JAXA's plan for the IPY using the ALOS PALSAR

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ESA / ESRIN

Contents

1) PALSAR observation
2) JAXA planning for IPY observation
3) Antarctica
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5) Observation Planning
6) Conclusions

Introduction

ALOS was launched on Jan. 24 2006 to 46 day revisit orbit.

PALSAR and its five observation modes (FBS, FBD, POL, SCAN, and DSN) have been calibrated. The sensor data show the good stability and accuracy.

Satellite is maintained in the good condition. No major failure was confirmed except for one data transmitter lost. The remained fuel expects 10 years more life.

The systematic observation strategy was adopted for earth observation.

PALSAR collected more than 700,000 scenes.

ALOS

Launch date	2006/1/24
launcher	H-IIA-8
mass	about 4,000kg
Solar power	about 7kW
orbit	Sun synchronous
height	691.65km
cycle (Sub-Cycle)	46 days (2 days)

Star Tracker

Data Relay Antenna

PALSAR

GPS Antenna

PRISM

AVNIR-2

Solar Array Paddle

Velocity

Nadir

orbit determination : (10cm)

Yaw steering April 25 2006

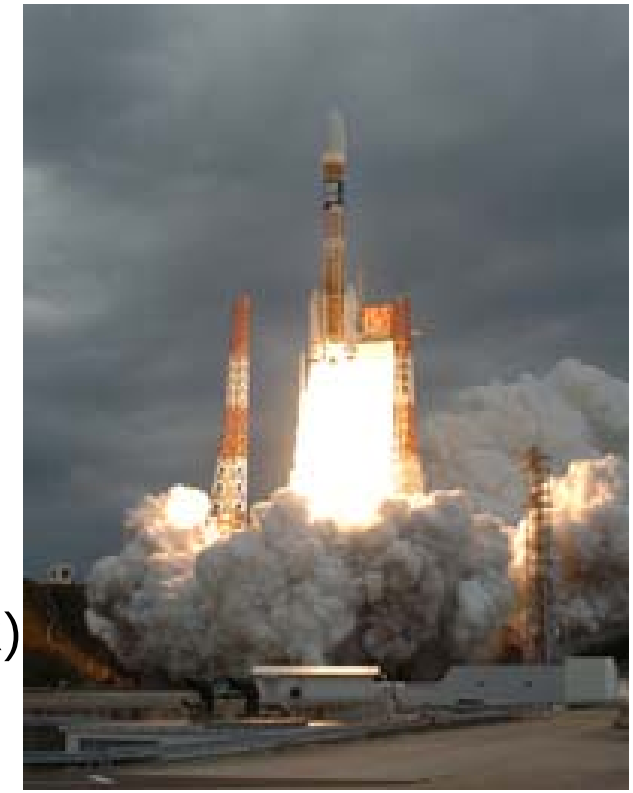
Orbital Tube ~500m (after Aug. 7)

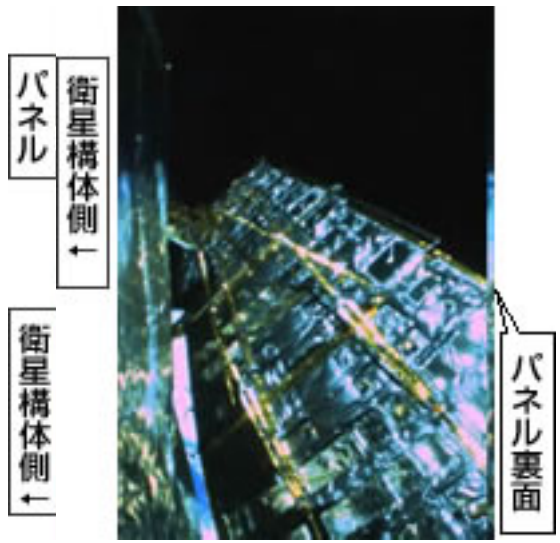
Mission objectives
Mapping
Regional observation
Disaster monitor
Resources
Technology development

History

Launch: 1:33:(UTC), January 24 2006
Site : Tanegashima Space Center
Launcher : H-IIA-No.8
Deployments: Solar Paddle (1:52:01:24:2006)
DRC Antenna(23:47:01:24:2006)
SAR Antenna (03:09:01:26:2006)
Time system : GPS time ON :Feb. 14 day
First images Feb. 14~15 (PRISM, AV-2, PALSAR)
Accurate orbit determination : End of March (10cm)
Yaw steering ON April 25
Orbital Tube ~500m (after Aug. 7, for InSAR)

Commissioning ends: May 15 (One month behind)
Initial Calibration: May 16 ~ Oct. 23, 2006
Operation :Oct. 24 ~

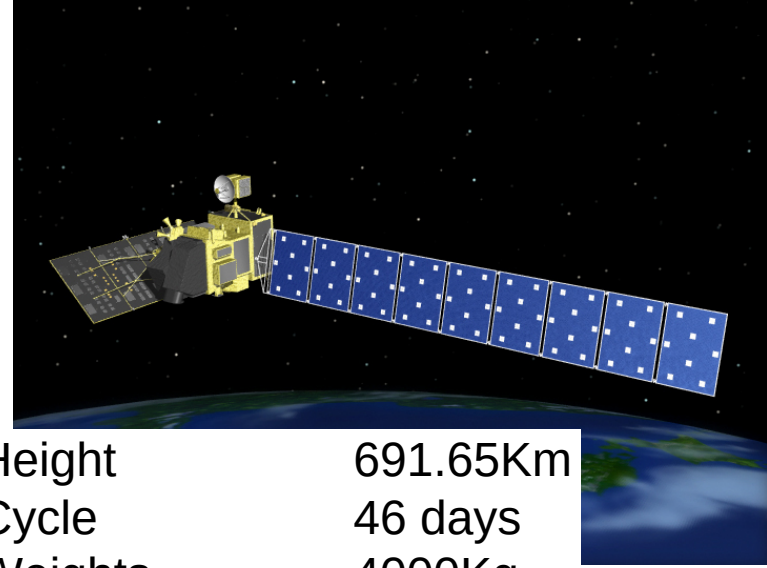




SAR Paddle Deployment

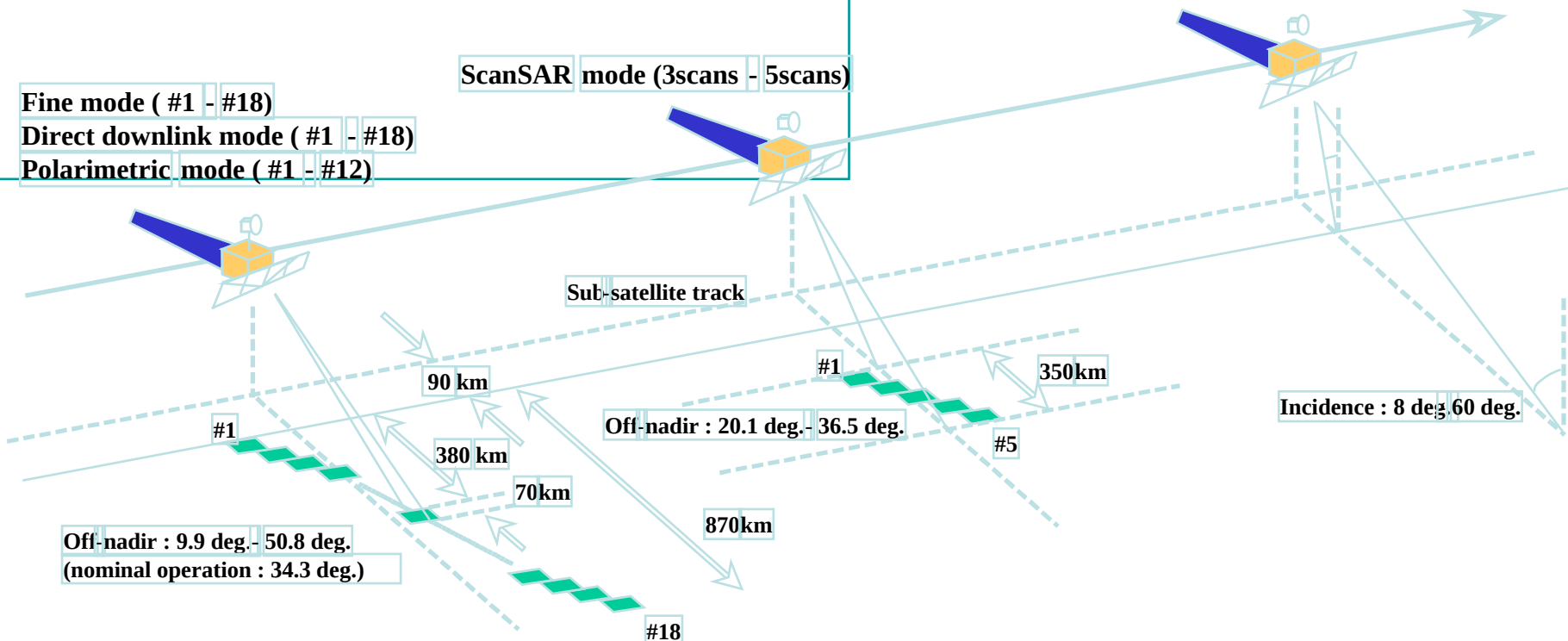
PALSAR onboard ALOS

Frequency	1270 MHz
Band Width	28/14MHz
Modes	FBS,FBD,POL, SCAN
Antenna beams	18 (STRIP)+5 SCANs
Image Width	70Km
Incidence	7.7 - 60 degrees
Tr. power	2Kw
Resolution	9m(2L)
Data rate	240Mbps
ADC	5 bits I&Q



Height	691.65Km
Cycle	46 days
Weights	4000Kg
Solar power	7Kw

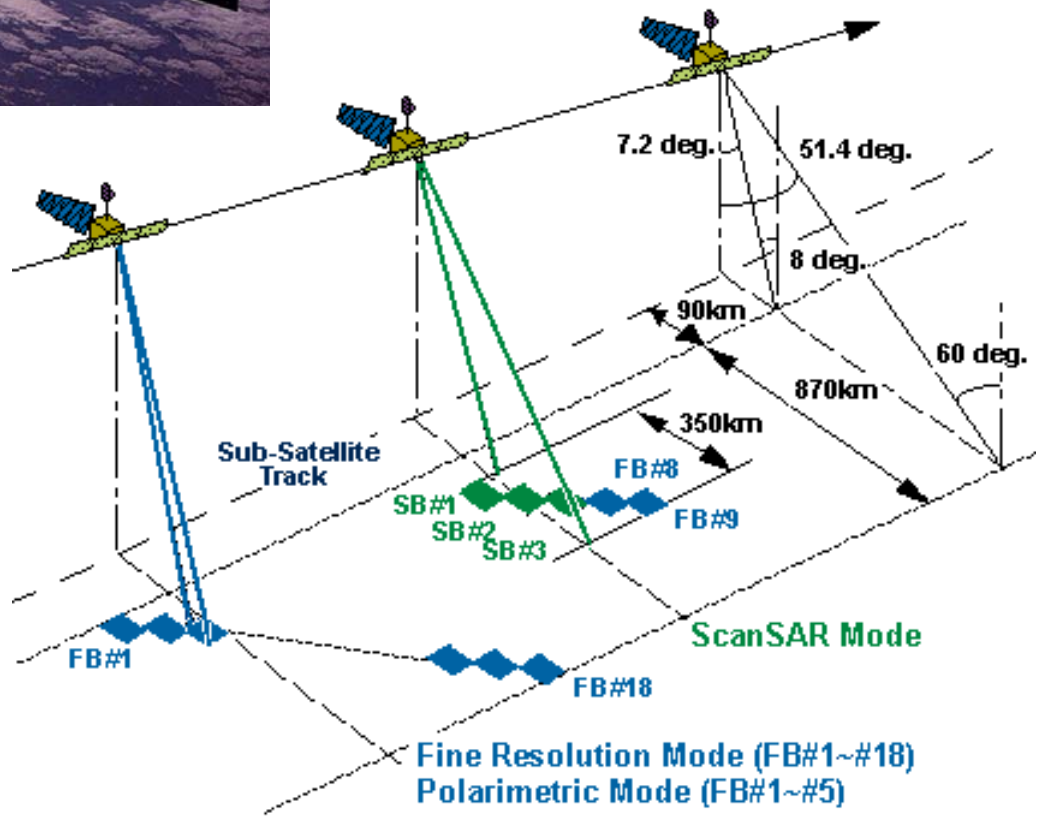
Fine mode (#1 - #18)
Direct downlink mode (#1 - #18)
Polarimetric mode (#1 - #12)



The Advanced Land Observation Satellite - ALOS

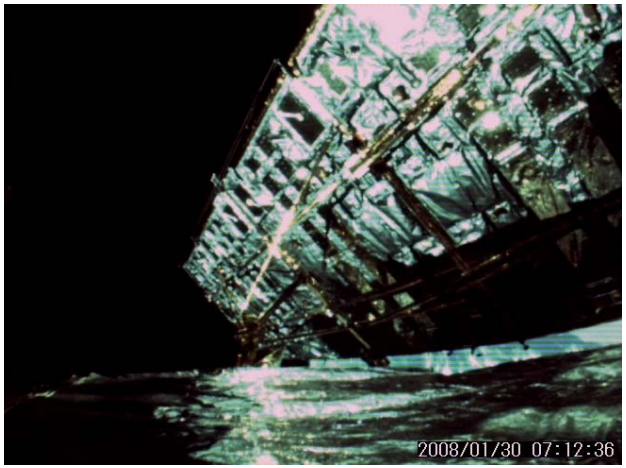
PALSAR
L-band (23.6 cm)
Synthetic Aperture Radar

Launch:
24 Jan. 2006

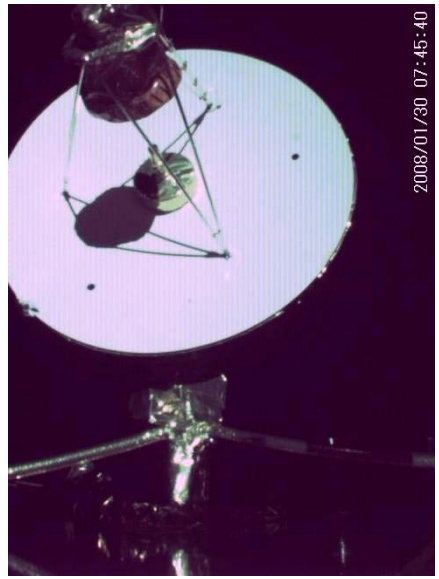


ALOS K&C

ALOS and its pictures

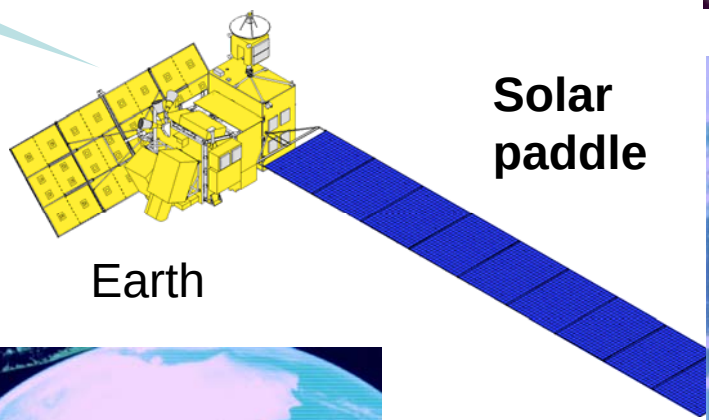


Jan. 30 2008



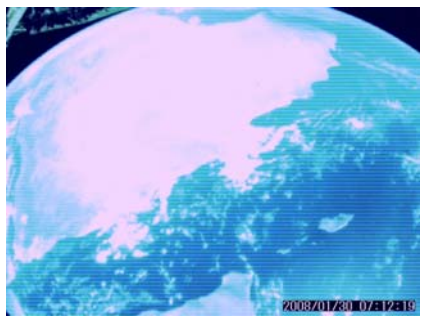
Antenna for
Inter satellite
communication

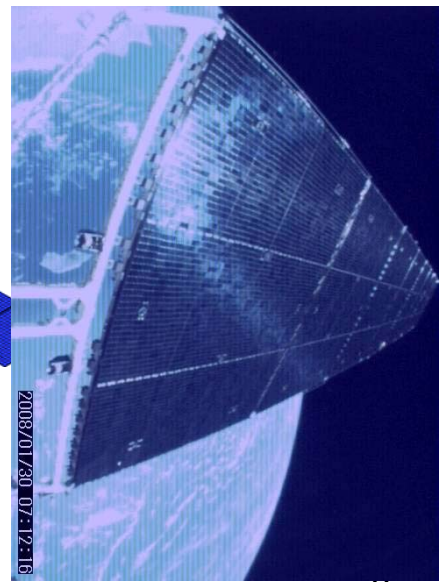
PALSAR Antenna backside



Solar paddle

Earth





ALOS operation status (3/3)

Operation status of each sensor

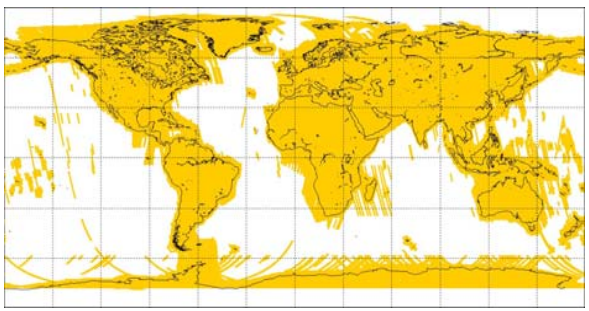
Observation results

Duration : 2006/5/16 (CAL/VAL) ~ 2008/3/8 (17cycles)

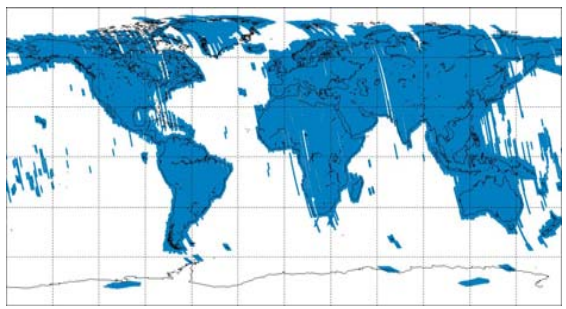
Following images contains all the operation modes.

	Total number of scenes	Cloudless scenes
PRISM	918,144	316,351
AVNIR-2	418,092	127,341
PALSAR	723,801	-

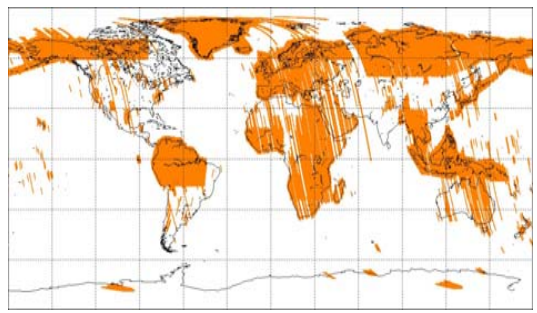
8 times global covers by PALSAR.



FBS



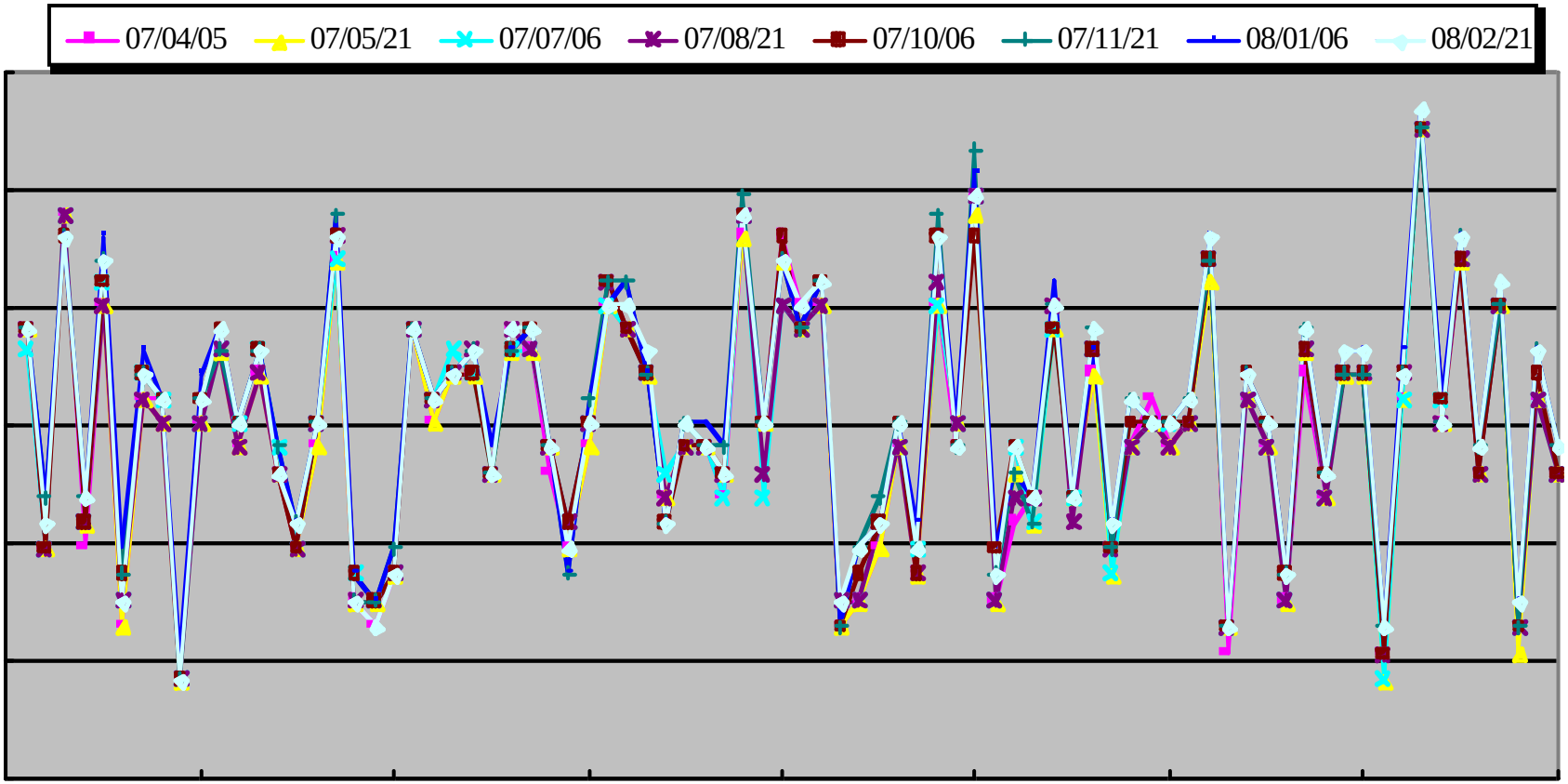
FBD



PLR

PALSAR Status PALSAR is very stable.

PALSAR Transmission power monitor



PALSAR Power monitor results (80 T/R modules)

- Total Power>=2200W (Spec=2000W)
- No degradation measured.

1)ALOS-TDRScommunication test

1．Goal : communication test between ALOS and TDRS

2. Plan ALOS-TDRS(F-10) communication test（Ka）

ALOS->TDRS F-10 ->WSC ->ASF

3.Schedule May 29 2008 3 passes(June 5 ,3 passes(backup))

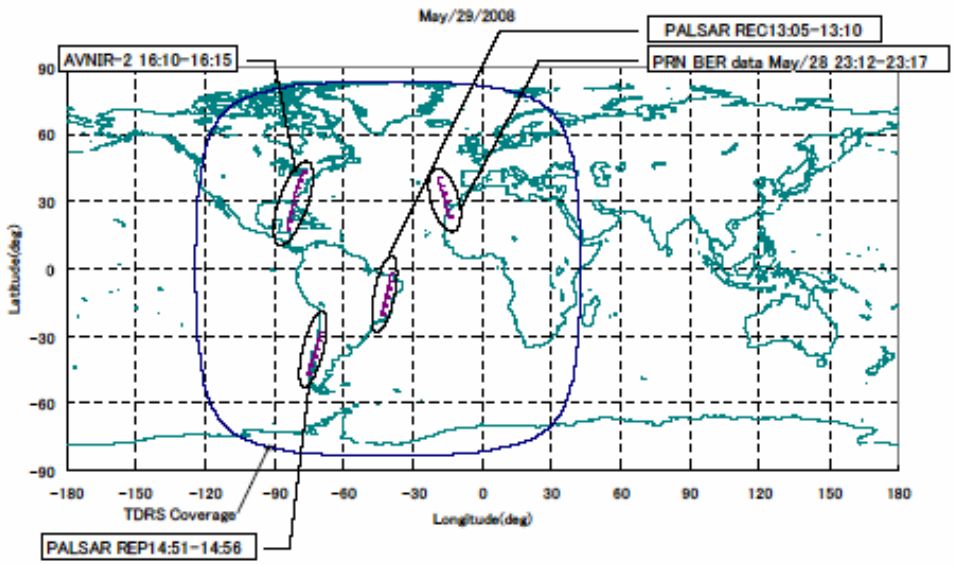
（Data: PN, PALSAR, and AVNIR-2）

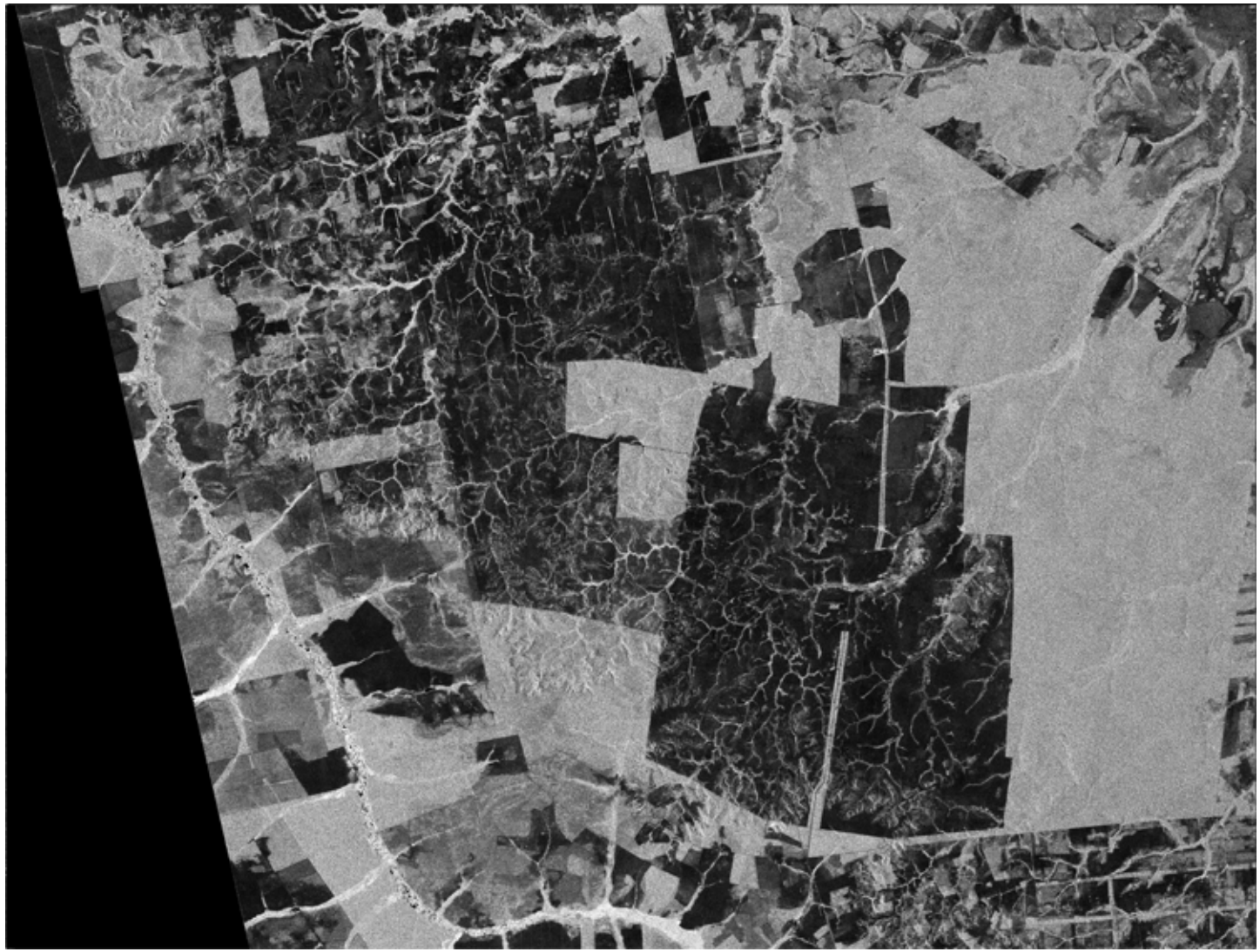
2)Orbit maneuver

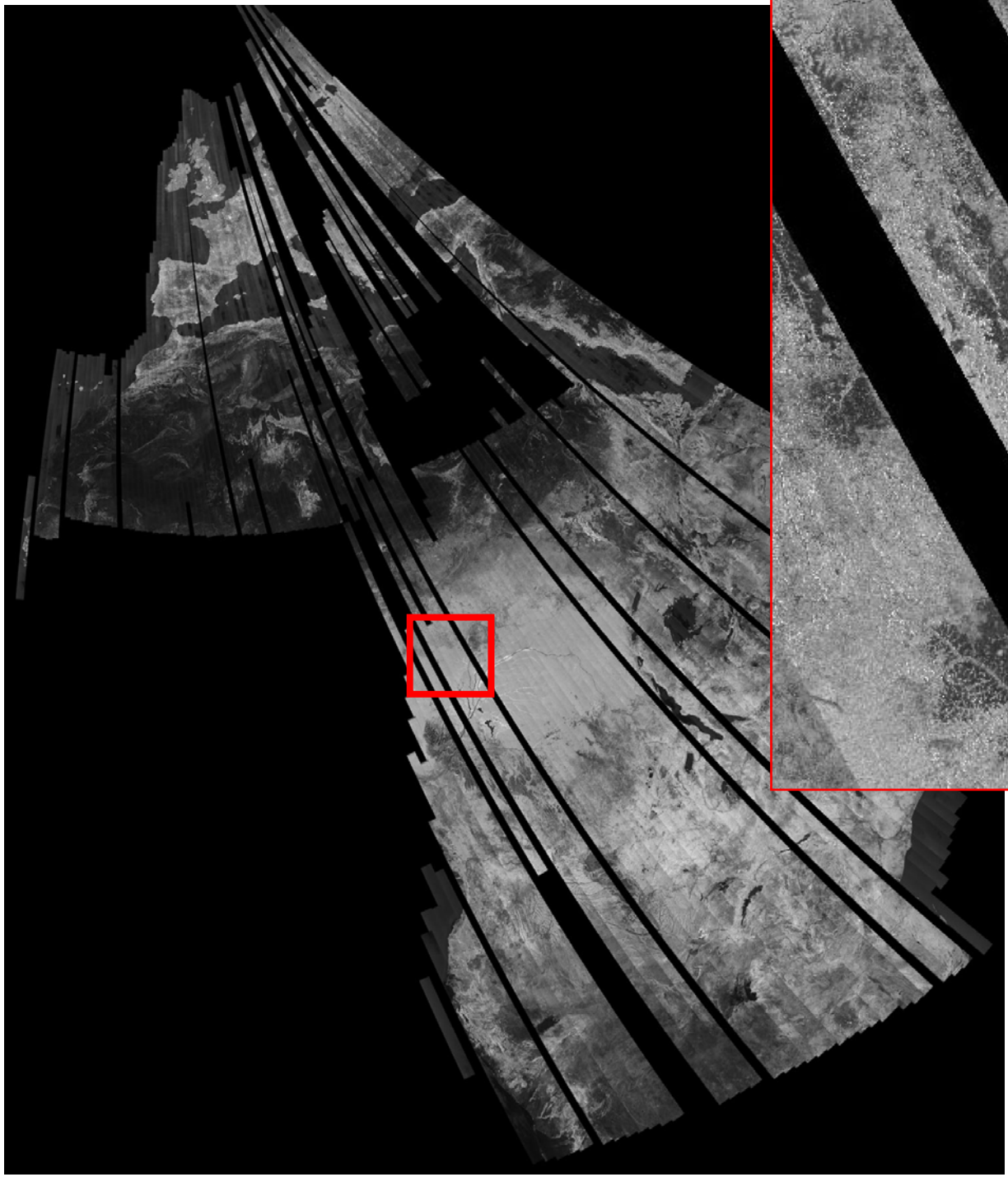
June beginning: maintain the orbital plane (inclination)

> Tuning of the inclination.

