KC#27 Project Report

Development of AI based forest change area detection in Brazil

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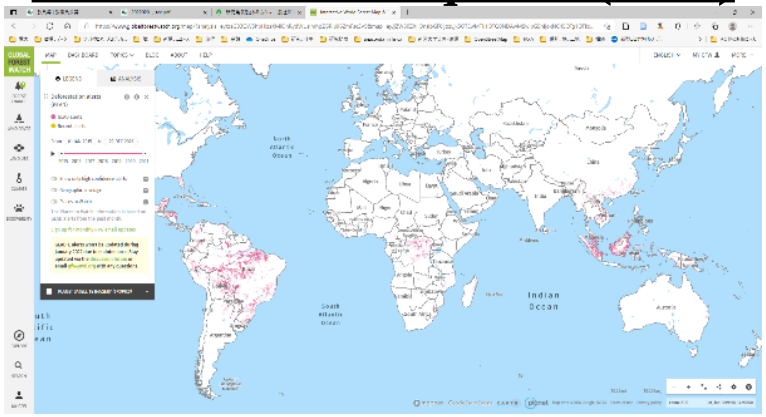
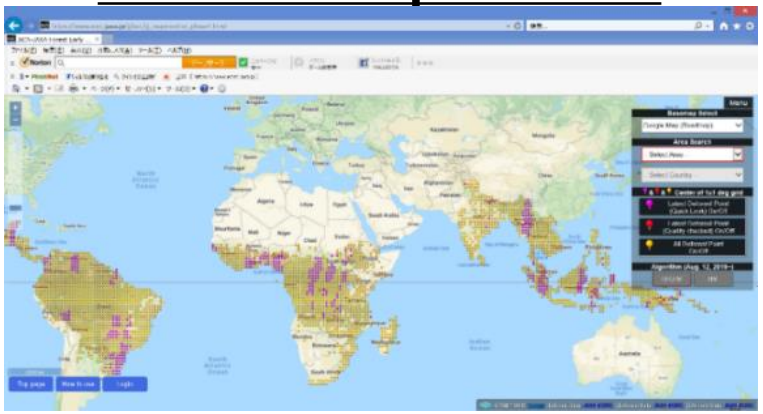
Global Forest change detection

GLAD: Around equator (±30°)



