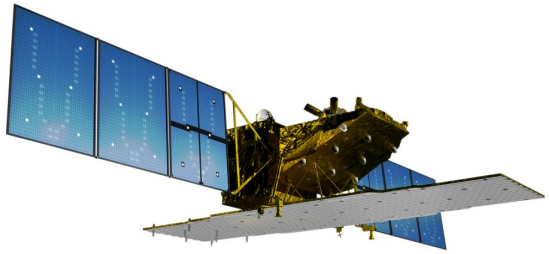
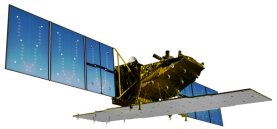


ALOS-2 Basic Observation Scenario (BOS)
(Rev. 131112)

Ake Rosenqvist, Masanobu Shimada, Shinichi Suzuki,
Fumi Ohgushi, Hiroki Nishi, Kaoru Tsuzuku, Tomohiro Watanabe,

Japan Aerospace Exploration Agency

K&C Science Team meeting
KC#18 – 7-9 Nov 2012



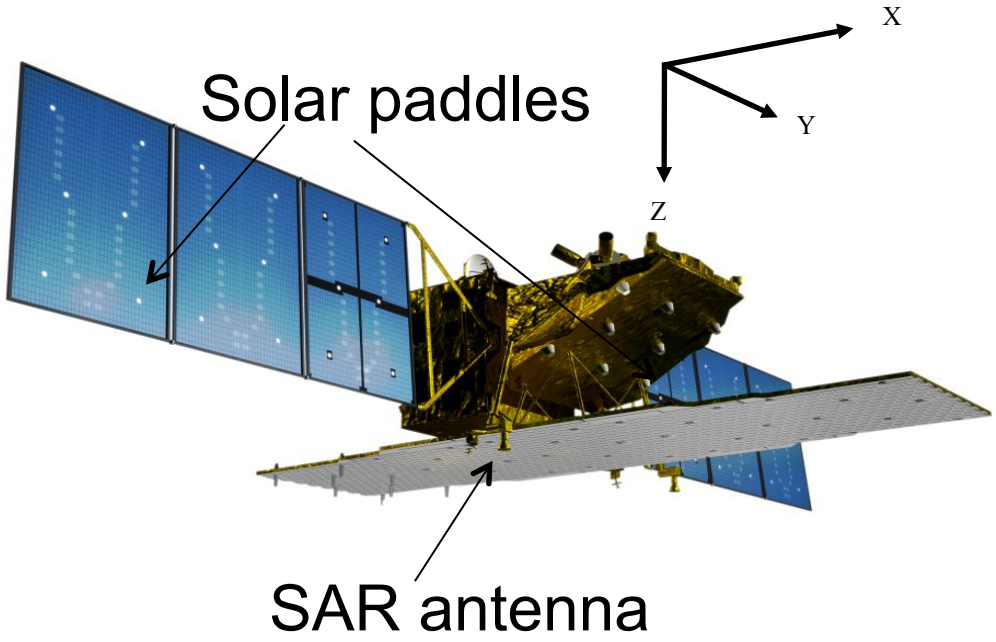
ALOS-2 Basic Observation Scenario

Japan Aerospace Exploration Agency

ALOS-2

ALOS-2 satellite

- Launch : 2013
- Revisit time : 14 days
- Orbit type : Sun-synchronous
- Altitude : 628 km +/- 500 m (for reference orbit)
- LSDN : 12:00 +/- 15 min



PALSAR-2

- L-band Synthetic Aperture Radar
- Active Phased Array Antenna type two dimensions scan (range and azimuth)
- Antenna size : 3m(El) x 10m(Az)
- Bandwidth : 14 – 84MHz
- Peak transmit Power : 5100W
- Observation swath : 25 – 490km
- Resolution : Range: 3 m to 100 m
  Azimuth: 1 m to 100 m

PALSAR-2 Specifications

		Spotlight	Ultra Fine	High sensitive	Fine	ScanSAR nominal		ScanSAR wide
Bandwidth		84MHz	84MHz	42MHz	28MHz	14MHz	28MHz	14MHz
Resolution		Rg×Az: 3×1m	3m	6m	10m	100m		60m
Swath		Rg×Az: 25×25km	50km	50km	70km	350km (5-scan)		490km (7-scan)
Polarization		SP	SP/DP	SP/DP/QP/CP		SP/DP		
NESZ		-24dB	-24dB	-28dB	-26dB	-26dB	-23dB	-23dB
S/A	Rg	25dB	25dB	23dB	25dB	25dB		20dB
	Az	20dB	25dB	20dB	23dB	20dB		20dB

SP : HH or VV or HV , DP : HH+HV or VV+VH , FP : HH+HV+VH+VV , CP : Compact pol (Experimental mode)

Main applications:

Fine beam (DP): Forest and land cover monitoring / DinSAR

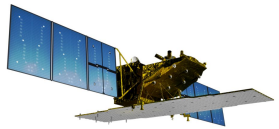
ScanSAR (DP): Rapid deforestation / wetlands / InSAR (ScanSAR-ScanSAR)

Spotlight (SP): Emergency observations

Ultra Fine (SP) : Global map, InSAR base mapping

High sensitive (QP): Global map

ScanSAR wide (SP) : Polar ice



ALOS-2 Basic Observation Scenario

Japan Aerospace Exploration Agency

ALOS-2 status

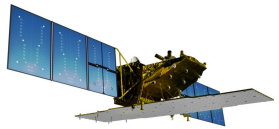
- ALOS-2 is planned for launch in late 2013, with a design lifetime of 7 years.
- A global systematic acquisition strategy (“Basic Observation Scenario” – BOS) is under development. It is comprised of a global (described here) and a dedicated national component covering Japan.
- The ALOS-2 BOS builds on the ALOS acquisition strategy (2006-2011). It will provide continuity of key acquisitions but with enhanced image characteristics (spatial resolution, polarisations, radiometric sensitivity).
- The ALOS-2 Data Policy is yet to be determined.

The ALOS-2

Basic Observation Scenario (BOS)

– Global component –

(as of September 2012)



ALOS-2 Basic Observation Scenario

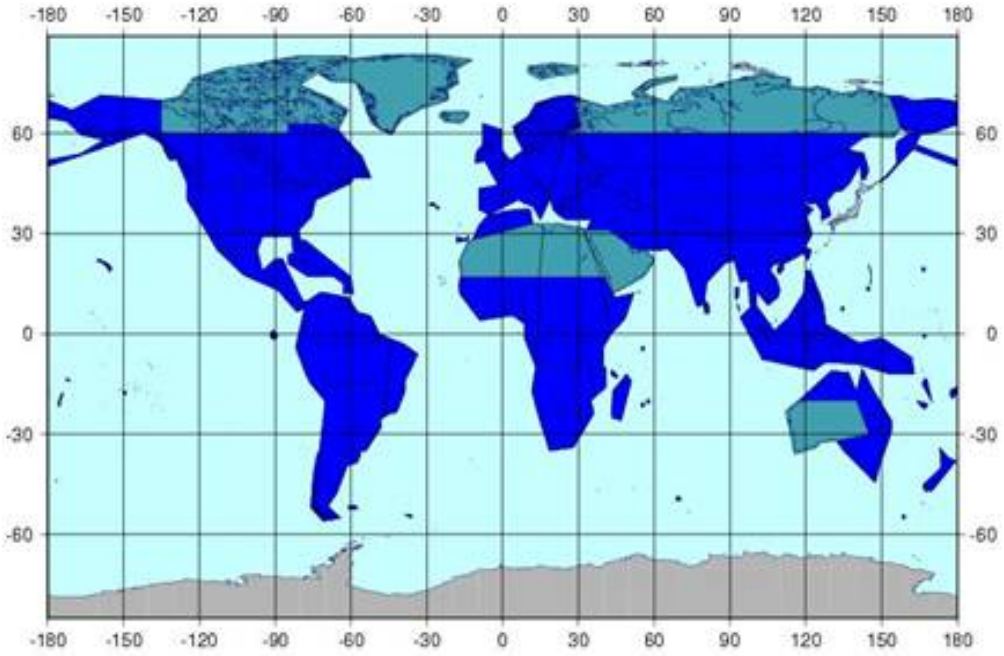
Japan Aerospace Exploration Agency

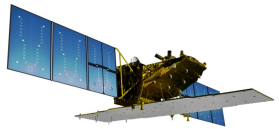
Global land areas – baseline mapping

Temporal repeat: 2 cov/year

Mode: Dual-pol HH+HV (Beams 5-7: Inc.angl.rg.: 28.5º~42.5º)