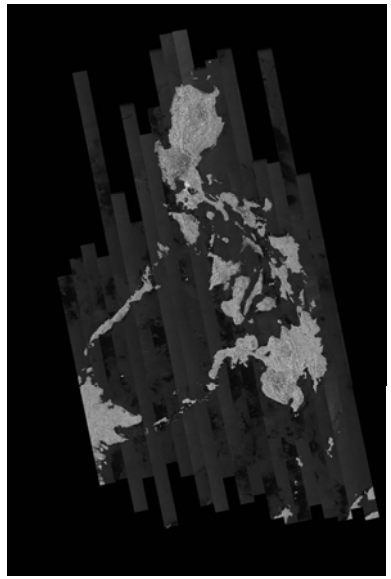
（White Sands Complex） （Alaska Satellite Facility）

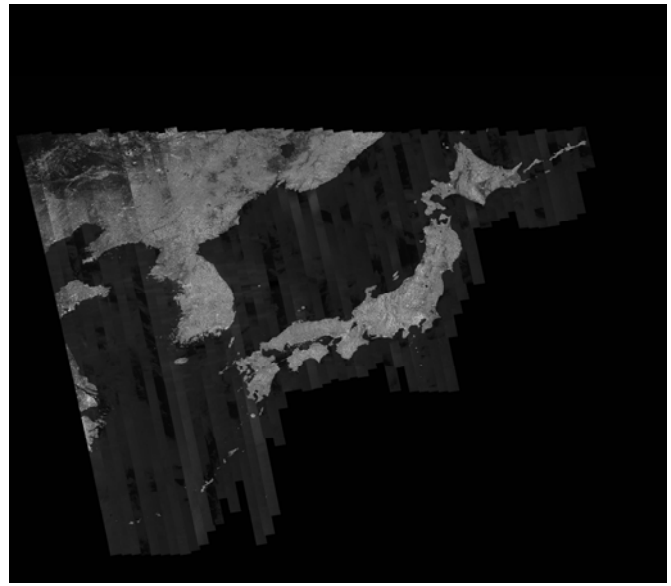


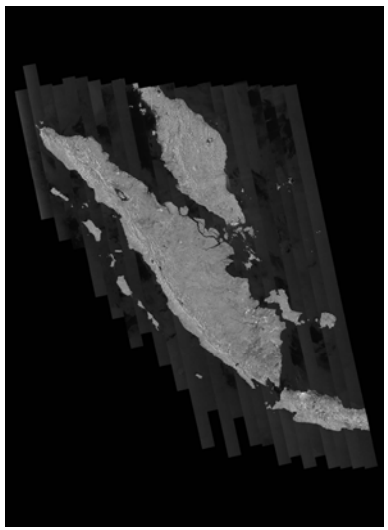


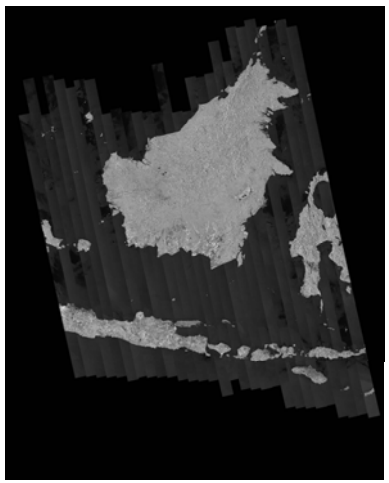


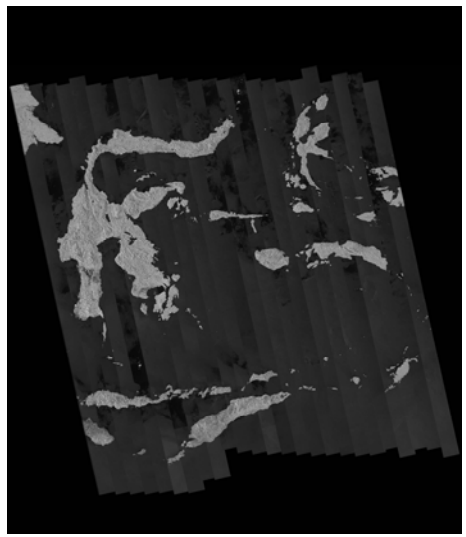
Current Mosaic products

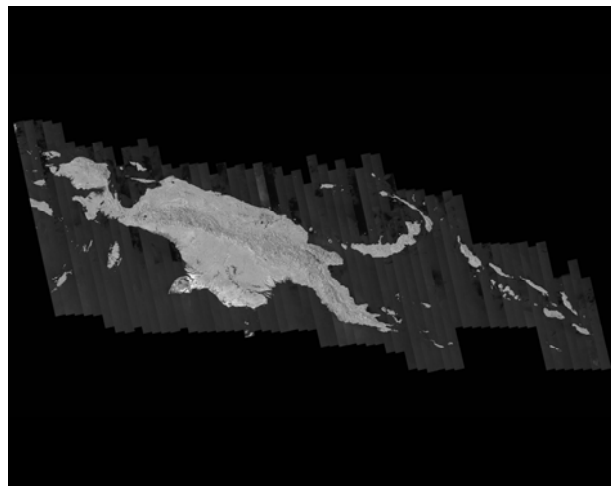






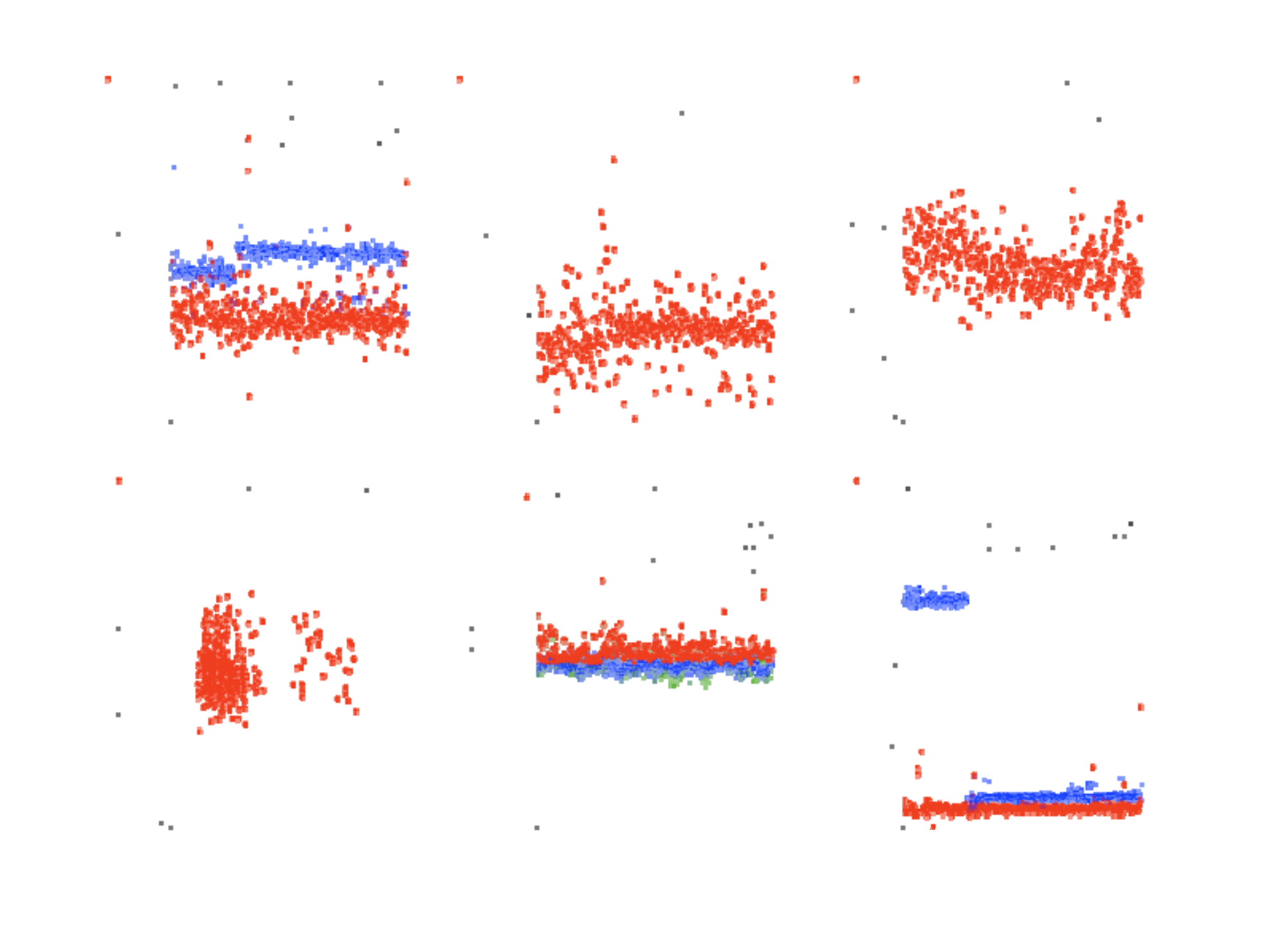






Calibration - Summary

- PALSAR : FBS, FBD, SCANSAR, Polarimetry, DSN
- PALSAR Initial Image : Feb. 11 2006
- Initial calibration: (May ~ October, 2006)
- Reference: Corner reflectors and Amazon distributed targets. Raw data characteristics, geometric and radiometric parameter tuning, Polarimetric calibration, Image Quality.
- Collaboration: worldwide (CVST teamwork)
- Routine calibration phase after Oct. 24 2006 confirmed the calibration stability of the PALSAR. The accuracy of these data are
- Geometry : 9.3 meter RMS
- Radiometry : 0.6 dB (0.13 dB) for 1 sigma
- Polarimetry : VV/HH : 0.03 dB, 0.3 degrees (1 deg)
- Data acquisitions : 600 scenes.



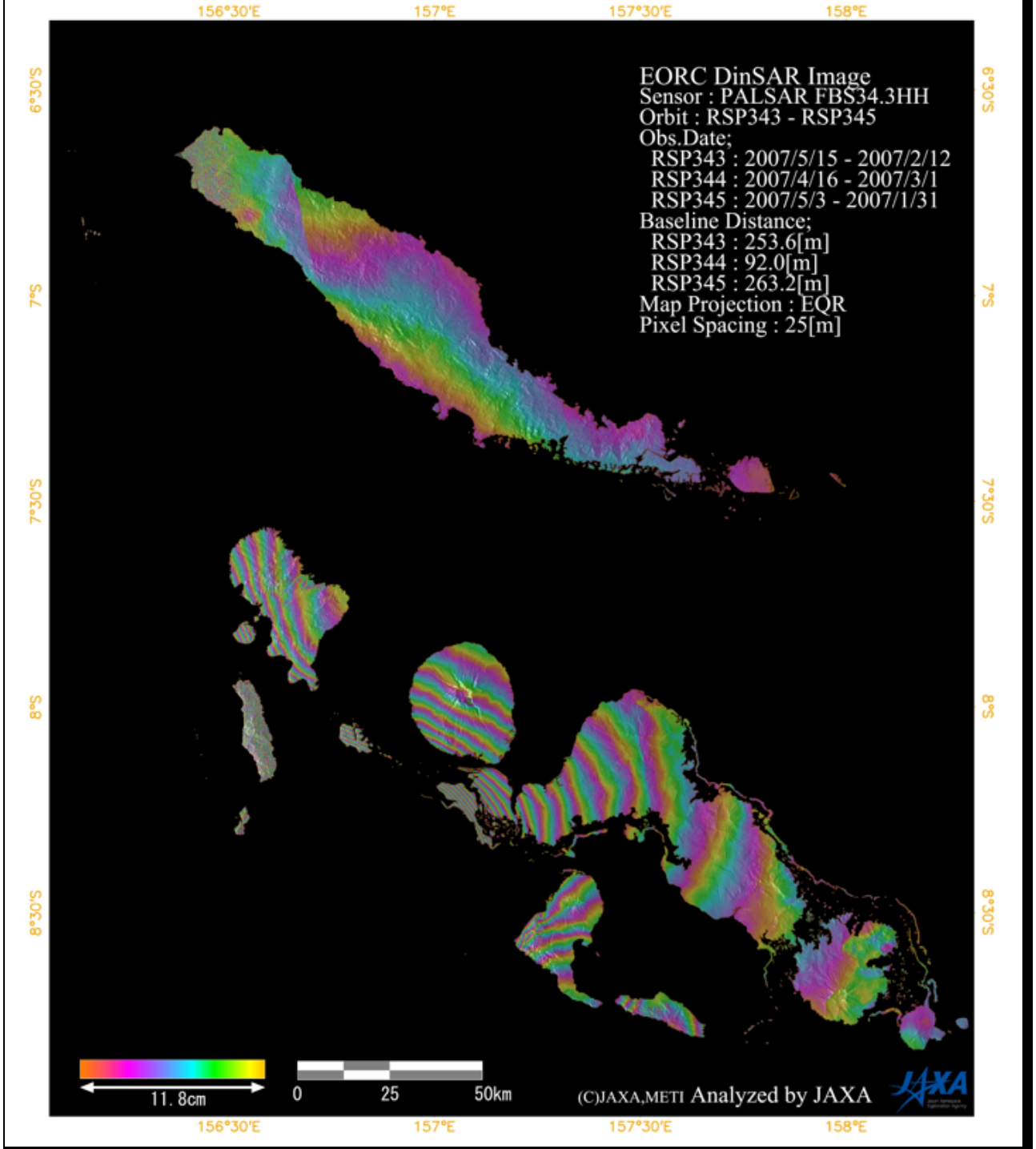
Solomon Earthquake

M8.1
April 2 2007

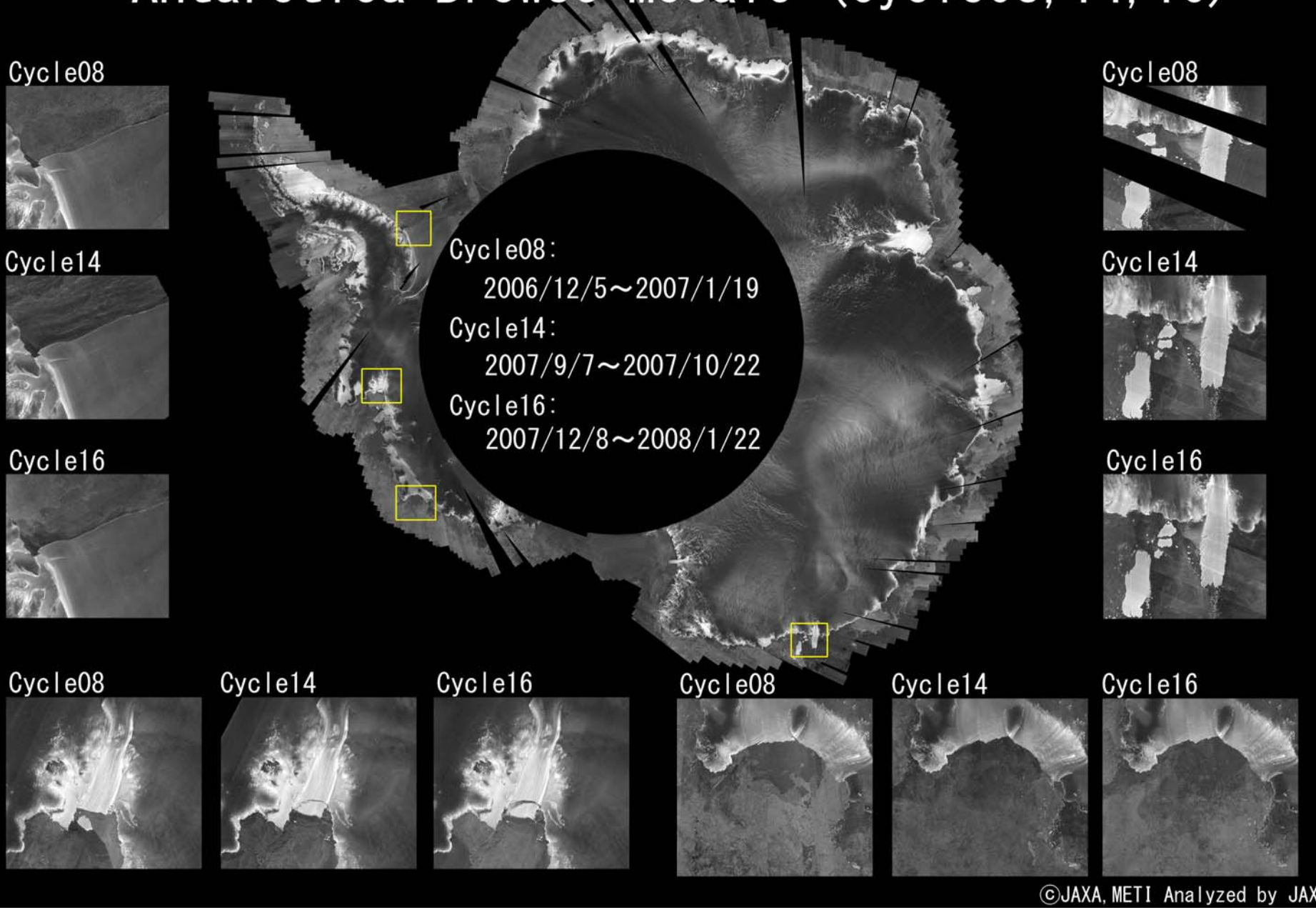
Three DinSAR
344:4/10-2/23
345:5/3-1/31
343:5/10-2/12

FBS343HH

No orbit tuned.
No further corrected.
Three paths overlaid.



Antarctica Browse Mosaic (Cycle08, 14, 16)



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ALOS observation for IPY

2006-2008
Sensor : PALSAR (FBS, FBD, SCANSAR, PLR)

Target : North pole and Antarctica : several times coverages (not daily observation)

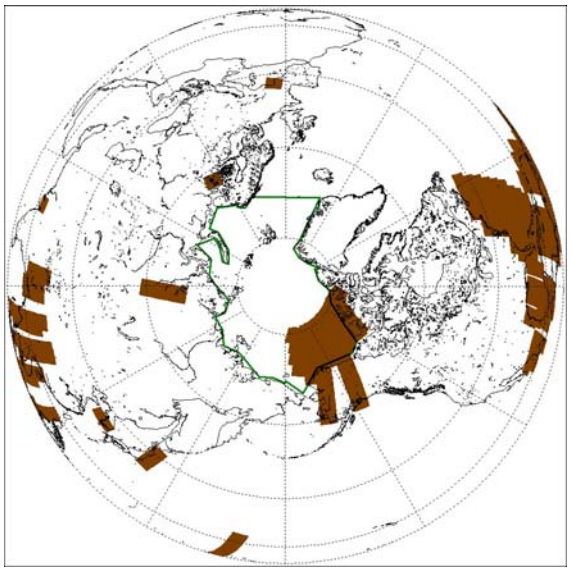
After 2009
PALSAR will be used.
Target : North and south pole regions will be observed.
Frequencies are not decided yet.

Arctic

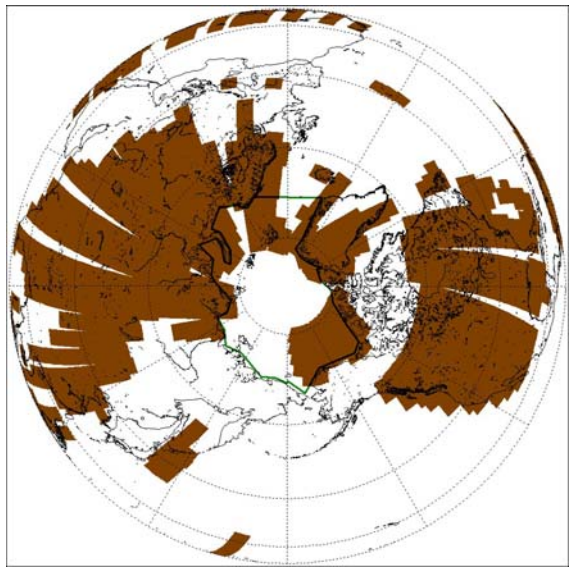
PAST

PALSAR WB1
Cycle07 ~ 12(20-Oct.-2006 ~ 22-Jul.-2007)

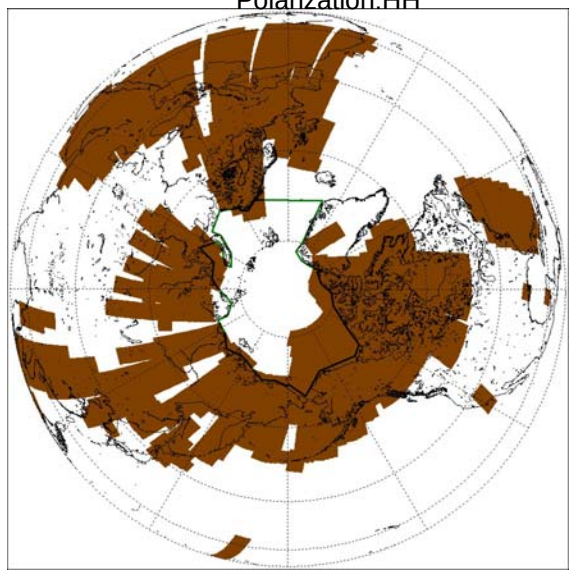
WB1：ScanSAR 5-beam Short burst
Off-nadir:27.1deg
Polarization:HH



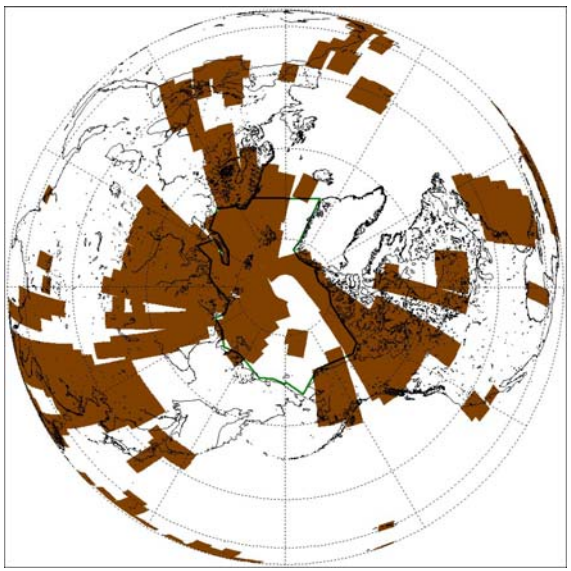
Cycle07 / 20-Oct.-2006



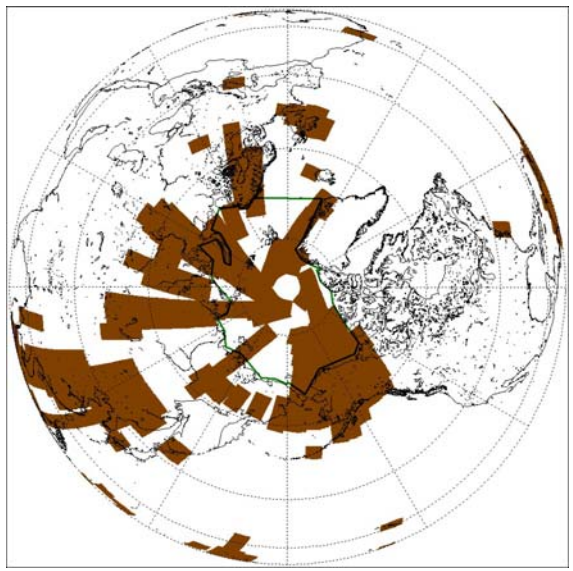
Cycle08 / 05-Dec.-2006



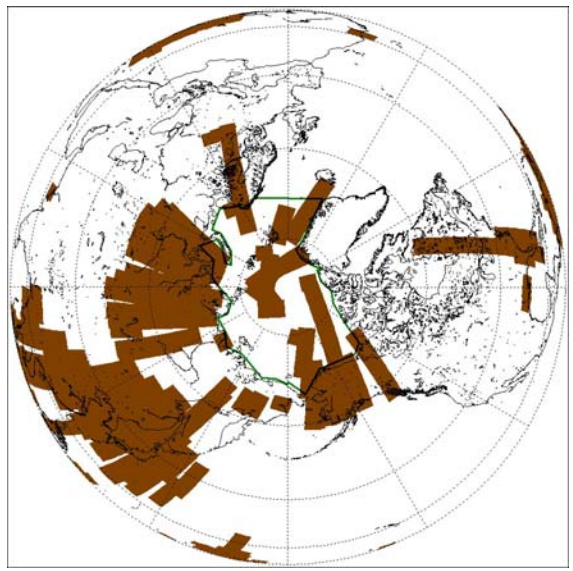
Cycle09 / 20-Jan.-2007



Cycle10 / 07-Mar.-2007



Cycle11 / 22-Apr.-2007

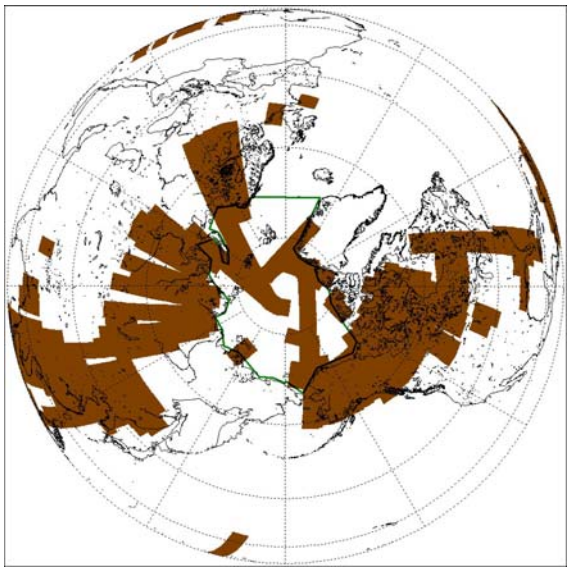


Cycle12 / 07-Jun.-2007

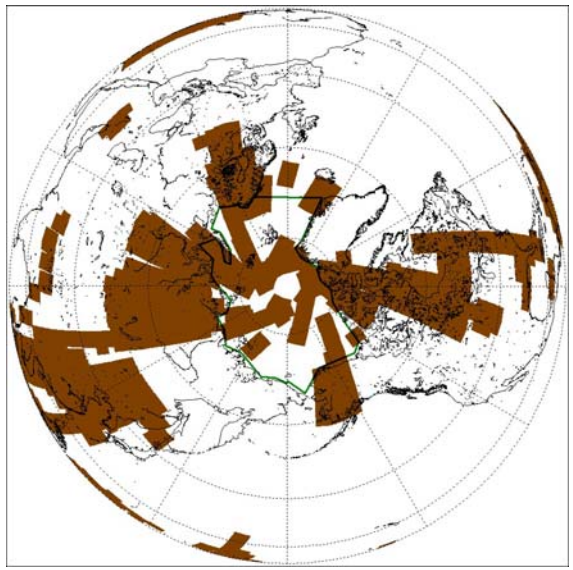
PAST

PALSAR WB1
Cycle13 ~ 18(23-Jul.-2007 ~ 23-Apr.-2008)