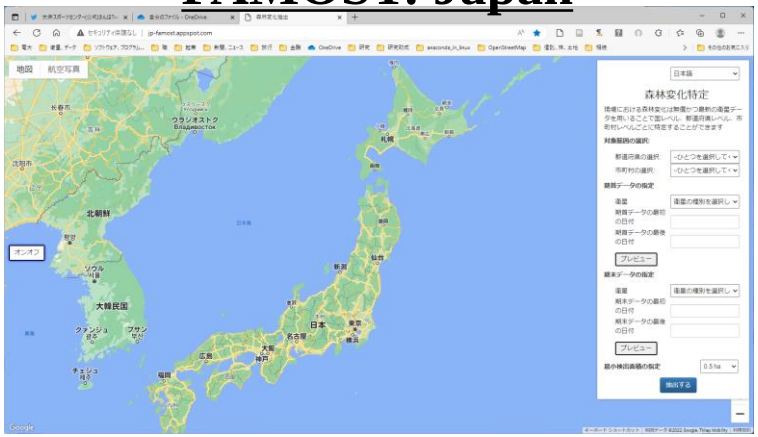
Satellite ：Sentinel-1, 2, Landsat 7, 8

JJ-FAST: Tropical forest



Satellite ：PALSAR2

FAMOST: Japan



Satellite ：Landsat 8, 9, Sentinel-2

Input

Optical → detection

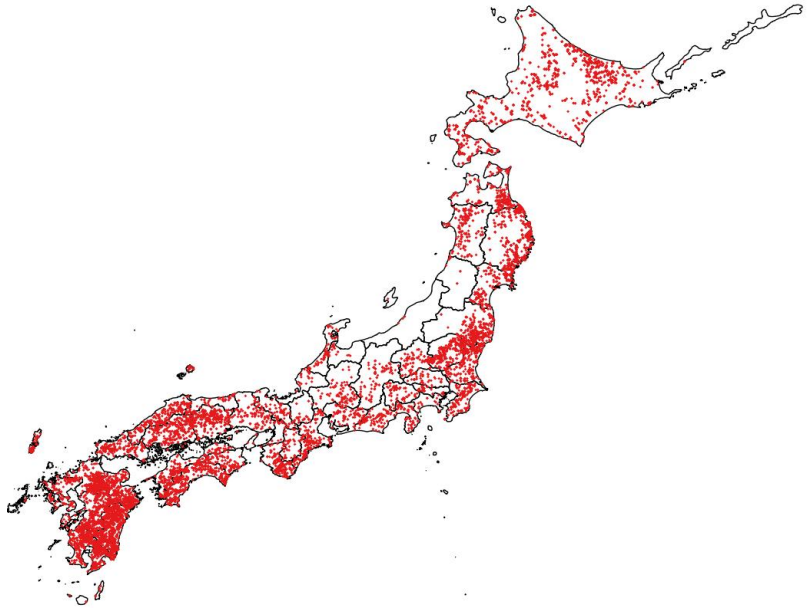
SAR → detection

Optical + SAR to AI algorithm?

(multi modal AI)

Forest change detection in Japan

- CNN+Sentinel-2
- From 2021 to now.

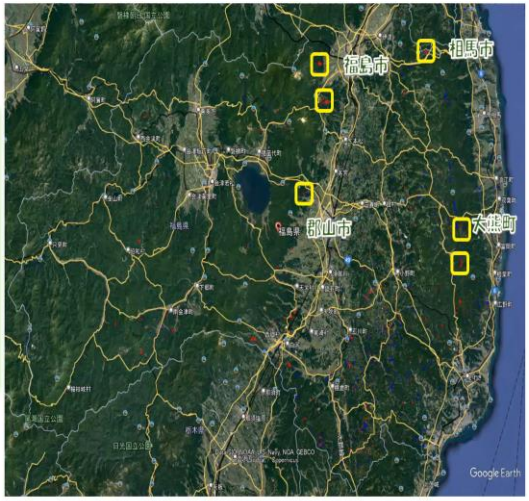


Deforestation polygons **freely available**

- Using Google My Maps
- ~100,000 deforestation polygons

Forest change news by YouTube

- Every prefecture & seasons
  (AIを使って森林変化見つけちゃいました)



