

*K&C meeting
Alos 2 workshop
SAOCOM Mission
Status*

January 24, 2020
Tokyo, Japan



- *Introduction to SAOCOM Mission*
- *Instrument, beams and modes*
- *Integrated Mission Acquisition Scenario (IMAS)*
- *Products*
- *Status*

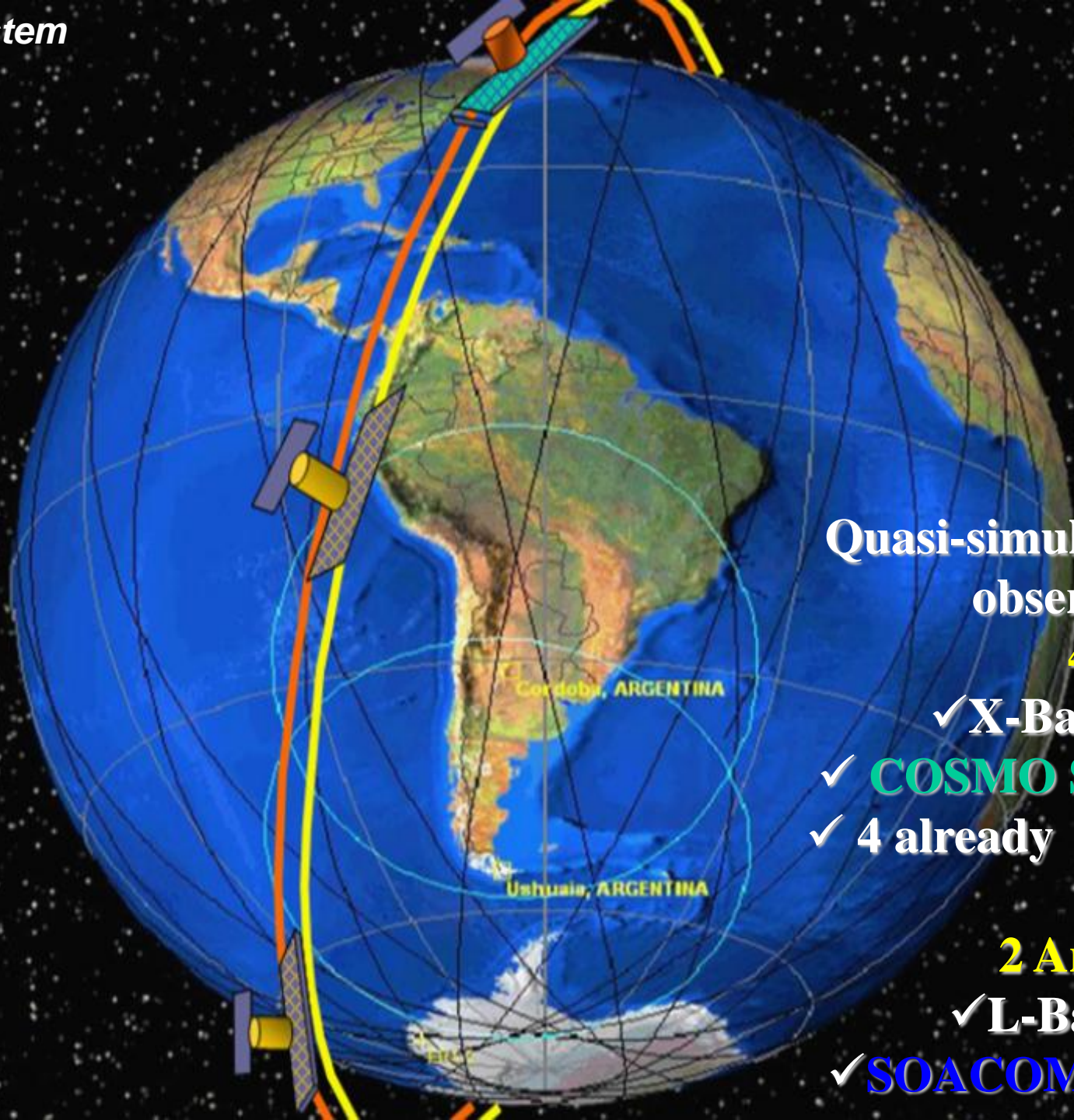


instruments	Polarimetric L band SAR (1,275 GHz, 50 Mhz) (SAOCOM 1A/SAOCOM 1B)
orbit	sun synchronous nearly circular frozen polar
inclination	97.89°
altitude	619.6 km
local time of asc. node	~06:10 am
time for one orbit	97.2 minutes
Revisit	16 days (1 satellite)/ 8 days (constellation)
mission lifetime/exp.	5 years/7 years
commissioning	6-9 months



looking direction	right (nominal)/left (capability)
↘ right looking	<ul style="list-style-type: none">✓ continuous acquisitions of 10 minutes when the satellite is in visibility of ETC✓ 15 minutes per orbit as an average on a daily basis✓ 20 minutes of non continuous acquisitions in an orbit
↙ left looking	up to 5 minutes , according to resources and preserving spacecraft safety, returning afterwards to the nominal side looking
acquisition modes	real time/stored
coverage	world wide (except near poles)

σ° (measurement range)	-35 to 5 dB
absolute radiometric accuracy	less than or equal to 0.5 dB (QP) less than or equal to 1.0 dB (SP, DP)
polarimetric accuracy ($\sigma^\circ_{hh}/\sigma^\circ_{vv}$)	less than or equal to 0.3 dB
Satellite Weight:	~3 tons
Solar Array area	~13 m ²
SAR antenna	10m x 3.5m active phased array antenna with 140 TRMs



**Quasi-simultaneous
observacions**

4 Italian

✓ **X-Band SAR**

✓ **COSMO SkyMed**

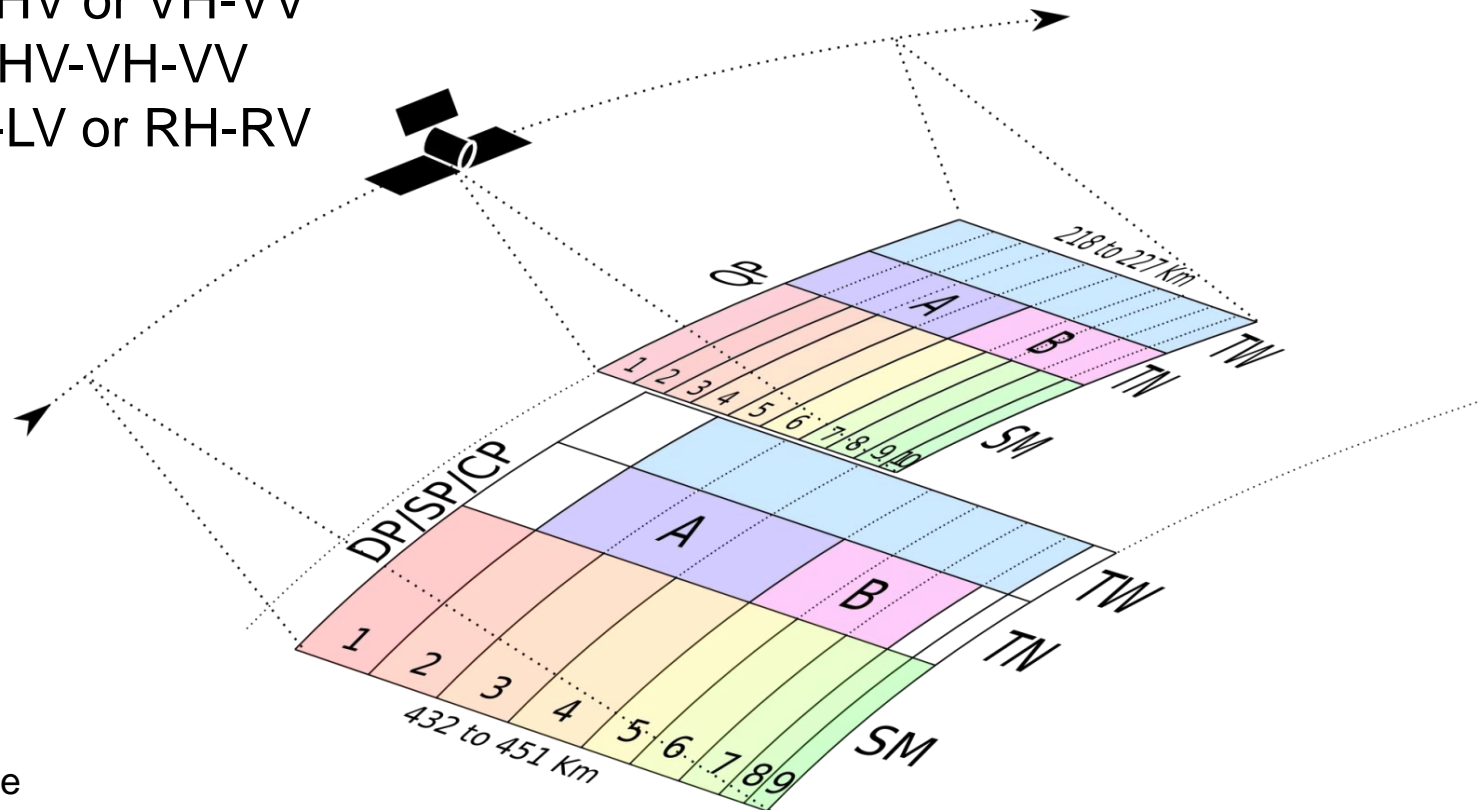
✓ **4 already en orbit**

2 Argentine

✓ **L-Band SAR**

✓ **SOACOM 1A, 1B**

- 25 modes
- StripMap and TOPSAR modes
- 8 possible polarization combinations
 - SP: HH or VV
 - DP: HH-HV or VH-VV
 - QP: HH-HV-VH-VV
 - CP*: LH-LV or RH-RV