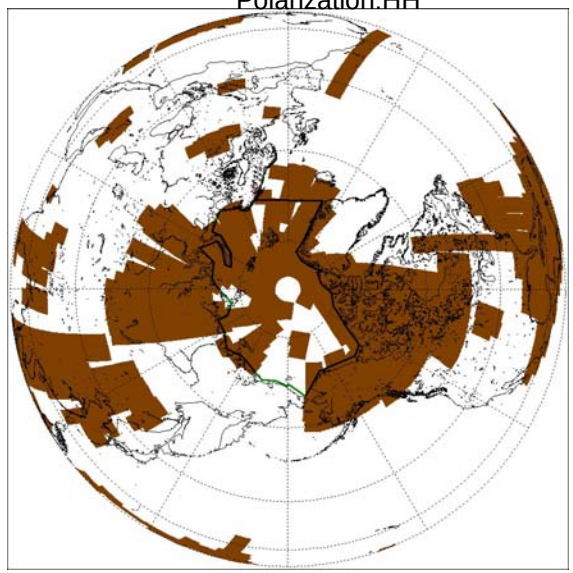
WB1 : ScanSAR 5-beam Short burst
Off-nadir:27.1deg
Polarization:HH



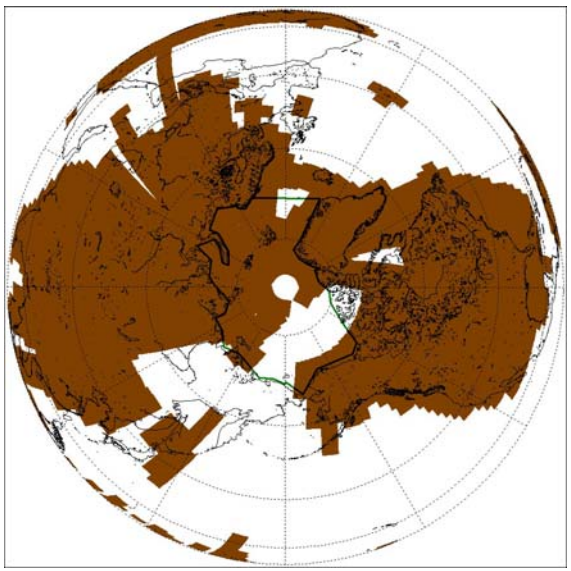
Cycle013 / 23-Jul.-2007



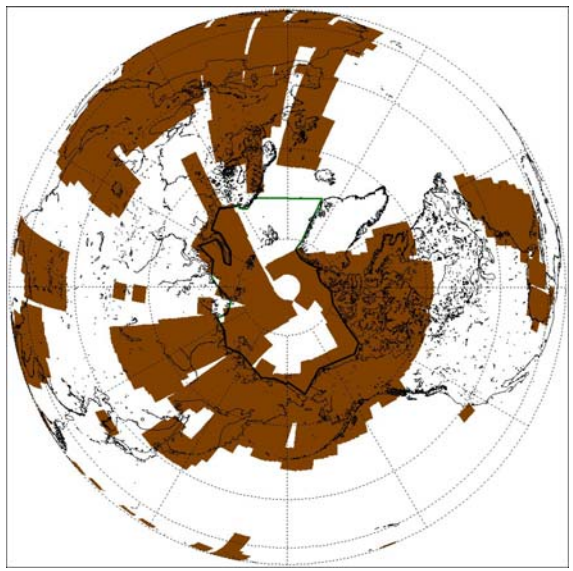
Cycle14 / 07-Sep.-2007



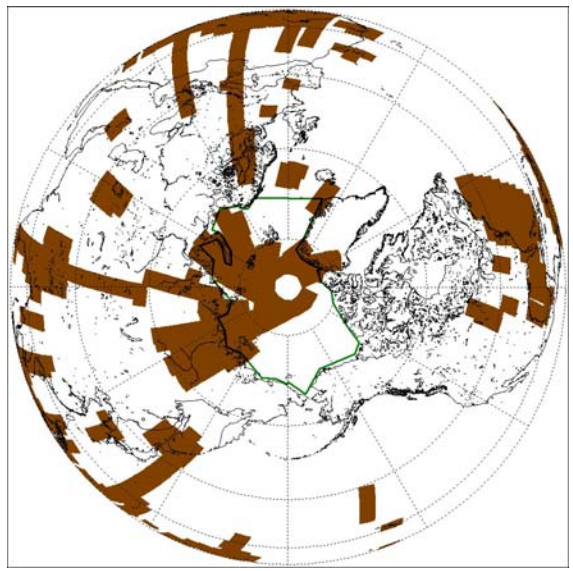
Cycle15 / 23-Oct.-2007



Cycle16 / 08-Dec.-2007



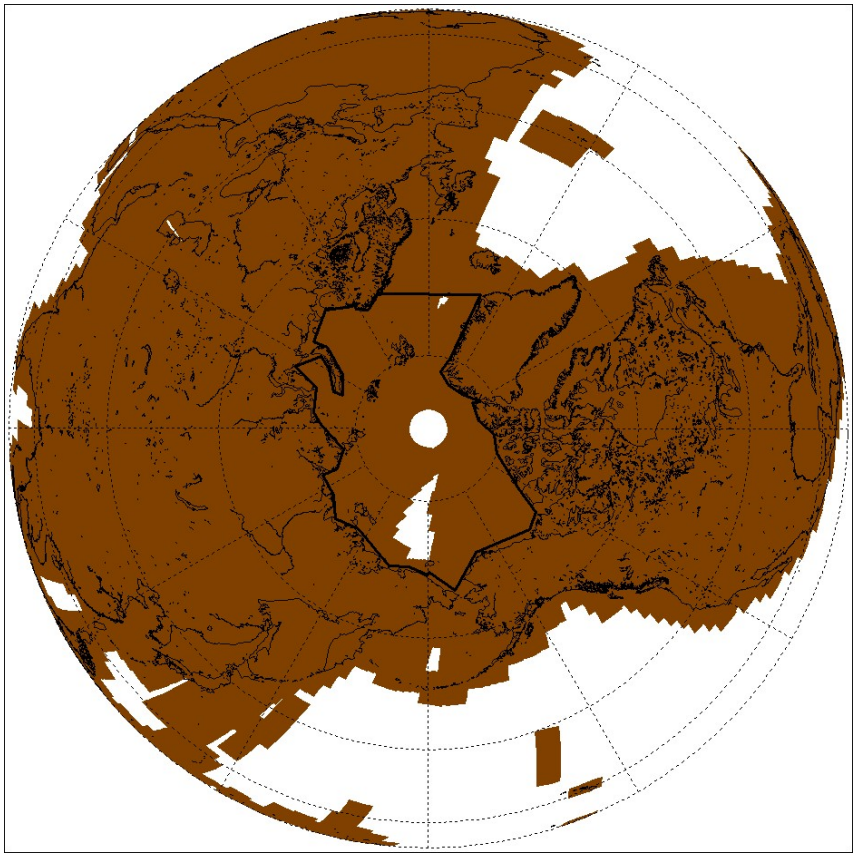
Cycle17 / 23-Jan.-2008



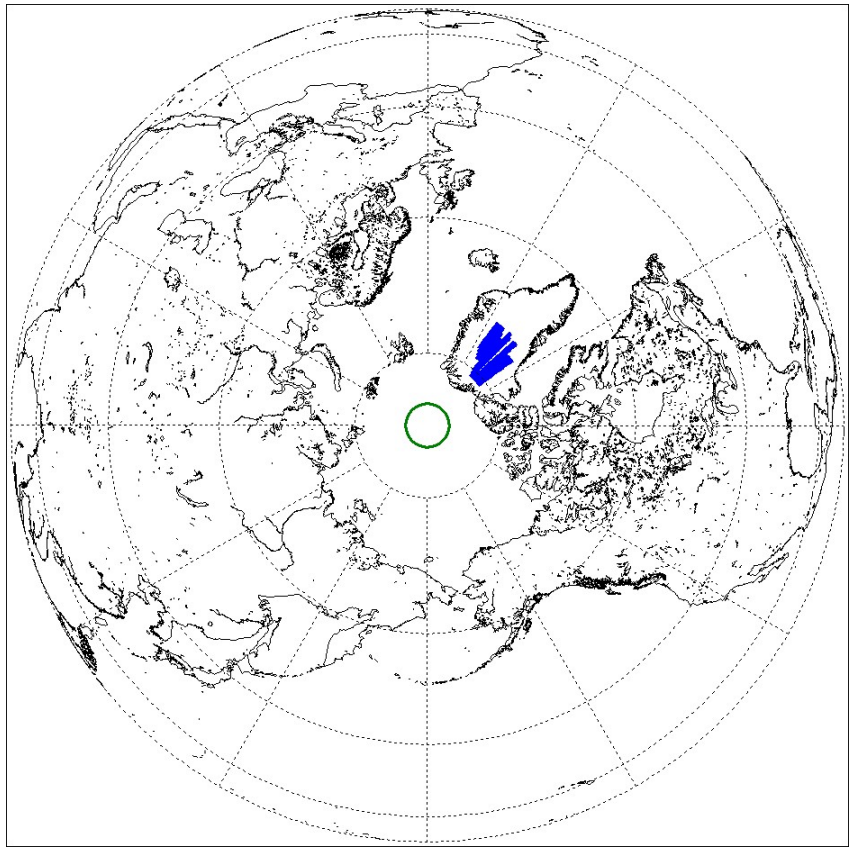
Cycle18 / 09-Mar.-2008

PAST

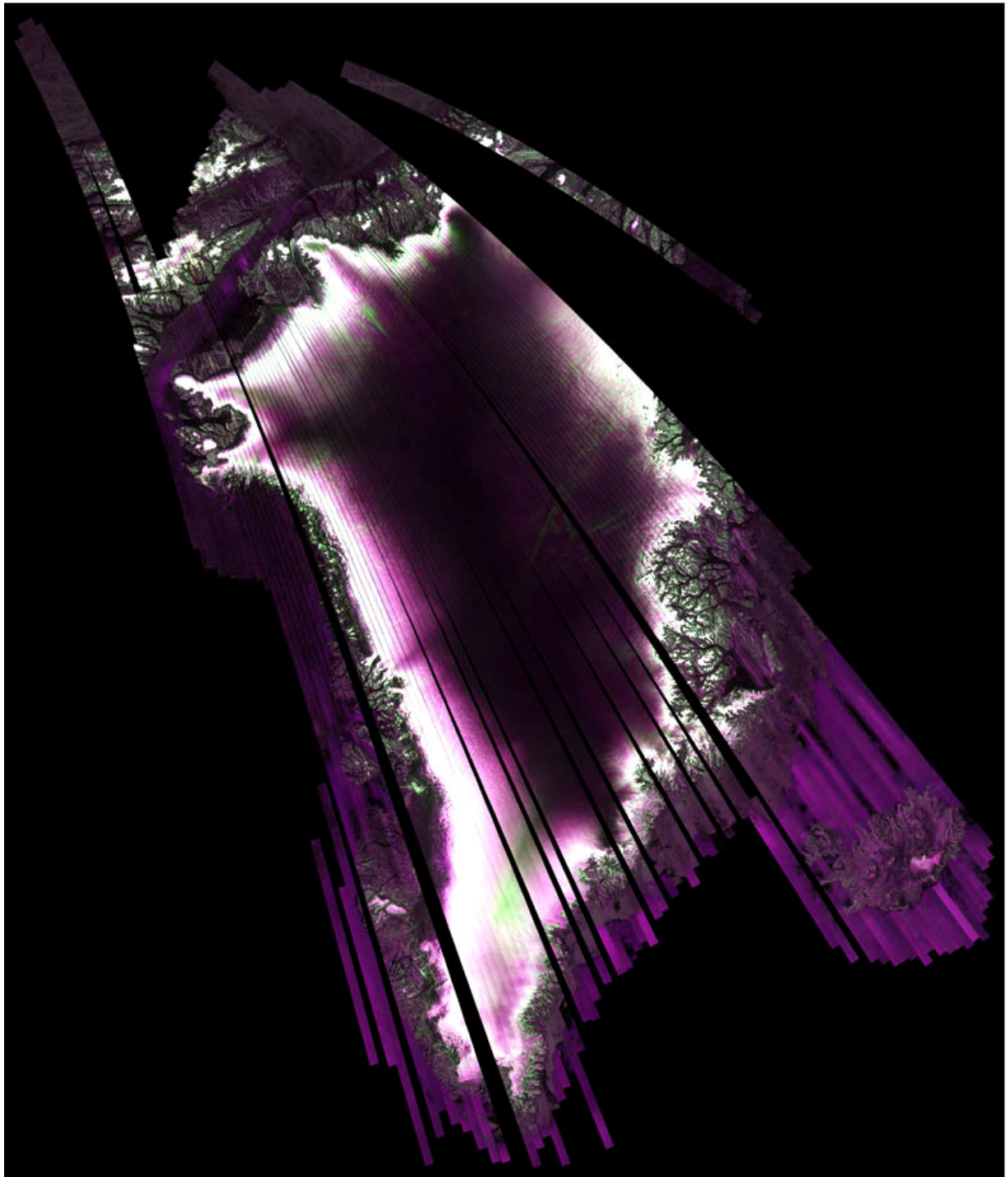
PALSAR WB1/FBD
Cycle07 ~ 18(20-Oct.-2006 ~ 23-Apr.-2008)



WB1：ScanSAR 5-beam Short burst
Off-nadir:27.1deg
Polarization:HH



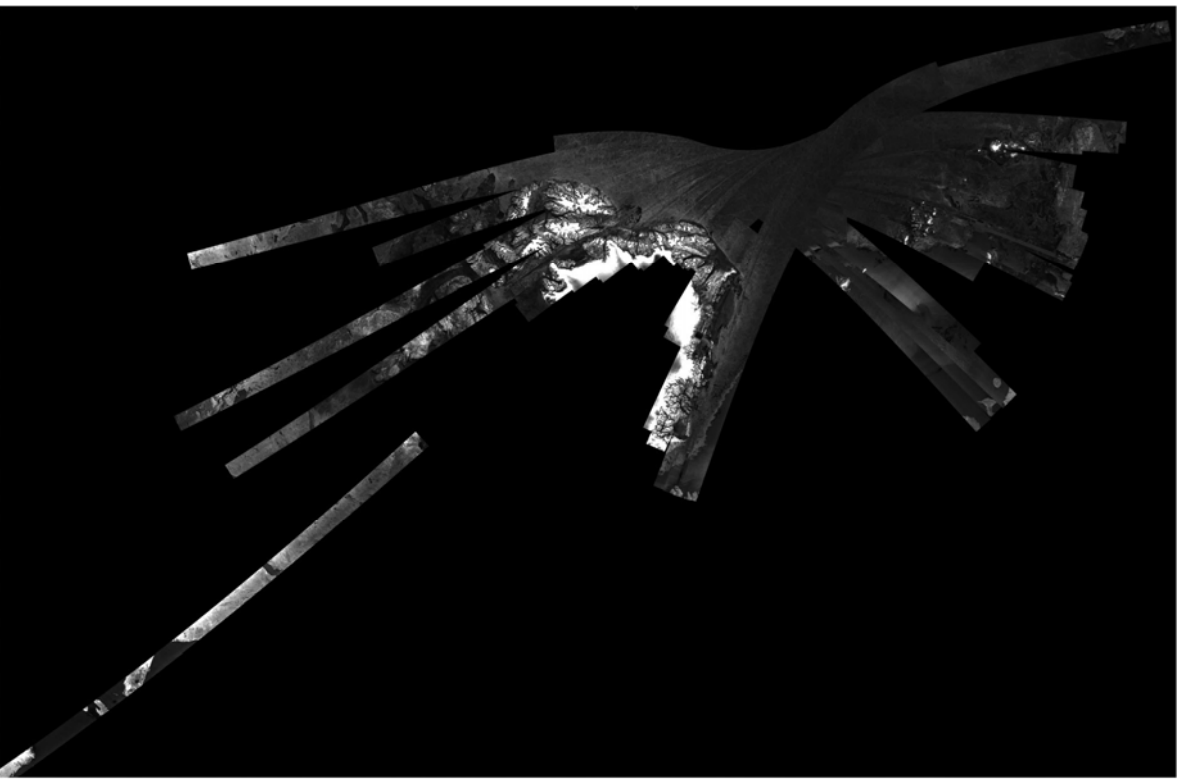
FBD：Fine Beam
Off-nadir:51.0deg
Polarization:HH+HV



