ALOS-2/PALSAR-2 Calibration and Validation Results
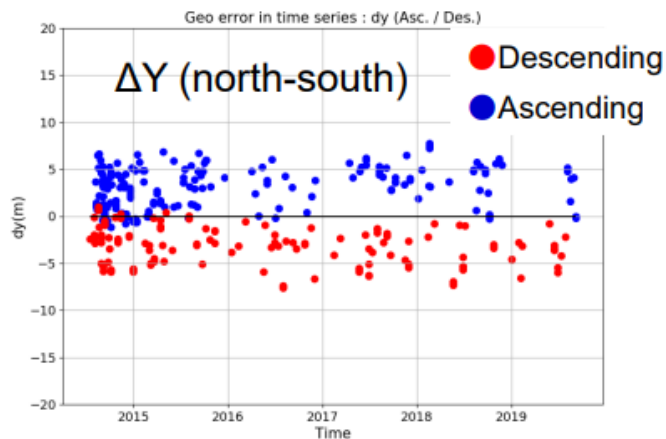
Ver. 2021.1

JAXA EORC & ALOS-2 Project Team
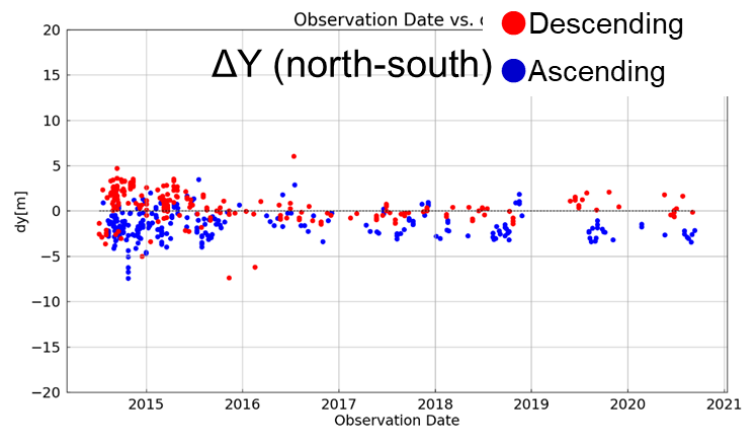
Summary

- Geometric, radiometric and polarimetric accuracies are stable and no degradation have observed.

- The evaluation result of geometric accuracy in the north-south direction has changed because the previous evaluation processing has been modified. After revising the evaluation process, bias errors were calculated smaller than before. For details, please refer to the evaluation result shown on page 6.

Before (ver. 2019.10)

After (ver. 2021.1, this time)

Summary of evaluation results of ALOS-2 PALSAR-2 standard products [1/3]

✓ Observation dates of the evaluated scenes: July, 2014 ~ September, 2020

Items		Observation modes	Results	Number of data	Requirements
Geometric accuracy [m]		Stripmap and Spotlight	5.53 m (L1.1) 6.73 m (L2.1)	479 129	≦20 m
		ScanSAR	60.77 m (L1.1) 29.33 m (L2.1)	7 8	≦100 m
Radiometric accuracy [dB]	Evaluation using corner reflectors	Stripmap and Spotlight	0.535 dB (1σ) (mean CF: -83.000 dB)	319	≦1.0 dB
	Evaluation using images over Amazonian forests	Stripmap and Spotlight	0.41 dB (1σ) (mean γ^0: -7.50 dB)	30 scenes	
Polarimetry	VV/HH amplitude ratio	Stripmap 6m (polarimetry)	1.003 (σ=0.012)	45	≦1±0.047
	VV/HH phase difference [deg.]		-0.248 deg (σ=1.441)		≦5 deg
	Cross talk [dB]		-43.245 dB (σ=6.615) [HV/HH] -42.762 dB (σ=5.498) [VH/VV]		≦-30 dB

Summary of evaluation results of ALOS-2 PALSAR-2 standard products [2/3]

Items		Observation modes	Results	Number of data	Requirements
Resolution [m]		Spotlight	Az. 0.95 (σ=0.32) Rg. 1.69 (σ=0.01)	8	Az. 1.00 x 1.1 Rg. 1.78
		Stripmap 3m	Az. 2.81 (σ=0.02) Rg. 1.71 (σ=0.02)	156	Az. 2.75 x 1.1 Rg. 1.78
		Stripmap 6m	Az. 4.01 (σ=0.03) Rg. 3.51 (σ=0.02)	92	Az. 3.75 x 1.1 Rg. 3.57
		Stripmap 10m	Az. 4.96 (σ=0.05) Rg. 5.32 (σ=0.05)	74	Az. 5.00 x 1.1 Rg. 5.36
Sidelobe (dB)	PSLR	All	Az. -16.217 (σ=2.377) Rg. -12.812 (σ=0.495)	330	≦-13.26+2.00 dB
	ISLR	All	-9.191 (σ=1.656)		≦-10.16+2.00 dB