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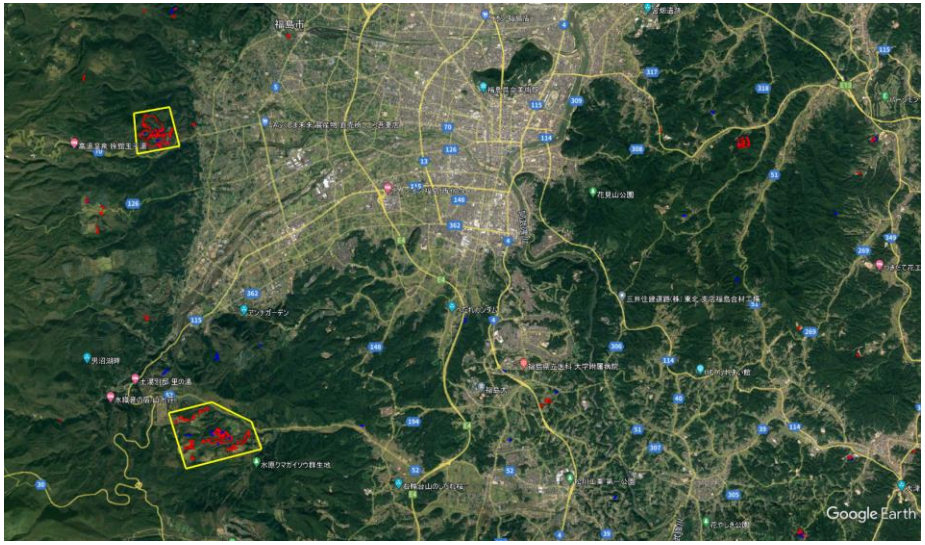
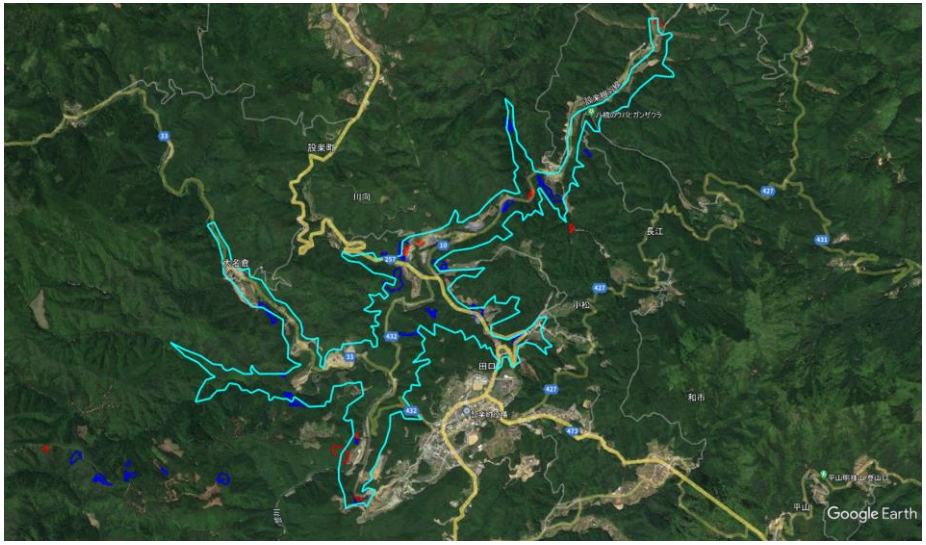
Recent impressive events

Fukushima pref.



- Two mega solar projects
- ~100 ha forest change observed between Jul. to Sept, 2023

Aichi pref.



- Dam project
- ~400 ha area is going to be dam water surface
- Construction period: 1978 ~ 2034

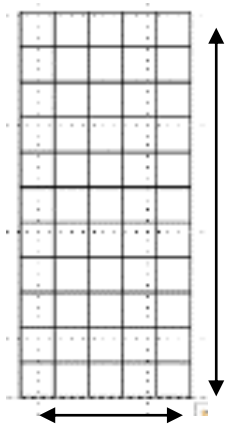
Steps for the deforestation detection method