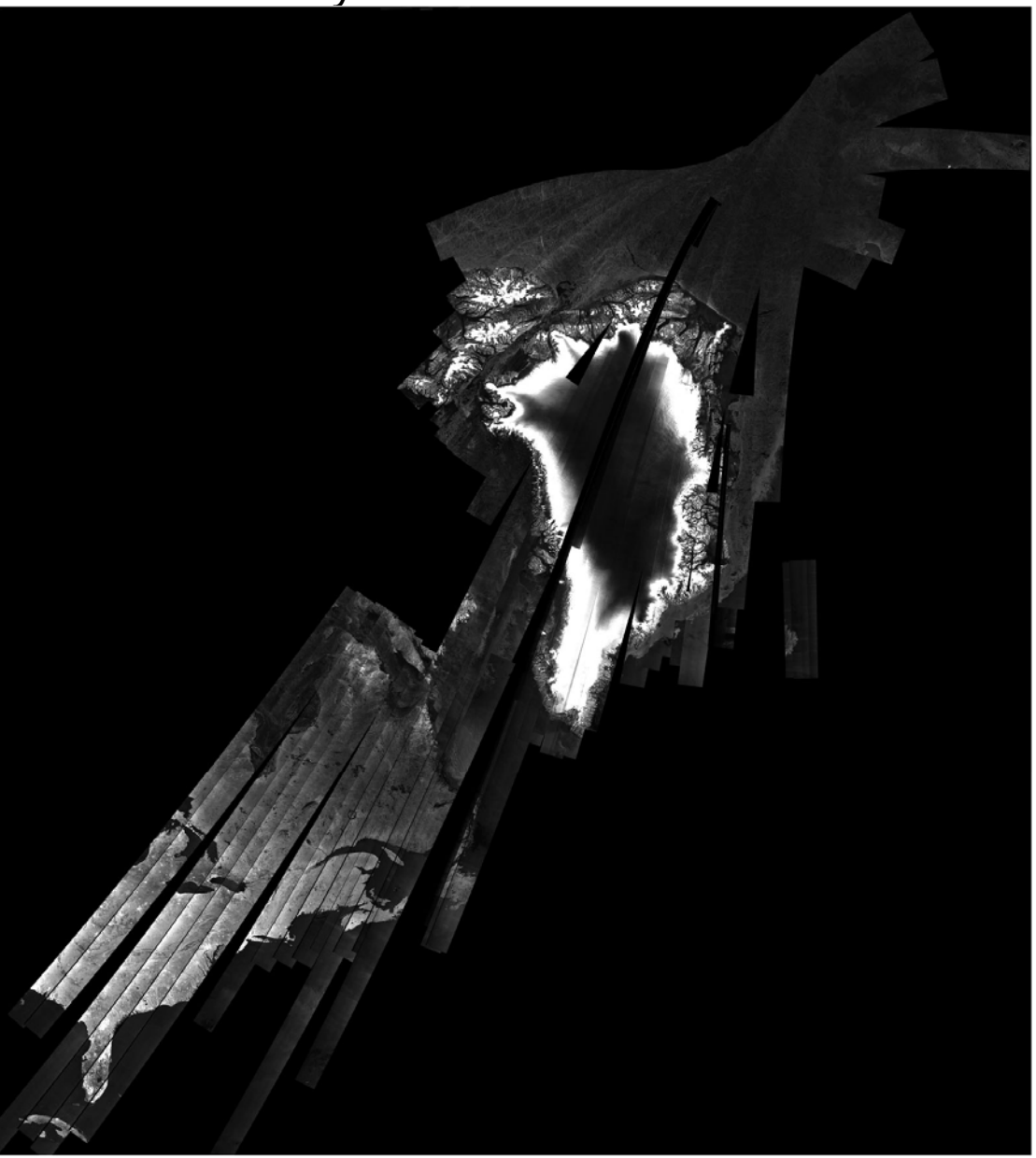
Cycle11 POL

Cycle15 FBS

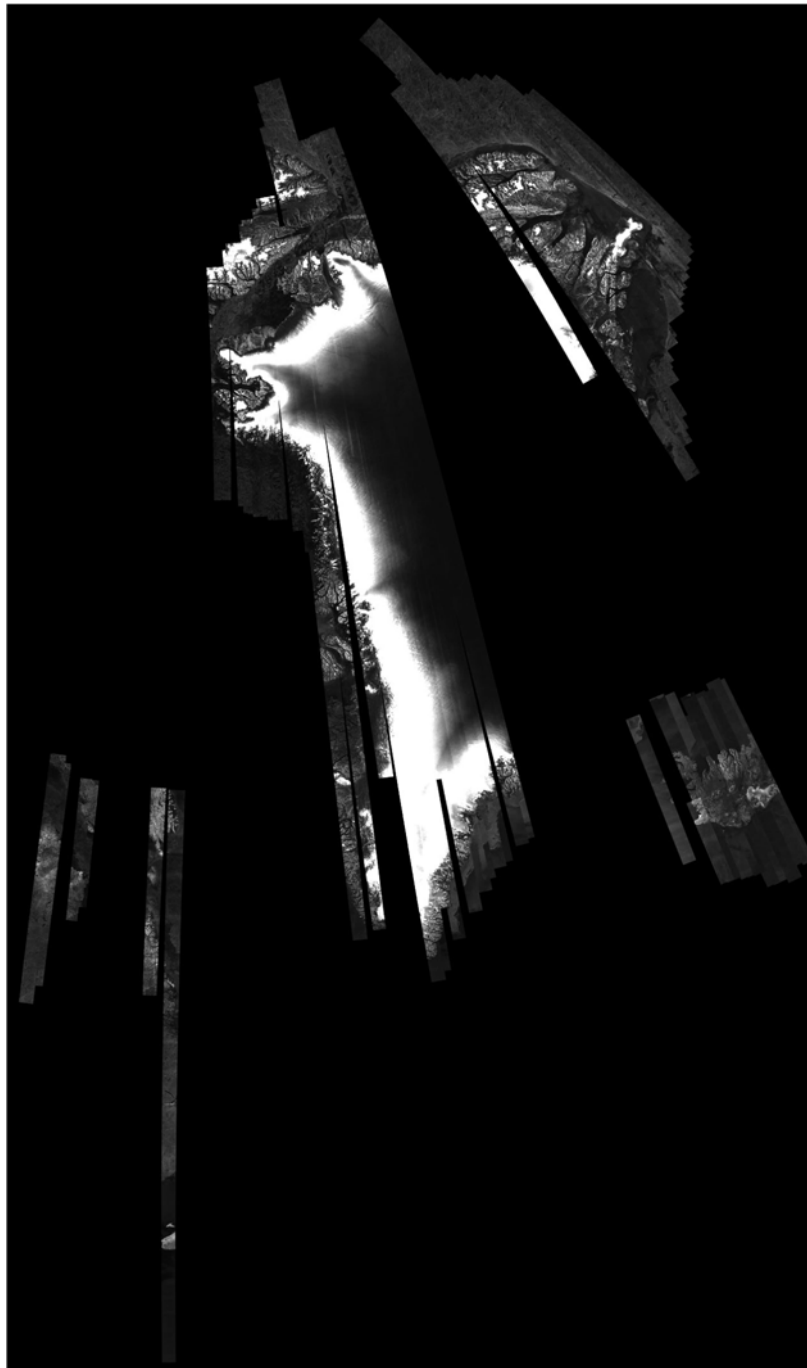
Cycle15 WB1



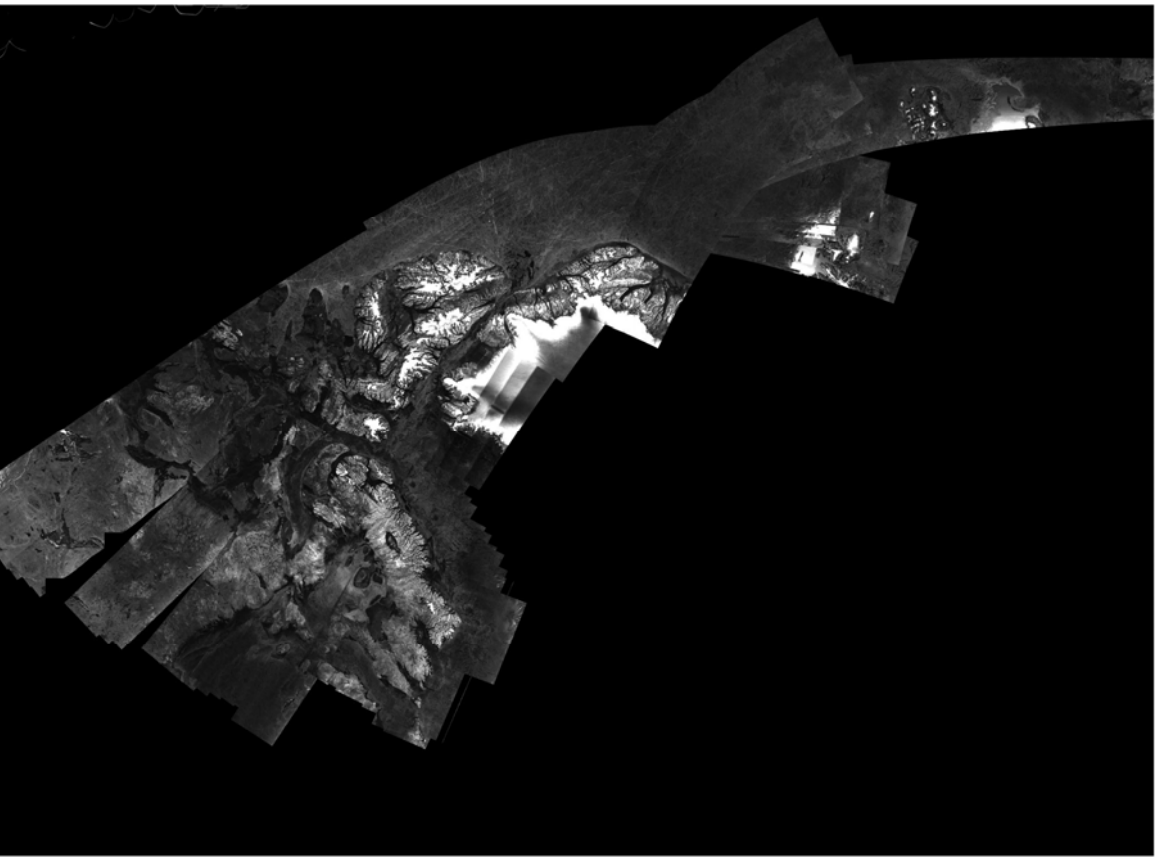
Cycle16 WB1



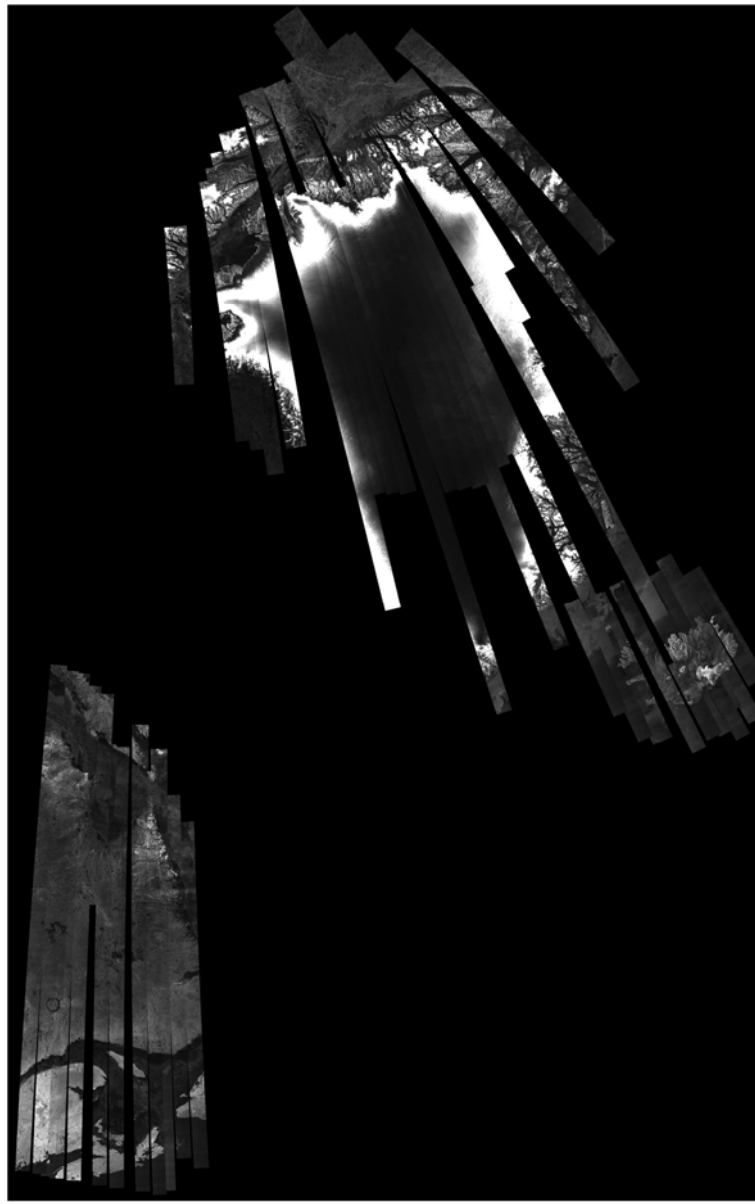
Cycle16 FBS



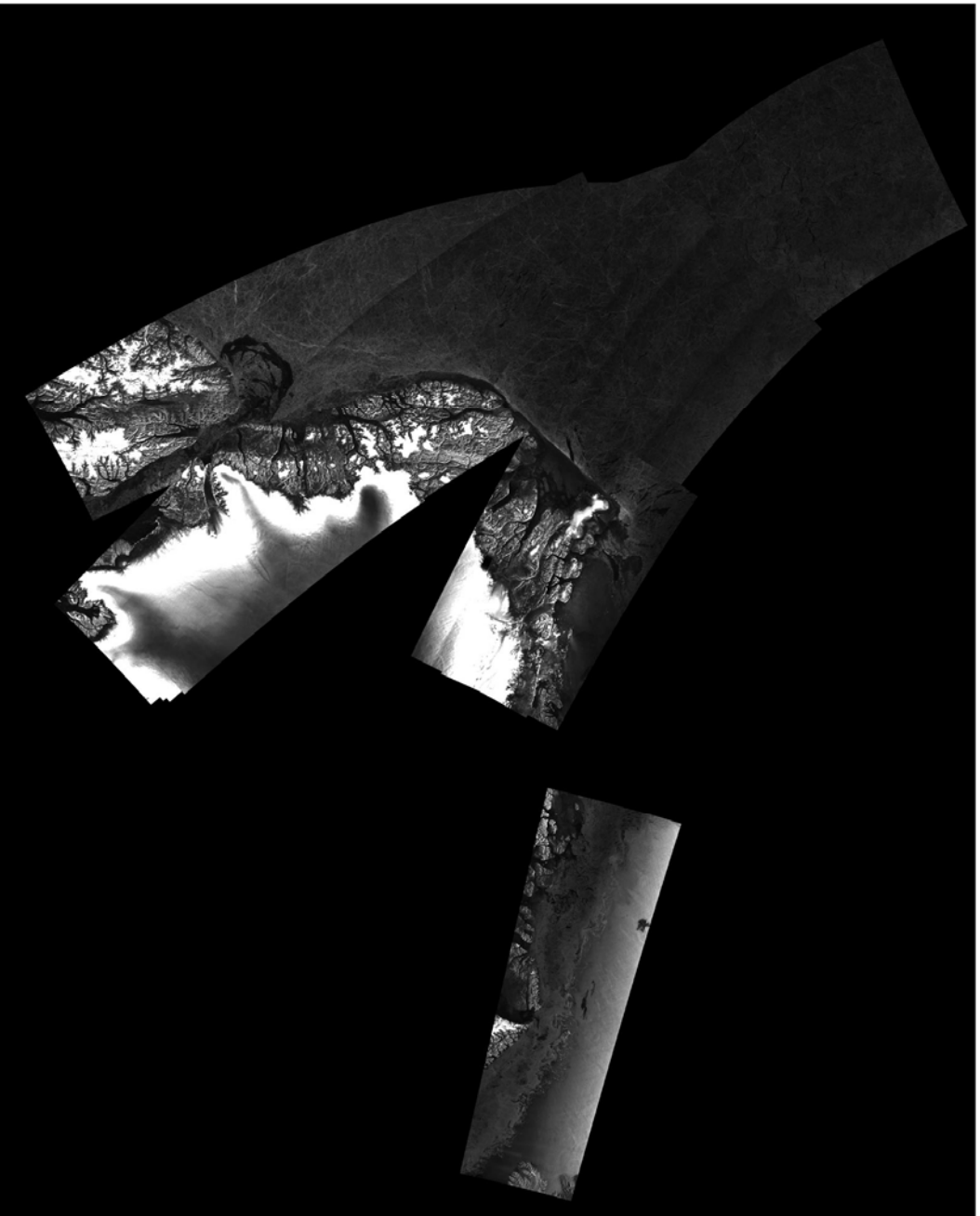
Cycle17 WB 1



Cycle17 FBS



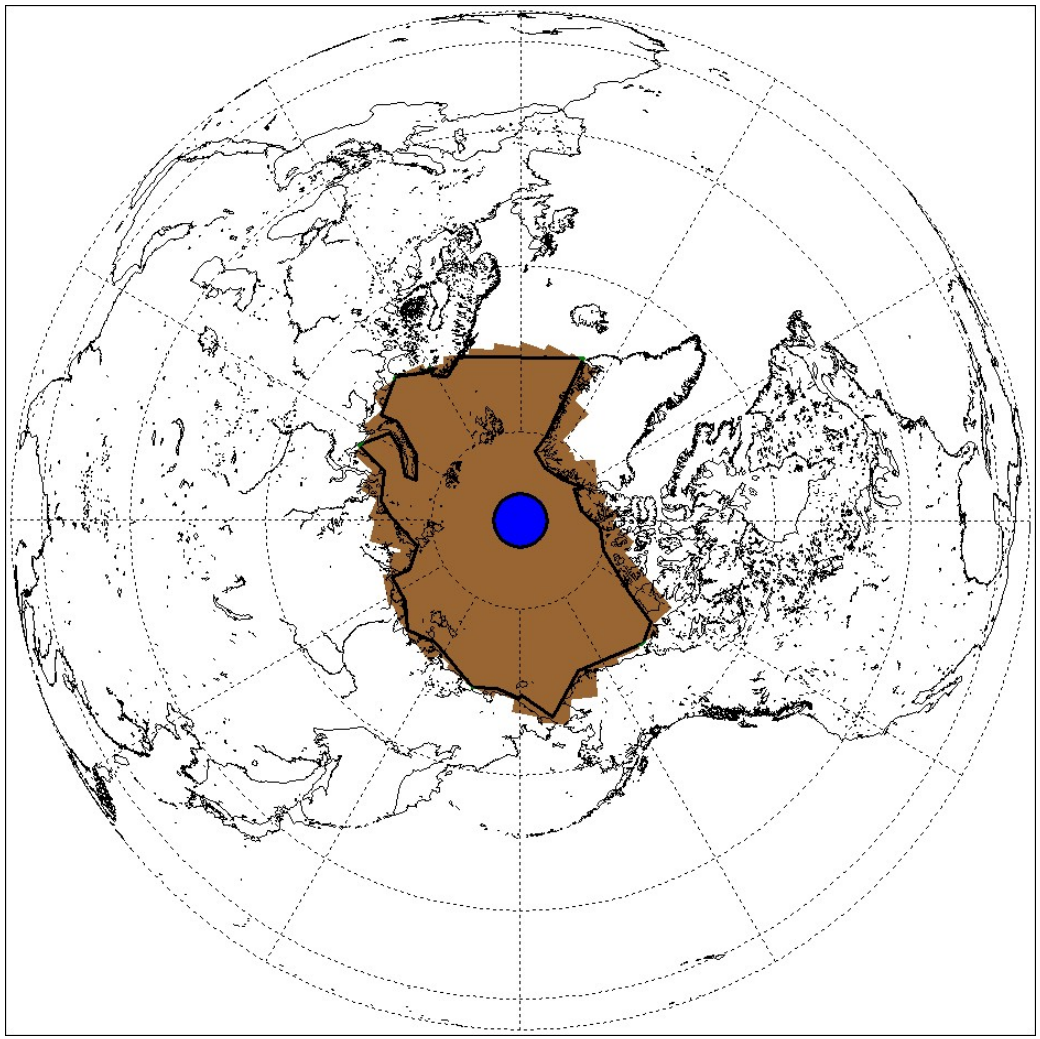
Cycle18 WB1



Cycle18 FBS

PALSAR (WB1/FBD)
Cycle20 ~ 22(09-Jan.-2008 ~ 24-Oct.-2008)

FUTURE

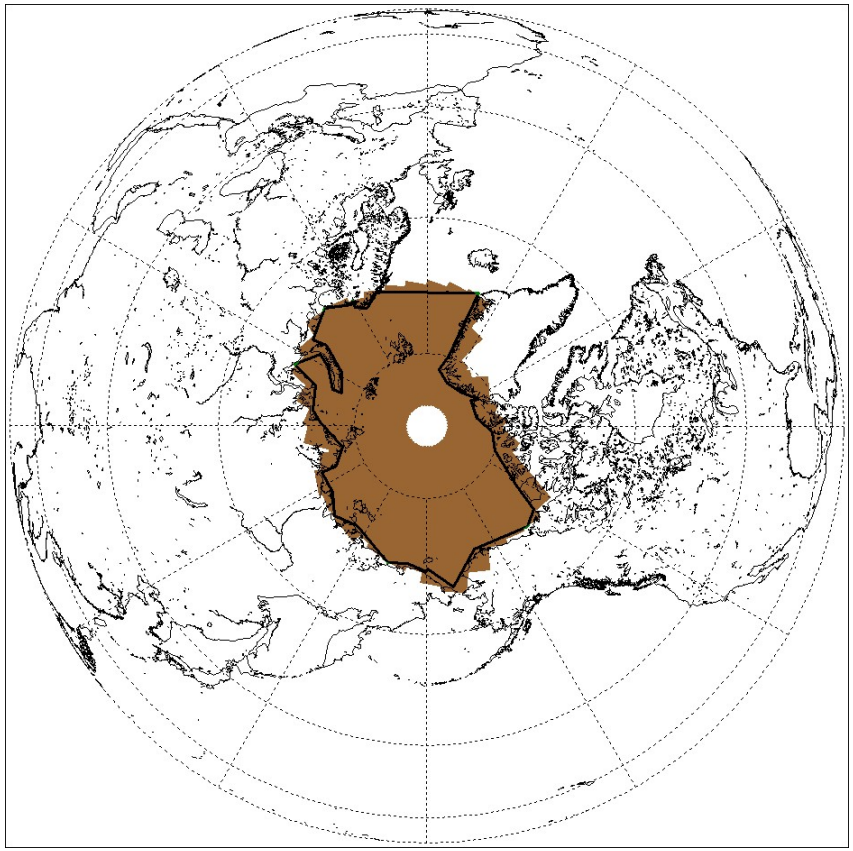


WB1：ScanSAR 5-beam Short burst
Off-nadir:27.1deg
Polarization:HH

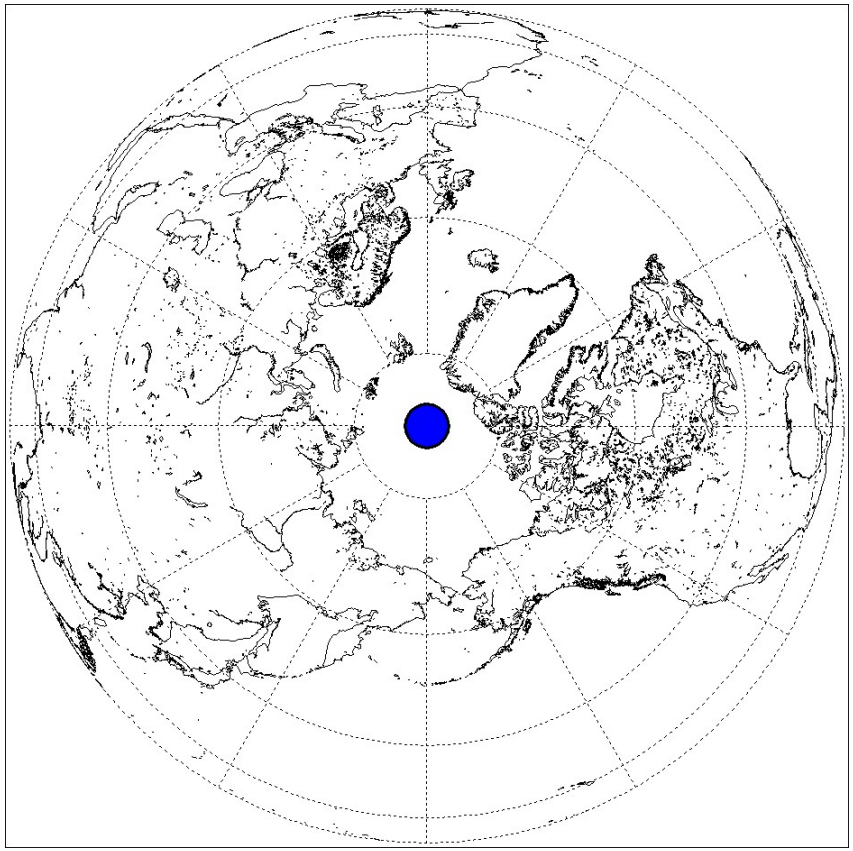
FBD：Fine Beam
Off-nadir:51.0deg
Polarization:HH+HV

PALSAR (WB1/FBD)
Cycle20 ~ 22(09-Jan.-2008 ~ 24-Oct.-2008)

FUTURE



WB1：ScanSAR 5-beam Short burst
Off-nadir:27.1deg
Polarization:HH



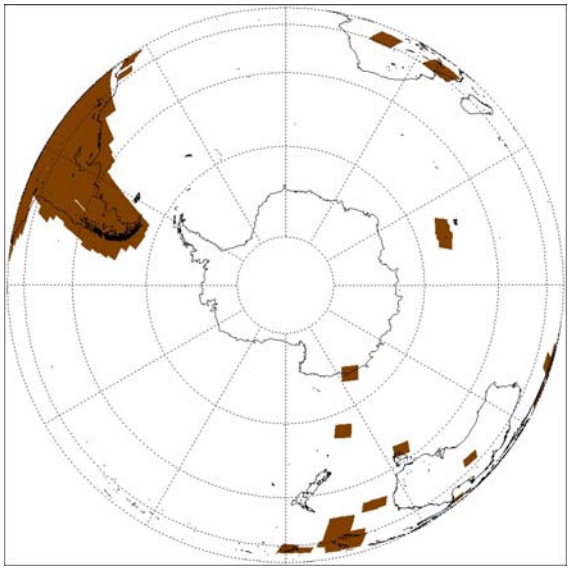
FBD：Fine Beam
Off-nadir:51.0deg
Polarization:HH+HV

Antarctica

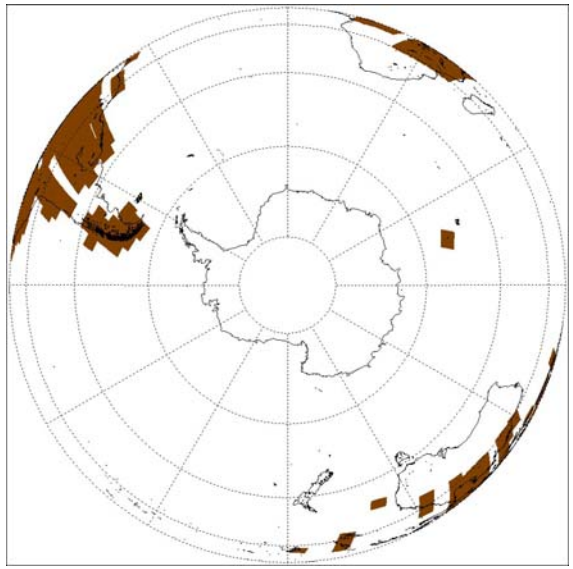
PAST

PALSAR WB1
Cycle07 ~ 12(20-Oct.-2006 ~ 22-Jul.-2007)

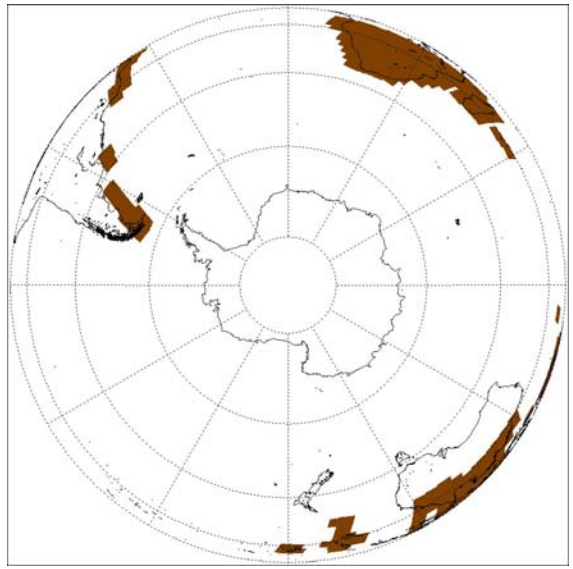
WB1 : ScanSAR 5-beam Short burst
Off-nadir:27.1deg
Polarization:HH



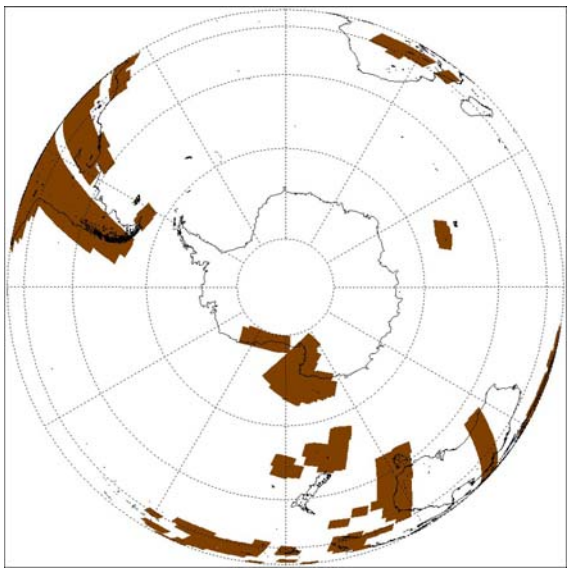
Cycle07 / 20-Oct.-2006



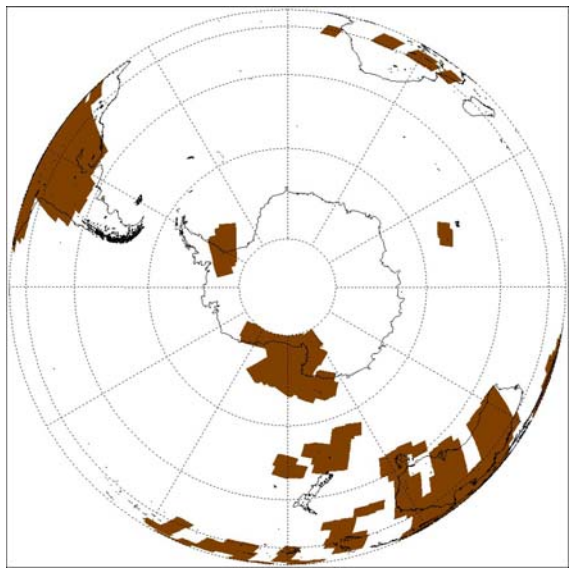
Cycle08 / 05-Dec.-2006



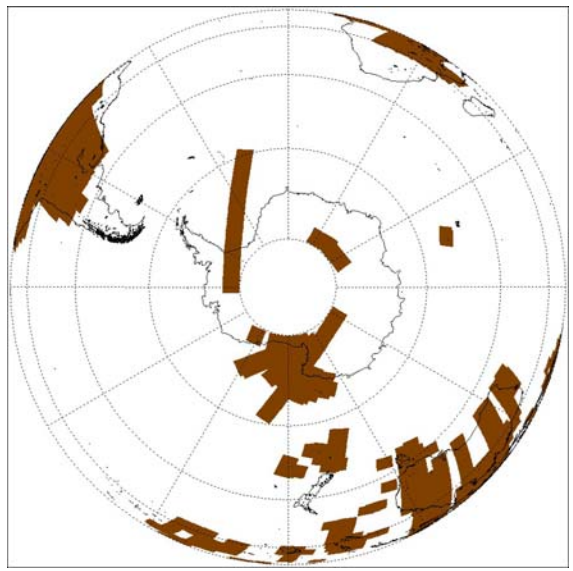
Cycle09 / 20-Jan.-2007



Cycle10 / 07-Mar.-2007



Cycle11 / 22-Apr.-2007

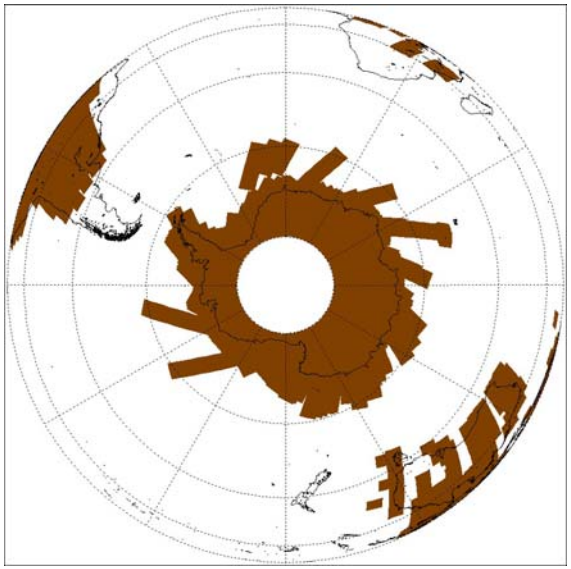


Cycle12 / 07-Jun.-2007

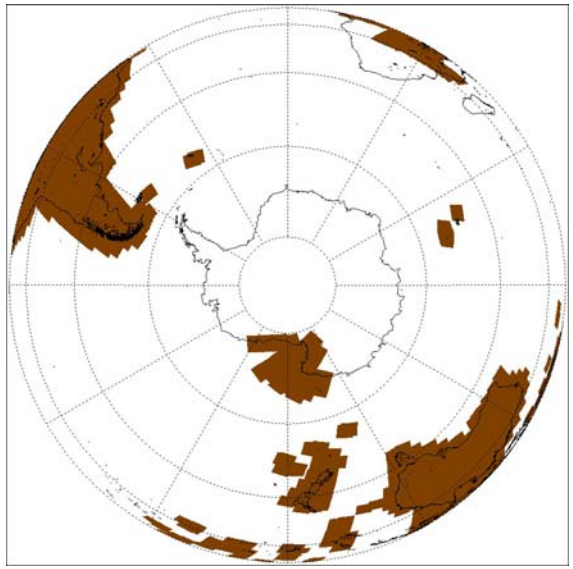
PAST

PALSAR WB1
Cycle13 ~ 18(23-Jul.-2007 ~ 23-Apr.-2008)

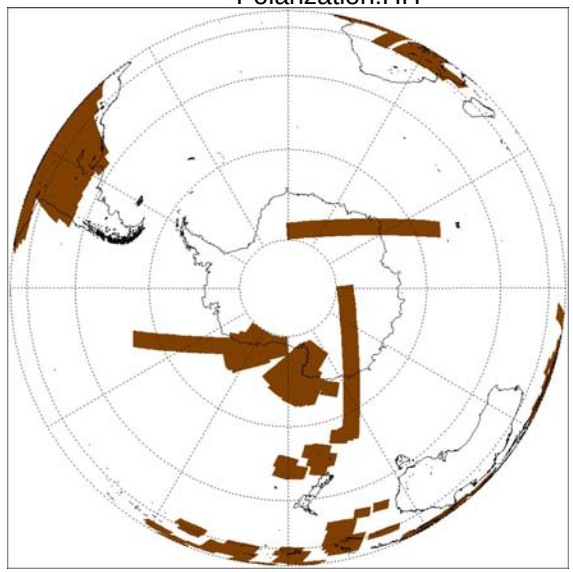
WB1 : ScanSAR 5-beam Short burst
Off-nadir:27.1deg
Polarization:HH