Pass dir.: Ascending GSD: 10 m





ALOS-2 Basic Observation Scenario

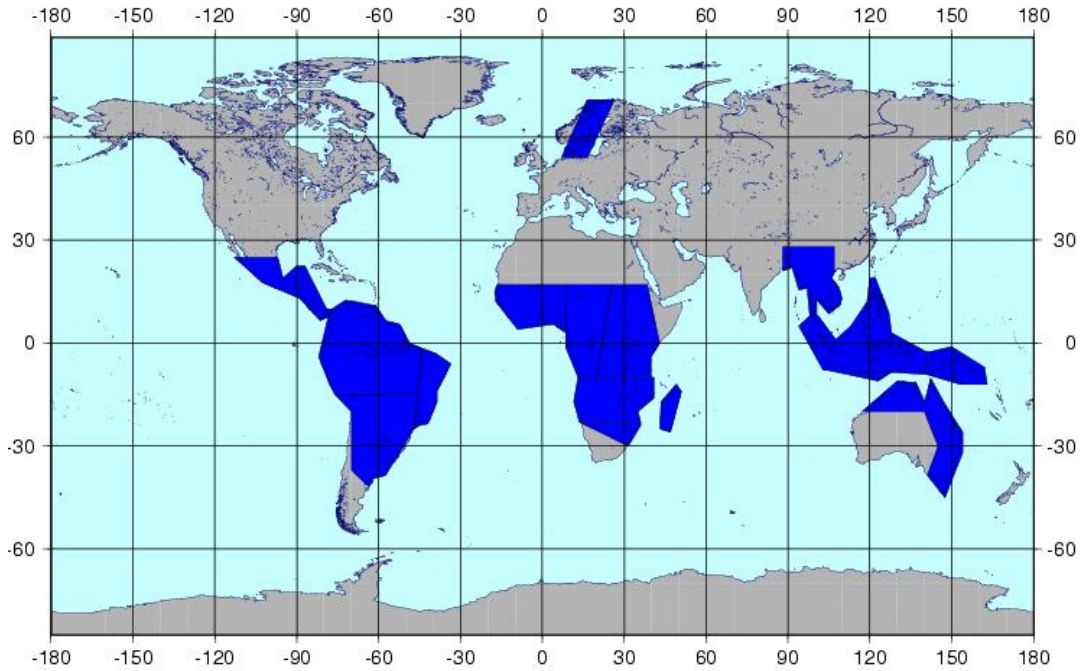
Japan Aerospace Exploration Agency

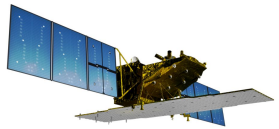
Forest and Wetlands monitoring

Temporal repeat: 4 cov/year + 2 cov/yr (14-day InSAR)

Mode: Dual-pol HH+HV (Beams 5-7: Inc.angl.rg.: 28.5º~42.5º)

Pass dir.: 4*Asc, 2*Desc (InSAR) GSD: 10 m





ALOS-2 Basic Observation Scenario

Japan Aerospace Exploration Agency

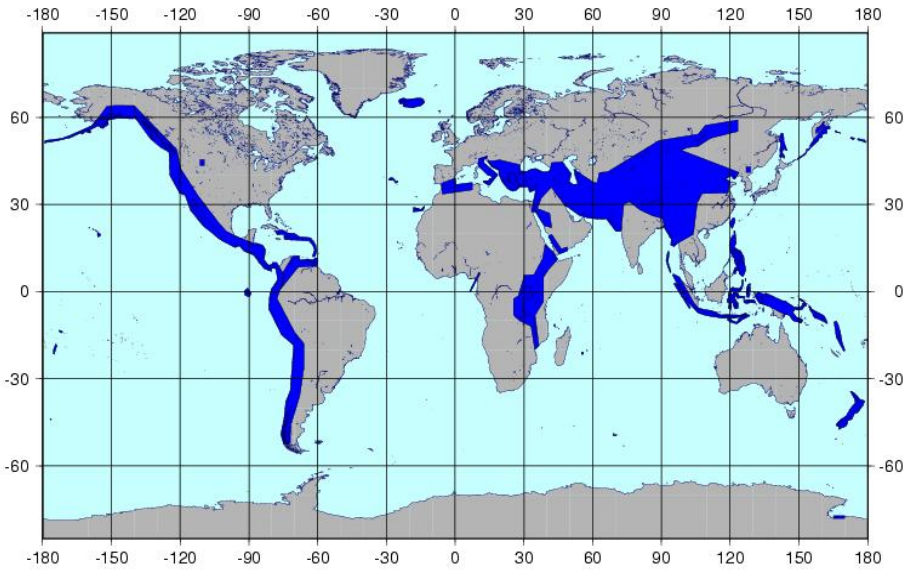
Crustal Deformation

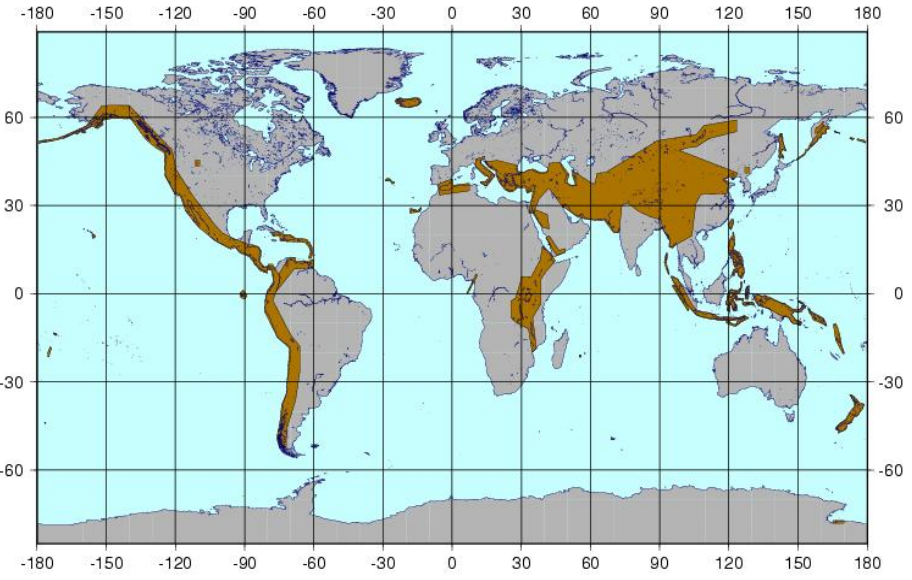
Temporal repeat: 2-6 cov/year & 9 cov/year (42 days)