*Technological mode

acquisition mode	polarization mode	swath width	spatial resolution	minimum incidence angle range
StripMap (SM)	SP: HH or HV or VH or VV	> 40 km	< 10 m	21° - 50°
	DP: HH/HV or VV/VH	> 40 km	< 10 m	21° - 50°
	CL-POL:RH/RV or LH/LV	>40 km	<10 m	21° - 50°
	QP: HH/HV/VH/VV	> 20 km	< 10 m	20° - 35°
TOPSAR Narrow (TN)	SP: HH or HV or VH or VV	> 150 km	< 30 m	25° - 45°
	DP: HH/HV or VV/VH	> 150 km	< 30 m	25° - 45°
	QP: HH/HV/VH/VV	> 100 km	< 50 m	20° - 35°
TOPSAR Wide (TW)	SP: HH or HV or VH or VV	> 350 km	< 50 m	25° - 45°
	DP: HH/HV or VV/VH	> 350 km	< 50 m	25° - 45°
	QP: HH/HV/VH/VV	> 220 km	< 100 m	20° - 35°
	CL-POL: RH/RV or LH/LV	> 350 km	< 50 m	25° - 45°



- *Mission Acquisition Strategy*
- *IMAS components*
 - *Argentina National Acquisition Plan*
 - *CAL*
 - *SIASGE*
 - *Global Background Mission*

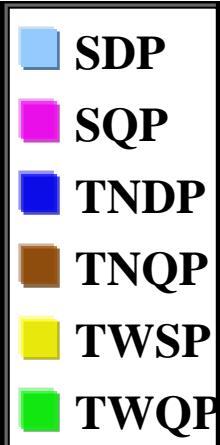


Argentina National Acquisition Plan - User requests

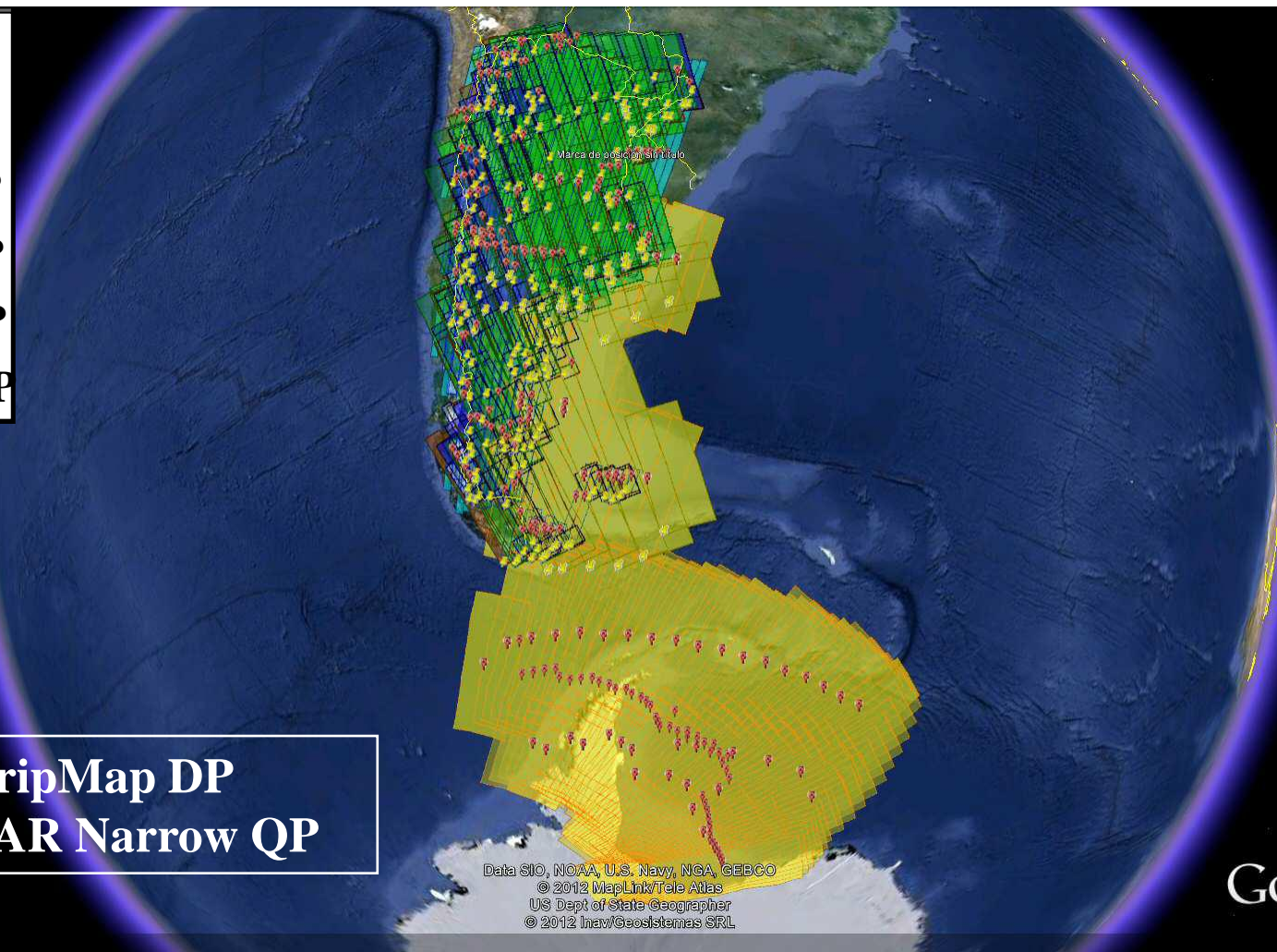
- 20 Application Areas identified by CONAE (through National *Space Information Cycles* programme, user surveys, own requests)

ARG-1	Pampas soil moisture
ARG-2	Flooding
ARG-3	Wild fires
ARG-4a	Oil spills (Argentine Sea)
ARG-4b	Oil spills (Paraná river)
ARG-5	Oil spills (land)
ARG-6	Land slides
ARG-7	Volcanoes
ARG-8	Landscape epidemiology
ARG-9	Desertification/draught
ARG-10	Urban sprawl
ARG-11	Forest Monitoring

ARG-12	Biomass
ARG-13a	Wetlands (open water bodies)
ARG-13b	Wetlands (Esteros del Iberá)
ARG-14	Land Cover/Land Use
ARG-15a	Marine surv. (Argentine Sea)
ARG-15b	Marine surv. (Antarctic Sea)
ARG-16	Coastal monitoring
ARG-17	Snow & ice
ARG-18	Glaciers
ARG-19	Geology & mining
ARG-20	Oil prospection
NATIONAL	National Image Data Base



✓ StripMap DP
✓ TOPSAR Narrow QP



Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2012 MapLink/Tele Atlas
US Dept of State Geographer
© 2012 Inav/Geosistemas SRL

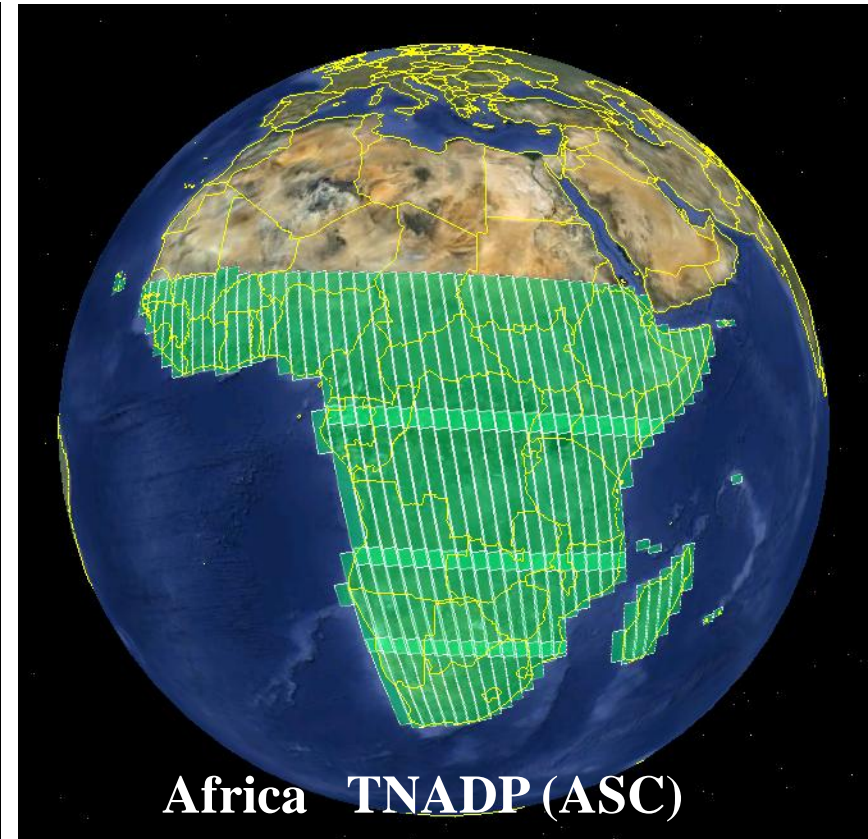
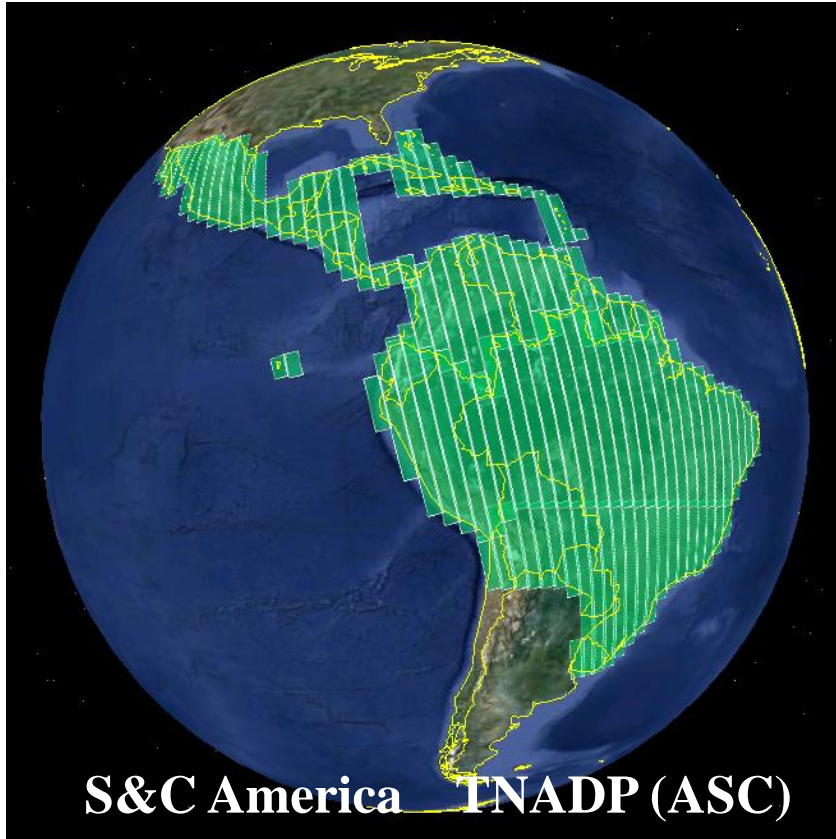
Google earth

