

The Geometric Accuracy Evaluation Results of RPC (Ver.1.2)

1. Purpose

This document describes the geometric accuracy evaluation results of RPC (Ver.1.2) produced by the ALOS-PRISM RPC generating software of JAXA-EORC/RESTEC. The updated points from Ver.1.1 [1] are as follows;

- CCD alignment parameters are updated (interior orientation parameters).
- The Fourier series model is applied for PRISM sensor alignment orbit cycle trend (after Mar.22, 2007) instead of the cubic polynomial model (exterior orientation parameters).
- The parabola model is applied for PRISM sensor alignment long term trend of Pitch angle (after Mar.22, 2007) instead of the linear model (exterior orientations parameters).

2. Method

Same as Ver.1.0/Ver.1.1 [2].

3. Data

1) PRISM Standard Product L1B1

10 triplet data sets which were observed from Mar.23 through Aug.27, 2007 are used for the evaluation. Those data sets are sampled from the calibration data sets of JAXA-EORC/RESTEC geometric Cal/Val activities.

2) Geometric models

The CCD alignment data (interior orientation parameters) is version 3 (Jun.20, 2007 release) which has already applied to the JAXA-EOC Standard Product processing. The PRISM sensor alignment (exterior orientation parameters) is version 3 which was calibrated at JAXA-EORC/RESTEC (briefly explained at section 1). No orientation processing with GCPs is performed.

3) GCP

Reference GCPs and its mensuration results are provided by JAXA-EORC/RESTEC Cal/Val activities.

4. Results

The number of GCPs and errors stats (Bias, SD = Standard Deviation, RMS) for “RPC for each image” and “RPC for full image” of forward, nadir, and backward images are described at Table 1~3 as RPC geometric accuracies evaluation results. The units of errors are converted to meters from pixels by using the default pixel spacing of 2.5m. The relative accuracies of “RPC for full image” against “RPC for each image” are almost same as the case of Ver.1.0 and Ver.1.1.

Table 1 The evaluation results of “RPC for each image” - forward

Scene			FWD					
			ΔP			ΔL		
Date	Site	No. of GCP	Bias[m]	SD[m]	RMS[m]	Bias[m]	SD[m]	RMS[m]
2007/03/23	Hamana	24	-5.481	1.593	5.708	-3.529	2.051	4.082
2007/03/30	Tsukuba-L	9	-3.907	0.660	3.962	-9.829	1.289	9.913
2007/05/03	Saitama	213	0.537	1.447	1.543	-1.780	1.712	2.470
2007/05/08	Hamana-U	19	1.912	1.117	2.214	0.191	1.313	1.327
2007/06/14	Bangkok (Thai)	6	0.436	2.145	2.189	2.937	1.100	3.137
2007/06/28	Kyoto	8	0.689	1.128	1.321	0.389	0.994	1.068
2007/07/03	Fairbanks (Alaska)	10	3.583	1.489	3.880	-5.062	1.734	5.351
2007/07/23	Brisbane (Australia)	19	10.437	1.972	10.622	6.968	1.256	7.081
2007/08/03	Saitama	34	-0.884	1.626	1.851	1.584	1.619	2.264
2007/08/27	Saroma	39	-2.591	1.324	2.910	-3.302	1.347	3.566
RMS			4.233	1.506	4.493	4.568	1.474	4.800

Table 2 The evaluation results of “RPC for each image” - nadir

Scene			NDR					
			ΔP			ΔL		
Date	Site	No. of GCP	Bias[m]	SD[m]	RMS[m]	Bias[m]	SD[m]	RMS[m]
2007/03/23	Hamana	24	-2.624	1.569	3.057	-4.961	1.269	5.120
2007/03/30	Tsukuba-L	9	-3.237	0.734	3.319	0.959	1.571	1.840
2007/05/03	Saitama	213	2.371	1.681	2.907	1.055	1.696	1.998
2007/05/08	Hamana-U	19	0.725	1.355	1.537	-0.528	0.957	1.093
2007/06/14	Bangkok (Thai)	6	0.124	1.411	1.416	-1.249	1.221	1.746
2007/06/28	Kyoto	8	0.634	1.683	1.799	2.451	0.790	2.575
2007/07/03	Fairbanks (Alaska)	10	0.550	1.292	1.404	-1.651	1.912	2.526
2007/07/23	Brisbane (Australia)	19	5.945	1.932	6.251	1.867	1.068	2.151
2007/08/03	Saitama	34	-1.056	1.600	1.917	-0.361	1.499	1.542
2007/08/27	Saroma	39	-1.428	1.545	2.104	-3.242	1.108	3.426
RMS			2.505	1.511	2.925	2.266	1.351	2.638

Table 3 The evaluation results of “RPC for each image” - backward

Scene			BWD					
			ΔP			ΔL		
Date	Site	No. of GCP	Bias[m]	SD[m]	RMS[m]	Bias[m]	SD[m]	RMS[m]
2007/03/23	Hamana	24	-0.788	1.458	1.657	0.329	2.111	2.137
2007/03/30	Tsukuba-L	9	-2.062	1.282	2.428	-8.492	2.413	8.829
2007/05/03	Saitama	213	1.147	1.805	2.139	-3.105	1.800	3.589
2007/05/08	Hamana-U	19	-0.442	1.564	1.625	-1.269	0.785	1.492
2007/06/14	Bangkok (Thai)	6	1.340	1.746	2.201	1.224	2.141	2.466
2007/06/28	Kyoto	8	-1.045	1.164	1.565	0.906	1.017	1.363
2007/07/03	Fairbanks (Alaska)	10	-3.083	1.653	3.498	-3.224	1.819	3.702
2007/07/23	Brisbane (Australia)	19	1.977	1.631	2.563	11.256	1.449	11.349
2007/08/03	Saitama	34	-1.926	1.463	2.418	0.119	1.880	1.884
2007/08/27	Saroma	39	-4.503	1.507	4.749	-4.017	1.131	4.173
RMS			2.160	1.539	2.652	4.889	1.731	5.187

5. Summary

It is confirmed that the bias errors of RPC follow the fitting accuracy of PRISM alignment trend model calibrated by JAXA-EORC/RESTEC. In low latitude (south hemisphere) part, the bias errors still tend to be worse (max approx.11m in Australia backward ΔL) than other parts but it's better than Ver.1.1. This trend is consistent with the JAXA-EORC/ RESTEC validation results. The fitting accuracy of PRISM sensor alignment orbit cycle trend is still not sufficient at the low latitude part. This is still one of the main subjects to be fixed in JAXA-EORC/RESTEC Cal/Val activities.

References:

- [1] The Geometric Accuracy Evaluation Results of RPC (Ver.1.1): RESTEC, June 1, 2007.
- [2] The Geometric Accuracy Evaluation Results of RPC (Ver.1.0): RESTEC, April 4, 2007.