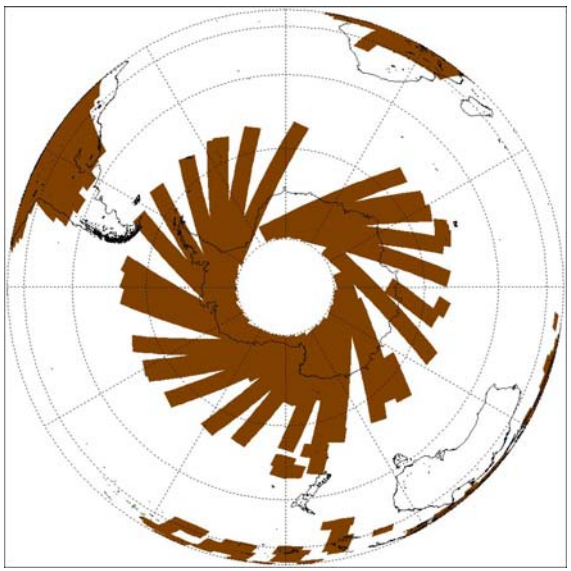
Cycle013 / 23-Jul.-2007



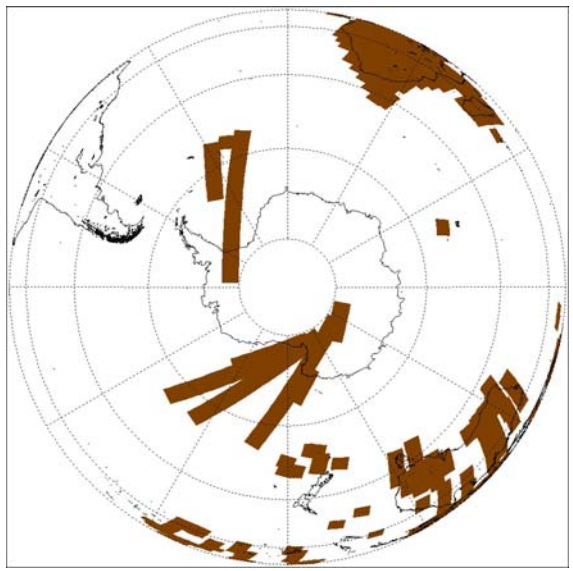
Cycle14 / 07-Sep.-2007



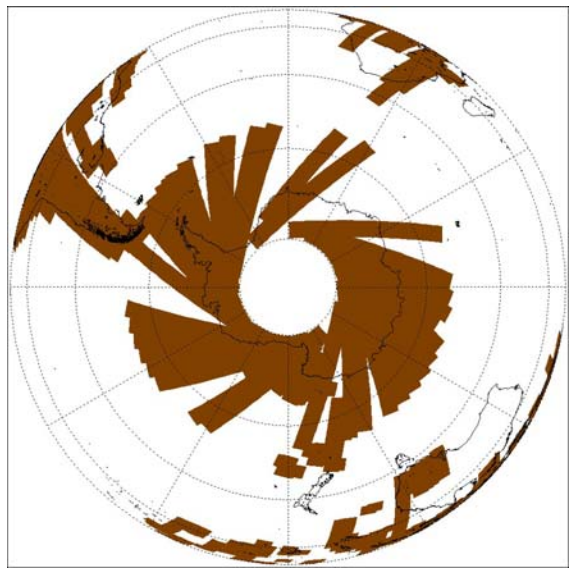
Cycle15 / 23-Oct.-2007



Cycle16 / 08-Dec.-2007



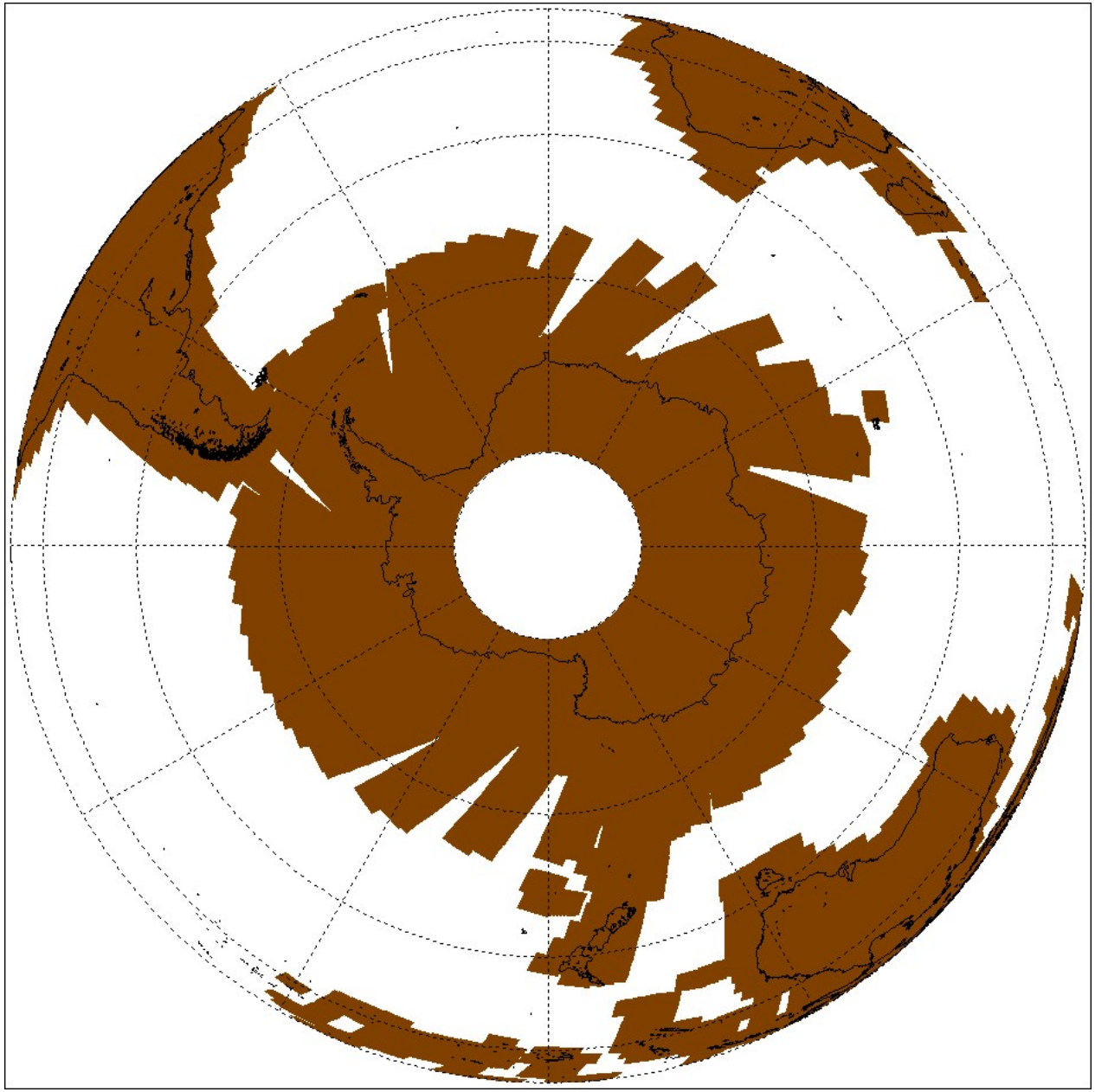
Cycle17 / 23-Jan.-2008



Cycle18 / 09-Mar.-2008

PAST

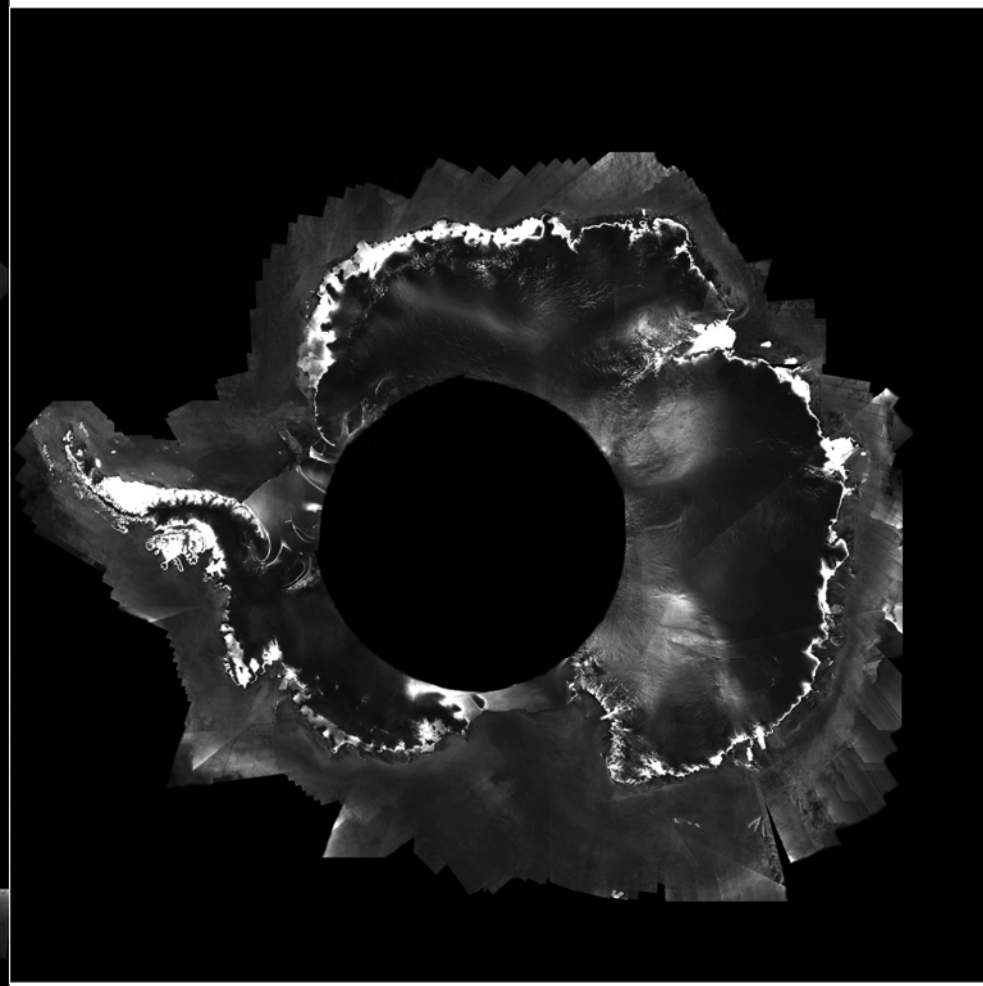
PALSAR WB1/FBD
Cycle07 ~ 18(20-Oct.-2006 ~ 23-Apr.-2008)



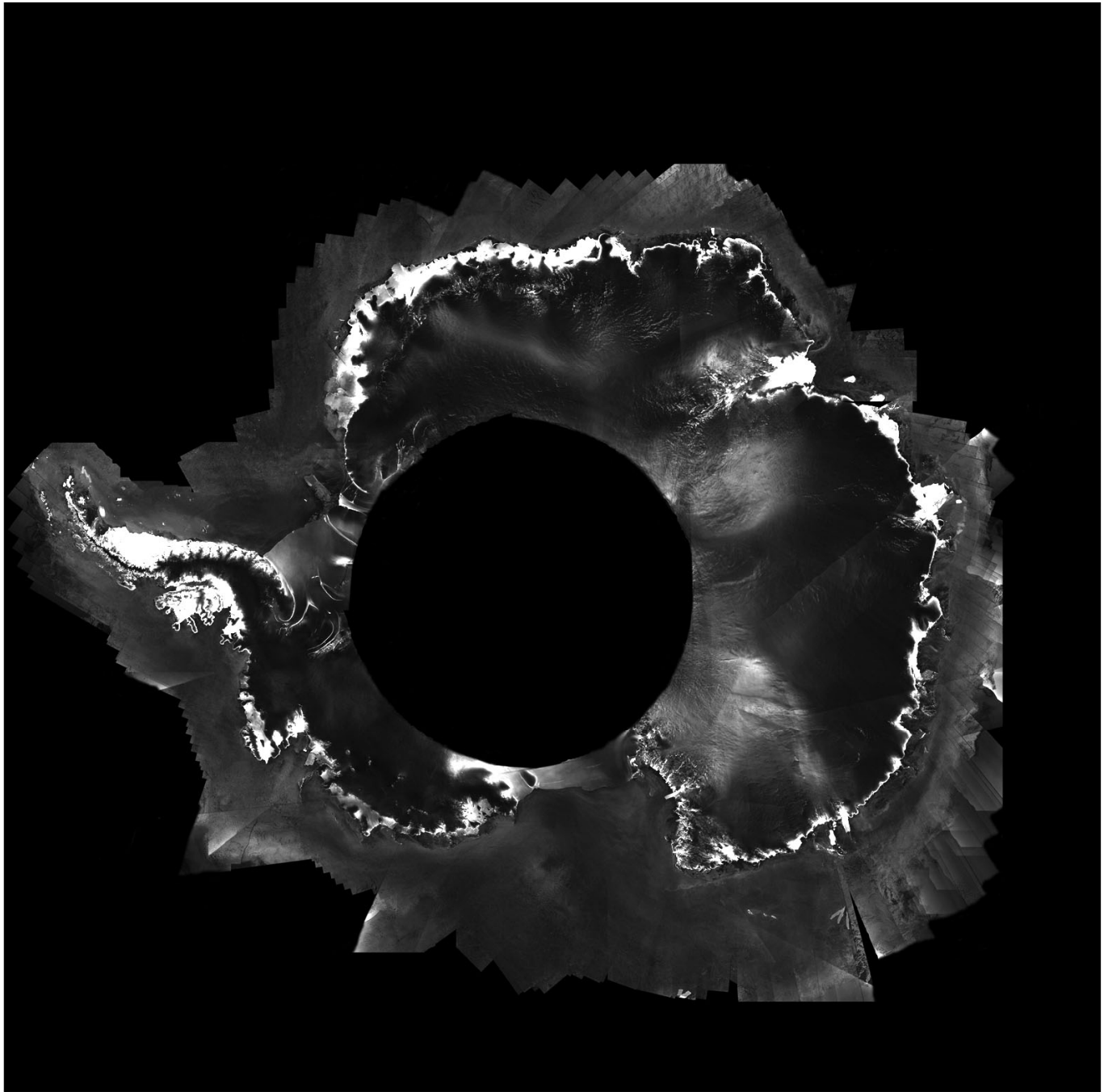
WB1：ScanSAR 5-beam Short burst
Off-nadir:27.1deg
Polarization:HH