Alt. ojo 9995.68 km

Ascending and Descending acquisitions on 23 cycles showing the different acquisition modes with different colours (one year of coverage)

SAO-1A: Annual dual-season pan-tropical observations (TNADP)

SAO-1B: Annual fine resolution pan-tropical observations (SDP)

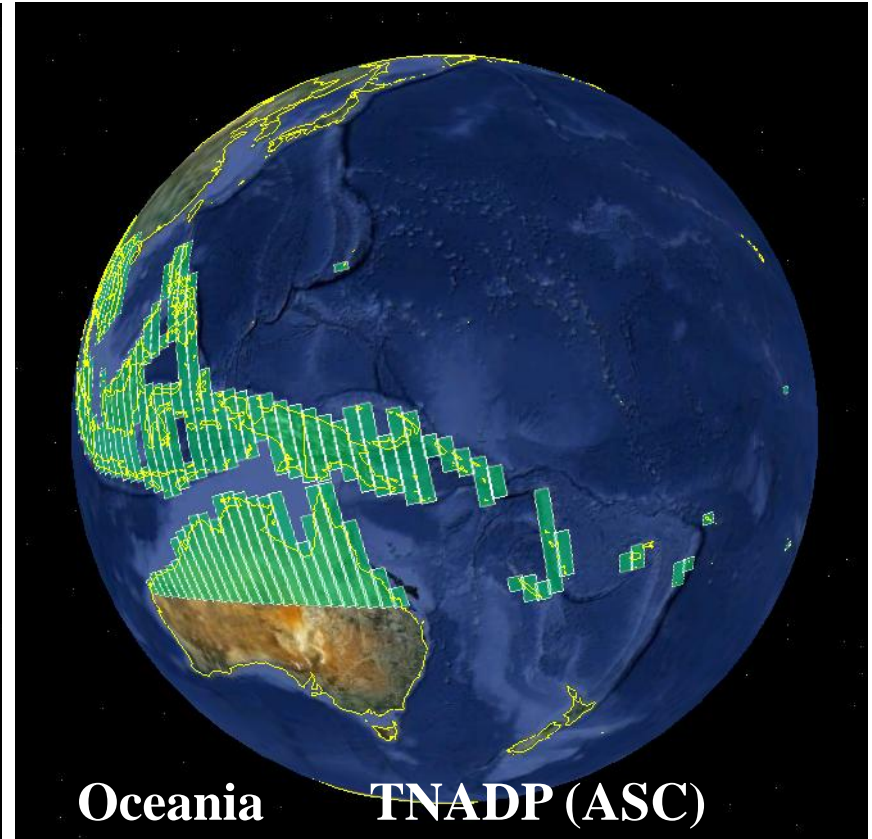
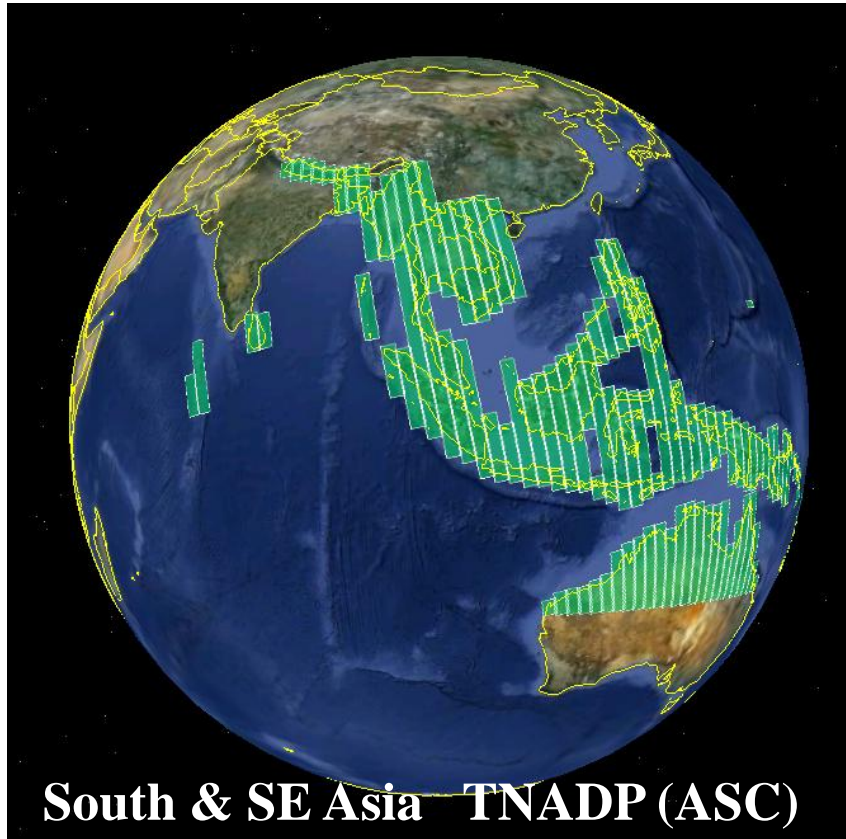


(1) In support of Space Data Coordination Group (SDCG) of the Committee on Earth Observation Satellites (CEOS) for Forest Carbon Tracking (FCT) integrated into Global Forest Observation

Initiative (GFOI)
SAOCOM Mission Status

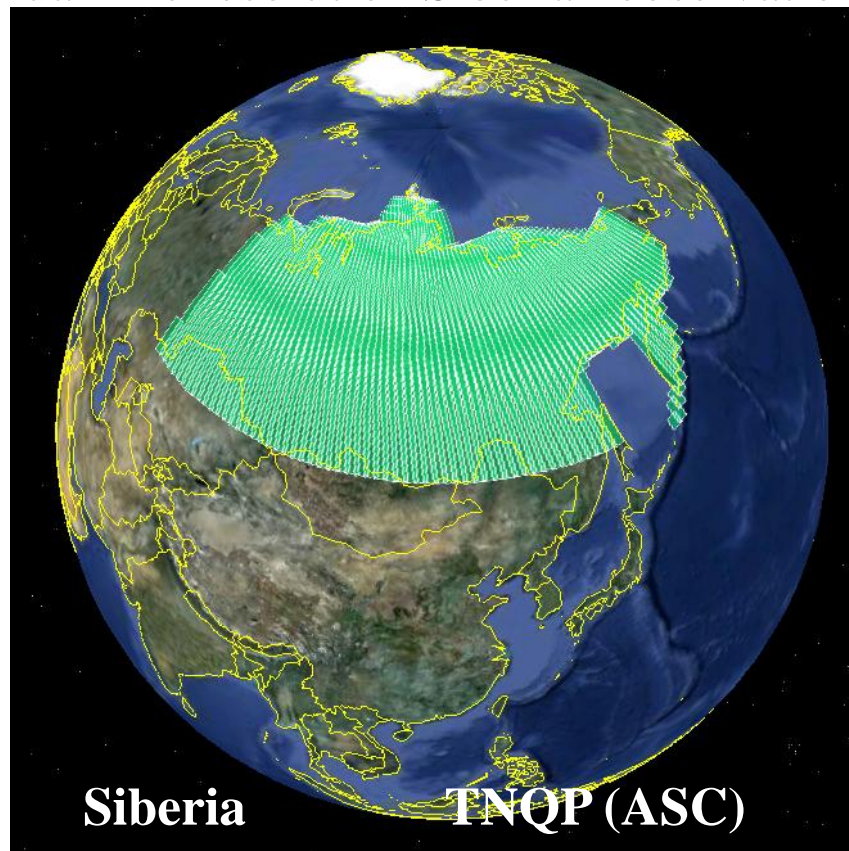
SAO-1A: Annual dual-season pan-tropical observations (TNADP)

SAO-1B: Annual fine resolution pan-tropical observations (SDP)

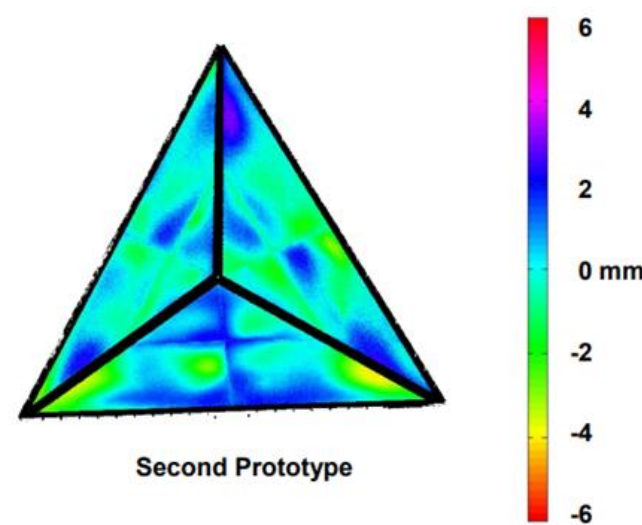


SAO-1A: Annual (single-season) observations over Siberia (TNQP)

SAO-1B: Annual fine resolution Siberian observations (SDP)



- **SAOCOM-1A** SAR System Calibration Commissioning Phase finished with very good performance results.
- **Monitoring** activities are currently being performed based on automatic algorithms.