1. Download cloud free Sentinel-2 from GEE

Target term

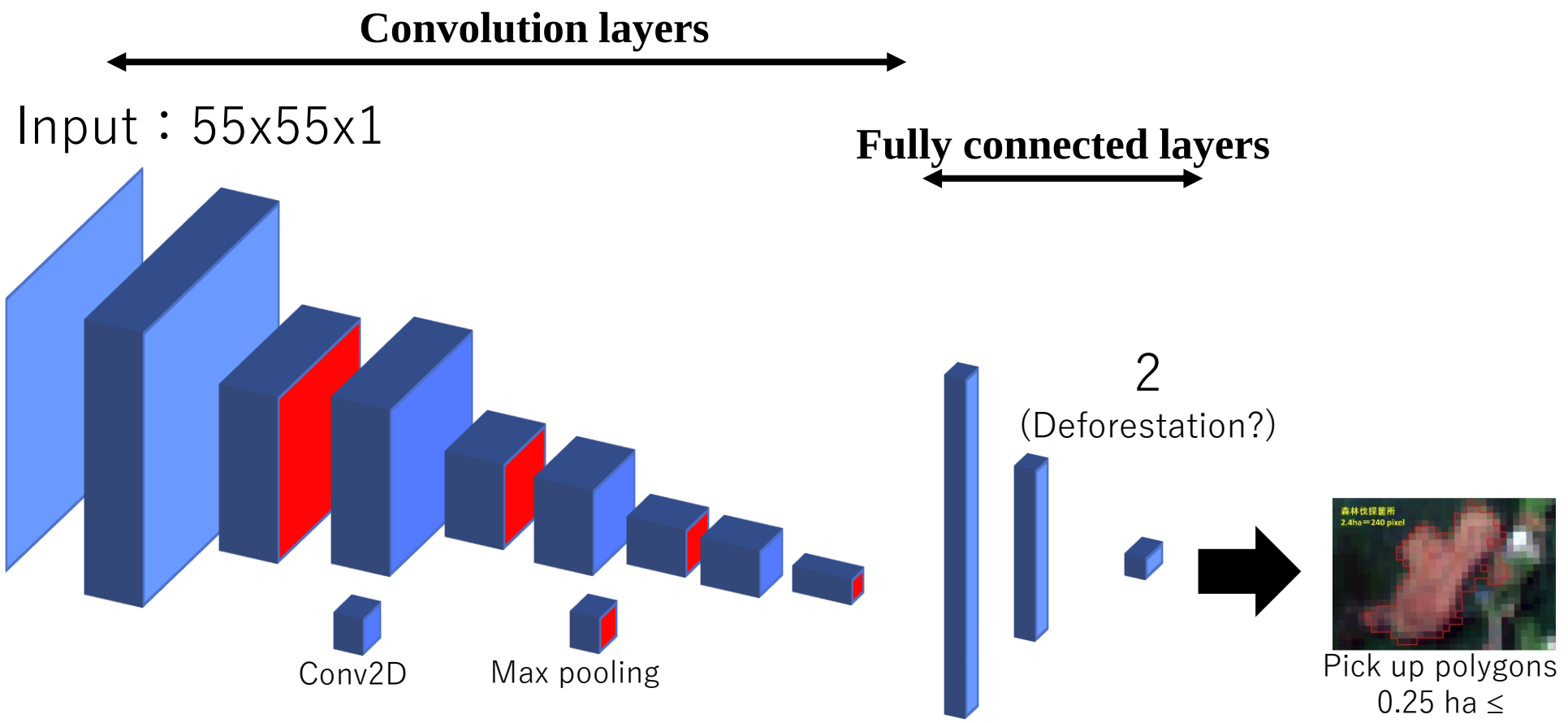
2020.07-09 **2020.10-12** **2021.01-03** **2021.04-06** **2021.07-09**

2. Make input chip image for each pixel.



5 × 11 Sentinel-2 Band information, etc.

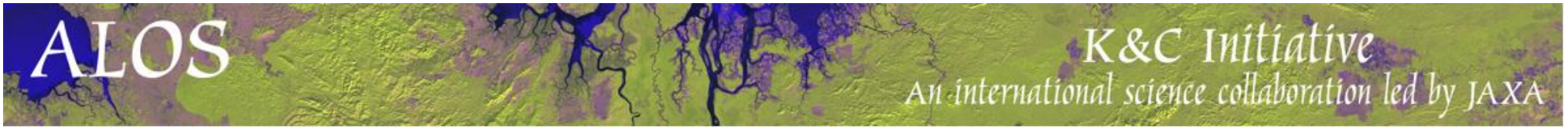
Time series



Characteristics of the AI

1. Easy to increase training data
2. Lower computer cost
3. Highly scalable

	Target term		
2021	Summer	2021.04-06 | 2021.07-09	Training data: A part of Saitama, Kanagawa, Miyagi obtained in summer, 2020 Use one AI model
2022	Winter	2021.10-12 | 2022.01-03	Adjust filter size and add new training data. Use several AI models depending on areas.
	Spring	2022.01-03 | 2022.04-06	
	Summer	2022.04-06 | 2022.07-09	
	Autumn	2022.07-09 | 2022.10-12	Add new training data. Use several AI models depending on areas and seasons.
2023	Winter	2022.10-12 | 2023.01-03	
	Spring	2023.01-03 | 2023.04-06	Apply slope correction to the detected deforestation area.