Cycle12 wb1

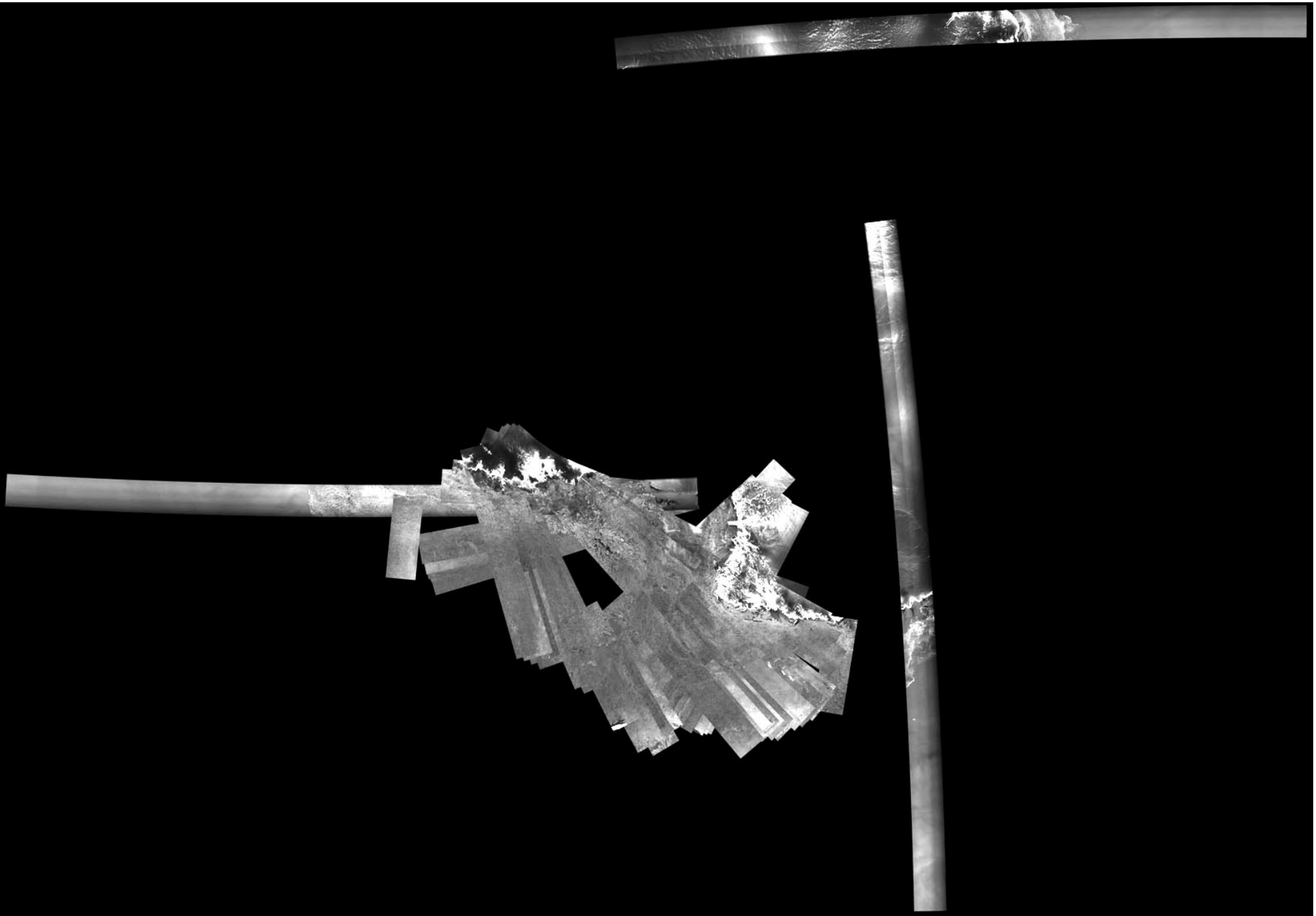
Cycle13 wb1



Cycle 13 Wb1

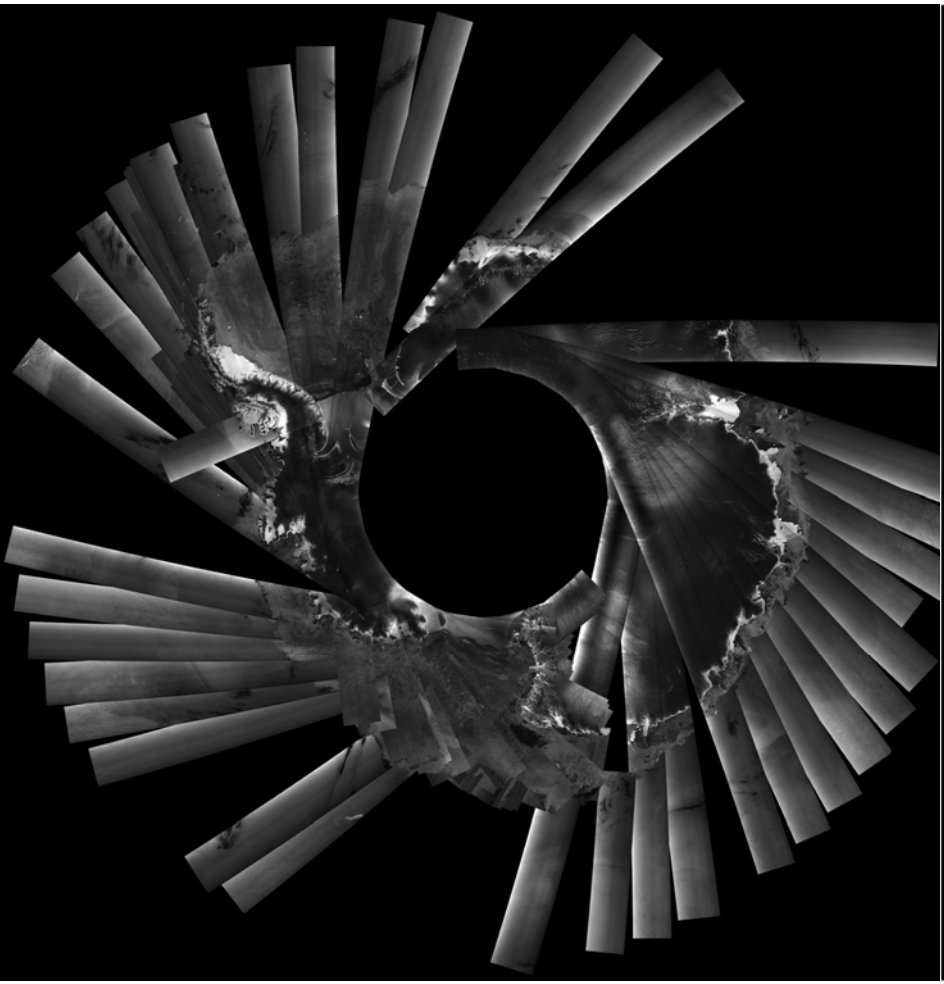


Cycle15　WB1

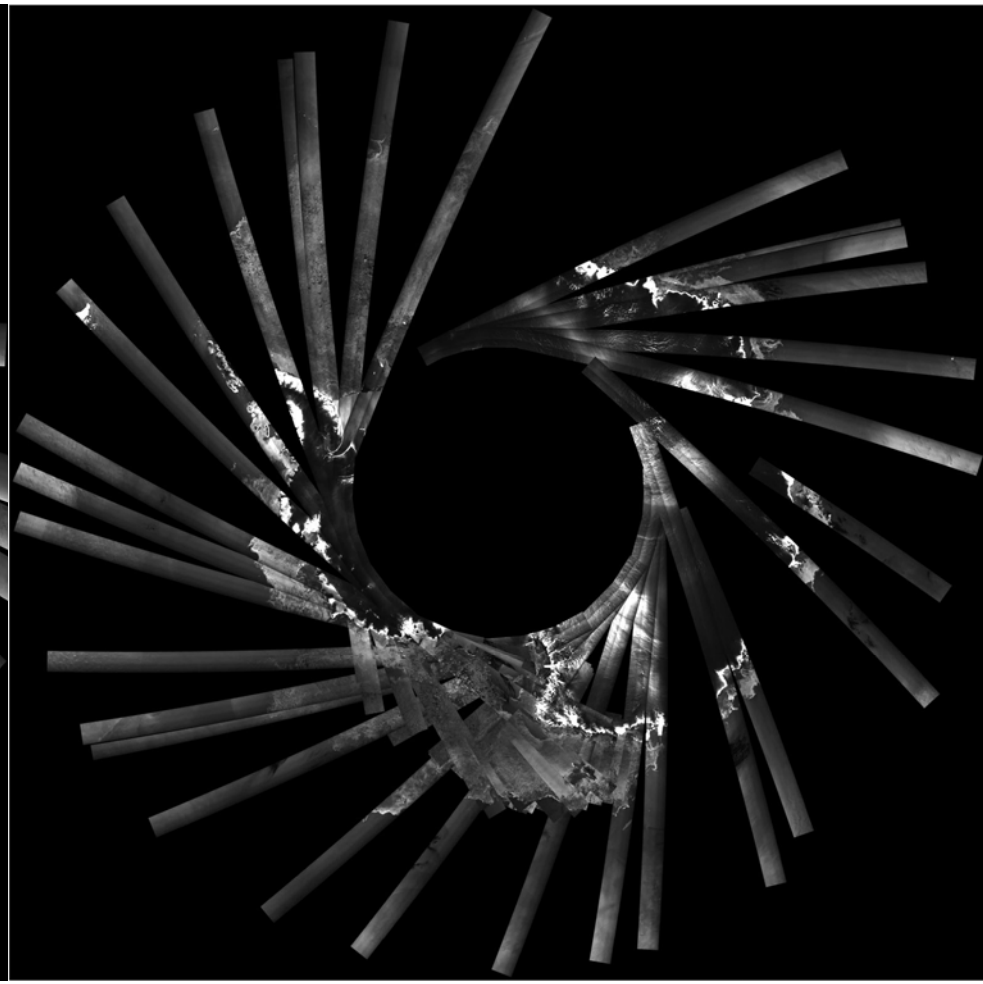


ScanSAR Antarctica

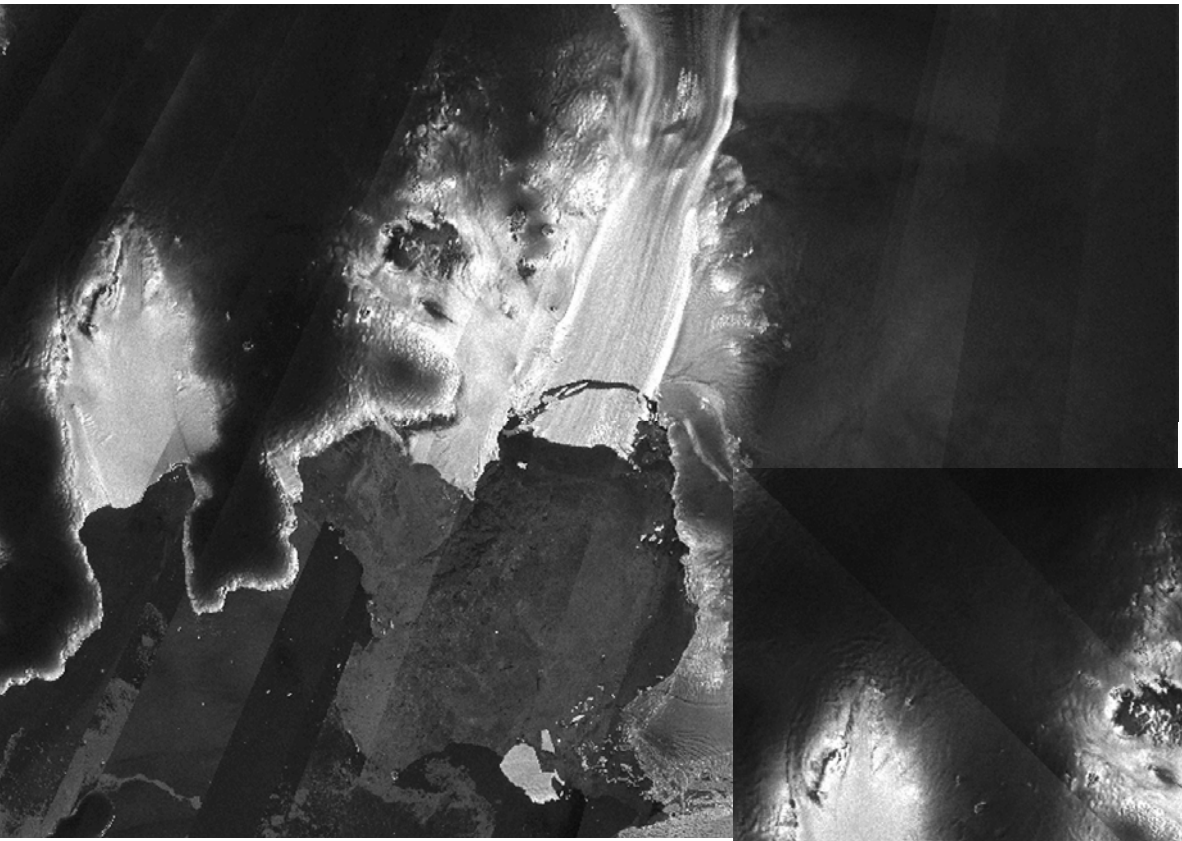
Cycle18 WB1



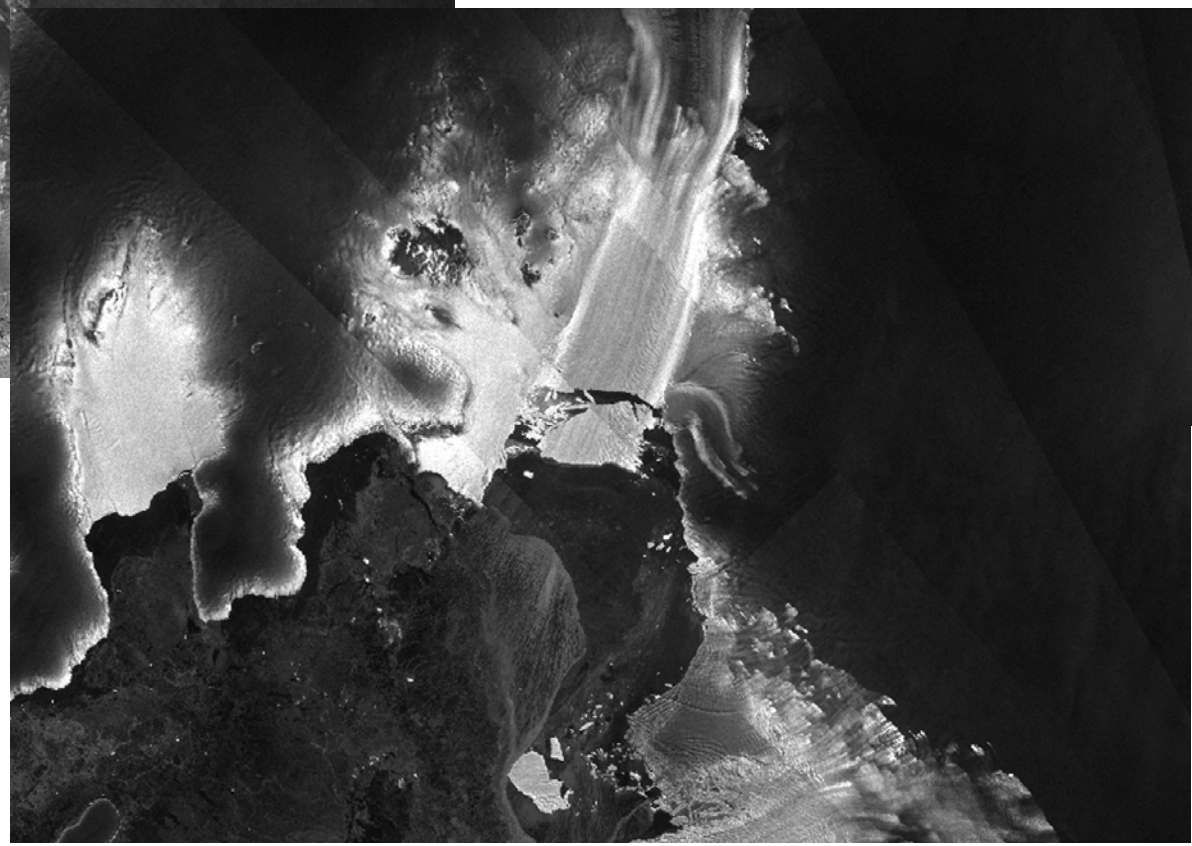
Cycle1 6 WB1



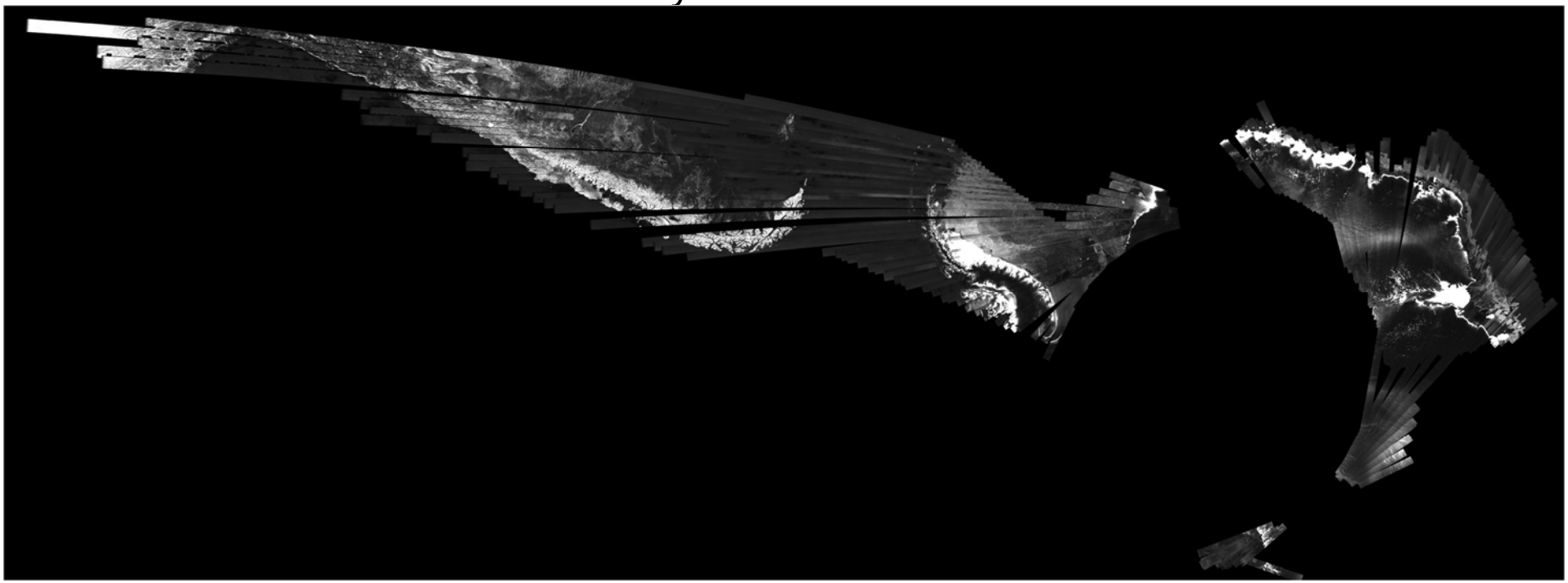
Cycle16 f b s



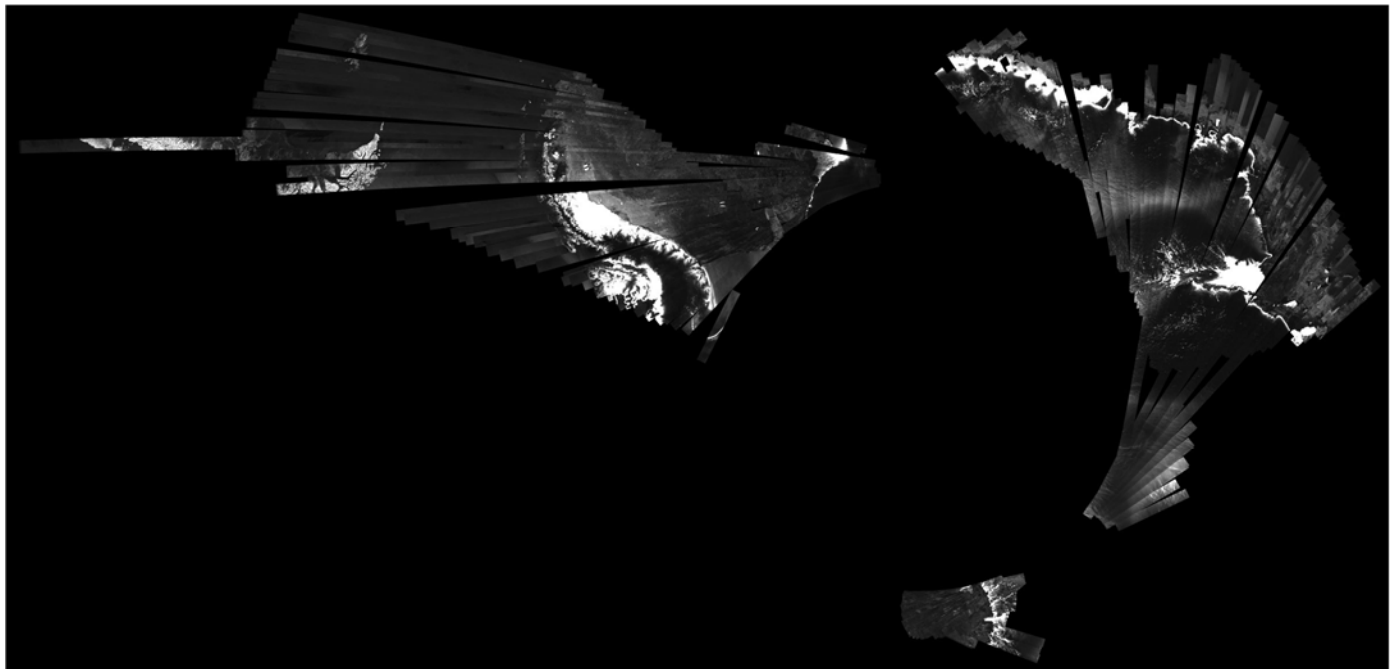
Cycle18 w b 1



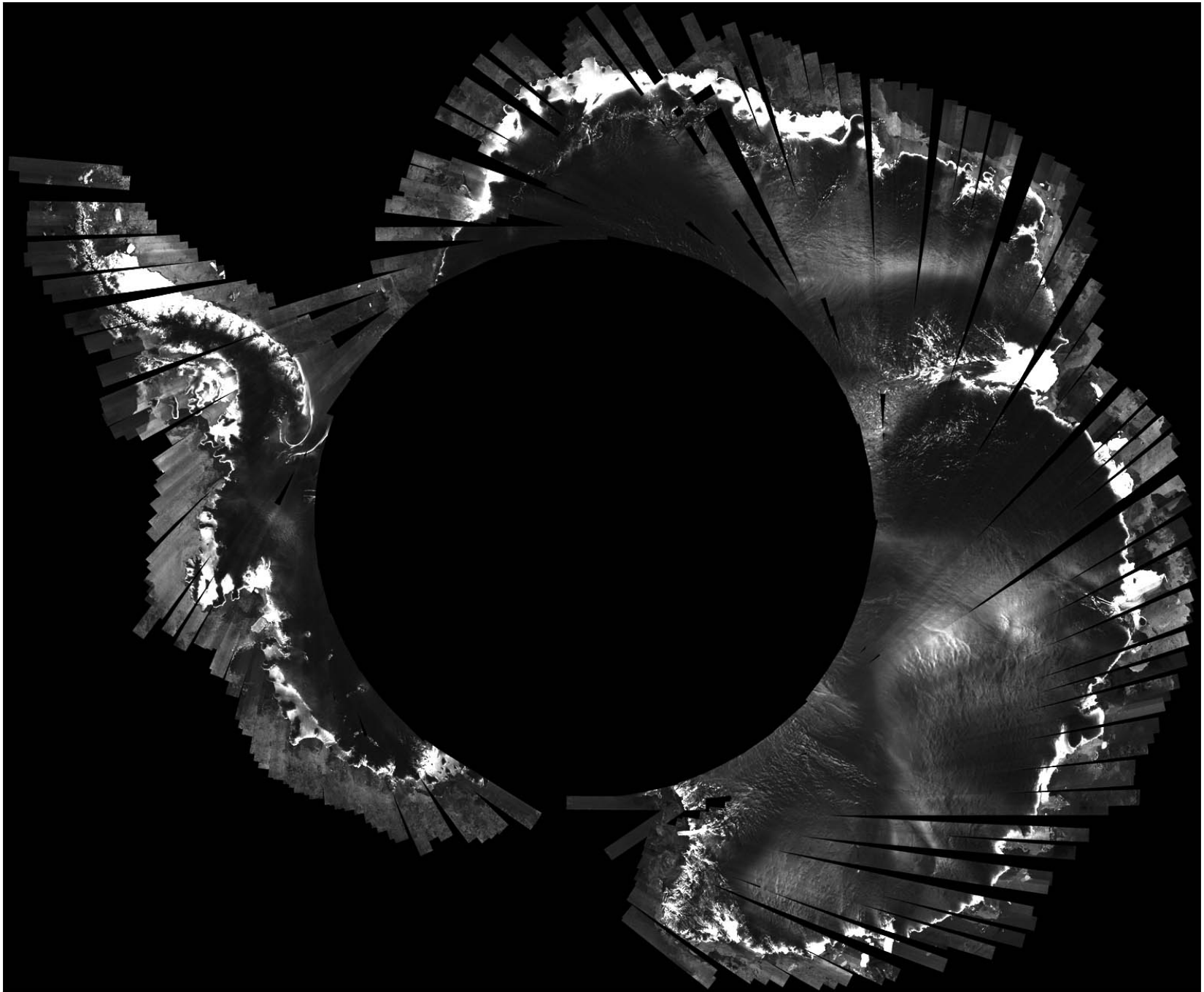
Cycle17 FBS



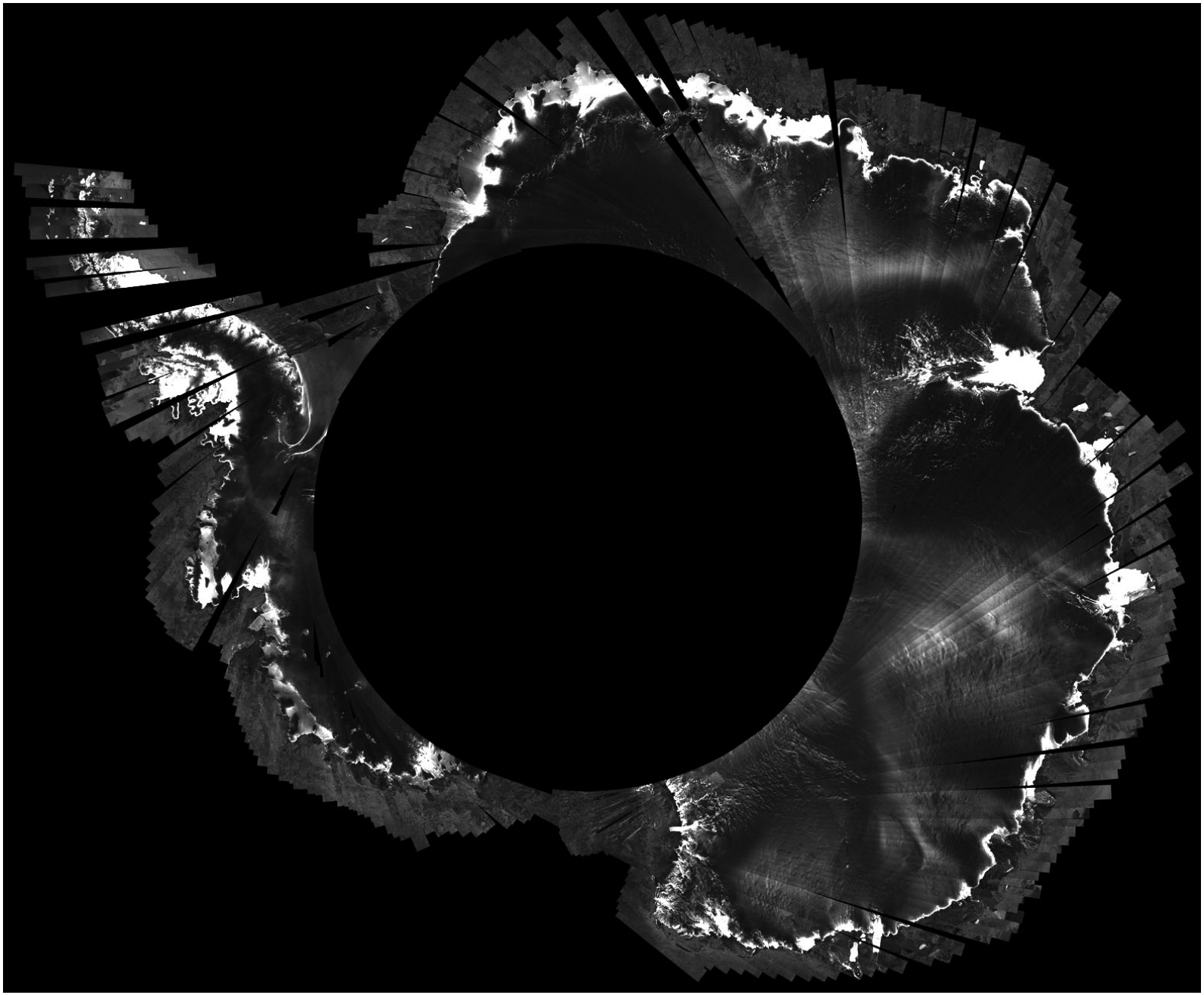
Cycle18 FBS



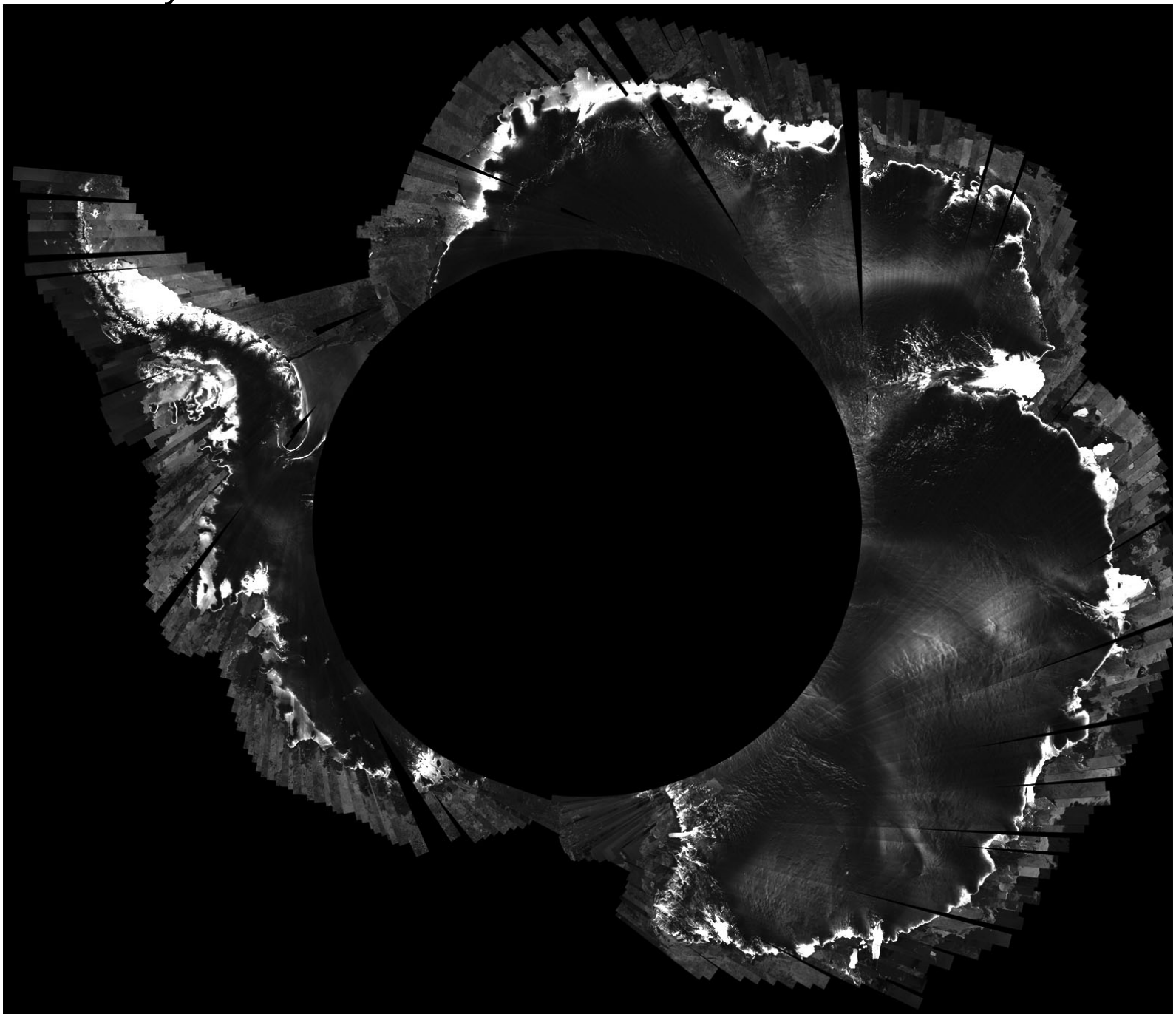
Cycle08 FBS



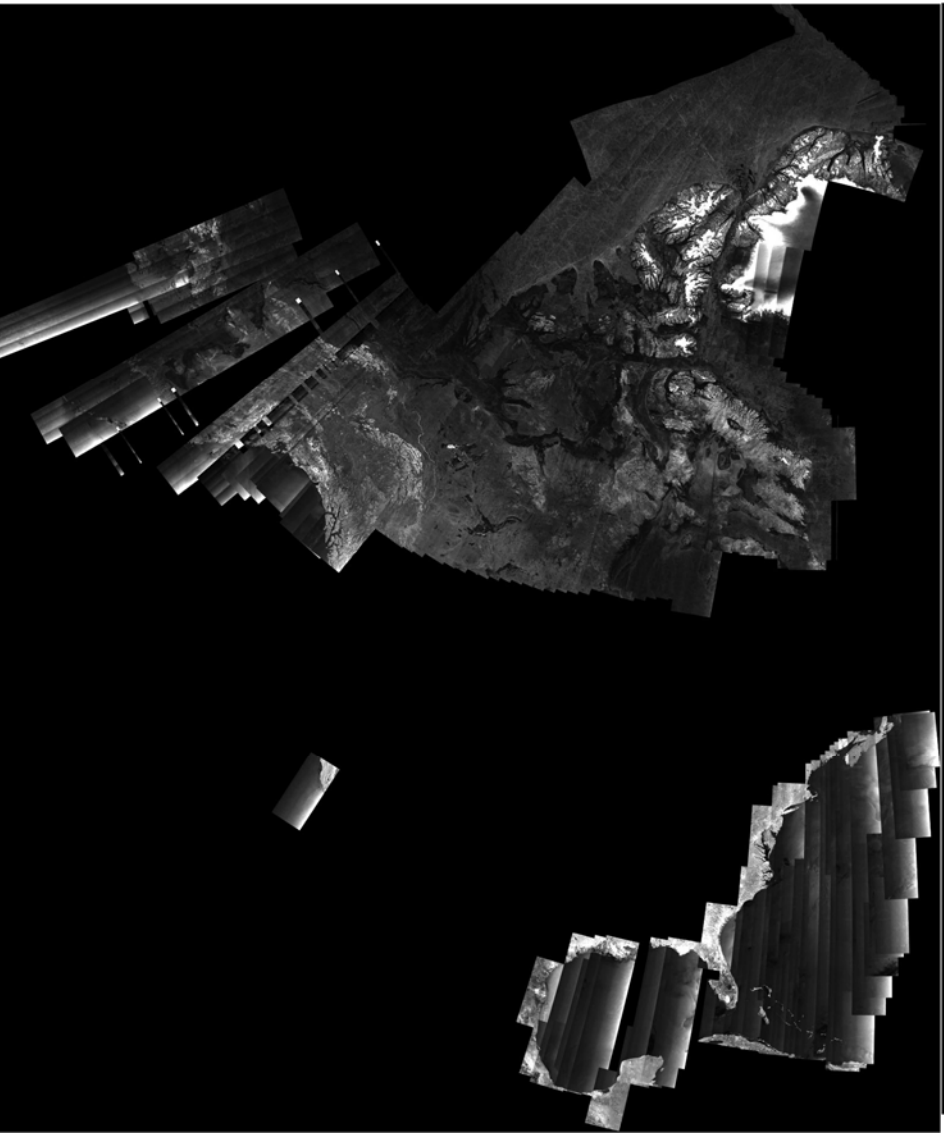
Cycle 15 FBS



Cycle 16 FBS

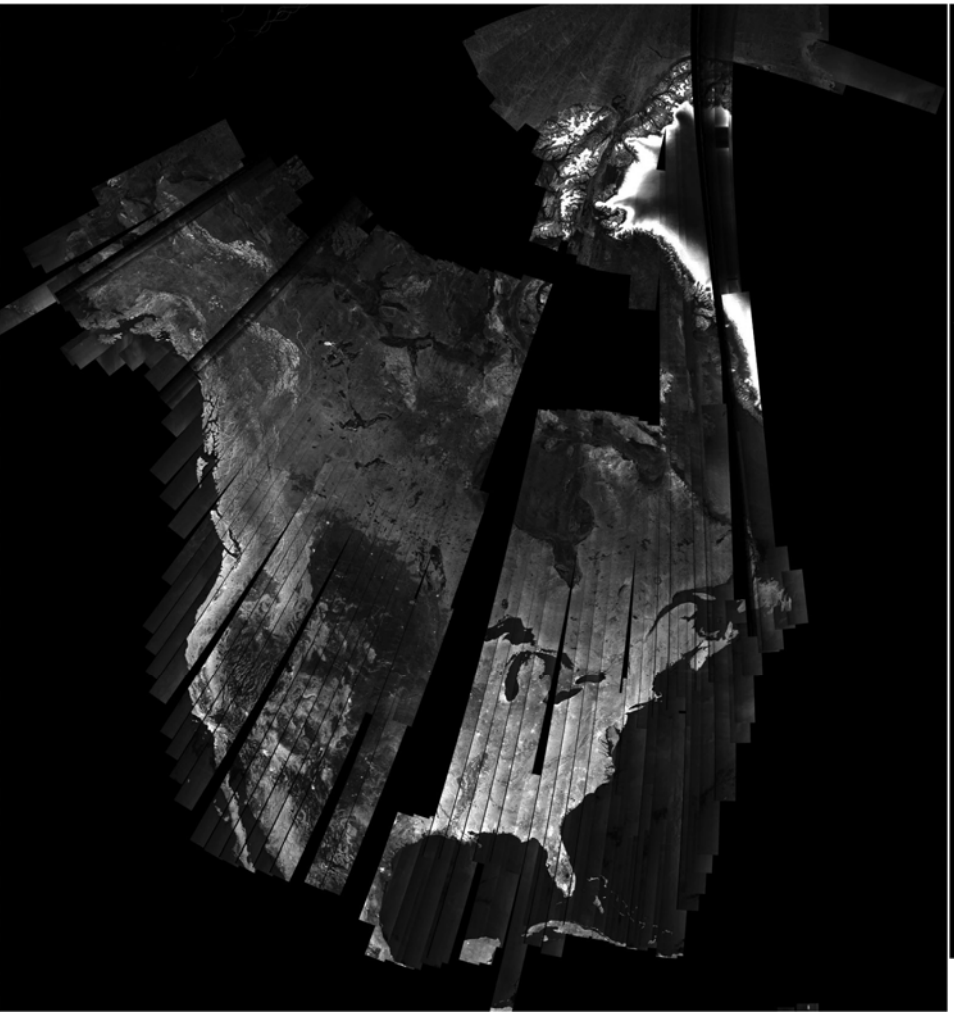


Cycle17 w b 1

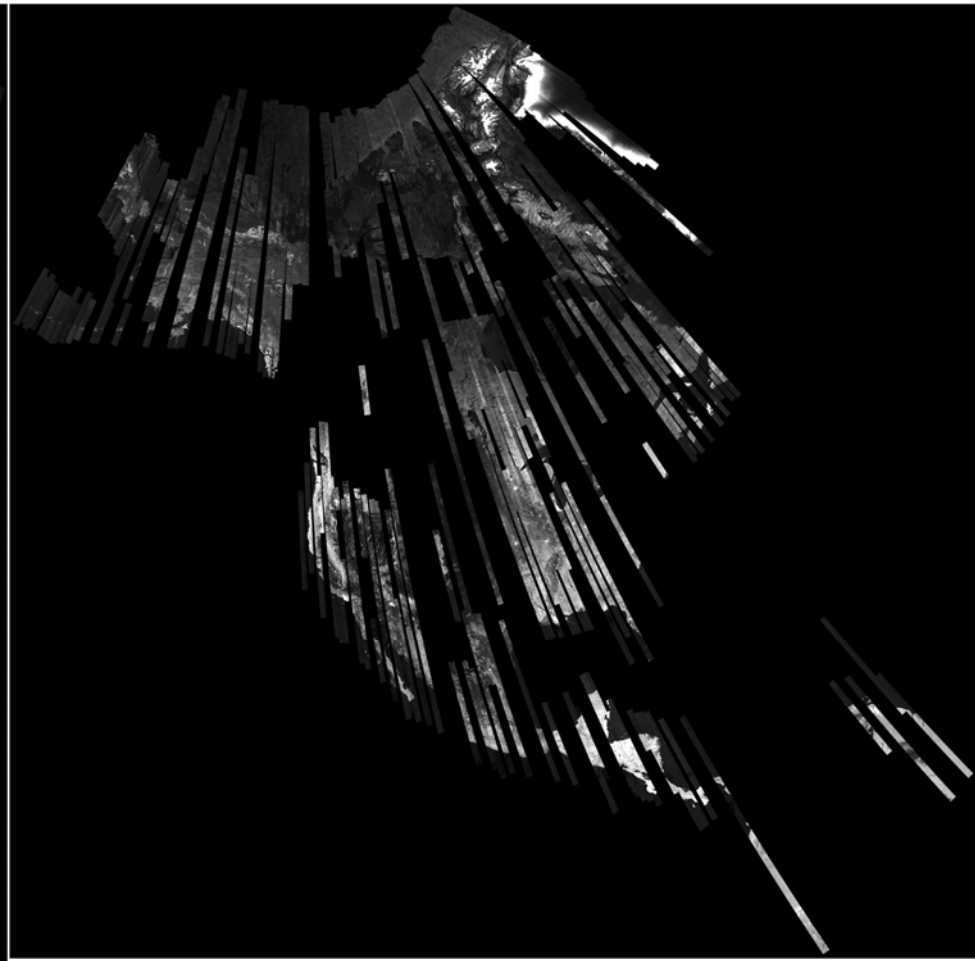


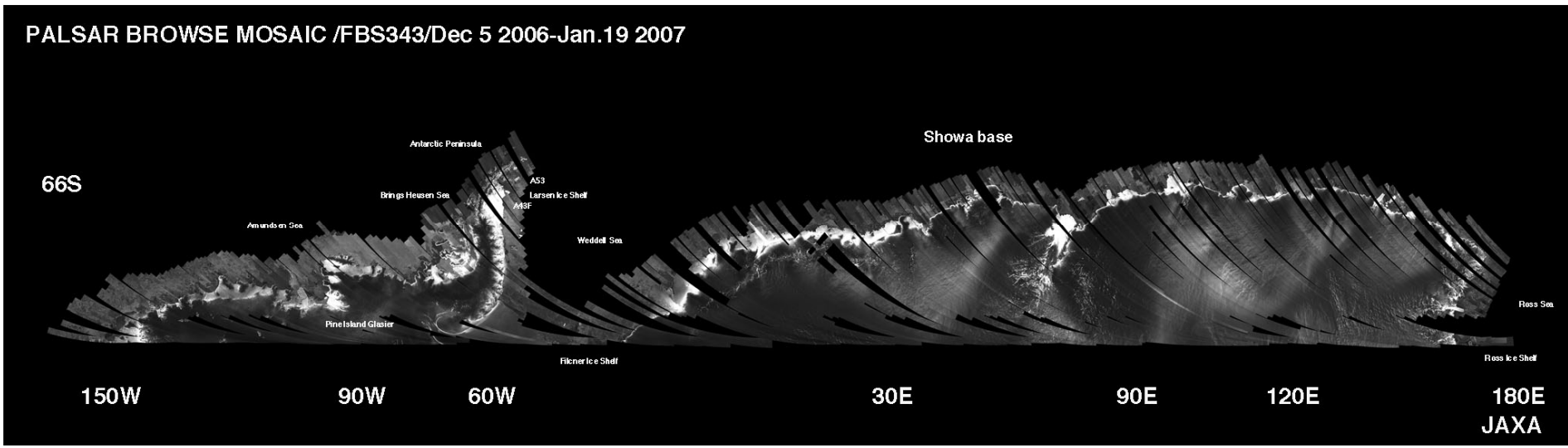
Cycle17 FBS

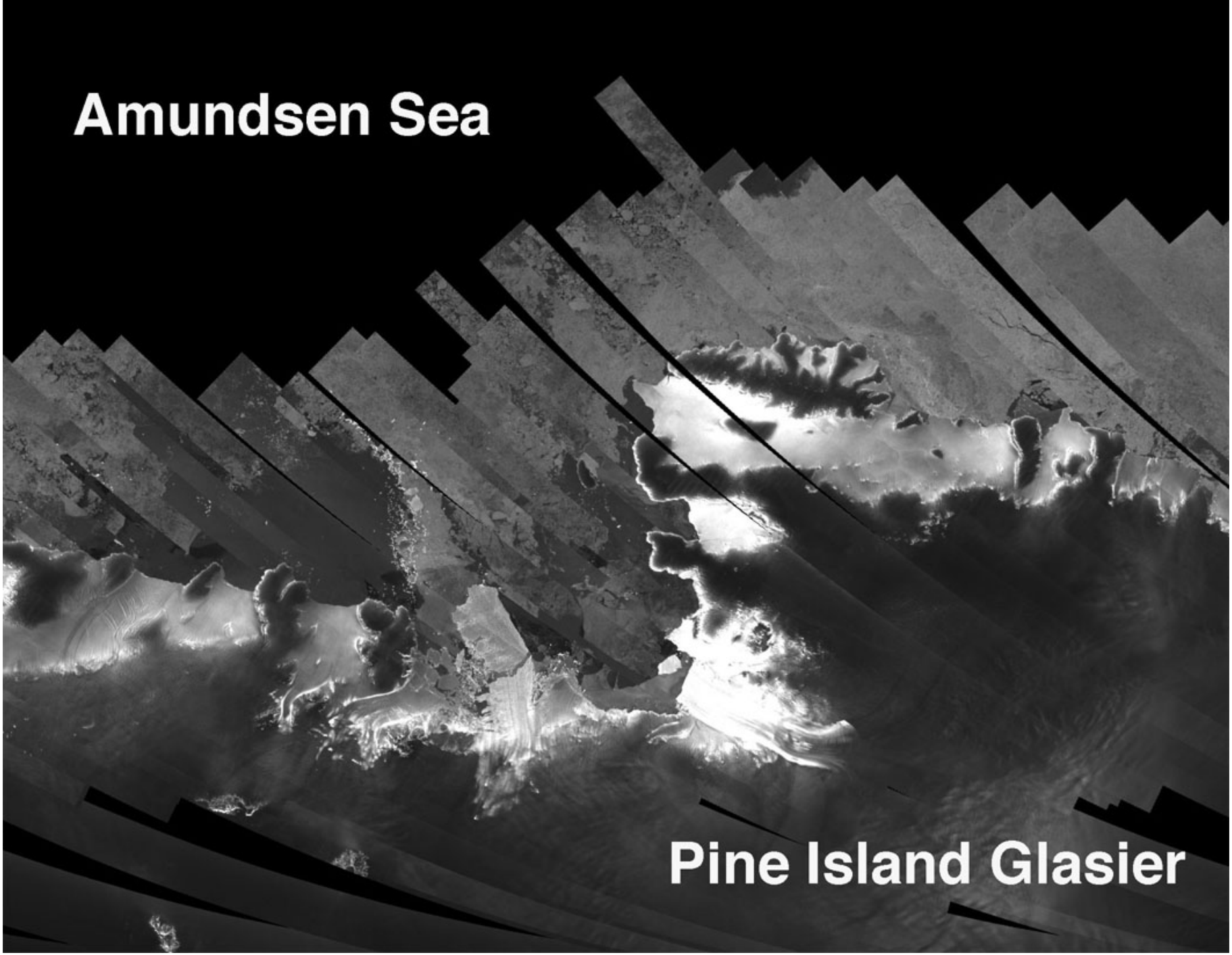
Cycle16 WB1

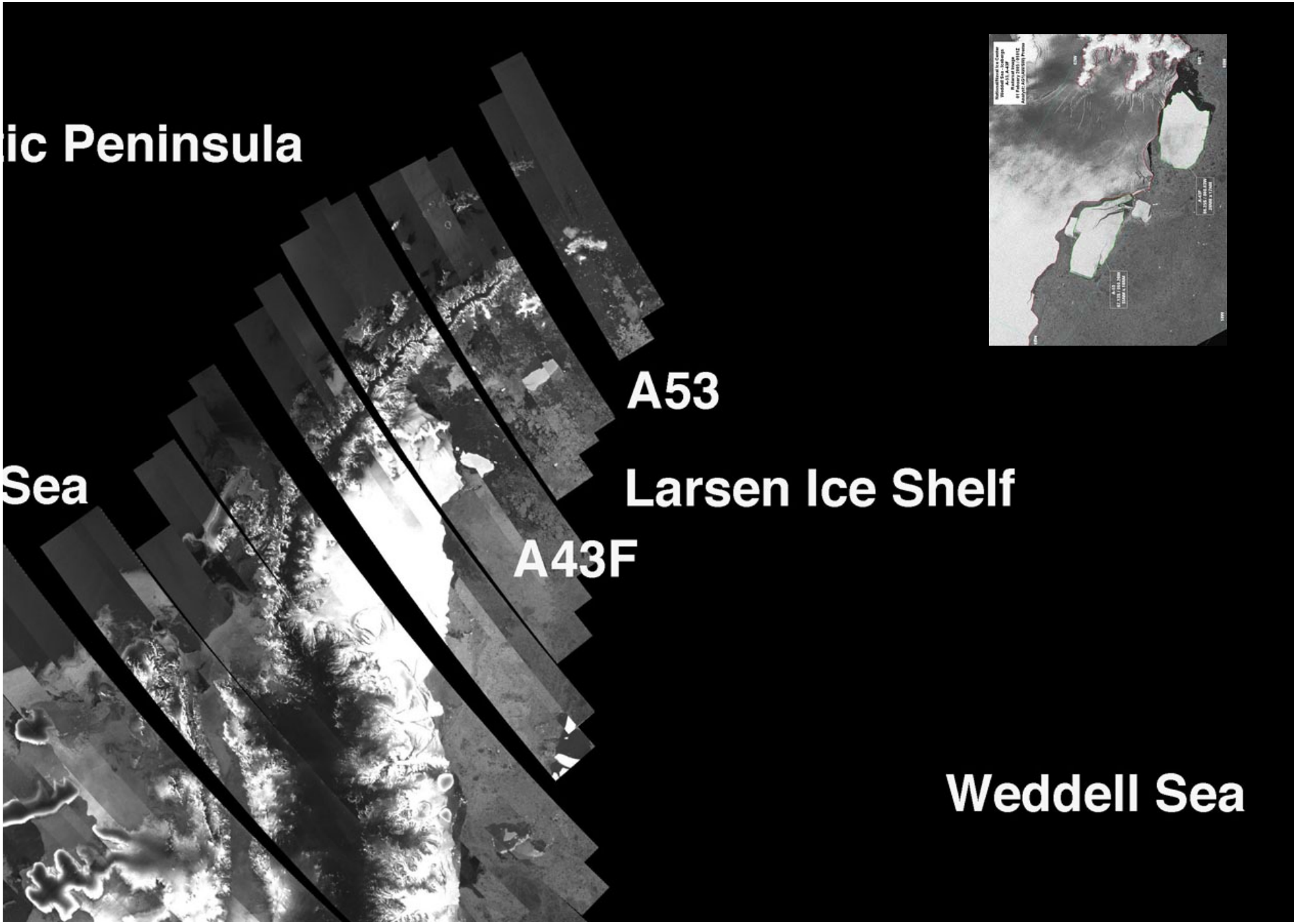


Cycle15 FBS

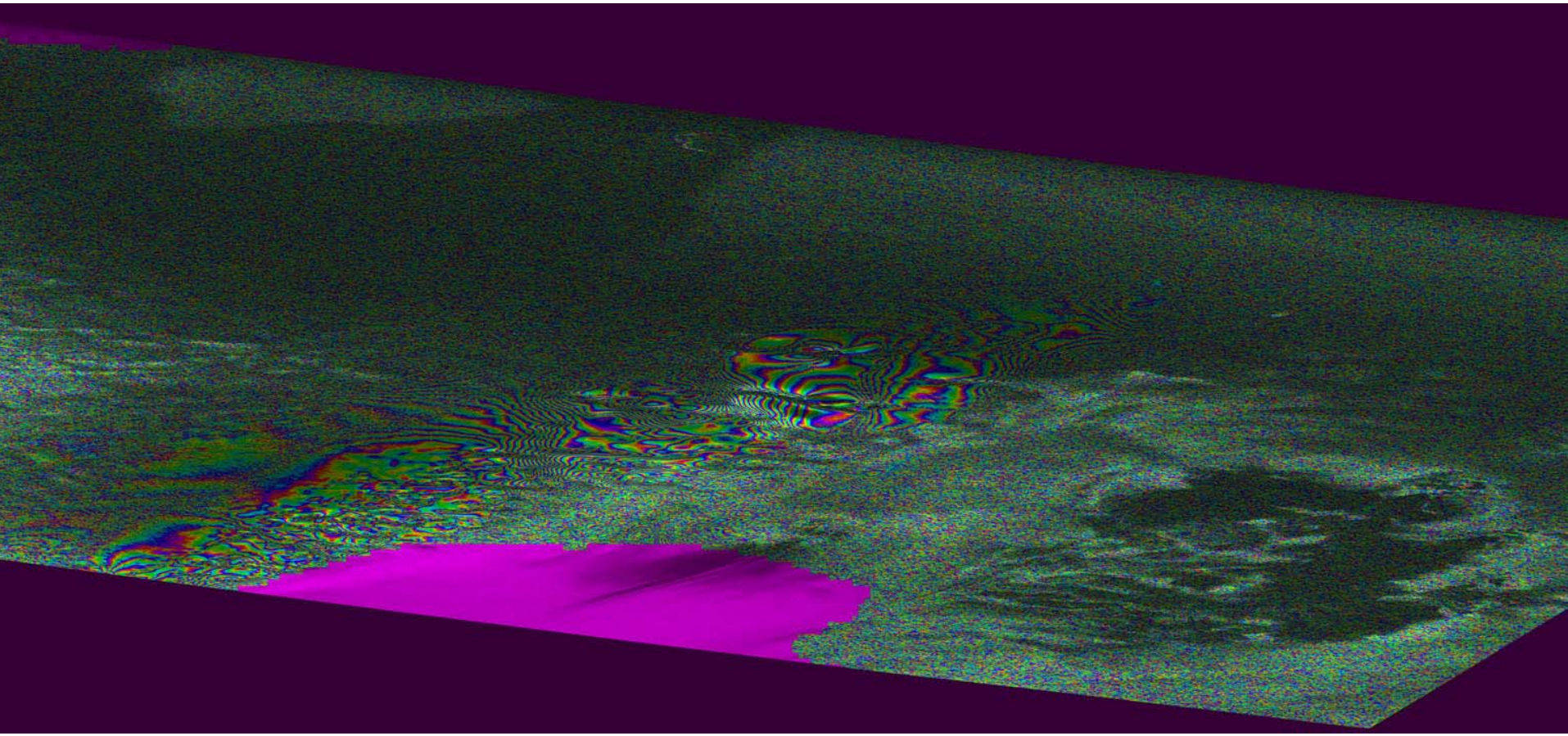



PALSAR BROWSE MOSAIC /FBS343/Dec 5 2006-Jan.19 2007
66S
Antarctic Peninsula
Showa base
A53
Bringshausen Sea
Larsen Ice Shelf
A43F
Amundsen Sea
Weddell Sea
Ross Sea
Pine Island Glacier
Filchner Ice Shelf
Ross Ice Shelf
150W
90W
60W
30E
90E
120E
180E
JAXA


Amundsen Sea
Pine Island Glasier


ic Peninsula
A53
Sea
Larsen Ice Shelf
A43F
Weddell Sea

InSAR processing of the antarctica data (Near Pine island graisier)



Data Processing and Web uploading

Processor for the product creation

Browse Data:
SPECAN Type path processor
All the data are being processed within 5 days after observation.
Mosaicking is being conducted when one cycle path data are collected.
100m is the final resolution (Coming soon): Currently 500 m is set bearing the 2G byte wall of 32 bit operating system.

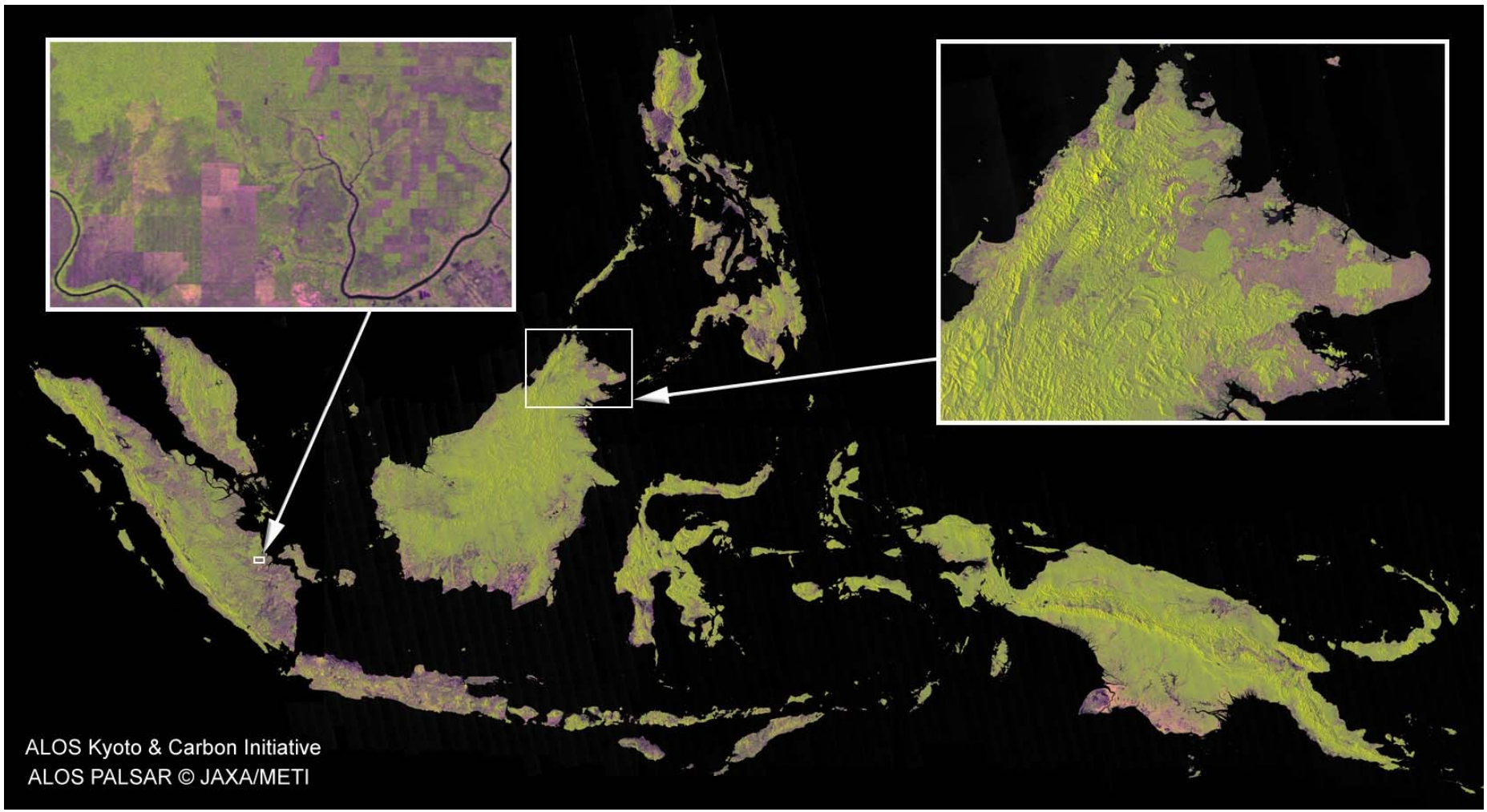
Fine process data :
Range Doppler type path processor.
Generation of the fine resolution mosaic (50m) is not planned yet.

Web uploading
Plans to use the K&C (Kyoto and Carbon web : open on may 15)

ALOS

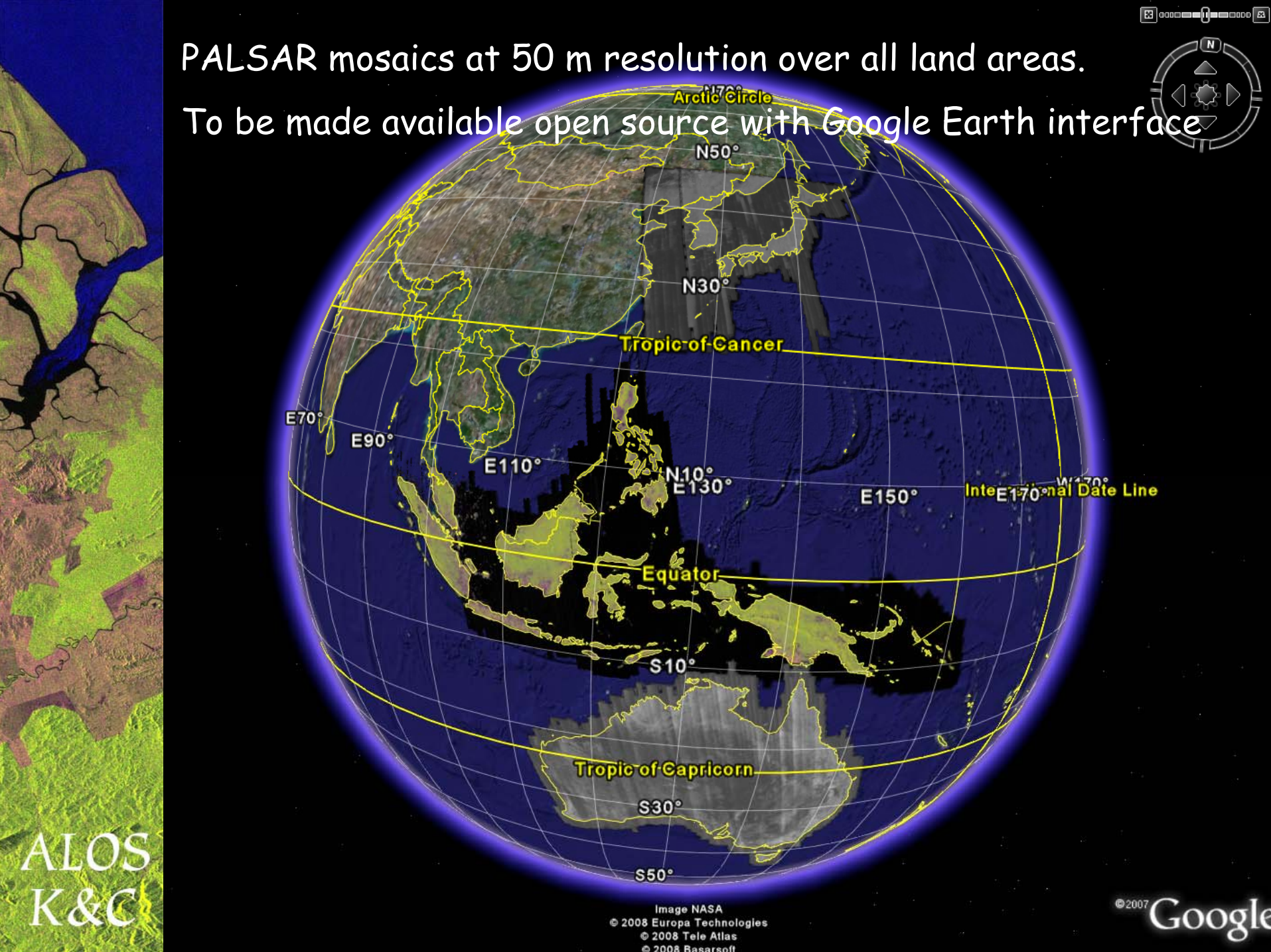
K&C Initiative

An international science collaboration led by JAXA



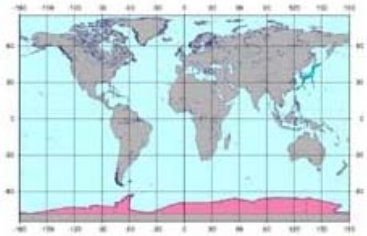
PALSAR mosaics at 50 m resolution over all land areas.

To be made available open source with Google Earth interface



Observation Plan after Cycle 18 (march 2008)

観測計画（ 1 ）



CYCLE_07 / 20-Oct.-2006

CYCLE_08 / 05-Dec.-2006

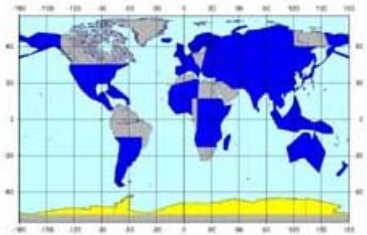
CYCLE_09 / 20-Jan.-2007

CYCLE_10 / 07-Mar.-2007

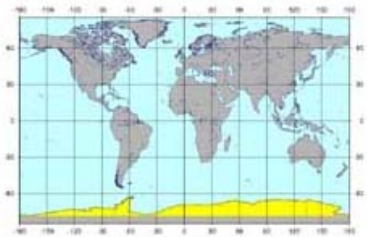
CYCLE_11 / 22-Apr.-2007

CYCLE_12 / 07-Jun.-2007

CYCLE_13 / 23-Jul.-2007



CYCLE_14 / 07-Sep.-2007



CYCLE_15 / 23-Oct.-2007

CYCLE_16 / 08-Dec.-2007

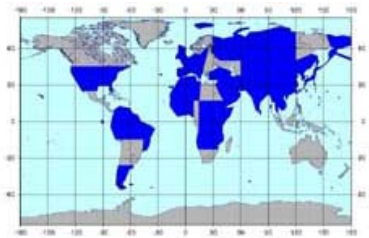
CYCLE_17 / 23-Jan.-2008

CYCLE_18 / 09-Mar.-2008

Sensor mode	Off-nadir	Polarizarion
Fine Beam	41.5°	HH
Fine Beam	34.3°	HH+HV
Fine Beam	21.5°	HH+HV+VH+VV
Fine Beam	34.3°	HH
Fine Beam	21.5°	HH

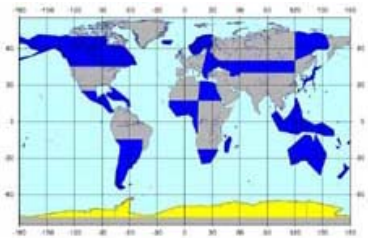
観測計画（２）

CYCLE_19 / 24-Apr.-2008

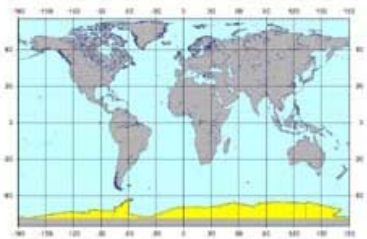


CYCLE_20 / 09-Jun.-2008

CYCLE_21 / 25-Jul.-2008



CYCLE_22 / 09-Sep.-2008