Range Antenna Patterns

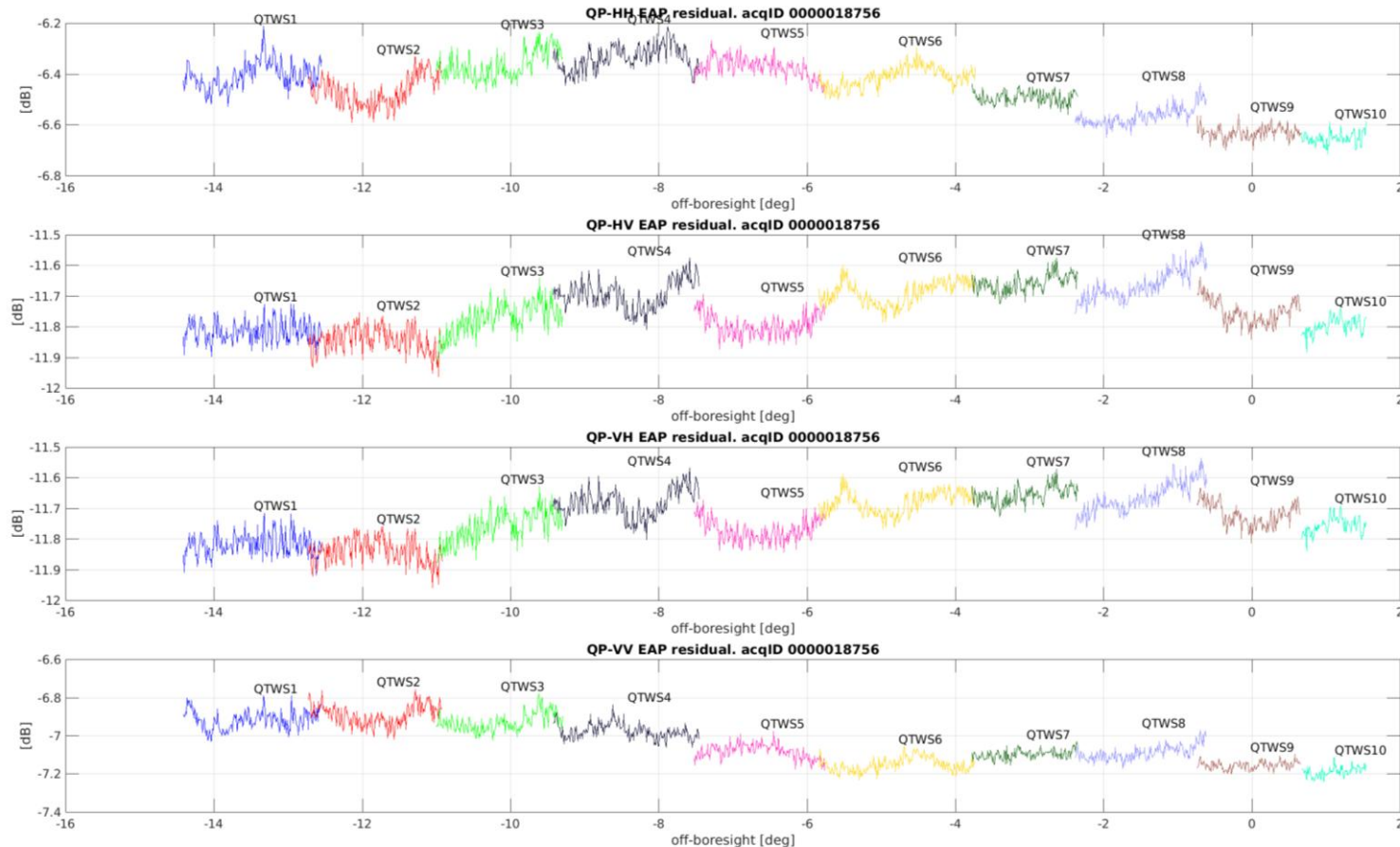
Gamma profile example



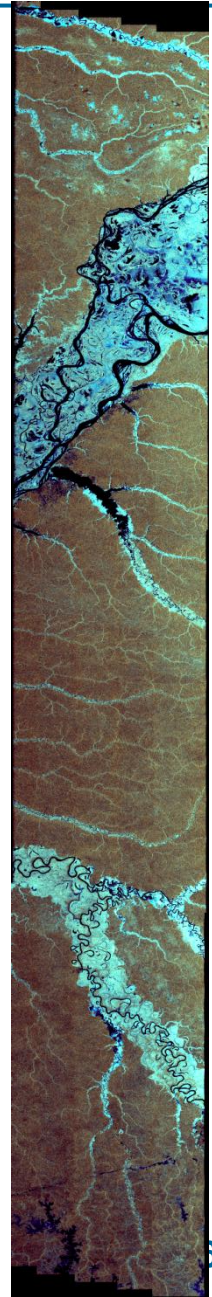
saocom



Ministerio de Ciencia,
Tecnología e Innovación
Argentina



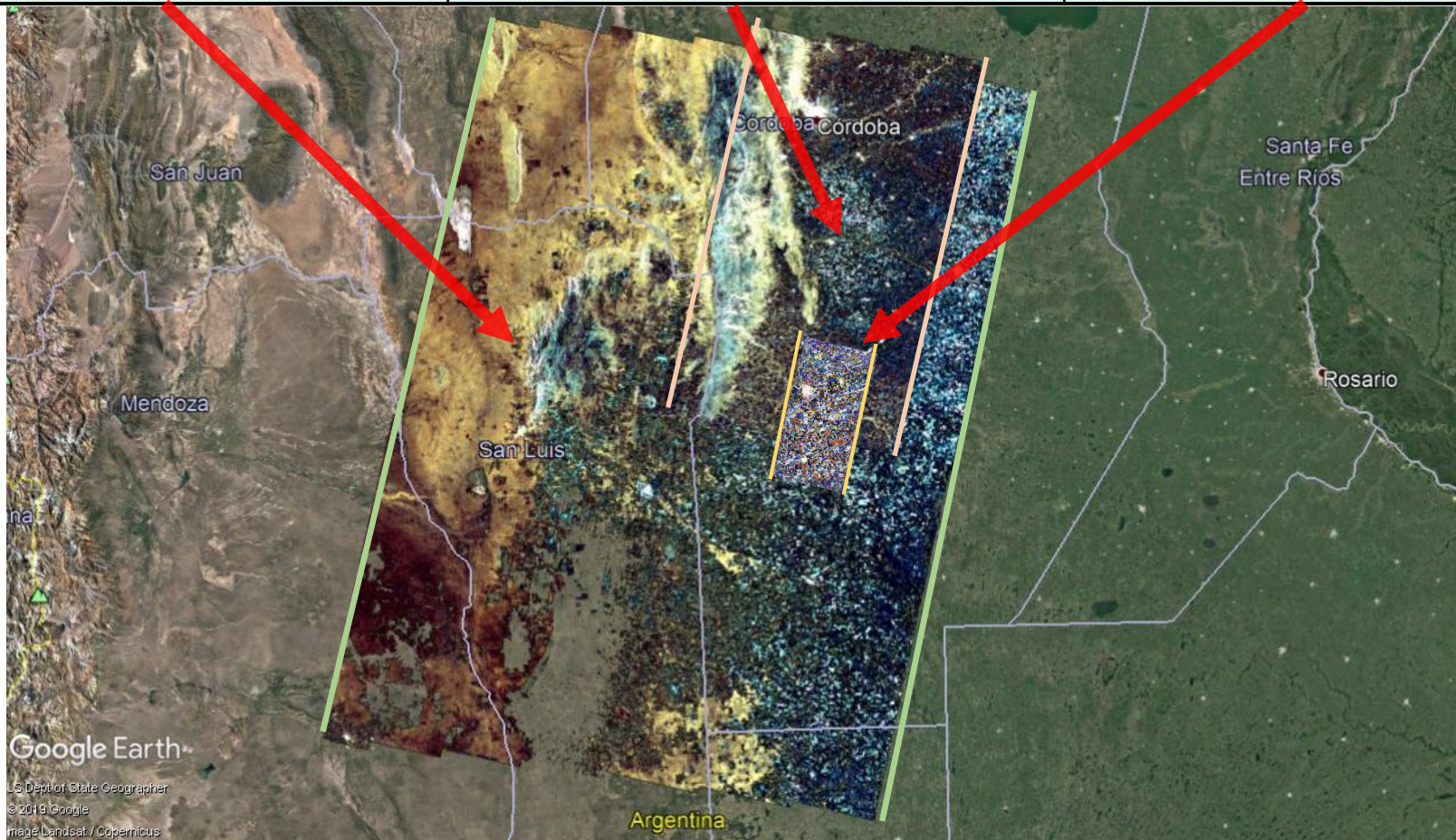
- Gamma nought over masked rivers in rain forest show very good matching between contiguous swaths. I.e. good antenna patterns shape, inter-beam gains and channel imbalances