Summary of evaluation results of ALOS-2 PALSAR-2 standard products [3/3]
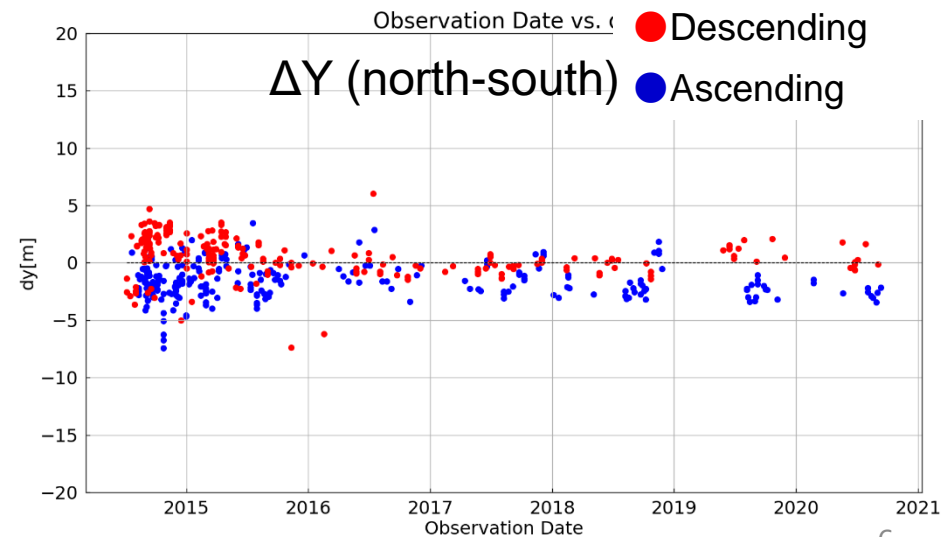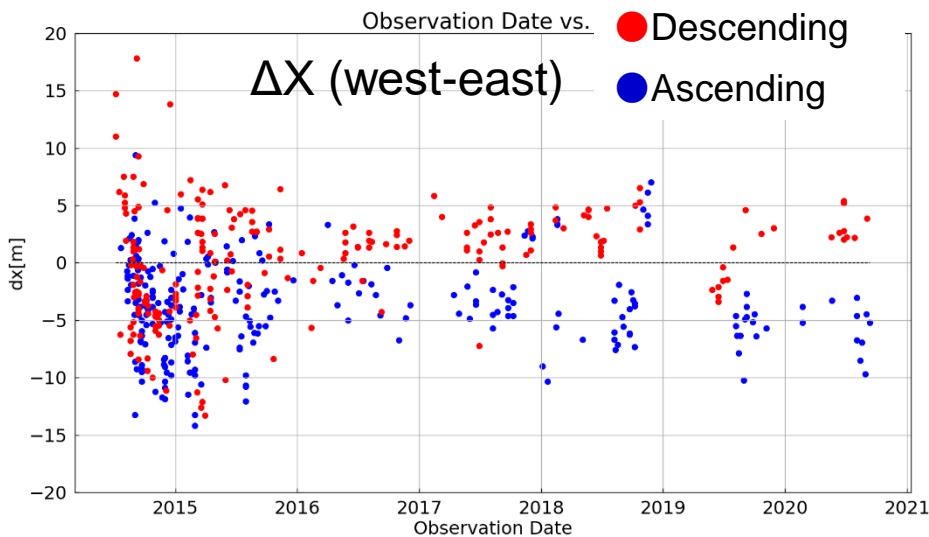
Items		Observation modes	Results	Number of data	Requirements
NESZ [dB]		Stripmap 3m (U2)	-36.6 (HH)	3	≦-24.0 dB (scene center)
		Stripmap 6m (FP6-3～7)	-36.0 (HH) -46.0 (HV)	5	≦-28.0 dB (scene center)
		Stripmap 10m (F2)	-41.1 (HH) -49.2 (HV)	3	≦-26.0 dB (scene center)
Ambiguity [dB]	Azimuth	All	14-23 dB (ave. 20dB)	7 scenes	≧20-25 dB
	Range	All	Not visible	7 scenes	≧20-25 dB

Evaluation results of geometric accuracy

Differences between point target responses in SAR images and in situ GPS measurements

