 from 2025+
- Annual flood duration (pixel value associated with duration of inundation)
- 25 m (0.8 arcsec) pixel spacing

Possible refinements –

if deemed of relevance for SARCalNet

- Open water mask
- Minimum inundation mask
- Forest/non-forest mask
- …



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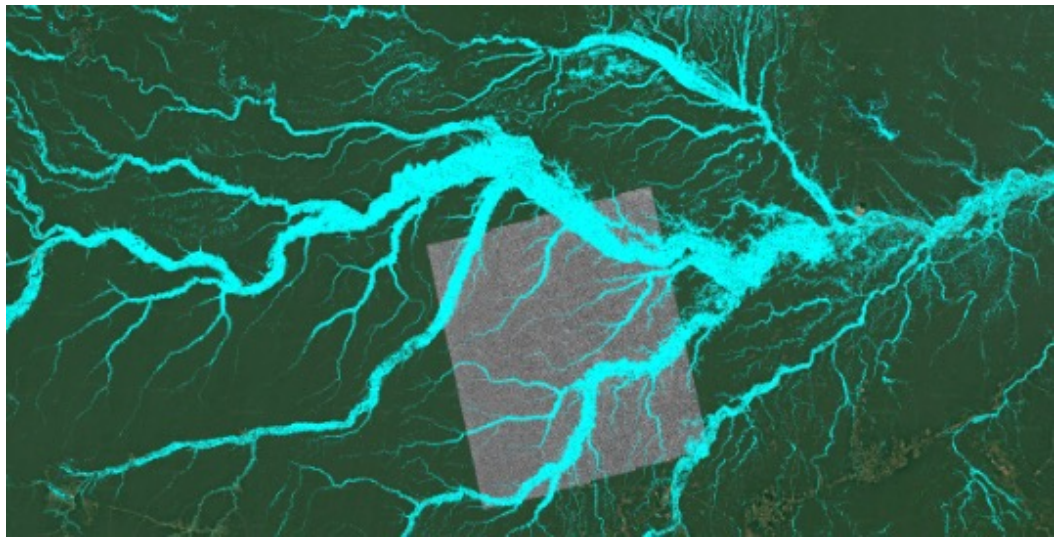

धन्यवाद Thank you.