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## Release Notes for the DPR Level 1 products

All users should keep them in mind when they use the data.

### <Major changes in the DPR Level 1 product V04>

#### 1. Improvement in noise power calculation

Based on a concept that noise echo should be handled as continuous wave, the noise echo power is adjusted by about -2dB from product version V03 in both KuPR and KaPR. These correction values are determined according to the band path filter and log amp characteristics.

Calculation of radar reflectivity and surface normalized radar cross section ( $\sigma^0$ ) in DPR Level 2 algorithm assumes the signal as pulse wave. Since the noise in received power cannot be handled separately, when the noise power is subtracted from the received power, the value of noise power is re-adjusted in PRE module in DPR Level 2 algorithm.

#### 2. Empty granule correction

In the case that quality flag is not nominal in all scans in a granule, the product is designated as 'Empty Granule'.

#### 3. Geolocation toolkit update

A typographic error in the calculation of the sun angle in the DPR Level 1 algorithm was corrected. The redundant precession term for the sun and moon angles was removed.

#### 4. Data format change

Following variables are added.

- 'rxGain' that indicates the DPR total receiver gain
- 'fcifFlagAB' and 'scdpFlagAB' that indicate which channel is used for FCIF and SCDP, respectively, in DPR.

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## < Caveats for DPR Level 1 products by JAXA >

### 1. Calibration of DPR

The calibration coefficients are the same as in V03 for both KuPR and KaPR. The analysis of  $\sigma^0$  of DPR shows that the current calibration coefficients that were determined before launch give consistent values of  $\sigma^0$  with those from TRMM/PR. Although some gain offsets of the DPR transmitter and receiver powers are detected by the external calibrations after launch, JAXA has decided not to adapt the gain offsets this time.

### 2. Scan flip of DPR

JAXA uploaded a proper set of phase code to the DPR on March 18<sup>th</sup>, 2014 at 13:20 UTC. Until that time, the beam scan direction of DPR had been reversed from the proper direction. After the proper code was uploaded, the beam has been scanned in the proper direction, i.e., from left to right with respect to the +X forward direction of the satellite.

The DPR Level 1 algorithm was modified to accommodate this change so that the geolocations in the products are correct from the beginning of the mission.

### 3. Special operations of DPR

The following caveats describe special operations of DPR. You can use these data with your discretion. You can also refer to the DPR invalid data lists at the following web site.

<DPR operation status (missing data list)>

- [https://www.gportal.jaxa.jp/gportal/file/qty/GPM/gpmom\\_vrfy\\_DPR\\_ope\\_st\\_atus\\_make\\_2014.csv](https://www.gportal.jaxa.jp/gportal/file/qty/GPM/gpmom_vrfy_DPR_ope_st_atus_make_2014.csv)
- [https://www.gportal.jaxa.jp/gportal/file/qty/GPM/gpmom\\_vrfy\\_DPR\\_ope\\_st\\_atus\\_make\\_2015.csv](https://www.gportal.jaxa.jp/gportal/file/qty/GPM/gpmom_vrfy_DPR_ope_st_atus_make_2015.csv)
- [https://www.gportal.jaxa.jp/gportal/file/qty/GPM/gpmom\\_vrfy\\_DPR\\_ope\\_st\\_atus\\_make\\_2016.csv](https://www.gportal.jaxa.jp/gportal/file/qty/GPM/gpmom_vrfy_DPR_ope_st_atus_make_2016.csv)

#### 3.1 Operation with the DPR transmitters off

JAXA carried out the receiving only mode to check the DPR receiver system. The orbits in which this operation was performed are shown in Appendix-A.

#### 3.2 Change of the DPR receiver attenuator (RX ATT) setting

JAXA has checked the dynamic range of the radar system by changing the



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attenuator setting in the DPR receivers. The received power in the DPR Level 1 products is not affected, because the offset caused by the receiver attenuator is accounted for in the DPR Level 1 algorithm. The orbits in which this operation was performed are shown Appendix-A.

### 3.3 Operation of GPM satellite maneuver

NASA has carried out several maneuver operations such as a delta-V maneuver and a Yaw maneuver. In addition, pitch offset maneuvers have also been conducted to check the GPM satellite status. The orbits in which this operation was performed are shown Appendix-A.

### 3.4 Test operation for adjusting the phase code in the KuPR instrument

The JAXA DPR project team has conducted several test operations using different phase codes in the phase shifters in order to mitigate the effects of sidelobe clutter in KuPR. Please be cautious of the periods in these test operations. The orbits in which this operation was performed are shown Appendix-A.