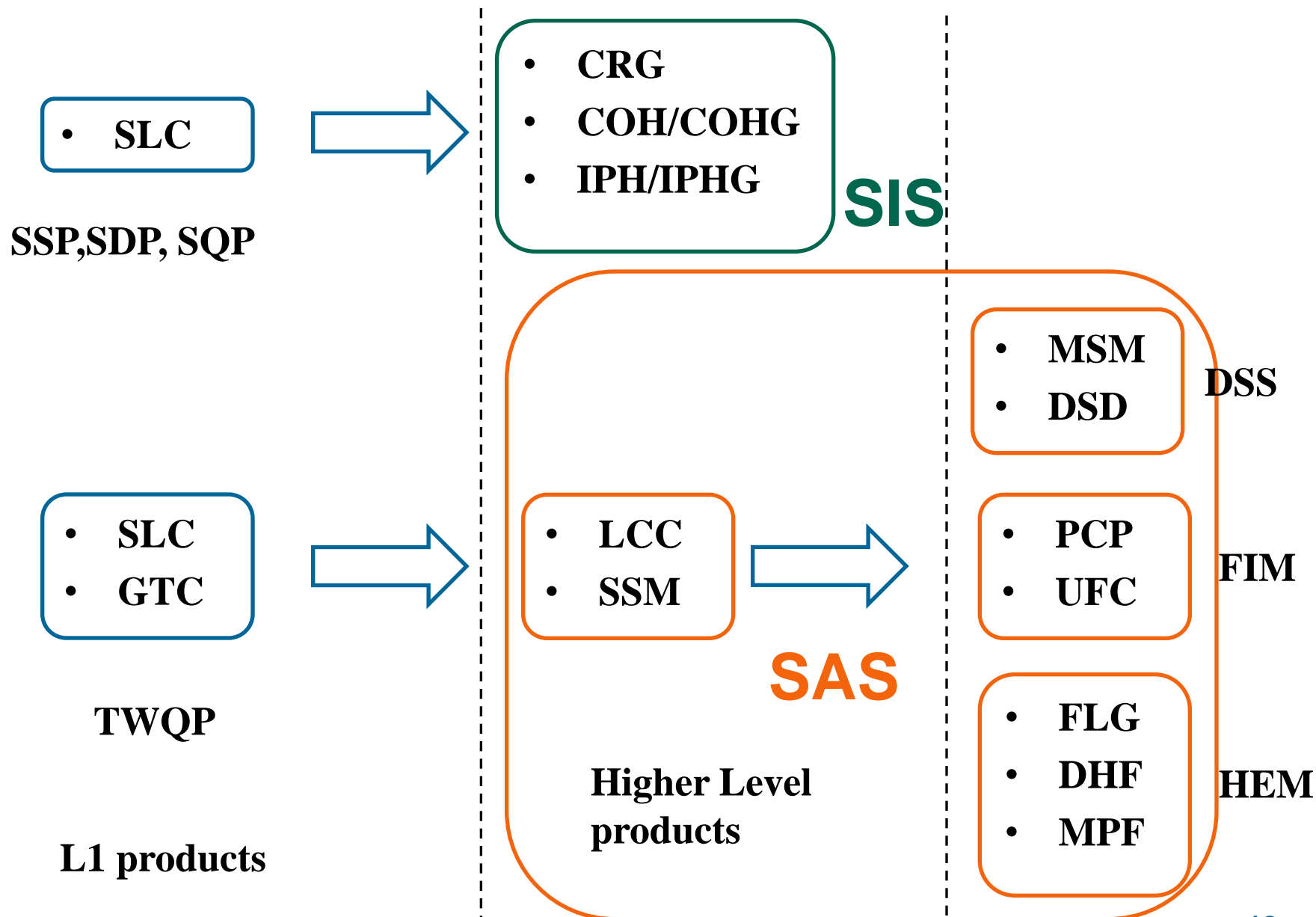
TOPSAR Wide Dual Pol (350 Km, 50 m)

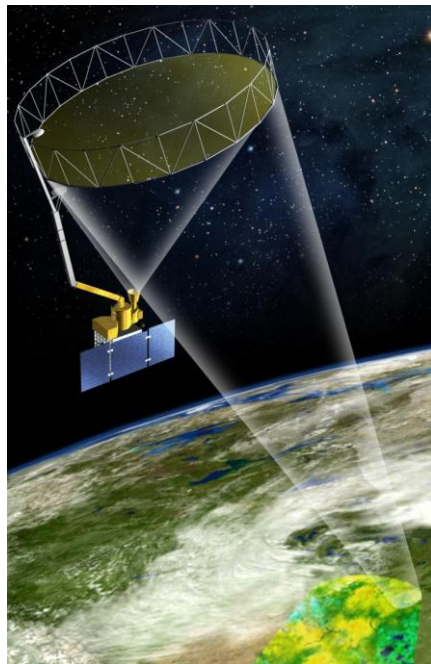
TOPSAR Narrow Dual Pol (150 km, 50 m)

STRIPMAP Quad Pol (40 km, 10 m)

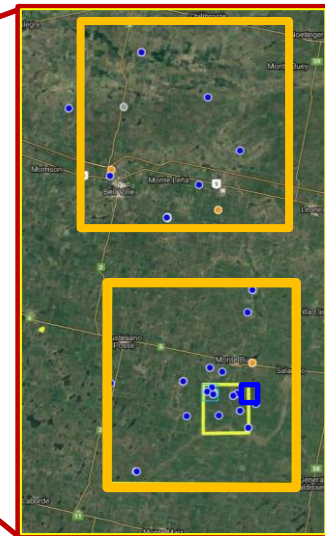
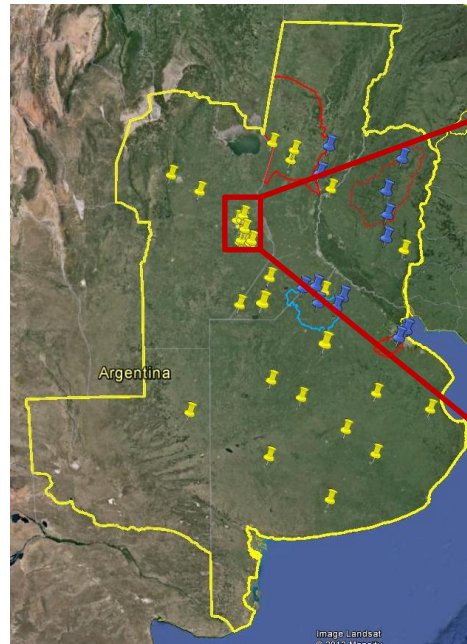


SAOCOM-1A CALVAL commissioning phase already finished





SMAP



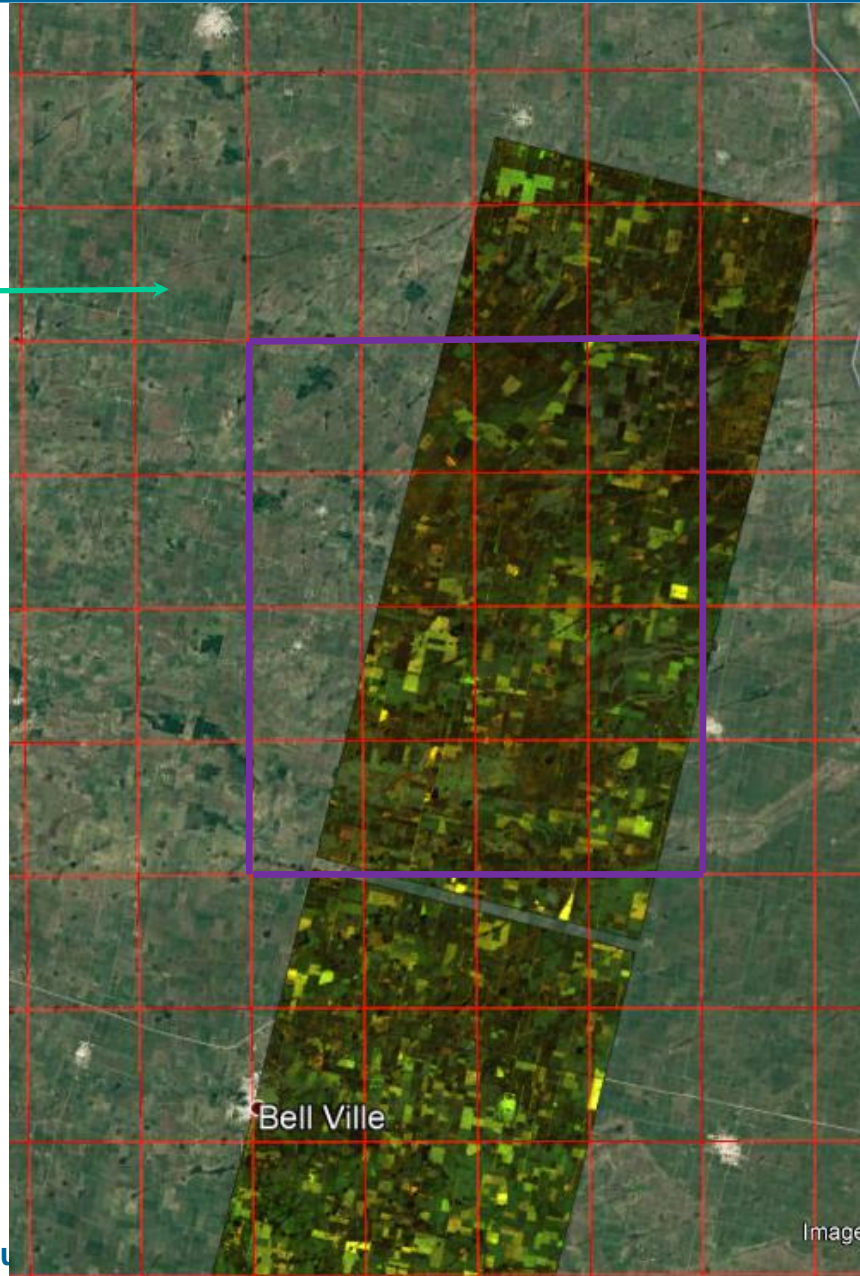
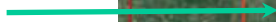
**SMAP Cal/Val. Core site,
also ALOS-2 CVST site**

**SMAP CAL-VAL Rehearsal,
Research Announcement ALOS-
2, Participation in CSVT ALOS-2**



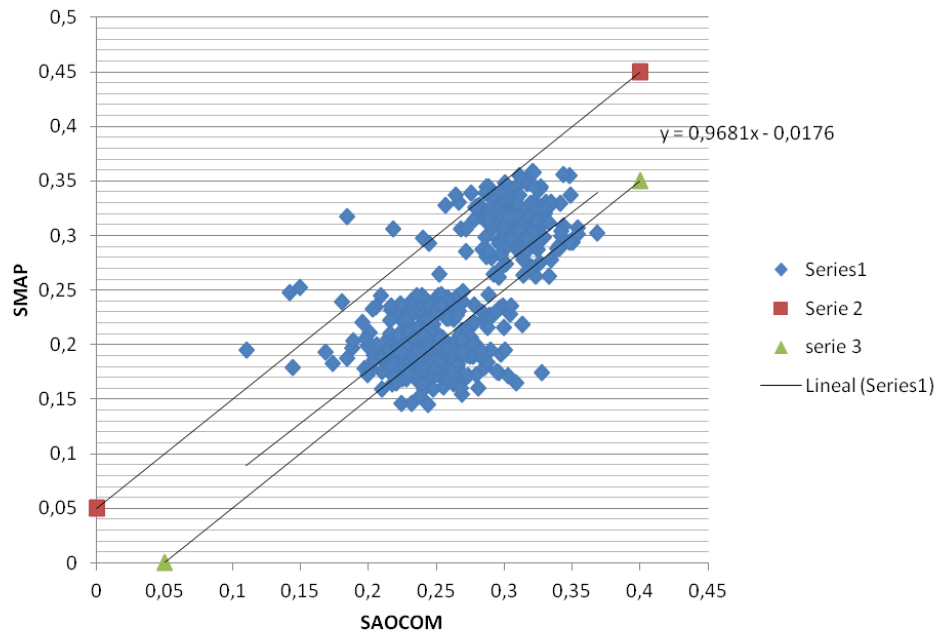
ALOS-2

Easy grid
9km x 9km



We average the soil moisture pixel that fall on the same easy grid pixel and compare with corresponding SMAP Soil Moisture value.