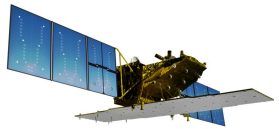
Mode: Dual-pol (HH+HV) & WB-350km (HH+HV)

Pass dir.: 4*Asc+ 9*Desc + 2*Desc (14-day InSAR)

GSD: 10 m & 100 m





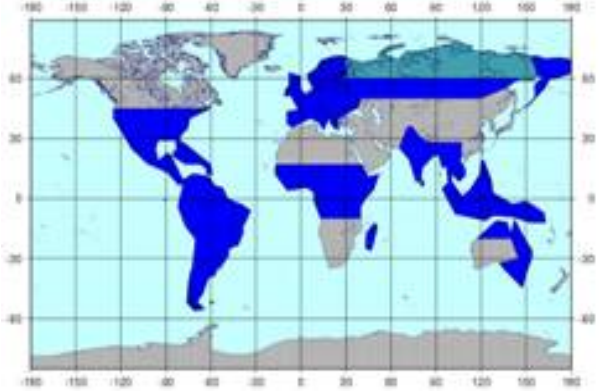


ALOS-2 Basic Observation Scenario

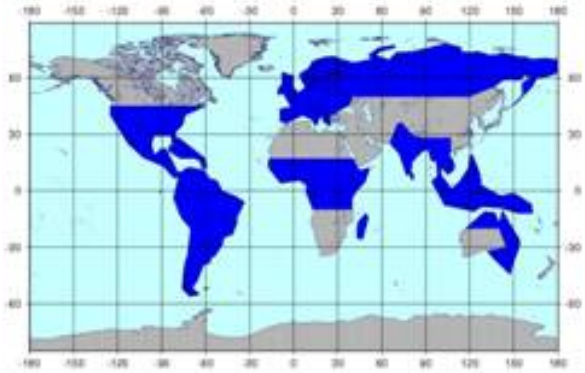
JAXA Japan Aerospace Exploration Agency

Global land + Forest & Wetlands + Crustal Def.

World 1 – Year 1



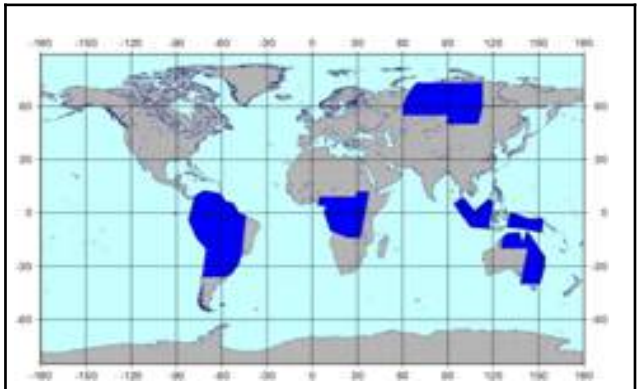
World 1 – Year 2



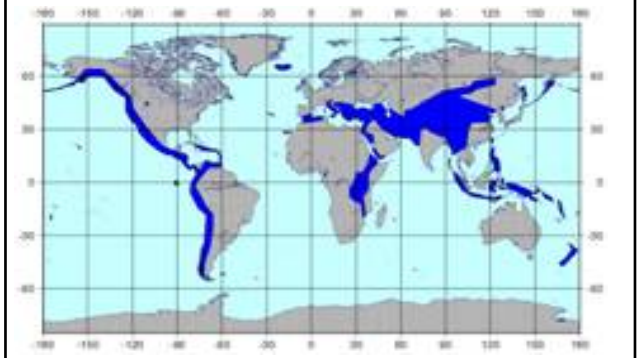
World 2 – Year 1

World 2 – Year 2

Prio1 Prio2

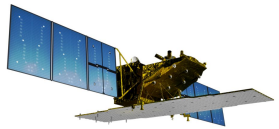


Forest and Wetlands



Crustal deformation

Observed simultaneously with World 1&2, but with prio 1.5



ALOS-2 Basic Observation Scenario

Japan Aerospace Exploration Agency

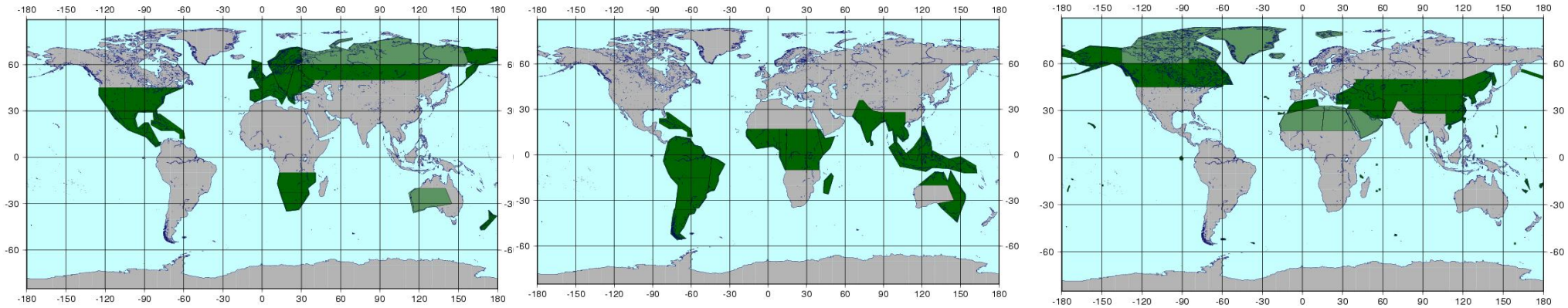
Global land areas – VHR baseline mapping

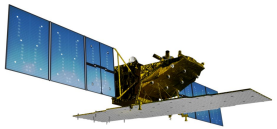
Temporal repeat: 1 cov/ 3 years

Mode: Single-pol (HH or HV)

Beam 6-9: Incidence angle range: 30.2º-44.4º

Pass dir.: Desc GSD: 3 m





ALOS-2 Basic Observation Scenario

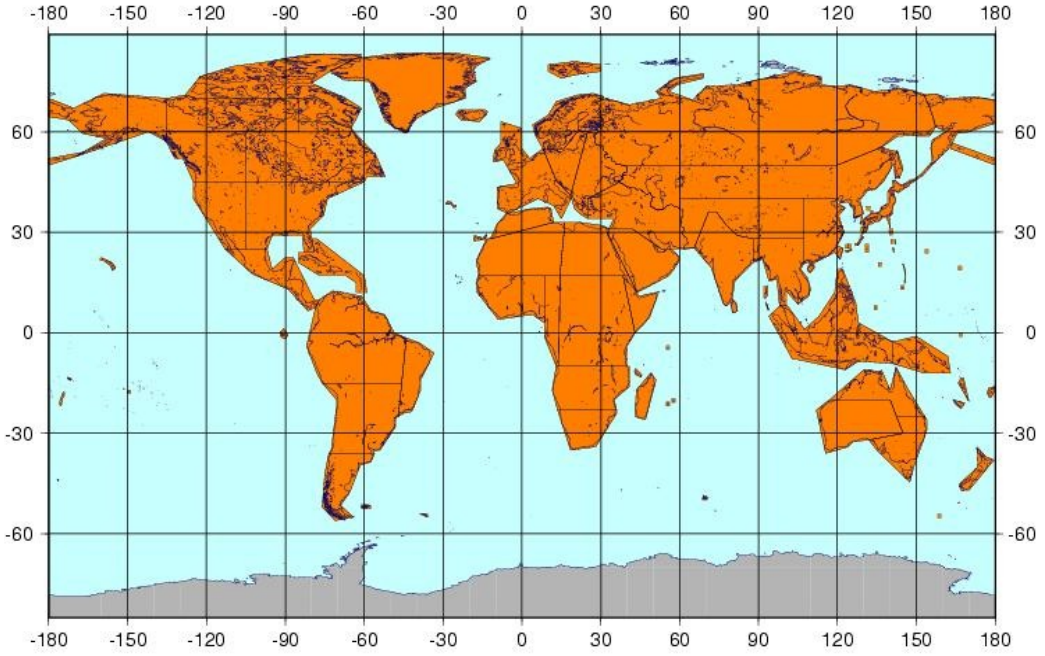
Japan Aerospace Exploration Agency

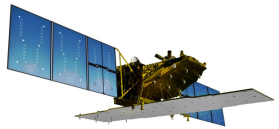
Global land areas – Polarimetric baseline (1/2)

