KC#27 Project Report

Combined Use of ALOS-3 and ALOS-4 Data Sets for Monitoring Agricultural Expansion in the Brazilian Cerrado and Amazon

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K&C Science Team meeting #27
Tokyo, Japan, November 5-11, 2023

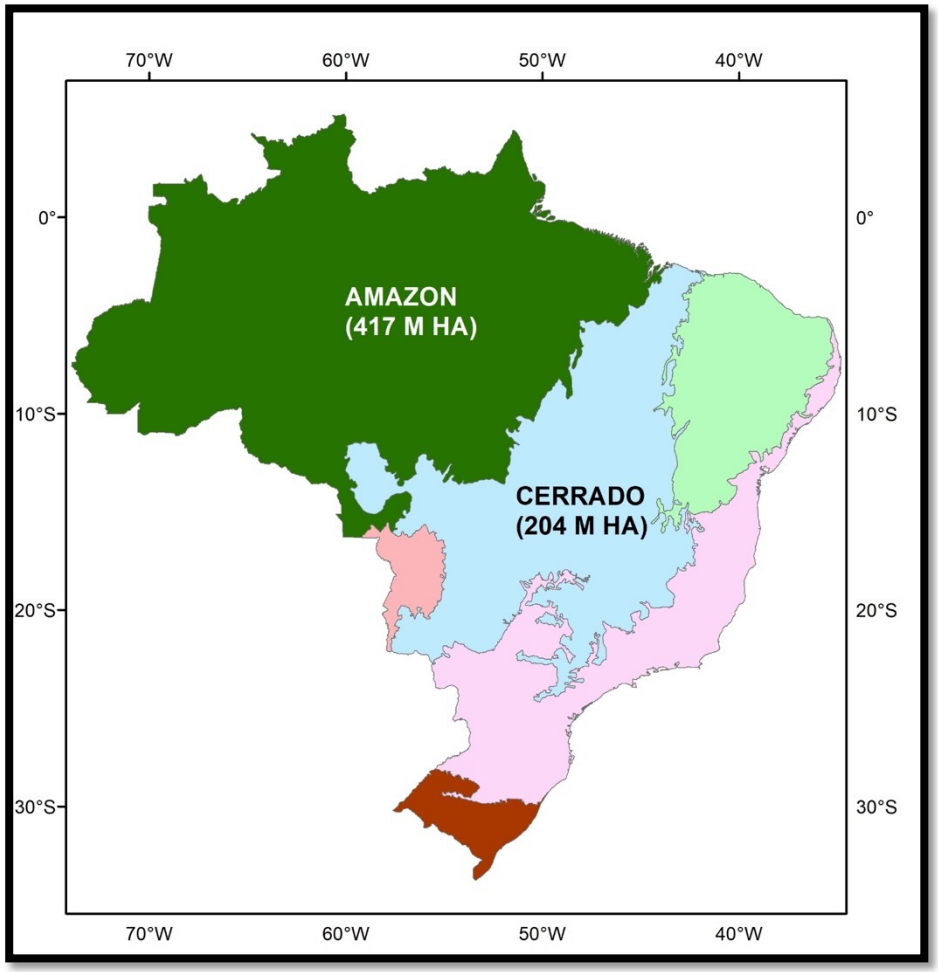
Project outline and objectives

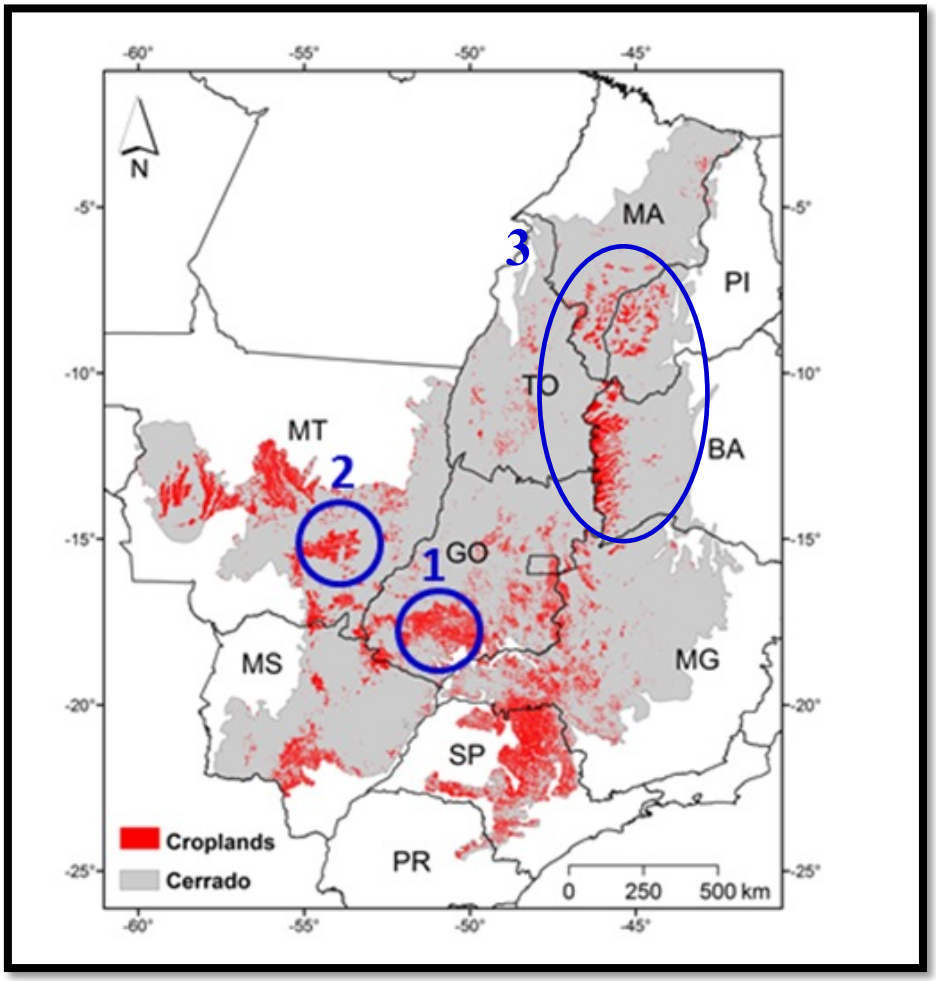
Project objective:

To analyze the potential of combined use of ALOS-3 and ALOS-4 data sets to monitor the agricultural expansion in the Brazilian Cerrado and Amazon (so far, not reached)

Project areas:

Consolidated and new agricultural frontiers in the Brazilian Cerrado and ecotone between Cerrado and Amazon regions





1 = old agricultural frontier (Cerrado)

2 = old agricultural frontier (Cerrado/Amazon ecotone)

3 = newest agricultural frontier (MATOPIBA)

Methods

ALOS-2 and ALOS-4 data processing to monitor double cropping system (Sigma0, polarimetric decomposition, GLCM textural features)

ALOS-3 data processing to identify pastures with different degradation levels (reflectance data, vegetation indices, linear mixture model)

Validation: field data and PlanetScope monthly mosaics from NCIFI.

IEEE GEOSCIENCE AND REMOTE SENSING LETTERS, VOL. 19, 2022 1001805

Performance of Speckle Filters for COSMO-SkyMed Images From the Brazilian Amazon

Tahisa N. Kuck, Luis D. Gomez, *Senior Member, IEEE*, Edson E. Sano, Polyanna da C. Bispo, and Douglas D. C. Honório