Scatter Plot SAOCOM vs SMAP



Mean

2,6 % (Vol/Vol)

Stand. Dev

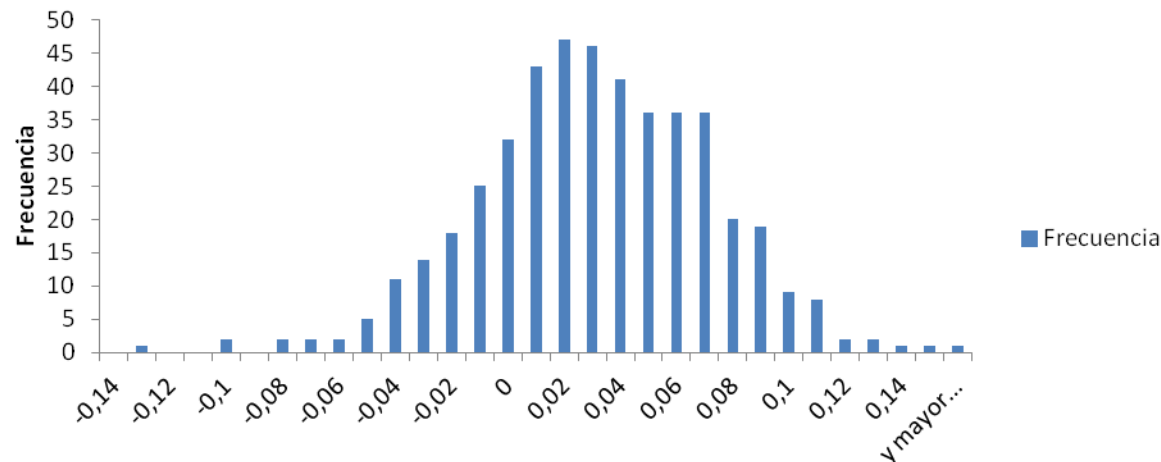
4,2 % (Vol/Vol)

RMSE

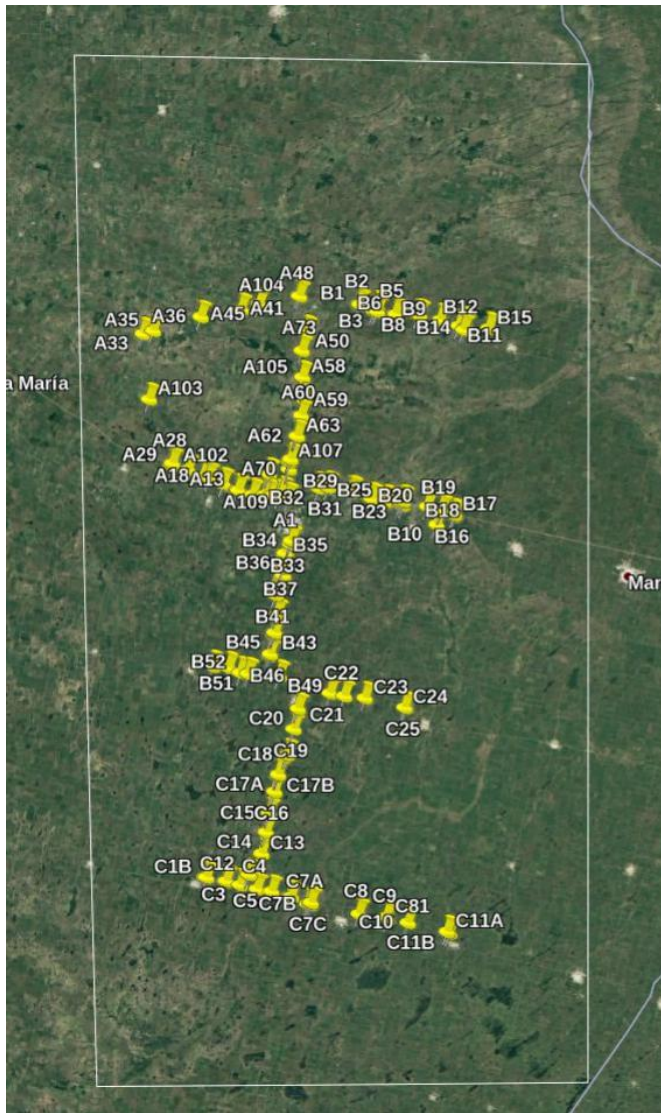
4,9 % (Vol/Vol)