Temporal repeat: 1 cov/5 years

Mode: Quad-pol (FB3-FB7: Inc.angl.rg.: 25.6º-40.2º)

Pass dir.: Asc GSD: 6 m

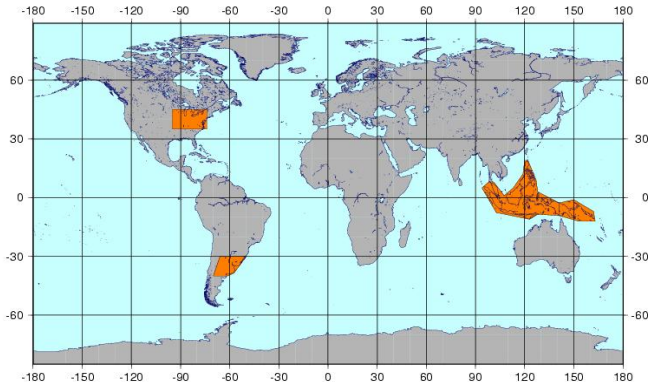




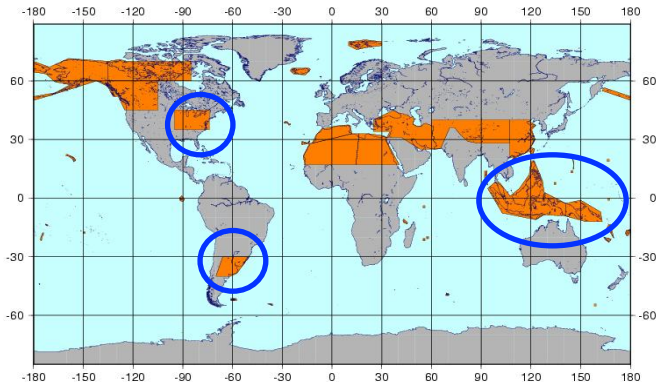
ALOS-2 Basic Observation Scenario

Japan Aerospace Exploration Agency

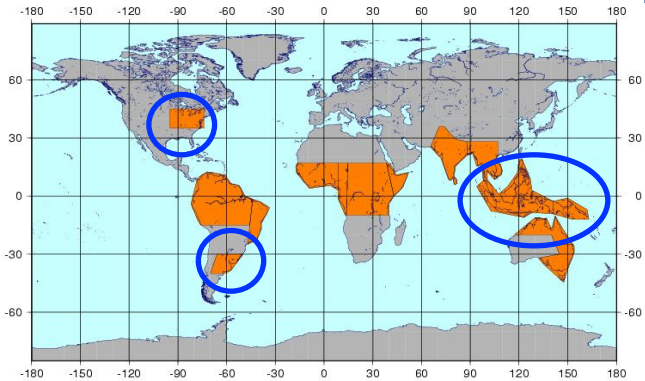
Global land areas – Polarimetric baseline (2/2)



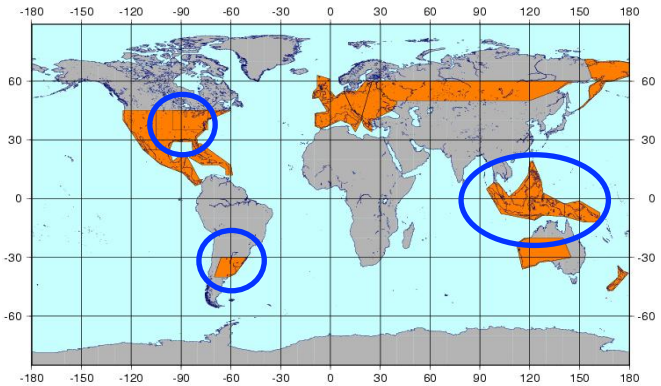
Main sites (every year)



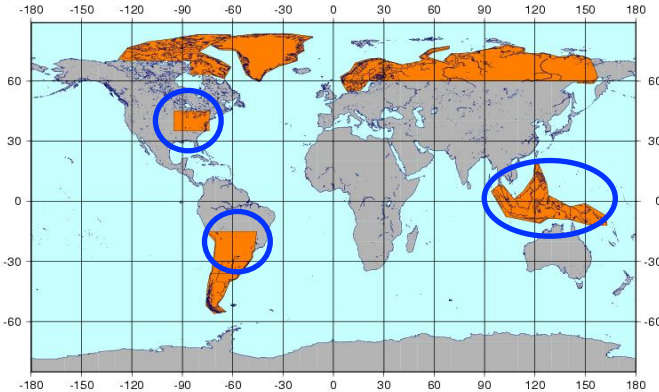
Year 1



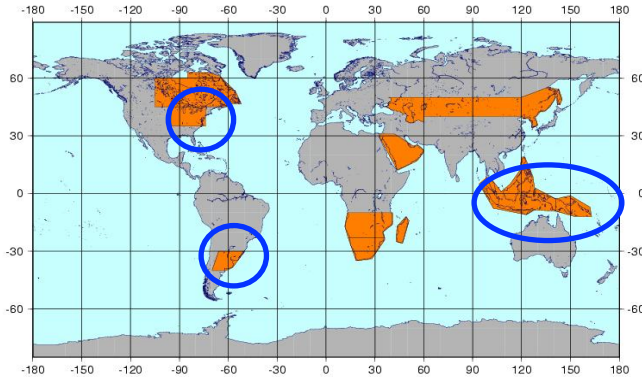
Year 2



Year 3

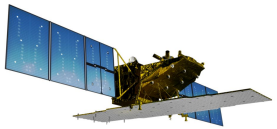


Year 4



Year 5

*JAPAN area (once/2 years)