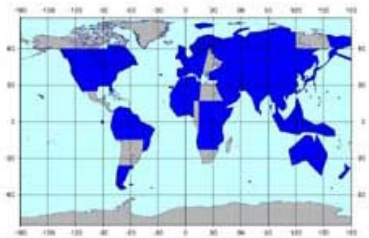
CYCLE_23 / 25-Oct.-2008

CYCLE_24 / 10-Dec.-2008

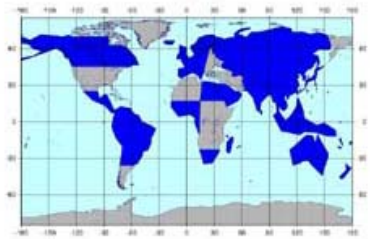
CYCLE_25 / 25-Jan.-2009

CYCLE_26 / 12-Mar.-2009

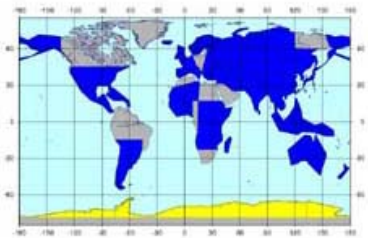
CYCLE_27 / 27-Apr.-2009



CYCLE_28 / 12-Jun.-2009



CYCLE_29 / 28-Jul.-2009

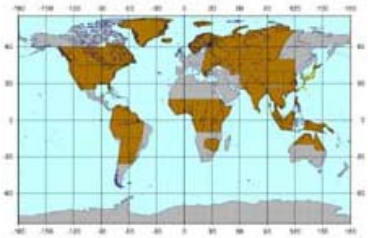


CYCLE_30 / 12-Sep.-2009

Sensor mode	Off-nadir	Polarizarion
Fine Beam	41.5°	HH
Fine Beam	34.3°	HH+HV
Fine Beam	21.5°	HH+HV+VH+VV
Fine Beam	34.3°	HH
Fine Beam	21.5°	HH

観測計画（ ３ ）

CYCLE_07 / 20-Oct.-2006

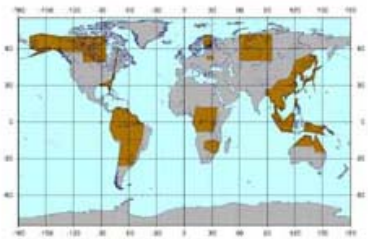


CYCLE_08 / 05-Dec.-2006

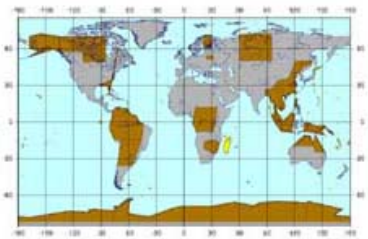
CYCLE_09 / 20-Jan.-2007

CYCLE_10 / 07-Mar.-2007

CYCLE_11 / 22-Apr.-2007



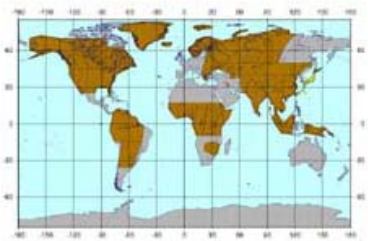
CYCLE_12 / 07-Jun.-2007



CYCLE_13 / 23-Jul.-2007

CYCLE_14 / 07-Sep.-2007

CYCLE_15 / 23-Oct.-2007



CYCLE_16 / 08-Dec.-2007

CYCLE_17 / 23-Jan.-2008

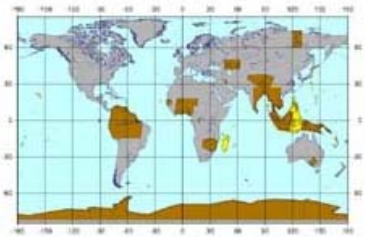
CYCLE_18 / 09-Mar.-2008

Mode	Off-nadir	Polarizarion
ScanSAR 5-beam short burst (120 Mbps)	20.1°- 36.5°	HH
Fine Beam	34.3°	HH

観測計画（SCANSARでの観測）

CYCLE_19 / 24-Apr.-2008

CYCLE_20 / 09-Jun.-2008



CYCLE_21 / 25-Jul.-2008

CYCLE_22 / 09-Sep.-2008

CYCLE_23 / 25-Oct.-2008

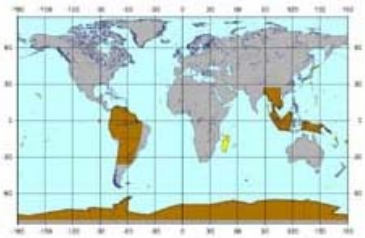
CYCLE_24 / 10-Dec.-2008

CYCLE_25 / 25-Jan.-2009

CYCLE_26 / 12-Mar.-2009

CYCLE_27 / 27-Apr.-2009

CYCLE_28 / 12-Jun.-2009



CYCLE_29 / 28-Jul.-2009

CYCLE_30 / 12-Sep.-2009

Mode	Off-nadir	Polarizarion
ScanSAR 5-beam short burst (120 Mbps)	20.1°- 36.5°	HH
Fine Beam	34.3°	HH

Evaluation items	Goal accuracy	mesasurements
Radiometry ●Attenuator chracteristics（STC/AGC） ●Antenna pattern（azimuth・range） ●Noise level ●Fundamental chrcatreistics saturation SNR I-Q orthogonality I-Q gain ballance Tranmission chirp chracteristics Doppler measurements Statbility of the trammission power Isolation of cross polarization ●absolute calibration ●sigma-naught ●polarimetric calibration ●simultaneous datatake with PiSAR ●resolution ●Chirp signal time change	0.1dB/step < 0.1dB以下（azimuth、range） < NEσ^0 -21 dB（@34.3） < 5% > 5 dB（生データ） 90+-5° < 0.2dB TBD Hz/sec以下 < 50Hz < 0.6 dB（1 revolution） > 25 dB < 1.5 dB <1.5 dB VV/HH<0.2 dB，phase of VV/HH < 5 deg. 8 / 19 ，10 / 4 10 m<2look ーーー	NA < 1 dB -22~-23 dB@ north pole Meets left at MGCMGC 8 dB(FBS),PLR(8 dB)、FBDは 3 dB 90+1.6 degrees 0.03dB --- Same to the left 0.03dB（separating 7 mins.） 26 dB (HV-HH) 0 ．7 dB 0 ．7 dB VV/HH:− 0 ．0 1 8 dB以下，<-1.7度 In evaluation Meets the left ーーーー
geometry ●geometric accuracy	200 m以下	10 m（ 13 m）：mean (std. Dev.)
Image quality ●radiometry		

Output

We will generate the 100 me ter spaced Antarctica mosaics twice/year frequency over three years.

PALSAR archives for Antarctica 3 rd cycle：14,459シーン（FBS41.5）523セグメント

4th cycle：14,192シーン（FBS41.5）　529セグメント

6th cycle：　2,447シーン（FBS41.5）　92セグメント

7th cycle：　3,112シーン（FBS34.3）　111セグメント

8th cycle：　7,457シーン（FBS34.3）　271セグメント

Conclusions

We introduced JAXA's plan for obseravting the polar regions using the PALSAR.

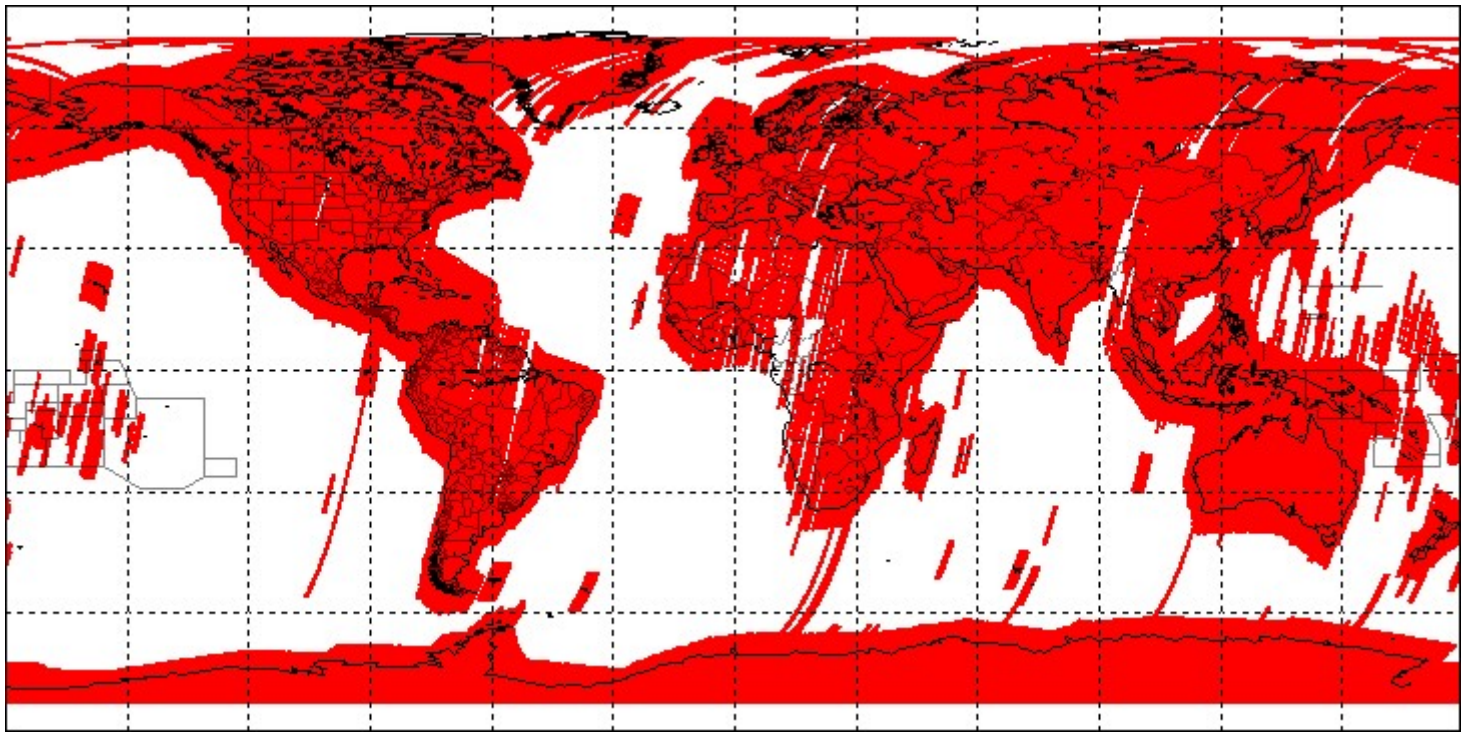
The data are being collected and processed.