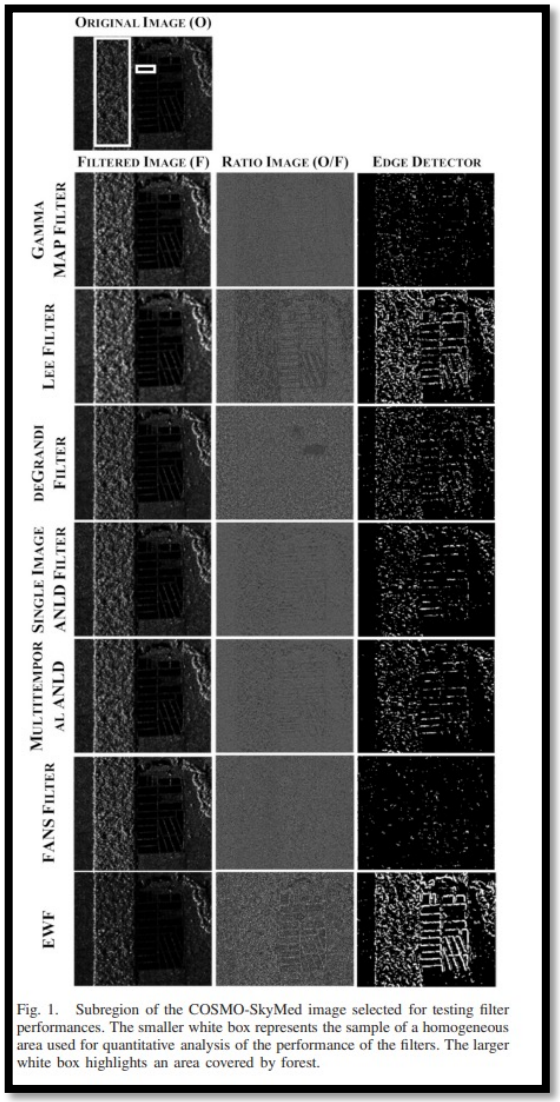


Fig. 1. Subregion of the COSMO-SkyMed image selected for testing filter performances. The smaller white box represents the sample of a homogeneous area used for quantitative analysis of the performance of the filters. The larger white box highlights an area covered by forest.

- Lack of speckle-free images for comparison
- Most of the judgments are based on visual analysis
- Good filter should preserve mean value, reduce variance and do not add artifacts (borders and shadings)
- Seven filters were evaluated with $\alpha.\beta$ estimation approach (goal: $\alpha.\beta = 0$)
- Best filter: Gamma Map

COSMO-SkyMed, Sentinel-1, ALOS-4

Bussinger, J.; Baptista, G.M.; Sano, E.E.; Leal, F.A. Understanding the spatio-temporal behavior of Sentinel-1 SAR vegetation indices over the Brazilian savanna. IEEE Trans. Geosci. Remote Sens. 2023 (under review).

Data sets:

149 Sentinel-1 SLC and GRD scenes (2017-2021)

Sigma0 and H-α polarimetric decomposition

SAR vegetation indices:

Dual-pol radar vegetation index (DpRVI)

Polarimetric radar vegetation index (PRVI)

Radar vegetation index (RVI))

Dual-pol)

Modified dual-pol SAR vegetation index (DPSV

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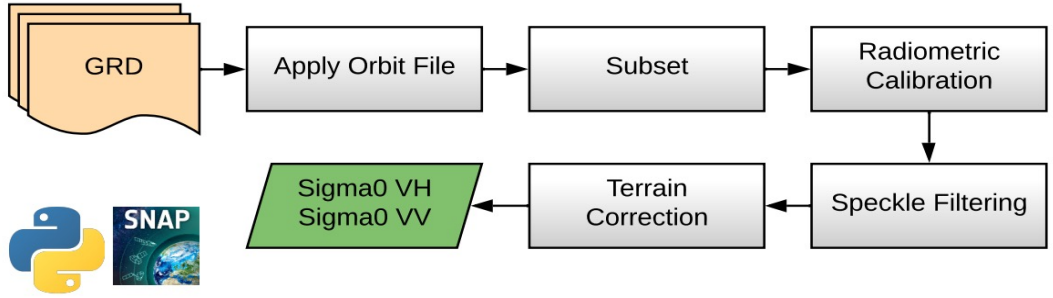

SAR vegetation indices:

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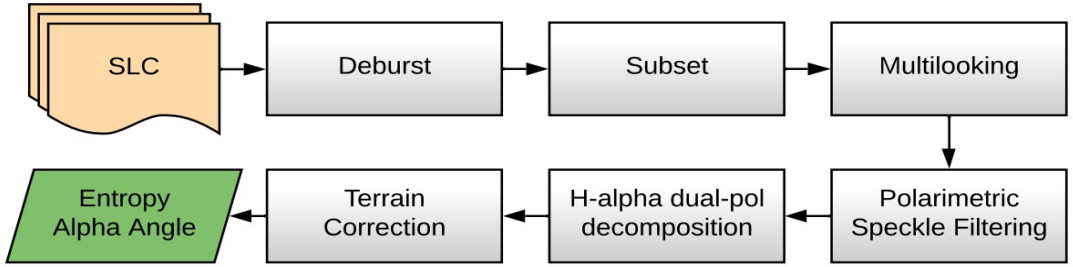
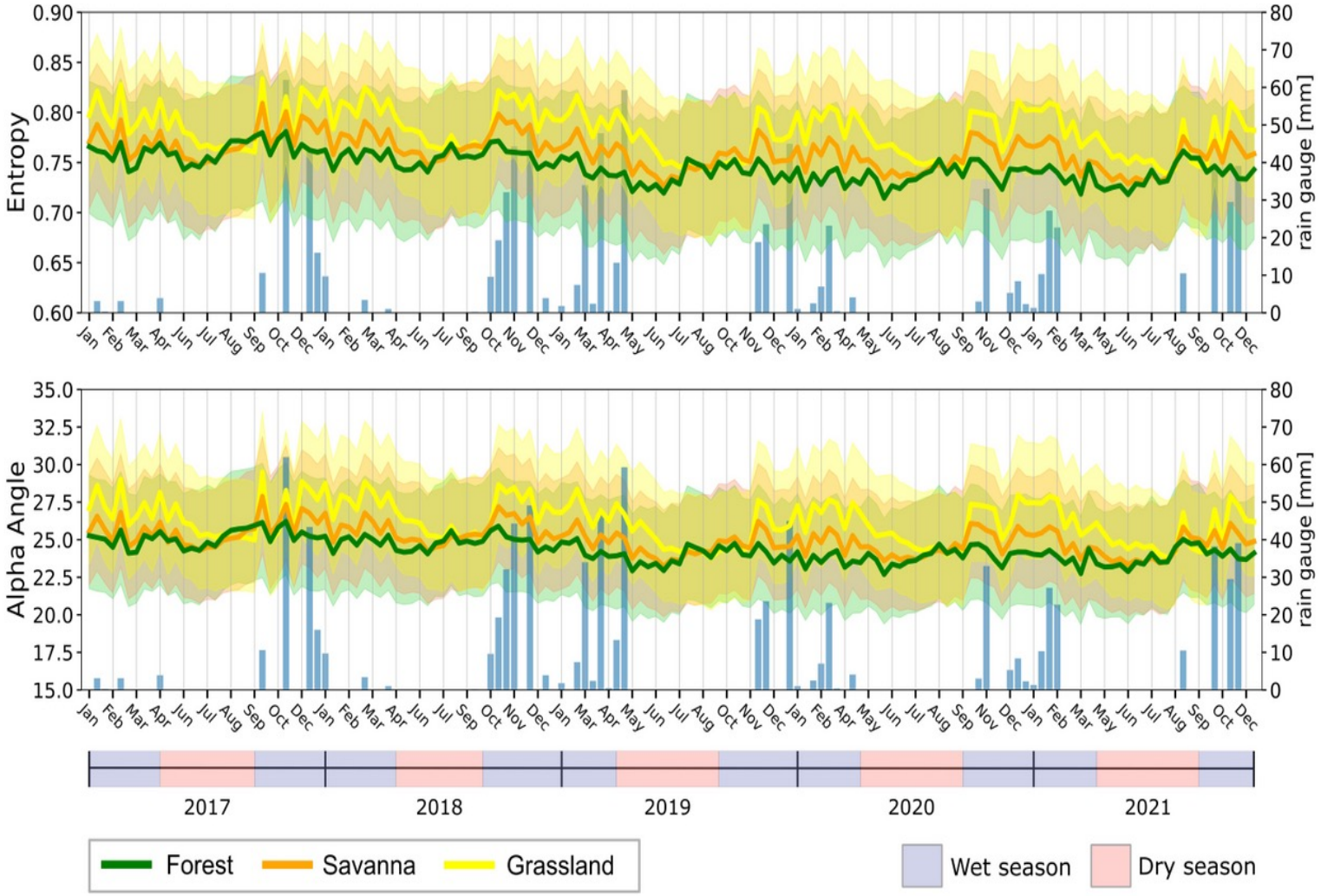
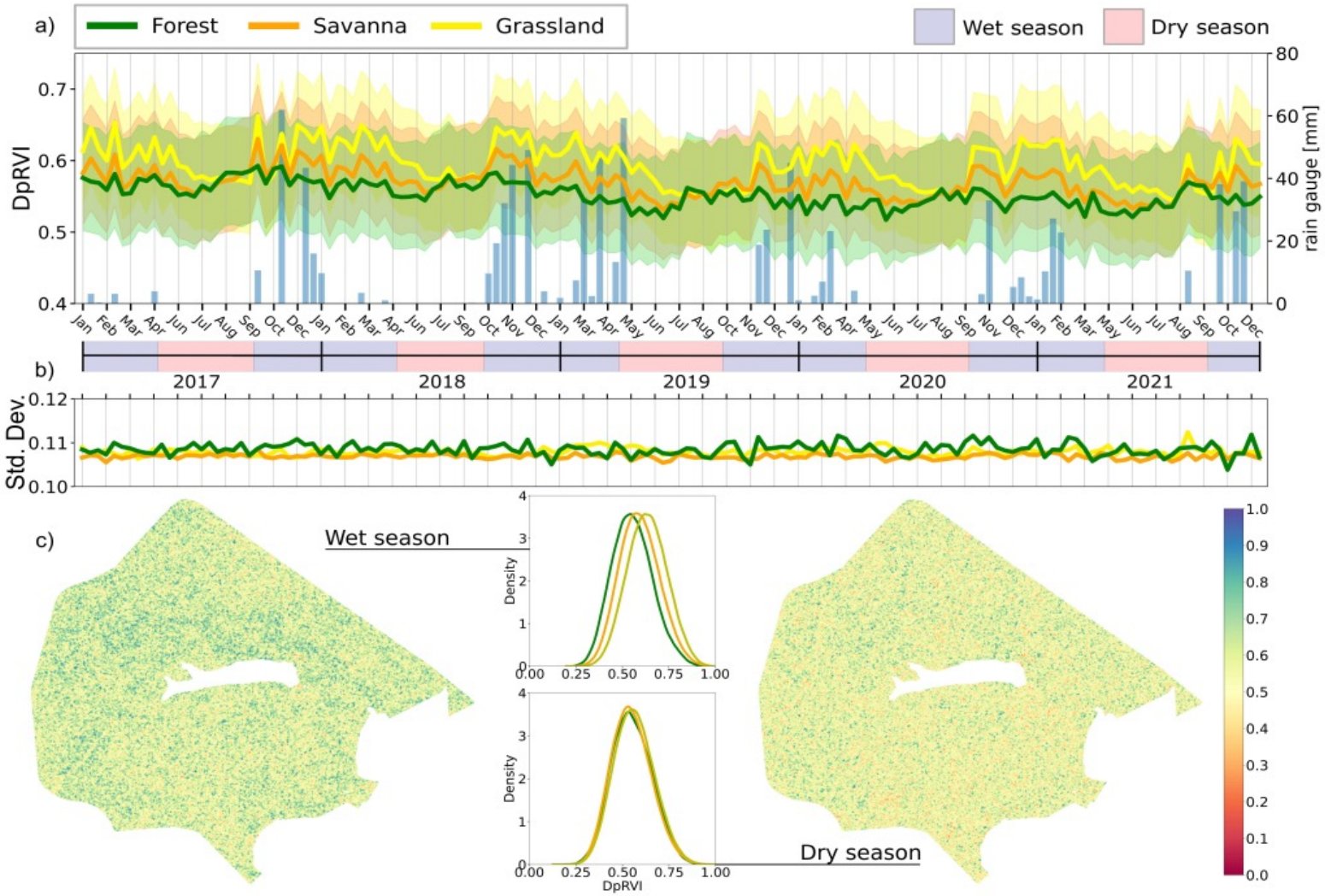