ALOS-2 Basic Observation Scenario

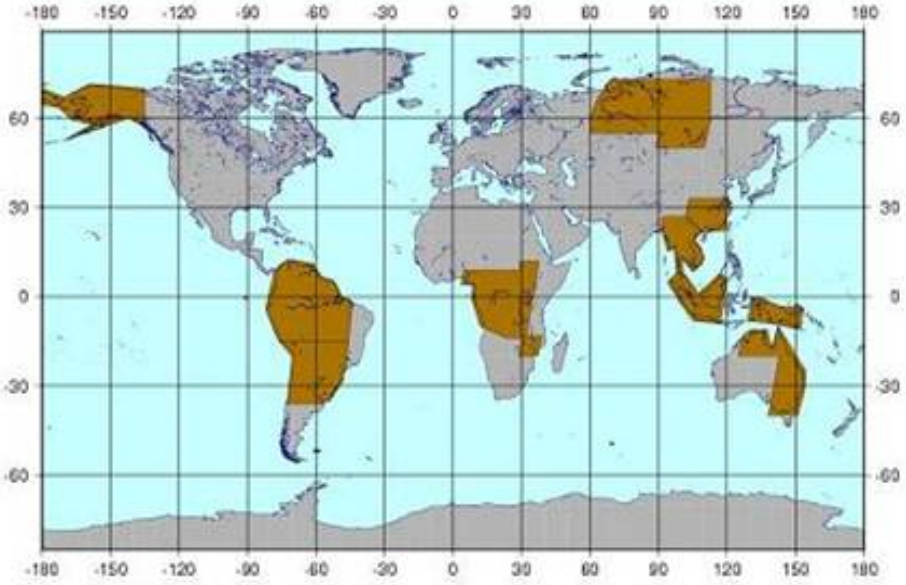
Japan Aerospace Exploration Agency

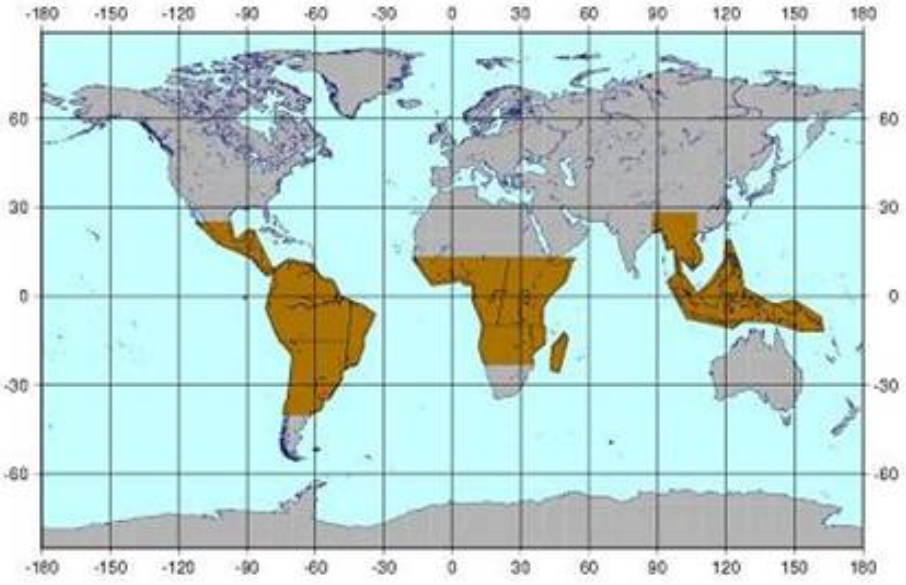
Wetlands & Rapid deforestation monitoring

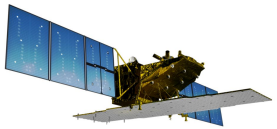
Temporal repeat: 9 cov/year (42 days repeat)

Mode: WB-350km HH+HV (Inc. angle range 25.7º~49.0º)

Pass dir.: Desc GSD: 100 m







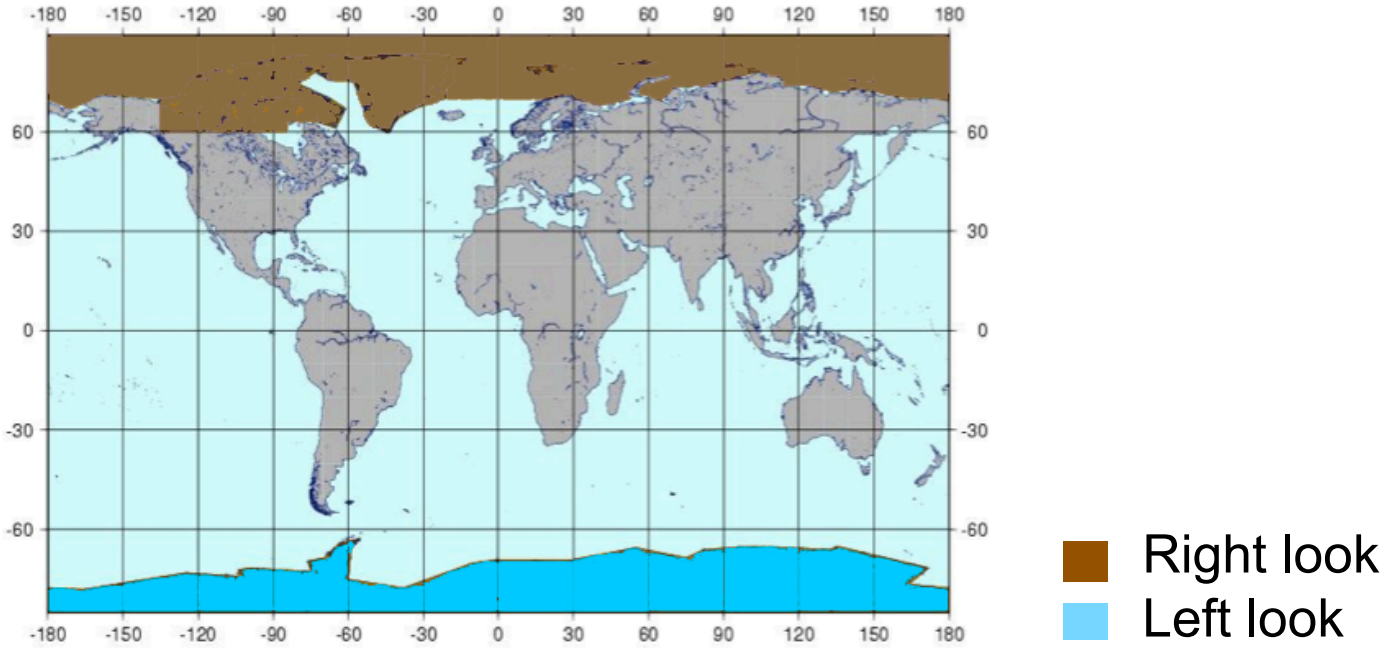
ALOS-2 Basic Observation Scenario

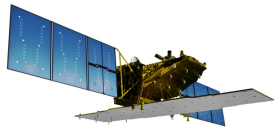
Polar Ice

Temporal repeat: 3 cov/year (2*winter, 1*summer)

Mode: WB (HH or HH+HV) (TBD)

Pass dir.: Desc (South Pole – left looking)





ALOS-2 Basic Observation Scenario

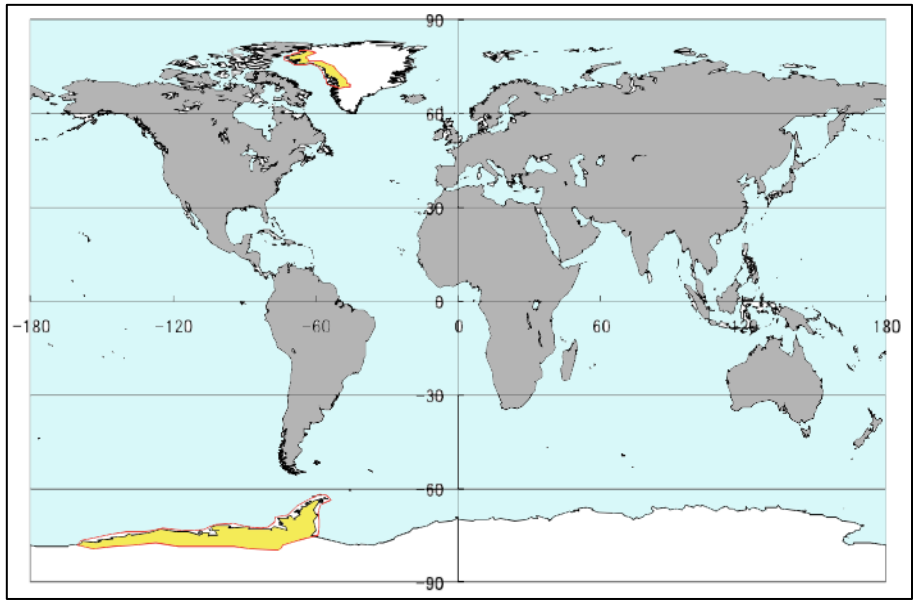
Glacier movement (Super Sites)