	Target term		Num. of polygons detected		Total area detected (ha)		User's acc. (%)	Producer's acc. (%)
2021	Summer	2021.04-06 | 2021.07-09	6582	**6582**	7767.5	**7767.5**	**48.0**	82.1(Yamagata) 61.5(Okayama)
2022	Winter	2021.10-12 | 2022.01-03	6046	**36,859**	6190.7	**38,901.3**	**51.3**	
	Spring	2022.01-03 | 2022.04-06	9819		10708.1		**88.6**	81.1(Chubu[1]) 92.1(Shikoku) 40.5(Tohoku[2])
	Summer	2022.04-06 | 2022.07-09	12,287		13,810.8		**85.4**	
	Autumn	2022.07-09 | 2022.10-12	8,707		8191.7		**77.1**	
2023	Winter	2022.10-12 | 2023.01-03	17,709	**40,585**	16,775.6	**38,611.9**	**87.5**	
	Spring	2023.01-03 | 2023.04-06	22,876		21,836.3		**90.4**	

1 Yamanashi, Shizuoka, Aichi 2 Miyagi, Iwate, Yamagata, Fukushima

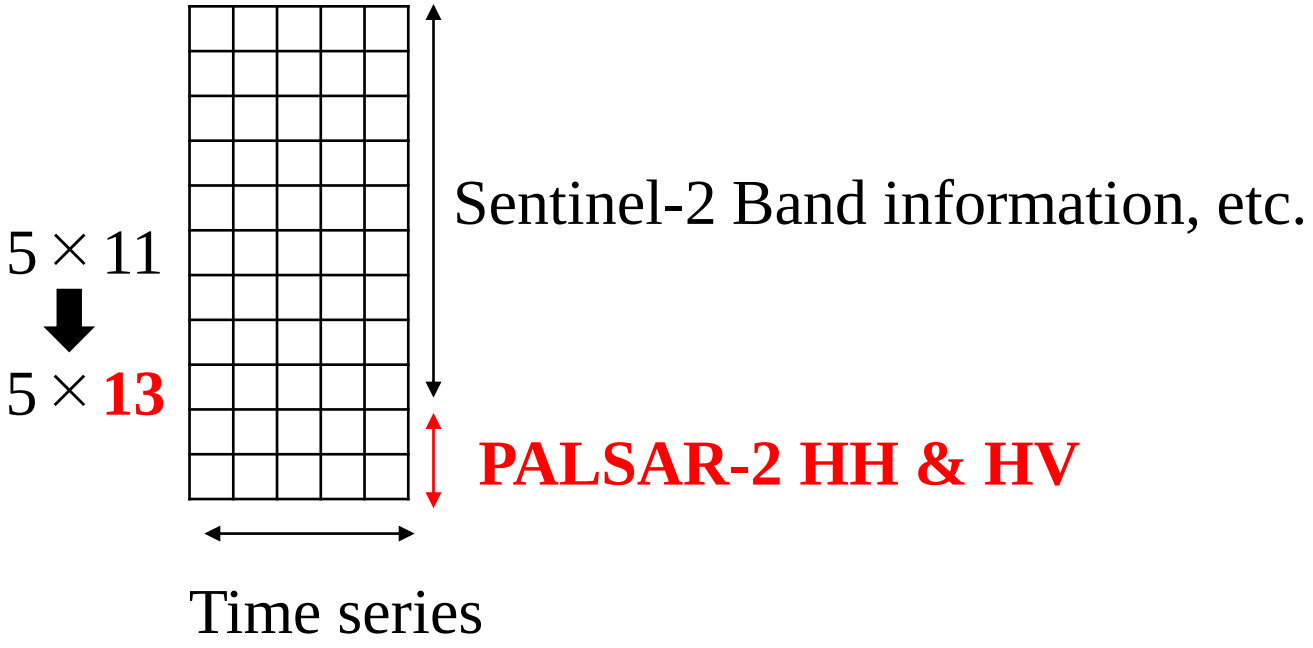
Accuuracies (simple version)

	Total area detected (ha)	Producer's Acc. (%)	User's acc. (%)
2022 (**12** months)	**38,901.3**	~50%?	**51.3**
			88.6
			85.4
			77.1
2023 (**6** months)	**38,611.9**	**?**	**87.5**
			90.4