Mode	ΔX (west-east) [m]			ΔY (north-south) [m]			n
	mean (bias)	SD	RMS	mean (bias)	SD	RMS	
Spotlight	-5.126	4.365	6.946	-0.569	1.870	1.964	10
Stripmap 3 m (U2-6~9, U3-10~14)	0.189	4.377	4.382	0.096	1.819	1.822	215
Stripmap 6 m (FP6-3~7)	-3.249	3.814	5.019	-1.487	1.447	2.079	135
Stripmap 10 m (F2-5~7)	-3.533	5.226	6.317	-0.736	2.282	2.399	119

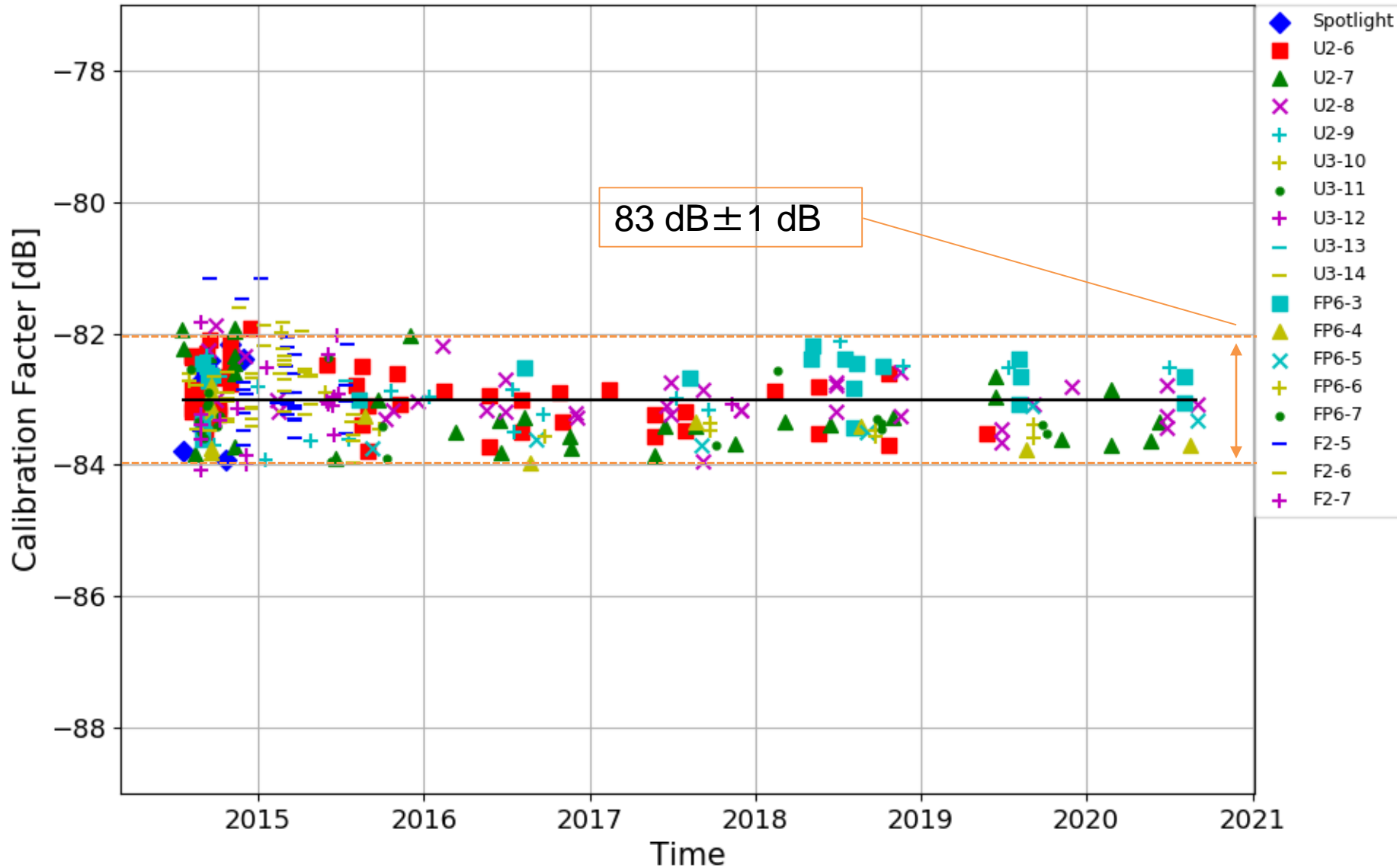Timeseries plot of Stripmap 3 m, 6m, 10m and Spotlight 1m

Evaluation results of radiometric accuracy – calibration factor (CR) [1/2]