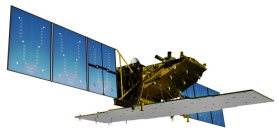
Temp repeat: 3 cov/yr (Antarctica) Descending

2 cov/yr (Greenland) Ascending

Mode: Single-pol HH (Beam 6: Inc. angle range: 33.7°~38.5°)

GSD: 10 m





ALOS-2 Basic Observation Scenario

Japan Aerospace Exploration Agency

Observation pattern for annual acquisitions *

Year	Annual																								
Week of year	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52
Cycle	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83
Desc	D+W+F			D+W+F	14-day InSAR		D+W+F	14-day InSAR		D+W+F	14-day InSAR		D+W+F		D+W+F	Glacier Antarctica		D+W+F	Glac. Antarc.		D+W+F	Global (n/3)		D+W+F	Global (n/3)	
	WB 100m			WB 100m	DP 10m	DP 10m	WB 100m	DP 10m	DP 10m	WB 100m	DP 10m	DP 10m	WB 100m		WB 100m	SP 10m	SP 10m	WB 100m	SP 10m		WB 100m	SP 3m	SP 3m	WB 100m	SP 3m	SP 3m
Asc	North Pole	World 1			Glacier Greenland		Global (n/3)						World 2			South Pole	N + S Pole	World 1					World 2			N + S Pole
	WB(R)	DP 10m	DP 10m	DP 10m	SP 10m	SP 10m	QP 6m	QP 6m	QP 6m	QP 6m	QP 6m		DP 10m	DP 10m	DP 10m	WB(L)	WB(R)	DP 10m	DP 10m	DP 10m			DP 10m	DP 10m	DP 10m	WB(R)
																	WB(L)									WB(L)

DP 10m — 10m DP (HH+HV)

SP 10m — 10m SP (HH)

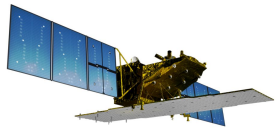
SP 3m — 3m SP (HH or HV)

QP 6m — 6m QP (HH+HV+VV+VH)

WB 100m — 100m WB (HH+HV) (Right)

WB (L) — 100m WB (HH+HV) (Left)

* 3m SP and 6m QP modes require 3 and 5 years for global coverage



ALOS-2 Basic Observation Scenario

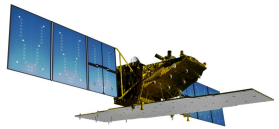
Japan Aerospace Exploration Agency

Pattern repeated on a 4-5 year basis

Year	2014年																									
Week of year	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52
Cycle	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Desc	D+W+F			D+W+F	14-day InSAR		D+W+F	14-day InSAR		D+W+F	14-day InSAR		D+W+F		D+W+F	Glacier Antarctica		D+W+F	Glac. Antarc.		D+W+F	Global (1/3)		D+W+F	Global (1/3)	
	WB 100m			WB 100m	DP 10m	DP 10m	WB 100m	DP 10m	DP 10m	WB 100m	DP 10m	DP 10m	WB 100m		WB 100m	SP 10m	SP 10m	WB 100m	SP 10m		WB 100m	SP 3m	SP 3m	WB 100m	SP 3m	SP 3m
Asc	Def	World 1			Glacier Greenland		Global (1/3)						World 2			South Pole	N + S Pole	World 1					World 2			N + S Pole
	WB 100m	DP 10m	DP 10m	DP 10m	SP 10m	SP 10m	QP 6m	QP 6m	QP 6m	QP 6m	QP 6m		DP 10m	DP 10m	DP 10m	WB(L)	WB(R)	DP 10m	DP 10m	DP 10m			DP 10m	DP 10m	DP 10m	WB(R)
																	WB(L)									WB(L)

Year	2015年																									
Week of year	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52
Cycle	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57
Desc	D+W+F			D+W+F	14-day InSAR		D+W+F	14-day InSAR		D+W+F	14-day InSAR		D+W+F		D+W+F	Glacier Antarctica		D+W+F	Glac. Antarc.		D+W+F	Global (2/3)		D+W+F	Global (2/3)	
	WB 100m			WB 100m	DP 10m	DP 10m	WB 100m	DP 10m	DP 10m	WB 100m	DP 10m	DP 10m	WB 100m		WB 100m	SP 10m	SP 10m	WB 100m	SP 10m		WB 100m	SP 3m	SP 3m	WB 100m	SP 3m	SP 3m
Asc	North Pole	World 1			Glacier Greenland		Global (2/3)						World 2			South Pole	N + S Pole	World 1					World 2			N + S Pole
	WB(R)	DP 10m	DP 10m	DP 10m	SP 10m	SP 10m	QP 6m	QP 6m	QP 6m	QP 6m	QP 6m		DP 10m	DP 10m	DP 10m	WB(L)	WB(R)	DP 10m	DP 10m	DP 10m			DP 10m	DP 10m	DP 10m	WB(R)
																	WB(L)									WB(L)

Year	2016年																									
Week of year	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52
Cycle	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83
Desc	D+W+F			D+W+F	14-day InSAR		D+W+F	14-day InSAR		D+W+F	14-day InSAR		D+W+F		D+W+F	Glacier Antarctica		D+W+F	Glac. Antarc.		D+W+F	Global (3/3)		D+W+F	Global (3/3)	
	WB 100m			WB 100m	DP 10m	DP 10m	WB 100m	DP 10m	DP 10m	WB 100m	DP 10m	DP 10m	WB 100m		WB 100m	SP 10m	SP 10m	WB 100m	SP 10m		WB 100m	SP 3m	SP 3m	WB 100m	SP 3m	SP 3m
Asc	North Pole	World 1			Glacier Greenland		Global (3/3)						World 2			South Pole	N + S Pole	World 1					World 2			N + S Pole
	WB(R)	DP 10m	DP 10m	DP 10m	SP 10m	SP 10m	QP 6m	QP 6m	QP 6m	QP 6m	QP 6m		DP 10m	DP 10m	DP 10m	WB(L)	WB(R)	DP 10m	DP 10m	DP 10m			DP 10m	DP 10m	DP 10m	WB(R)
																	WB(L)									WB(L)



ALOS-2 Basic Observation Scenario

Japan Aerospace Exploration Agency

Emergency observations

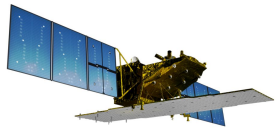
Emergency observations – such requested through the International Disaster Charter, by Japanese institutions or by JAXA itself – have highest priority and superseed the Basic Observation Scenario programming.

Cal/Val

Requests related to Cal/Val also have higher priority than the BOS, but are as far as possible already integrated into the BOS planning.

Top priority

Satellite house-keeping has top priority and superseed all the above.