Sensitive to:

Seasonality
Veg structure



Best SAR VIs:
DpRVI
RVI

Same analysis for ALOS-4

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2022, VOL. 55, NO. 1, 129–149
https://doi.org/10.1080/22797254.2021.2025154

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Taylor & Francis Group

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Near-real time deforestation detection in the Brazilian Amazon with Sentinel-1 and neural networks

Claudia Arantes Silva[a], Giorgia Guerrisi[b], Fabio Del Frate[b] and Edson Eyji Sano[c]

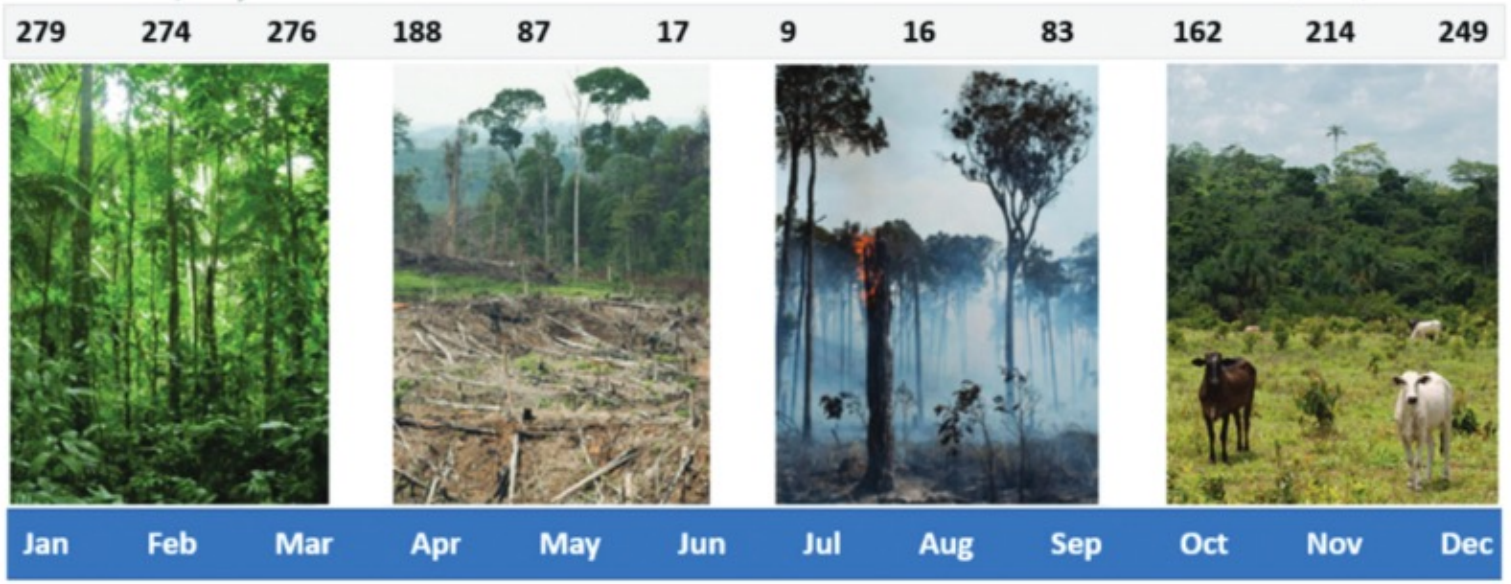

Figure 2. Deforestation process and weather conditions commonly found in the Brazilian Amazon over the year. The numbers above the images correspond to the monthly average precipitation (mm) for the southwest of Pará State from the period 1999–2020.

Table 1. Sentinel-1A interferometric wide (IW), single look complex (Level 1) overpasses from 2019 to 2018 considered in this study.