$$RMSE = \left(\frac{1}{N} \sum_{i=1}^N (SM_{inv} - SM_{obs})^2 \right)^{1/2}$$

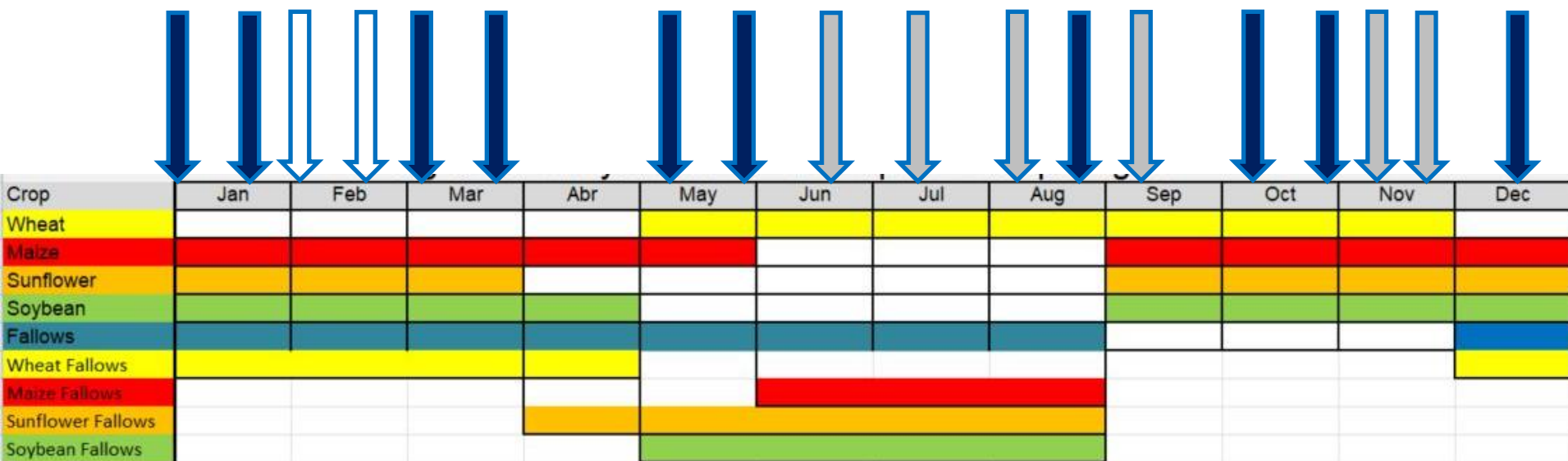
Diff. SAOCOM - SMAP



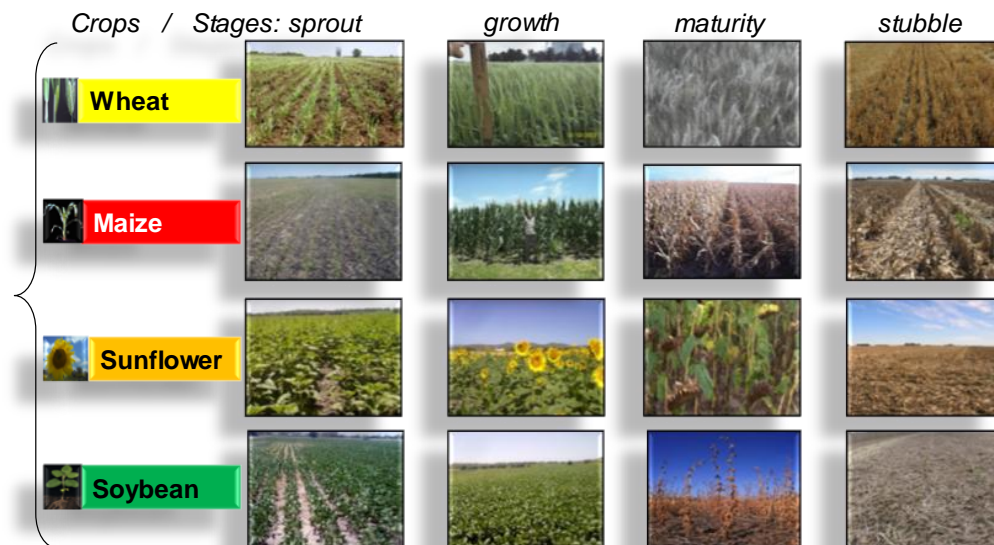
SMAP error: ~5%

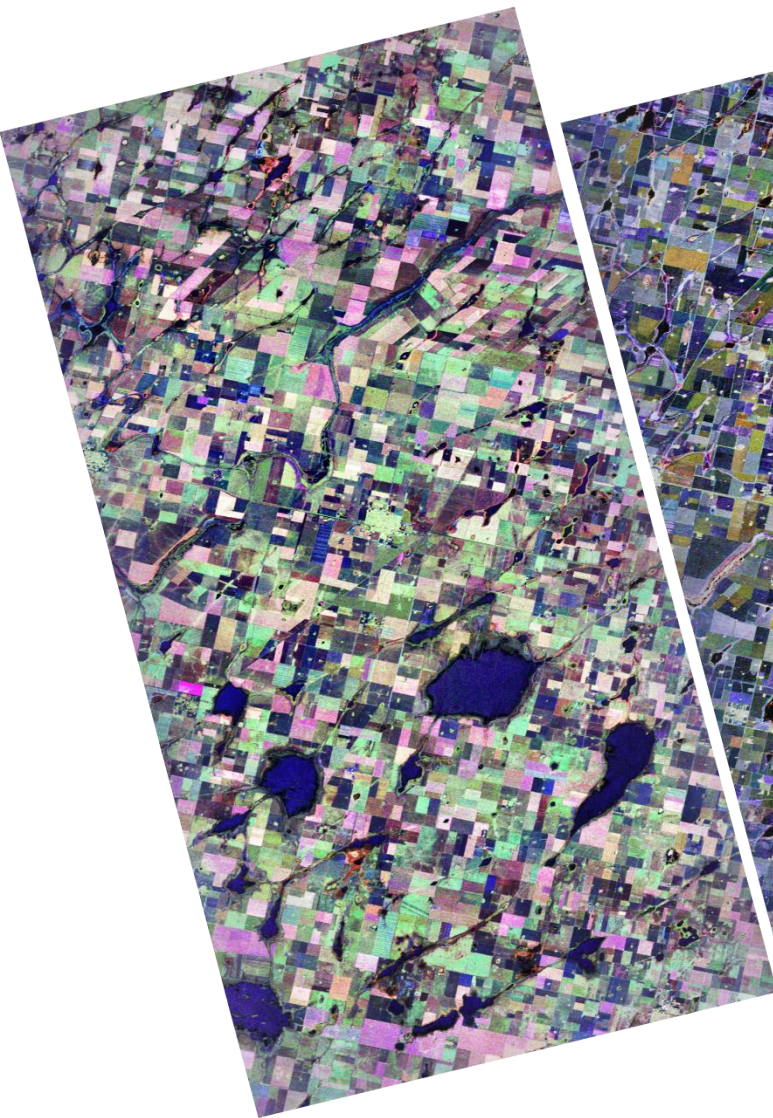


- **Field Campaigns**
- **3 teams:**
 - 1 field specialist
 - 1 developer
- **Revisit the same plot**
- **Focus on specific land cover**
- **Sampling and data following procedures developed earlier with NASA/USDA**
- **Acquisitions:**
 - **S6QP Asc. (morning)**
 - **S8QP Desc. (evening)**



At least 1 year of data is necessary in order to capture seasonal and land cover annual variation.