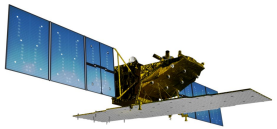


ALOS-2 Basic Observation Scenario

Japan Aerospace Exploration Agency

Schedule

2011-2013:	Observation plan development with associated software simulations to optimise data collection verses recording and downlink capacity and use of other system resources (power, etc.)
2013:	BOS implementation and satellite launch
L – L+2 m:	Initial mission check
L+2–6 m:	Cal/Val phase
L + 7 m:	Start of distribution of standard products
2013+	The BOS plan will be reviewed on a regular basis (ALOS: 2 times/year) by JAXA and related Japanese institutions, and modified as required.

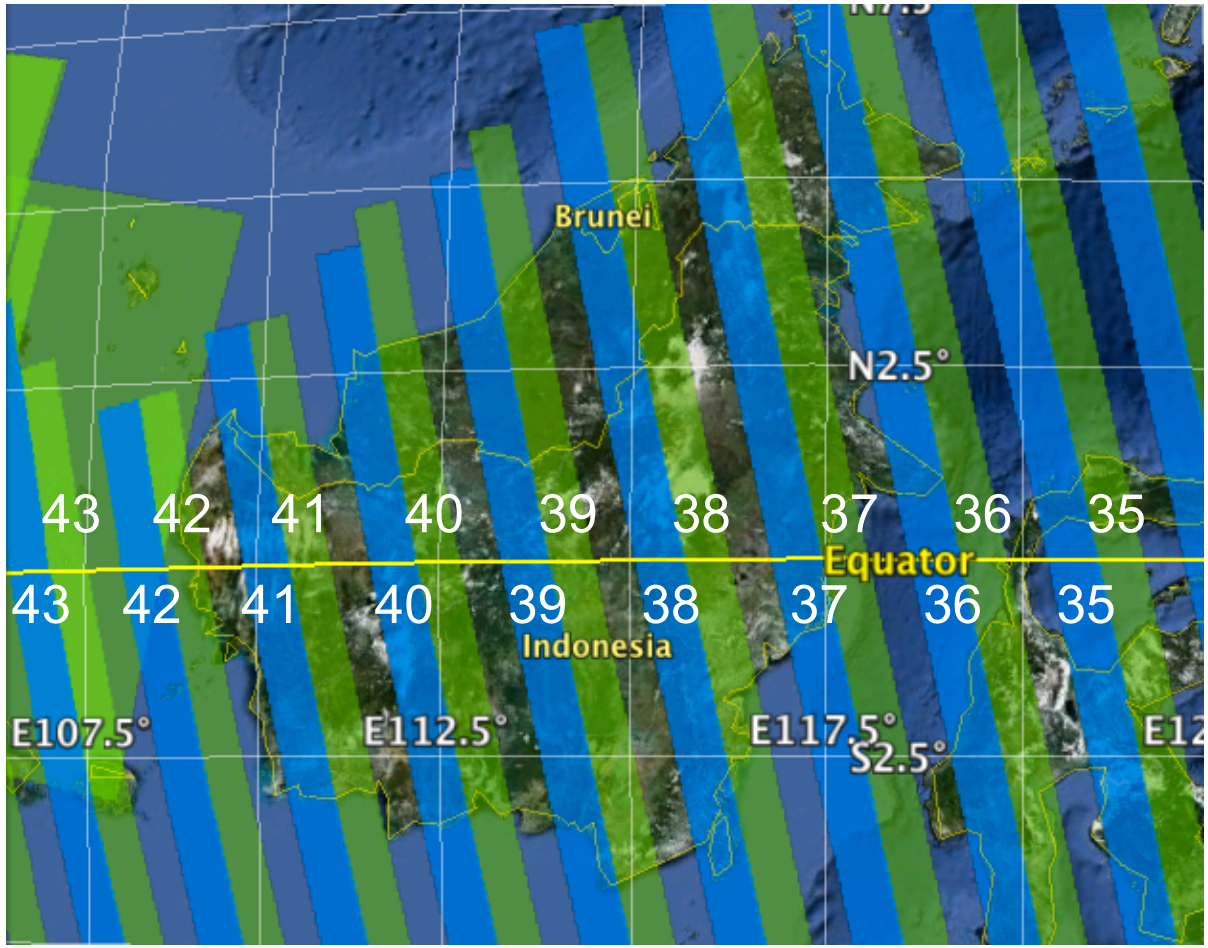


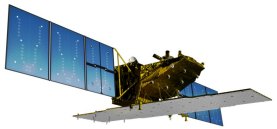
ALOS-2 Basic Observation Scenario

Japan Aerospace Exploration Agency

Cycle	RSP	Day	Days btw passes
1	35	2-Sep	
2	35	16-Sep	14
3	35	30-Sep	14
1	36	7-Sep	-23
2	36	21-Sep	14
3	36	5-Oct	14
1	37	29-Aug	-37
2	37	12-Sep	14
3	37	26-Sep	14
1	38	3-Sep	-23
2	38	17-Sep	14
3	38	1-Oct	14
1	39	8-Sep	-23
2	39	22-Sep	14
3	39	6-Oct	14
1	40	30-Aug	-37
2	40	13-Sep	14
3	40	27-Sep	14
1	41	4-Sep	-23
2	41	18-Sep	14
3	41	2-Oct	14
1	42	9-Sep	-23
2	42	23-Sep	14
3	42	7-Oct	14

Observation sequence – Fine Beam (e.g. FBD 10m)
3 cycles (42 days) required for regional coverage.
14-37 days between adjacent swaths