Large scale processing of two regions are being ready. Browse data will be soon opened to the public.

North pole of Summer 2008 will be observed by using the SCANSAR and FBS50 complementary for filling the Gap.

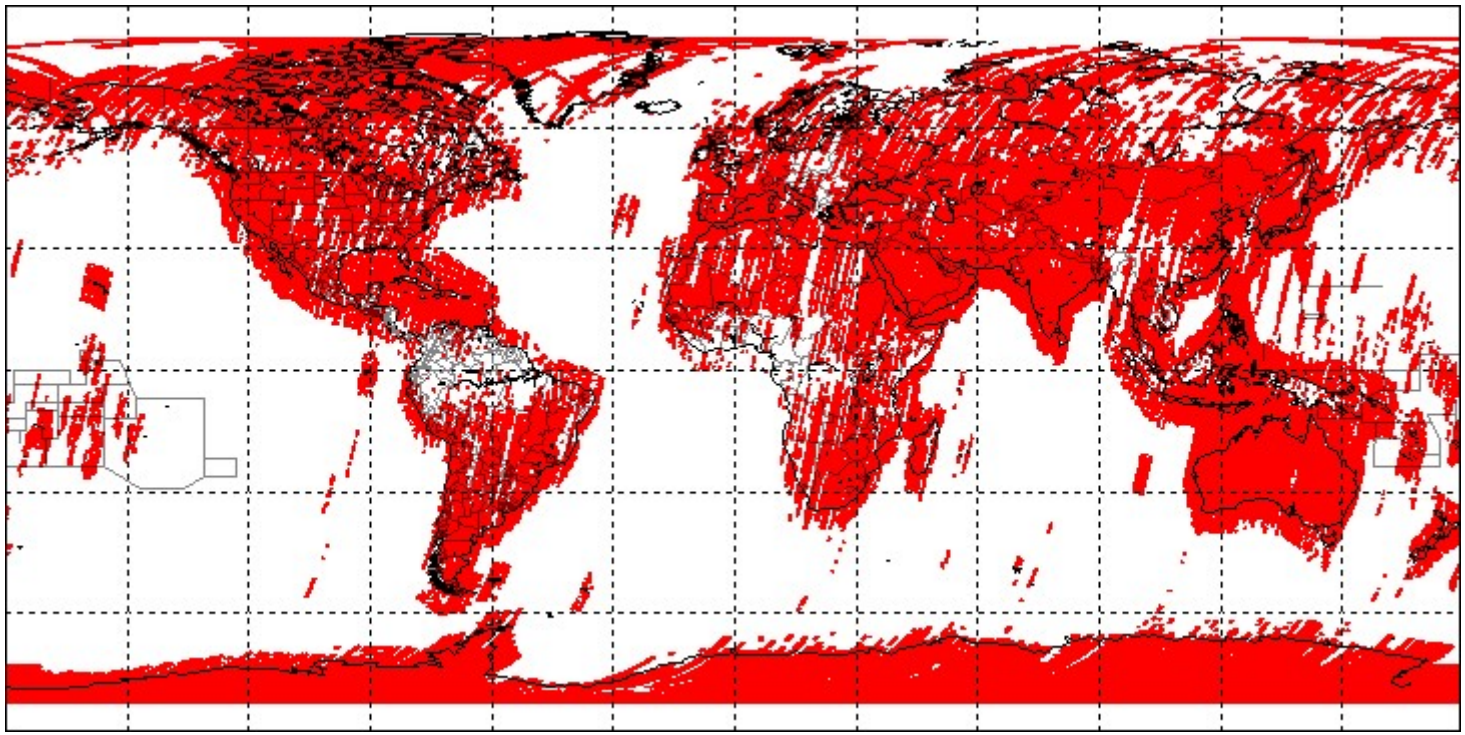
Mosaic browse(500m or 100m) will be open. Additionally, the path product is being considered for opeing.

全球シーン取得状況（PRISM直下視）



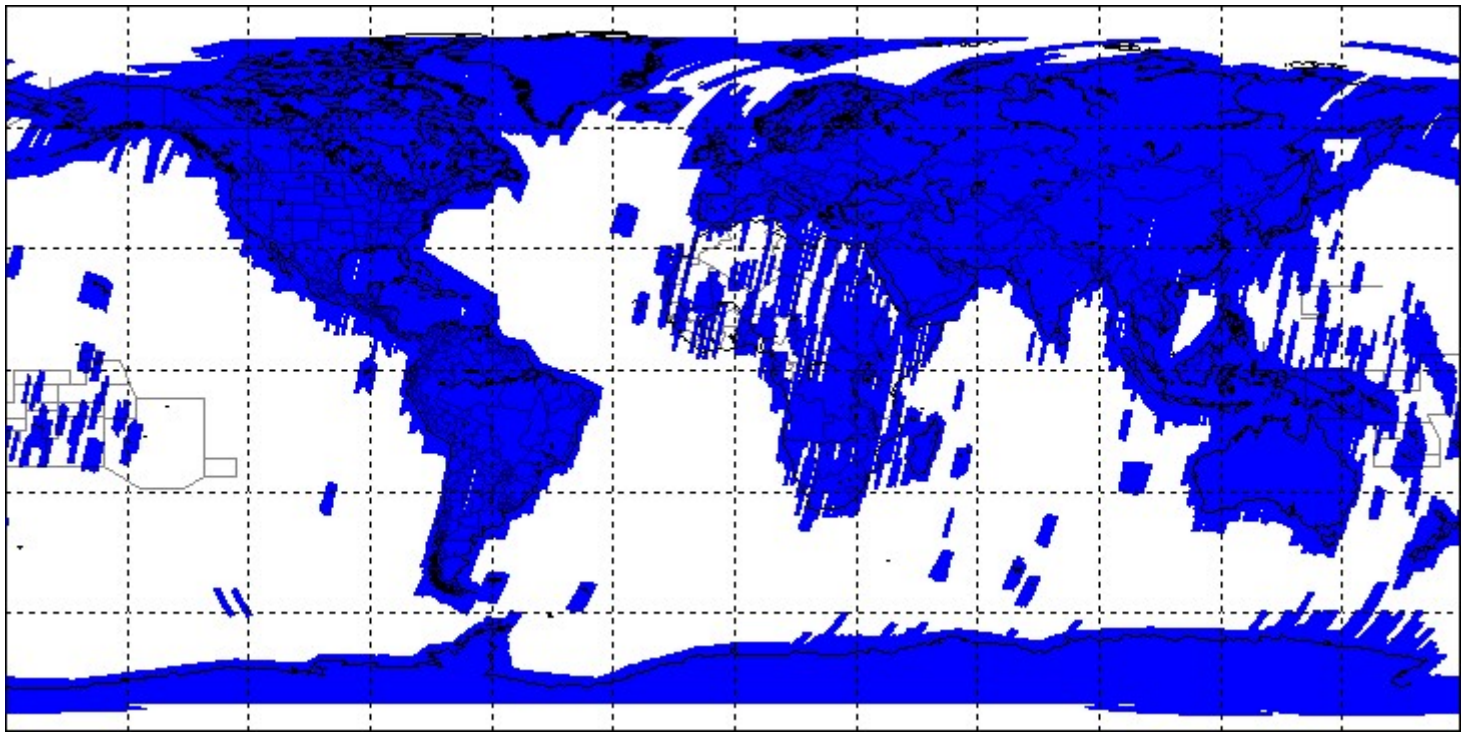
対象期間：2006年5月16日～2007年7月22日

全球シーン取得状況（ PRISM 直下視 ）



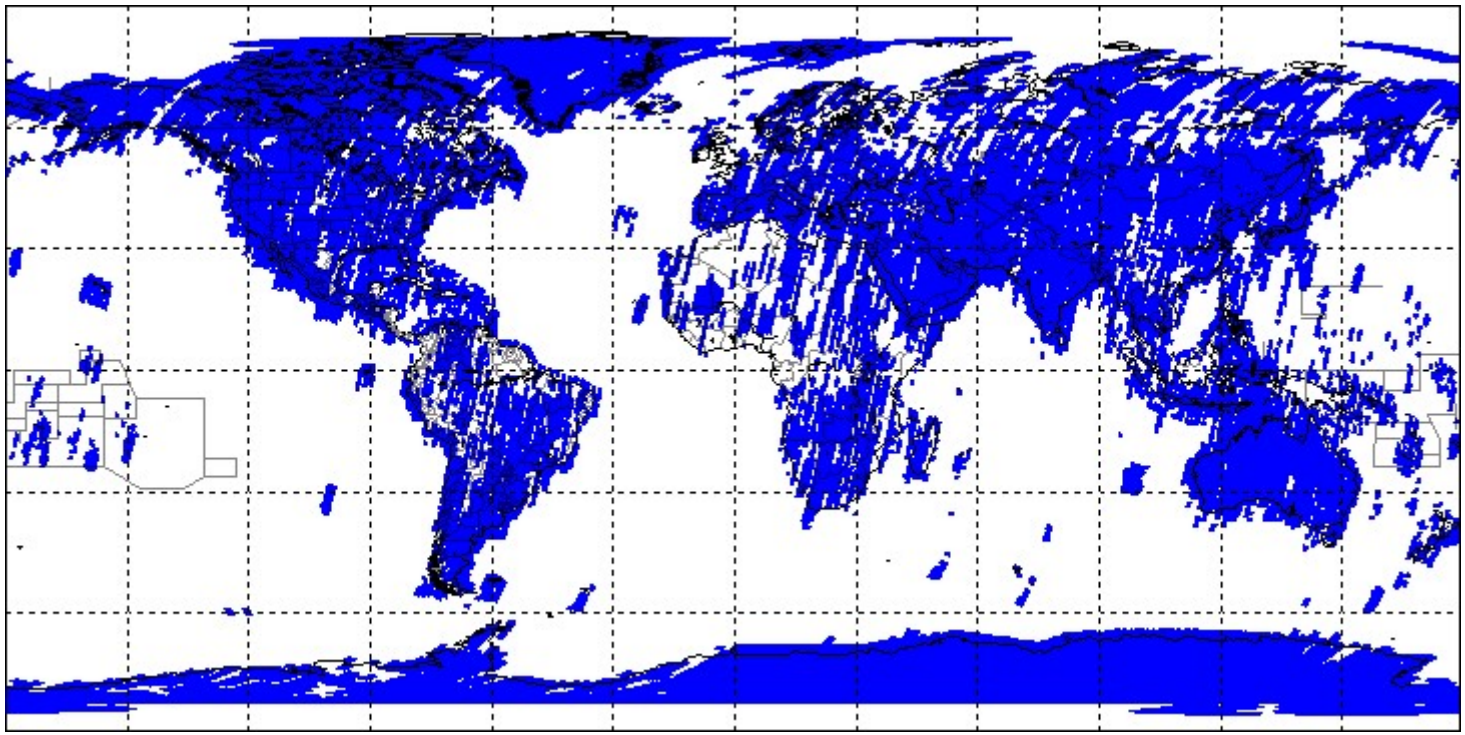
晴天シーン
対象期間：2006年5月16日～2007年7月22日

全球シーン取得状況（AVNIR-2）



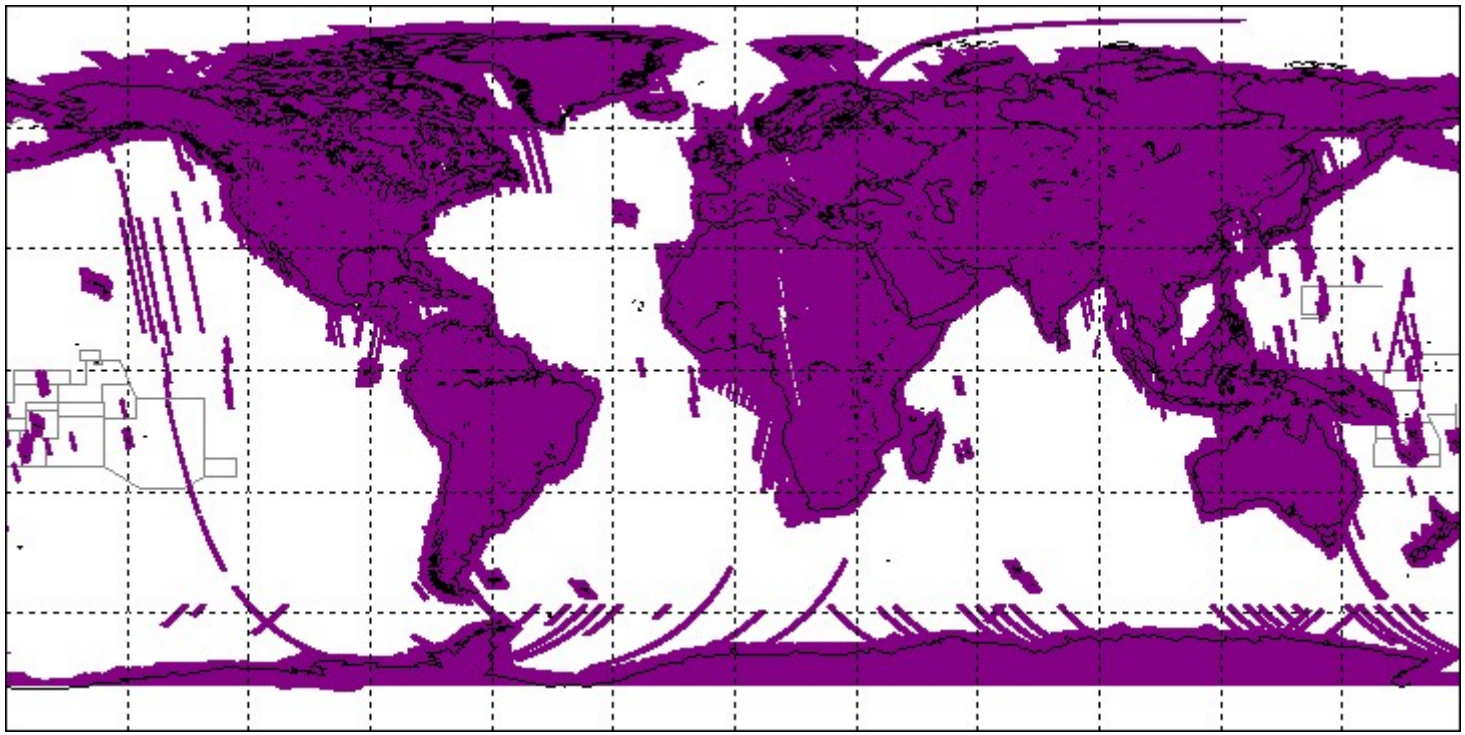
対象期間：2006年5月16日～2007年7月22日

全球シーン取得状況（AVNIR-2）



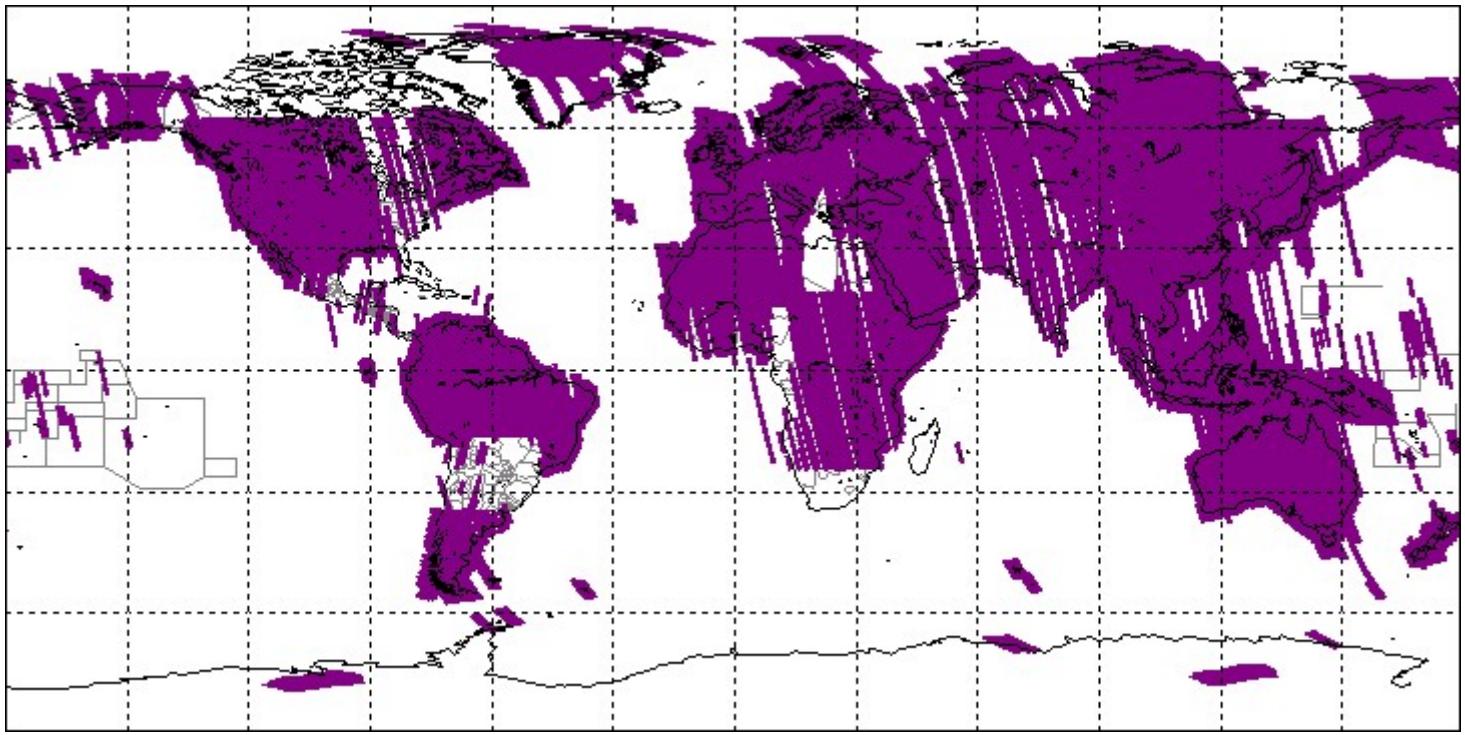
晴天シーン
対象期間：2006年5月16日～2007年7月22日

全球シーン取得状況（PALSAR FBS）



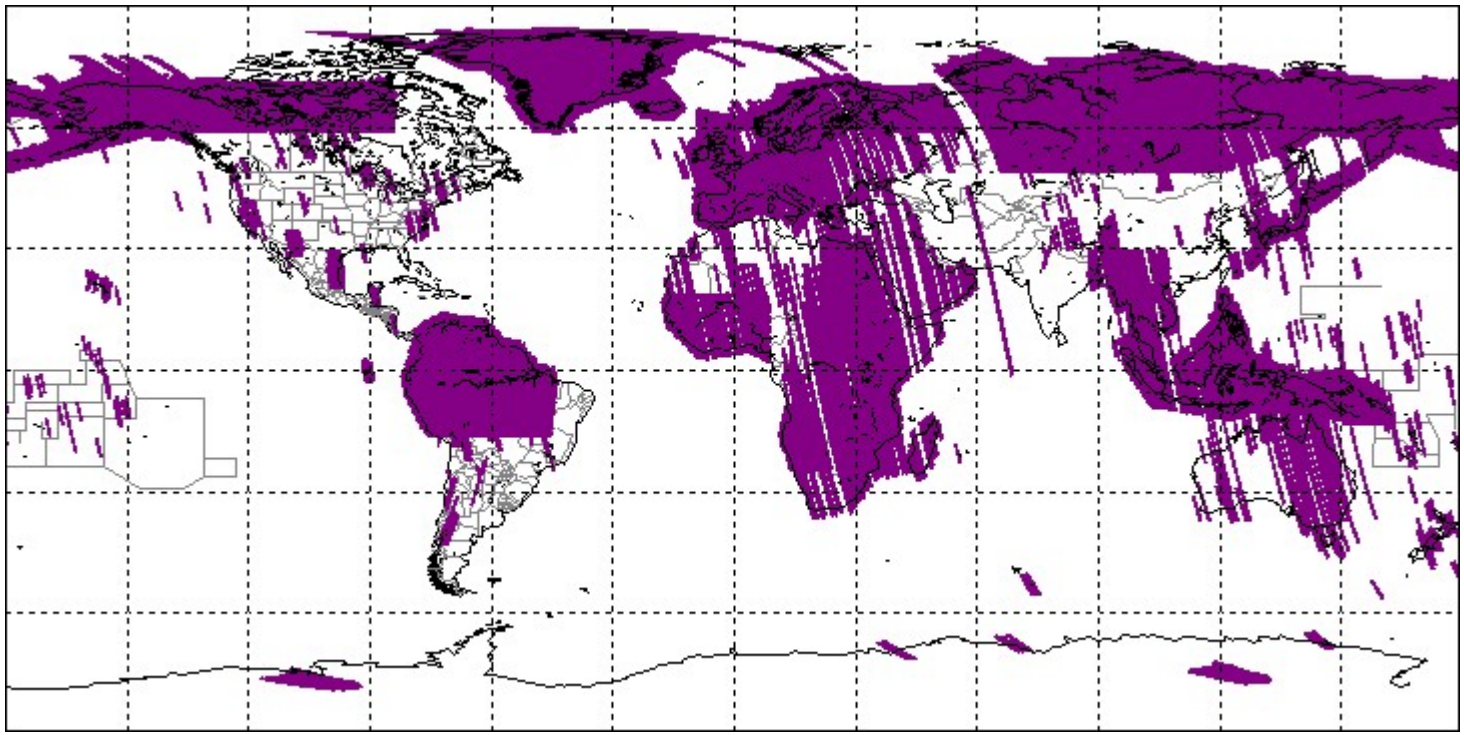
対象期間：2006年5月16日～2007年7月22日

全球シーン取得状況（PALSAR FBD）



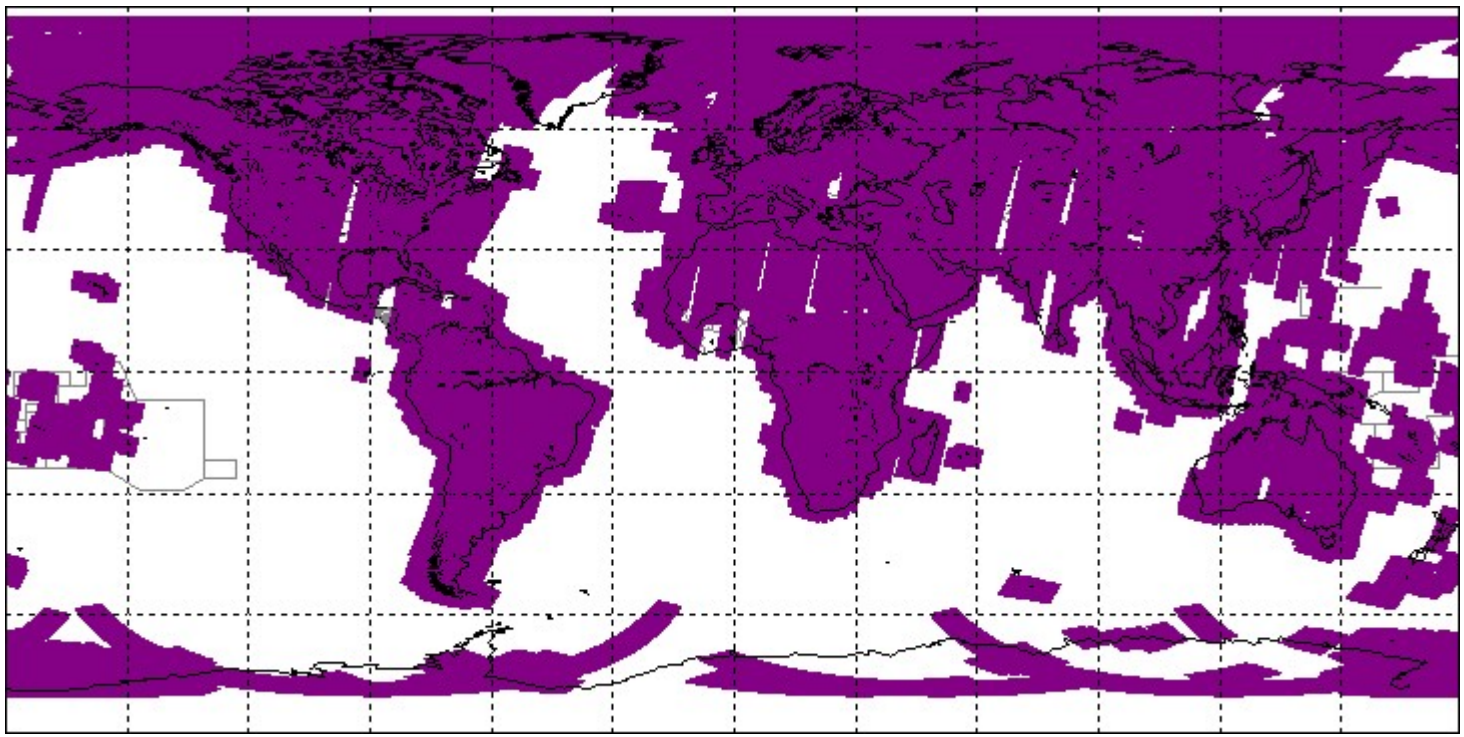
対象期間：2006年5月16日～2007年7月22日

全球シーン取得状況（PALSAR PLR）



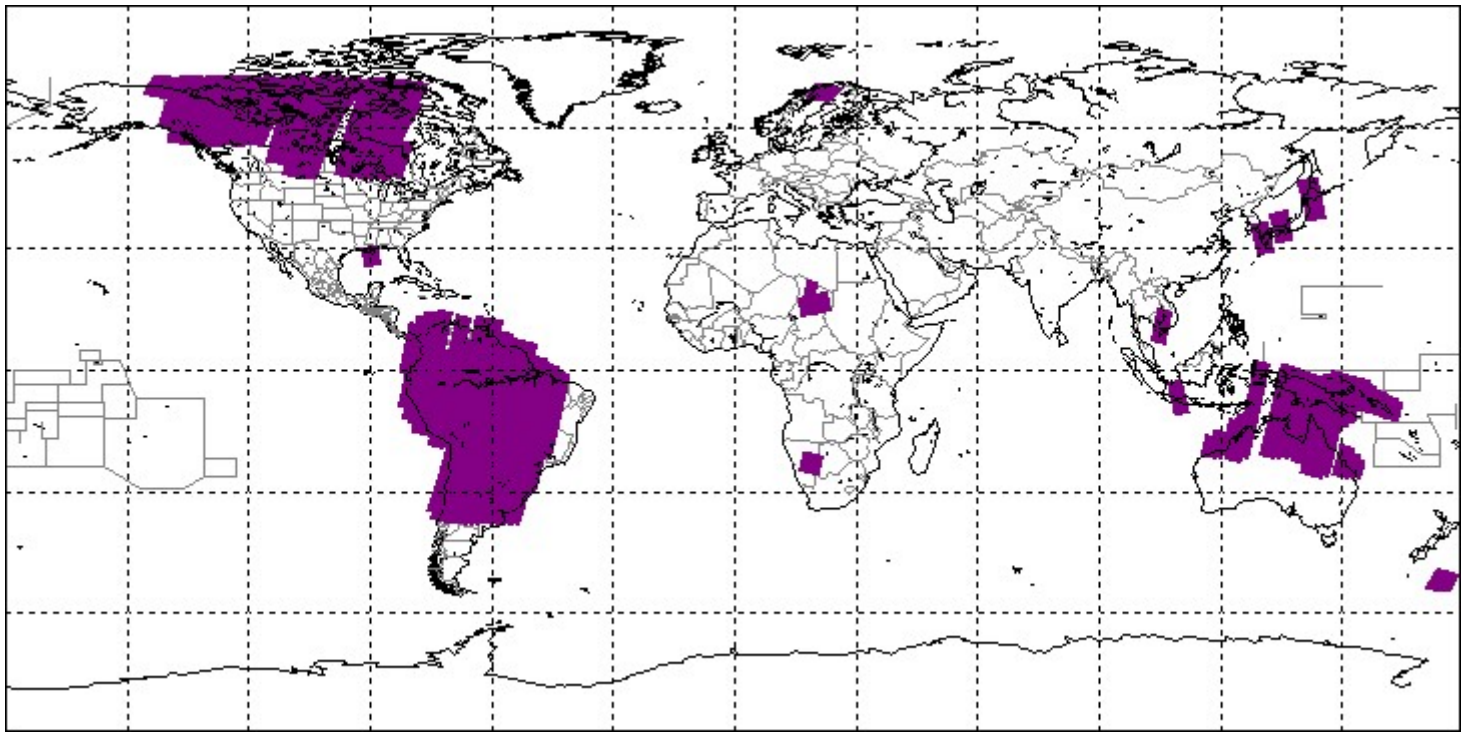
対象期間：2006年5月16日～2007年7月22日

全球シーン取得状況（PALSAR WB1）



対象期間：2006年5月16日～2007年7月22日

全球シーン取得状況（PALSAR WB2）



対象期間：2006年5月16日～2007年7月22日