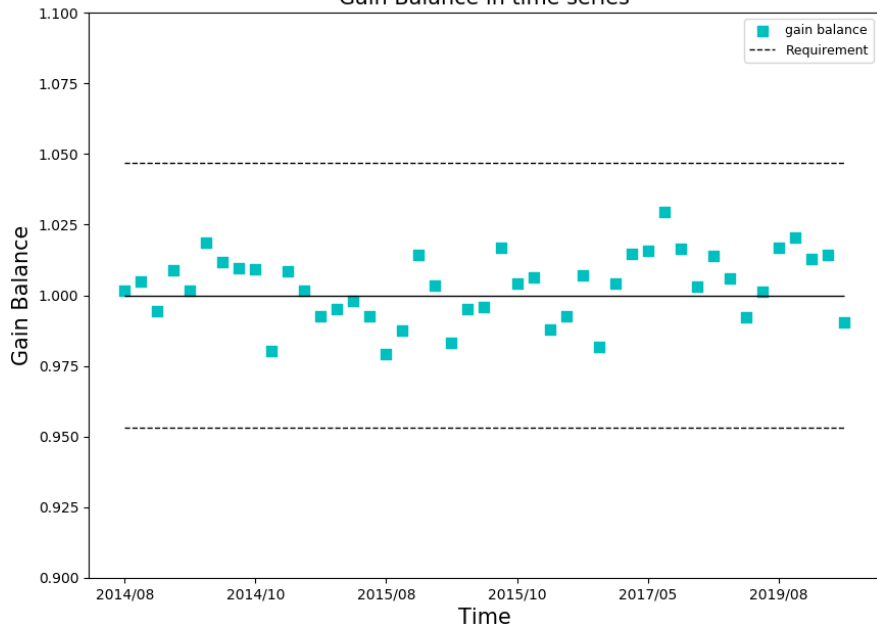| Mode	Mean [dB]	SD [dB]	RMS to -83 dB [dB]	n
Spotlight	-82.831	0.657	0.682	8
U2-6	-82.968	0.441	0.442	49
U2-7	-83.188	0.585	0.616	31
U2-8	-83.052	0.370	0.374	35
U2-9	-82.979	0.478	0.478	24
FP6-3	-82.747	0.389	0.467	20
FP6-4	-83.419	0.381	0.580	12
FP6-5	-83.471	0.233	0.559	7
FP6-6	-83.321	0.358	0.493	10
FP6-7	-83.272	0.377	0.469	19
F2-5	-82.806	0.659	0.687	31
F2-6	-82.838	0.526	0.551	44
F2-7	-83.172	0.583	0.609	17
ALL	-83.018	0.521	0.521	307

Evaluation results of radiometric accuracy – calibration factor (CR) [2/2]

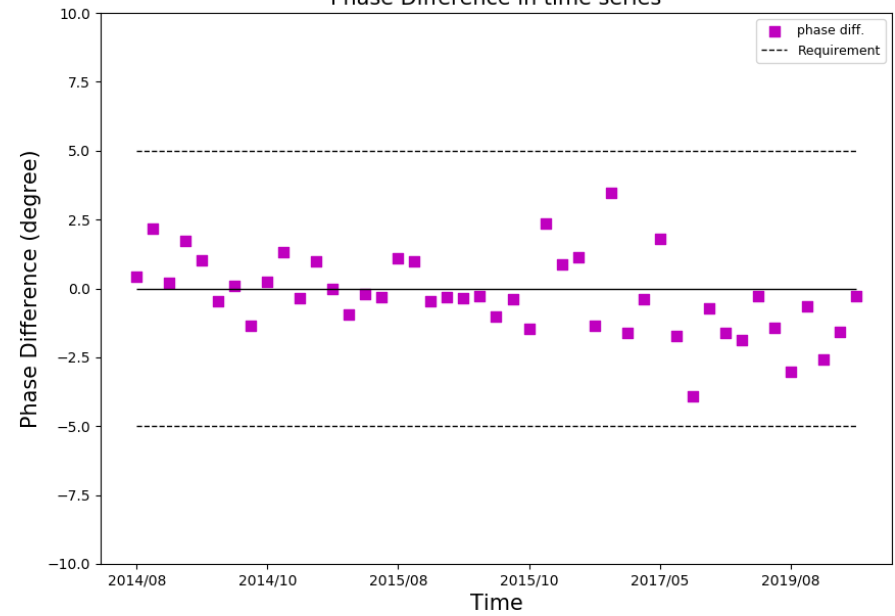Calibraion Factor by beams in time series

Evaluation results of polarimetric accuracy