ALOS-2 Basic Observation Scenario

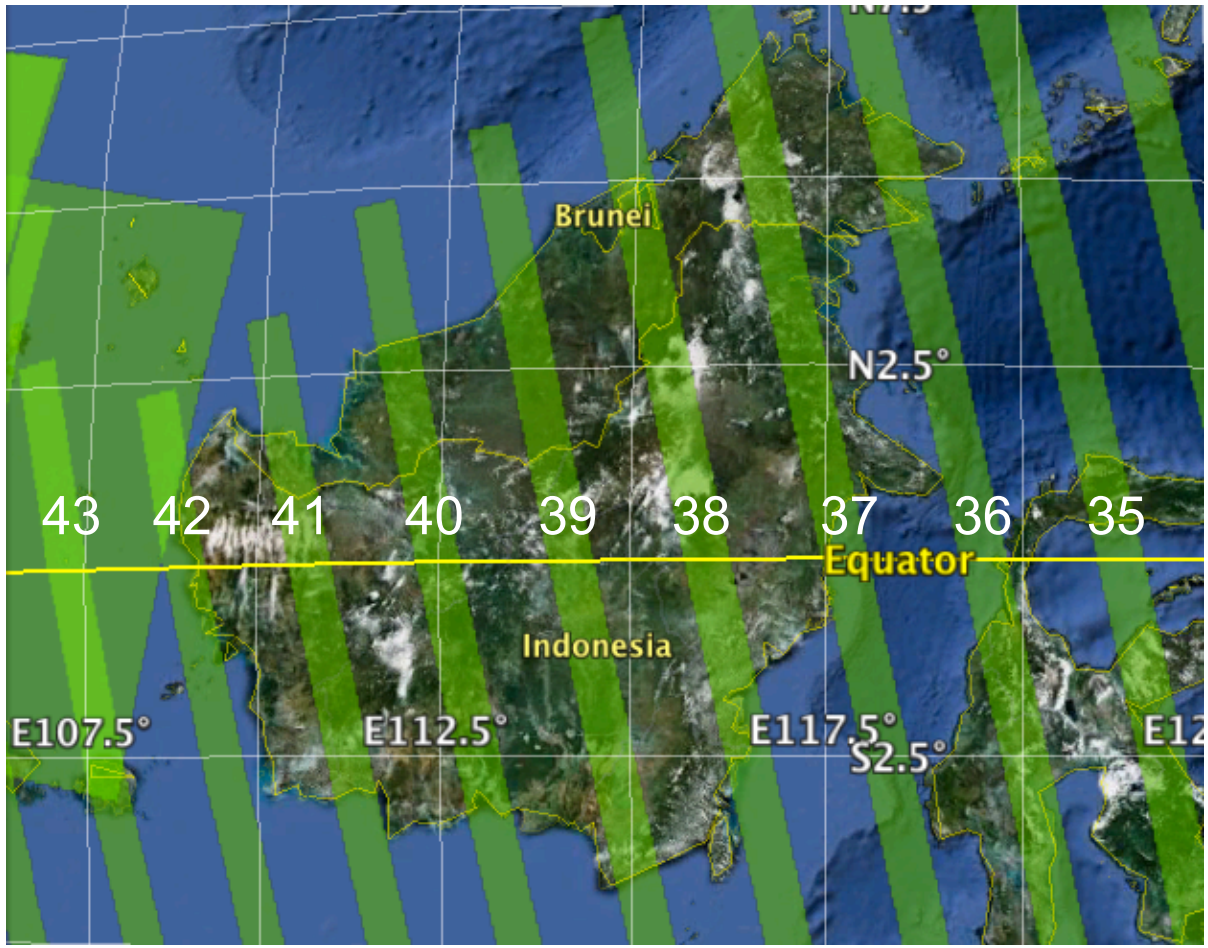
Japan Aerospace Exploration Agency

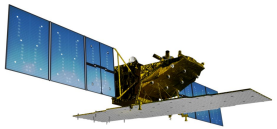
Cycle	RSP	Day	Days btw passes
1	35	2-Sep	
1	36	7-Sep	5
1	37	29-Aug	-9
1	38	3-Sep	5
1	39	8-Sep	5
1	40	30-Aug	-9
1	41	4-Sep	5
1	42	9-Sep	5
1	43	31-Aug	-9
1	44	5-Sep	5
1	45	10-Sep	5
1	46	1-Sep	-9
1	47	6-Sep	5
1	48	28-Aug	-9
1	49	2-Sep	5
1	50	7-Sep	5
1	51	29-Aug	-9
1	52	3-Sep	5
1	53	8-Sep	5
1	54	30-Aug	-9
1	55	4-Sep	5
1	56	9-Sep	5
1	57	31-Aug	-9
1	58	5-Sep	5

Observation sequence – ScanSAR

1 cycle (14 days) required for regional coverage

5-9 days between adjacent swaths





ALOS-2 Basic Observation Scenario

Japan Aerospace Exploration Agency

Cycle	RSP	Day	Days btw passes
1	35	2-Sep	
2	35	16-Sep	14
3	35	30-Sep	14
4	35	14-Oct	14
5	35	28-Oct	14
1	36	7-Sep	-51
2	36	21-Sep	14
3	36	5-Oct	14
4	36	19-Oct	14
5	36	2-Nov	14
1	37	29-Aug	-65
2	37	12-Sep	14
3	37	26-Sep	14
4	37	10-Oct	14
5	37	24-Oct	14
1	38	3-Sep	-51
2	38	17-Sep	14
3	38	1-Oct	14
4	38	15-Oct	14
5	38	29-Oct	14
1	39	8-Sep	-51
2	39	22-Sep	14
3	39	6-Oct	14
4	39	20-Oct	14
5	39	3-Nov	14
1	40	30-Aug	-65

Observation sequence –

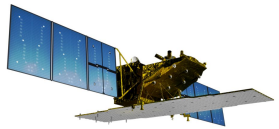
Ultra-Fine/High Sensitive Beams
(e.g. Single-pol 3m, Quad-pol 6m)

4-5 cycles (56-70 days) for regional coverage.

14-65 days between adjacent swaths

Comments to the BOS-2

- K&C Science Advisory Panel (KC SAP) – Nov 6, 2012
- ALOS-2 Cal-Val Science Team (CVST) – 12-13 Nov 2012



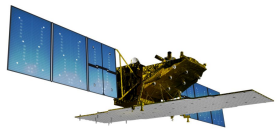
ALOS-2 Basic Observation Scenario

Japan Aerospace Exploration Agency

K&C SAP comments (1/3)

- 3m SP Global baseline mapping (1 obs/3 yrs)
  - Annual observations over selected regions (e.g. deforestation hot spots) preferred over global coverage every 3 years from a general science point of view.
  - HV recommended for vegetated areas, HH for desert areas

- 6m QP Global baseline mapping (1 obs/5 yrs)
  - Large incidence angles preferred to improve sensitivity to vegetation structure. Recommend to include Beam 7 (largest viewing angle) as default in all QP observations.
  - Annual mapping of super sites important to build polarimetric time-series (NOTE: SE-Asia, NE US and Pampas/Argentina current POL Super Sites)
  - Consider feasibility to include “CEOS Super Sites”



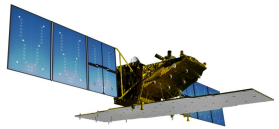
ALOS-2 Basic Observation Scenario

Japan Aerospace Exploration Agency

K&C SAP comments (2/3)

- 10m DP Global baseline mapping (2 obs/yr)
  - Recommend to include boreal areas up to N70° (currently N60°), Western tip of Australia and West Africa (up to Senegal) in Priority 1 regions

- 10m DP Forest mapping (6 obs/yr)
  - Consistent intra-annual time series over forest and wetlands regions acknowledged of key importance in the BOS. Consistency with ALOS-1 BOS.
  - Recommend to include Alaska, parts of central Siberia, west Canada, west Australia and west Africa (up to Senegal) in the high repetition coverage.
  - Recommend reference to “Forest *and Wetlands* monitoring” to acknowledge the importance of repetitive fine beam observations for wetlands applications (not only ScanSAR).

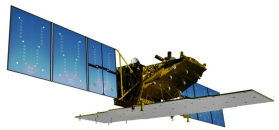


ALOS-2 Basic Observation Scenario

Japan Aerospace Exploration Agency

K&C SAP comments (3/3)

- 100m DP ScanSAR (9 obs/yr)
  - Consistent 42-day ScanSAR time series for wetlands and deforestation monitoring regions acknowledged of key importance in the BOS. Consistency with ALOS-1 BOS.
  - Recommend to include Indian rice areas in coverage (same as ALOS-1 BOS)
  - Repetitive ScanSAR over sub-arctic regions critical observation for climate change. Recommend to assess feasibility to include sampled ScanSAR coverage (e.g. 7-scan ScanSAR, every 4^{th} swath) over all areas above N50°. Alternatively, sampled transects across the arctic region.



ALOS-2 Basic Observation Scenario

Japan Aerospace Exploration Agency

CVST comments (1/1)

- Timing of 6m QP acquisitions (April-May) not useful
  - Boreal zone still frozen
  - Snow melting in temperate zone
  - Few crops in S. hemisphere (Pampas, Argentina)
- Mid-year (July-Sept) optimal, but not feasible to accommodate in BOS
- Change to Sept-Dec time window (swap with 3m global SP) proposed by JAXA, but rejected after discussions with the CVST team.

  → JAXA agreed to assess the feasibility to insert a limited regional QP observation campaign in the Jul-Sep time frame over some limited regions in the boreal zone and in Pampas. (Ridha and Marc T. to provide ROI polygons by end of Nov)

- Glacier movements (Antarctica, Greenland – FB-HH)
  - Suggestion to change observation mode from SP to DP (HH+HV)

  → JAXA agreed to assess the feasibility to accommodate in BOS.