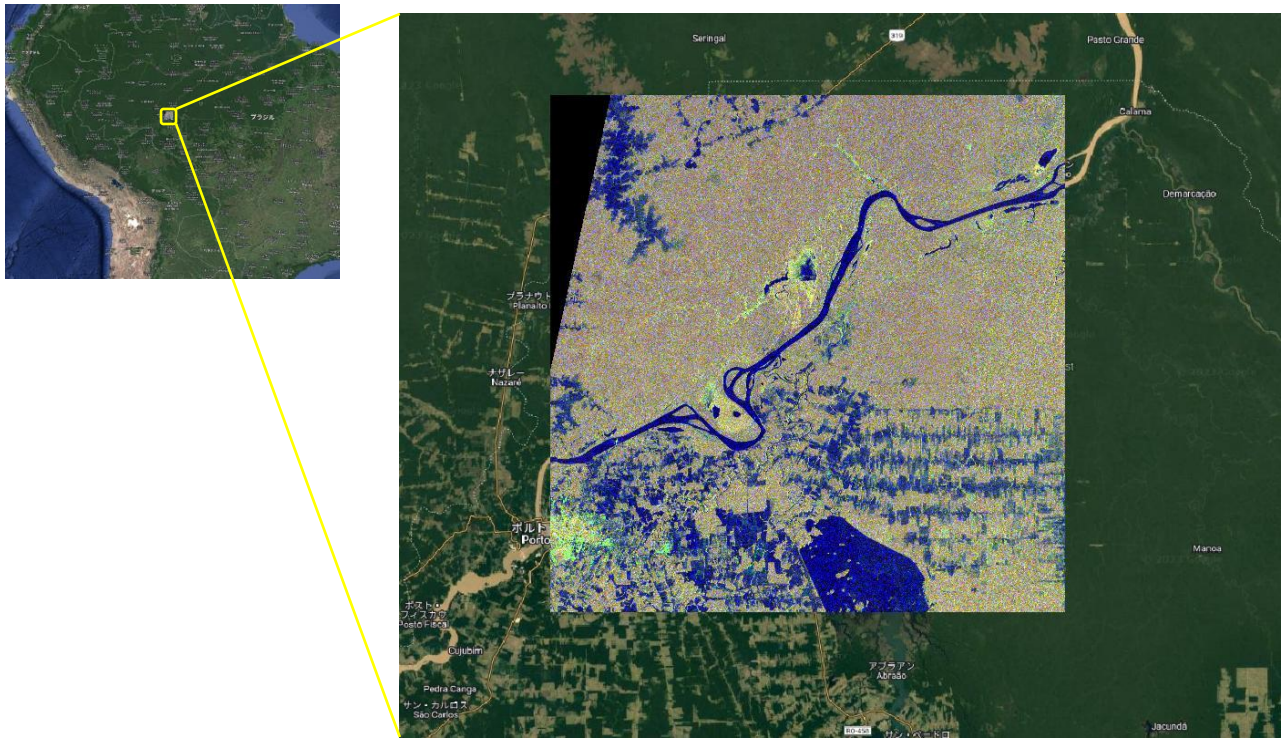
Improving

It is said that deforestation area for a year in Japan is **70,000~80,000 ha/year.**

Adding the PALSAR-2 data



Highly scalable



Target area : Porto Velho/Rondonia
Target term : Summer
Input data : 1) Sentinel-2
2) Sentinel-2 + PALSAR-2 (ScanSAR HH/HV)

Initial results showed detection accuracies is almost same.

Summary

- Deforestation detection algorithm by AI in Japan.
  - Satellite : Sentinel-2
  - Target : 2021 ~ Now. Every seasons & prefecture.
  - Method : Time series image + CNN
- User's accuracies Improving from 48.0 % to ~90%
  Producer's accuracies Improving from ~50% to ?
- Start to evaluate the AI model with sentinel-2 + PALSAR-2
  Initial results showed prospective detection accuracies in Brazil.