Overspass 2019	Scene Identification 2019	Overspass 2018	Scene Identification 2018
Jan-03	S1A_IW_SLC_1SDV_20190103T092340	Jan-08	S1A_IW_SLC_1SDV_20180108T092333
Jan-15	S1A_IW_SLC_1SDV_20190115T092340	Jan-20	S1A_IW_SLC_1SDV_20180120T092333
Feb-08	S1A_IW_SLC_1SDV_20190208T092339	Feb-01	S1A_IW_SLC_1SDV_20180201T092333
Feb-20	S1A_IW_SLC_1SDV_20190220T092339	Feb-13	S1A_IW_SLC_1SDV_20180213T092332
Mar-04	S1A_IW_SLC_1SDV_20190304T092339	Feb-25	S1A_IW_SLC_1SDV_20180225T092332
Mar –16	S1A_IW_SLC_1SDV_20190316T092339	Mar-09	S1A_IW_SLC_1SDV_20180309T092332
Mar –28	S1A_IW_SLC_1SDV_20190328T092339	Mar-21	S1A_IW_SLC_1SDV_20180321T092332
Apr-09	S1A_IW_SLC_1SDV_20190409T092339	Apr-02	S1A_IW_SLC_1SDV_20180402T092333
Apr-21	S1A_IW_SLC_1SDV_20190421T092340	Apr-14	S1A_IW_SLC_1SDV_20180414T092333
May-03	S1A_IW_SLC_1SDV_20190503T092340	Apr-26	S1A_IW_SLC_1SDV_20180426T092334
May-15	S1A_IW_SLC_1SDV_20190515T092341	May-08	S1A_IW_SLC_1SDV_20180508T092334
May-27	S1A_IW_SLC_1SDV_20190527T092341	May-20	S1A_IW_SLC_1SDV_20180520T092335
Jun-08	S1A_IW_SLC_1SDV_20190608T092342	Jun-01	S1A_IW_SLC_1SDV_20180601T092336
Jun-20	S1A_IW_SLC_1SDV_20190620T092343	Jun-13	S1A_IW_SLC_1SDV_20180613T092337
Jul-02	S1A_IW_SLC_1SDV_20190702T092344	Jun-25	S1A_IW_SLC_1SDV_20180625T092337
Jul-14	S1A_IW_SLC_1SDV_20190714T092344	Jul-07	S1A_IW_SLC_1SDV_20180707T092338
Jul-26	S1A_IW_SLC_1SDV_20190726T092345	Jul-19	S1A_IW_SLC_1SDV_20180719T092339
Aug-07	S1A_IW_SLC_1SDV_20190807T092346	Jul-31	S1A_IW_SLC_1SDV_20180731T092339
Aug-19	S1A_IW_SLC_1SDV_20190819T092347	Aug-12	S1A_IW_SLC_1SDV_20180812T092340
Aug-31	S1A_IW_SLC_1SDV_20190831T092347	Aug-24	S1A_IW_SLC_1SDV_20180824T092341
Sep-12	S1A_IW_SLC_1SDV_20190912T092348	Sep-05	S1A_IW_SLC_1SDV_20180905T092341
Sep-24	S1A_IW_SLC_1SDV_20190924T092348	Sep-17	S1A_IW_SLC_1SDV_20180917T092342
Oct-06	S1A_IW_SLC_1SDV_20191006T092349	Sep-29	S1A_IW_SLC_1SDV_20180929T092342
Oct-18	S1A_IW_SLC_1SDV_20191018T092348	Oct-11	S1A_IW_SLC_1SDV_20181011T092342
Oct-30	S1A_IW_SLC_1SDV_20191030T092349	Oct-23	S1A_IW_SLC_1SDV_20181023T092342
Nov-11	S1A_IW_SLC_1SDV_20191111T092349	Nov-04	S1A_IW_SLC_1SDV_20181104T092342
Nov-23	S1A_IW_SLC_1SDV_20191123T092348	Nov-16	S1A_IW_SLC_1SDV_20181116T092342
Dec-05	S1A_IW_SLC_1SDV_20191205T092348	Nov-28	S1A_IW_SLC_1SDV_20181128T092341
Dec-17	S1A_IW_SLC_1SDV_20191217T092347	Dec-10	S1A_IW_SLC_1SDV_20181210T092341
Dec-29	S1A_IW_SLC_1SDV_20191229T092347	Dec-22	S1A_IW_SLC_1SDV_20181222T092341

C-VV:
-2.0 dB from Apr/May to Sept/Oct

C-VH:
-2.3 dB

INPE:
DETER-R
(Sentinel-1)

IBAMA/JICA/JAXA:
JJ-FAST
(ALOS-2)

Challenges in monitoring Cerrado´s agriculture with RS

1970´s: 8% national production
2010´s: 52% national production

1970´s: 22%
2010´s: 54%

1970´s: 30%
2010´s: 96%

1970´s: 29%
2010´s: 51%

Large scale grain production

New environmentally sustainable land managements:

- Double cropping
- Crop-livestock integration

Mostly rainfed production

Different planting dates

The Joint PI Meeting of
JAXA Earth Observation Missions FY2023
November 6th - 10th, 2023 JAXA

Increasing spatio-temporal complexity

Different planting dates

Double cropping
Maize in Mato Grosso State:
48 thousand t (first crop);
5 million t (second crop)

Millet/sorghum

Brachiaria/maize consortium

Mapping degraded pastures of the Cerrado: Current top priority in Brazil

Definition of degradation is region-dependent
Most of the parameters are not sensitive to RS (e.g., soil fertility and soil erosion)

What are the contributions of ALOS-3 & ALOS-4?

Key issue: time series of RS data

Thanks a lot !

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