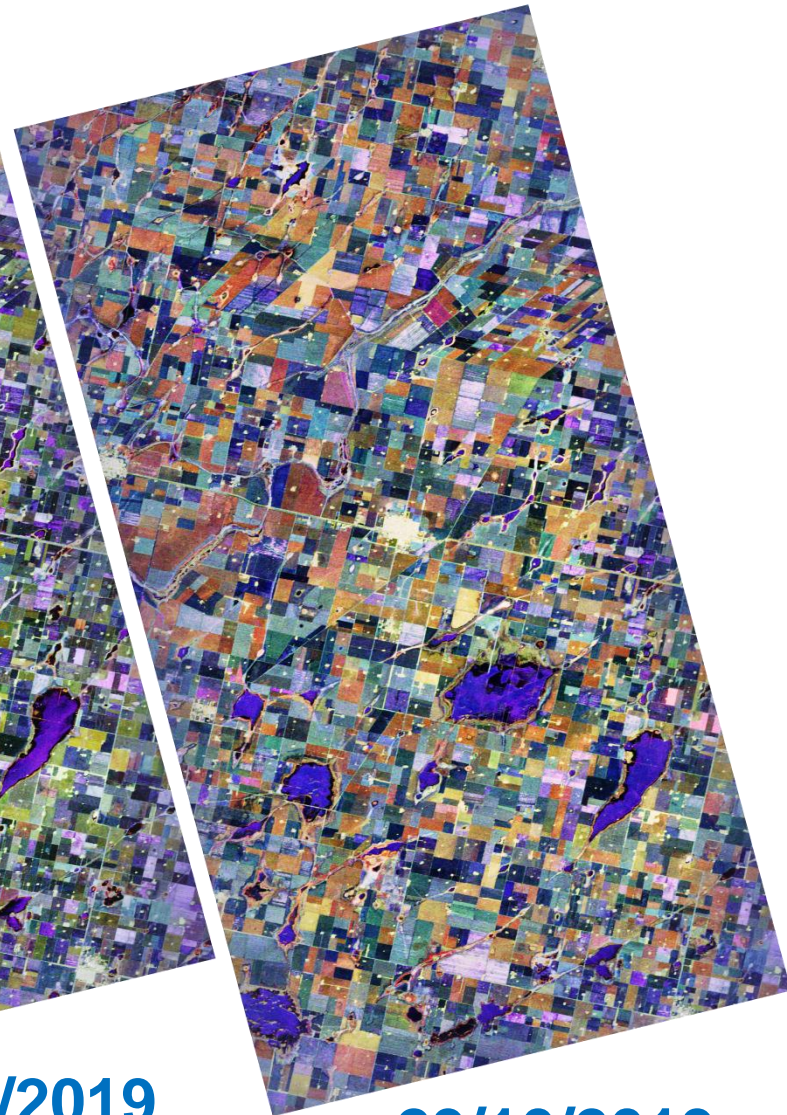




19/03/2019

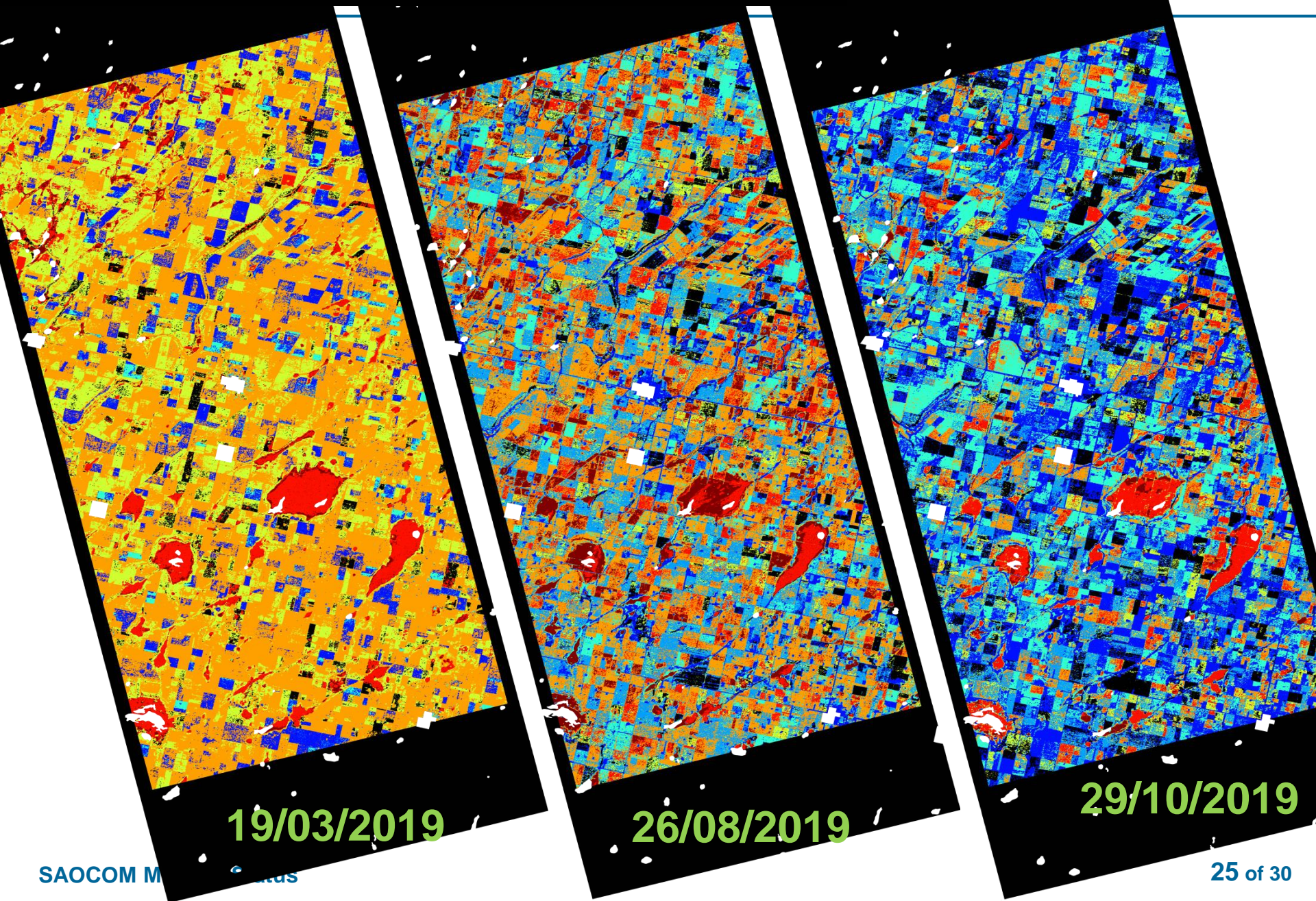


26/08/2019

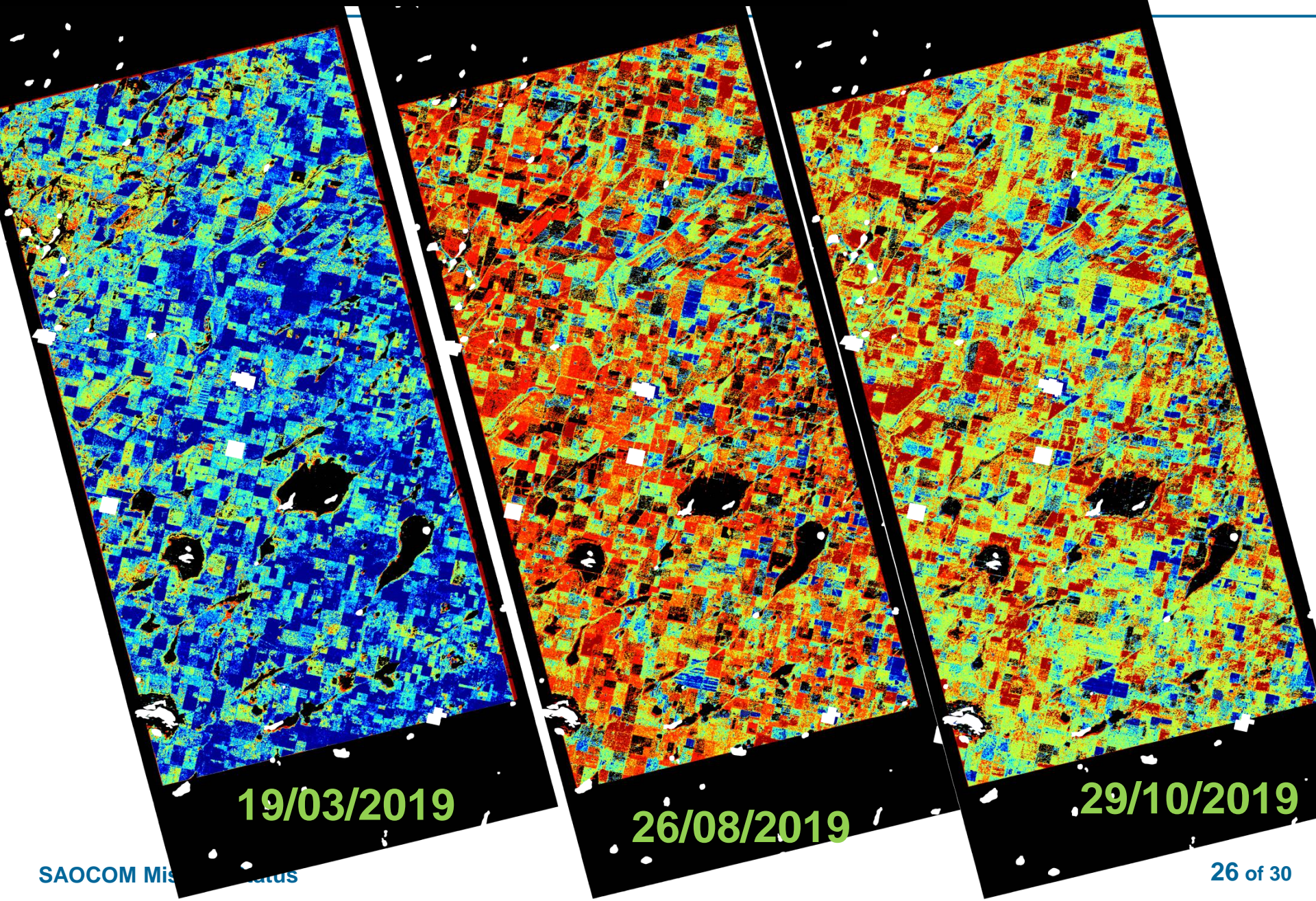


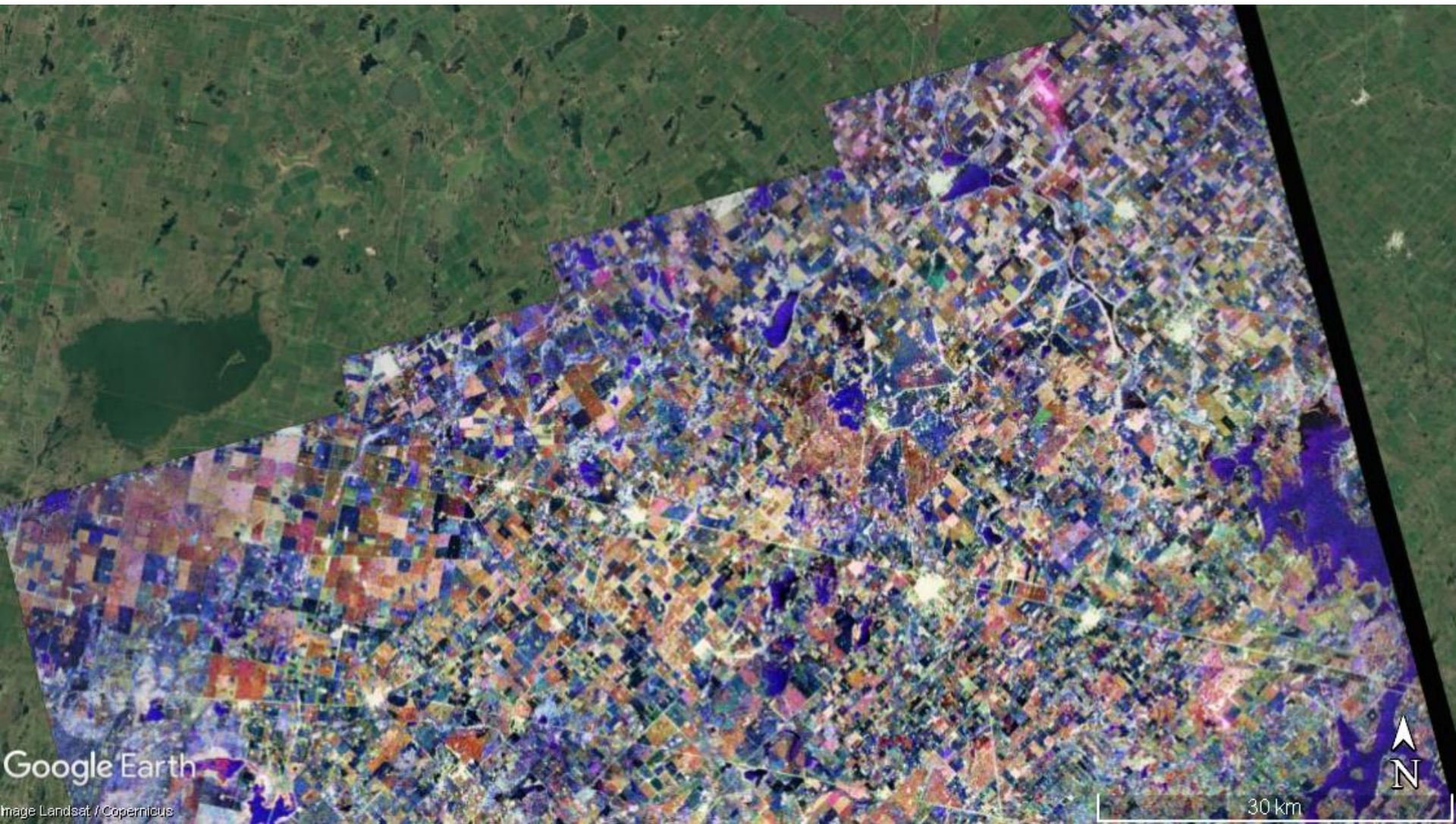
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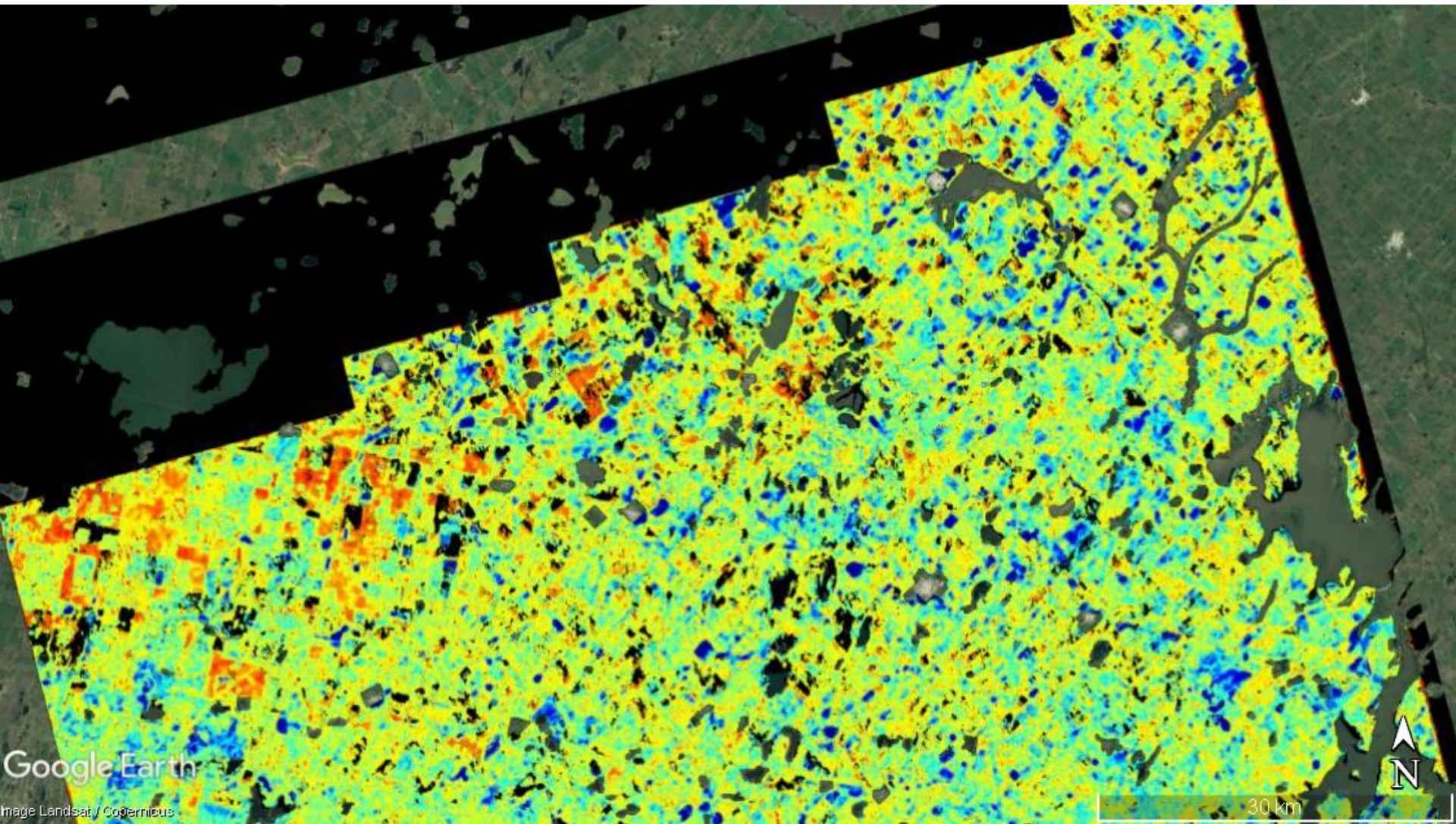
LCC products (classification map)



SSMH products (classification map)







SAOCOM 1A:

- **Commissioning Completion Review next week**
- **CalVal Soil Moisture related products ongoing**

SAOCOM 1B: Launch next March

Thank you



Questions ?