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<Appendix A: Major DPR events>

Major DPR events until September 2, 2014 are as follows. After September 2, you can visit the following web site to check the DPR status.

[https://www.gportal.jaxa.jp/gportal\\_file/qty/GPM/gpmom\\_vrfy\\_DPR\\_ope\\_status\\_make\\_2014.csv](https://www.gportal.jaxa.jp/gportal_file/qty/GPM/gpmom_vrfy_DPR_ope_status_make_2014.csv)

Orbit No.	UTC	DPR Event
#144	2014/3/8 21:54	DPR observation start
#171	2014/3/10 16:29	Change DPR FCIF-B to A
#201	2014/3/12 14:24	GPM Delta-V Maneuver
#206	2014/3/12 22:43	DPR power OFF
#207-231	2014/3/13-14	GPM EEPROM change
#232	2014/3/14 14:14	DPR SCDP-A ON
#232	2014/3/14 14:41	DPR check out restart
#236	2014/3/14 20:02	DPR observation restart
#263	2014/3/16 14:08	Change DPR FCIF-A to B
	2014/3/16 14:59	DPR transmitters off (f1/f2 off) test
#264	2014/3/16 15:49	
#279	2014/3/17 15:10	GPM 180deg Yaw Maneuver (+X to -X)
#294	2014/3/18 13:20	Proper phase code upload
#296	2014/3/18 17:18	DPR SCDP-B ON Observation mode
#310	2014/3/19 14:21	GPM Delta-V Maneuver
#325	2014/3/20 13:41	DPR patch adaption
#328	2014/3/20 17:56	DPR observation restart
#374	2014/3/23 17:26	DPR transmitters off observation
#375	2014/3/23 19:05	
	2014/3/23 19:06	SSPA LNA analysis mode
#377	2014/3/23 22:35	DPR observation restart
#380	2014/3/24 2:11	DPR External calibration
#404	2014/3/25 15:07	DPR transmitters off observation
#418	2014/3/26 12:32	
#419	2014/3/26 14:20	GPM Delta-V Maneuver
#478	2014/3/30 9:53	DPR External calibration
#503	2014/4/1 0:00	DPR External calibration (Yaw + pitch)
#531	2014/4/2 19:47	GPM Delta-V Maneuver

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Orbit No.	UTC	DPR Event
#601	2014/4/7 7:37	DPR External calibration
#621	2014/4/8 14:10	Upload new test phase code of KuPR (#1)
#626	2014/4/8 21:46	DPR External calibration (Yaw + pitch)
#647	2014/4/10 6:36	DPR External calibration
#672	2014/4/11 20:43	DPR External calibration (Yaw + pitch)
#675	2014/4/12 1:45	GPM Delta-V Maneuver
#715	2014/4/14 15:28	Upload new test phase code of KuPR (#2)
#731	2014/4/15 15:44	Return to phase code (#1)
#675	2014/4/12 1:45	GPM Delta-V Maneuver
#747	2014/4/16 17:04	GPM Delta-V Maneuver
#748	2014/4/16 17:39	DPR transmitters off observation
#763	2014/4/17 17:07	
#770	2014/4/18 4:22	DPR External calibration (Yaw + pitch)
#795	2014/4/19 18:31	DPR External calibration (Yaw + pitch)
#795	2014/4/19 18:55	Ku/Ka RX ATT change 6dB to 9dB
#810	2014/4/20 17:59	Ku/Ka RX ATT change 9dB to 12dB
#824	2014/4/21 15:36	Ku/Ka RX ATT change 12dB to 6dB
#827	2014/4/21 20:34	GPM Delta-V Maneuver
#885	2014/4/25 13:05	GPM ST alignment and IRUCAL table updates
#886	2014/4/25 14:30	GPM +10 deg. roll slew
	2014/4/25 15:20	GPM +10 deg. pitch slew
#887	2014/4/25 16:10	GPM +10 deg. yaw slew
#901	2014/4/26 13:30	GPM 180deg Yaw Maneuver (-X to +X)
#907	2014/4/27 0:00	GPM -1 deg. pitch slew
#913	2014/4/27 8:20	GPM -1 deg. pitch slew (-2 deg. total)
#918	2014/4/27 16:20	GPM -2 deg. pitch slew (-4 deg. total)
#923	2014/4/28 0:25	
#924	2014/4/28 1:10	Ku/Ka RX ATT change 6dB to 9dB
#933	2014/4/28 15:04	Upload new test phase code of KuPR(#3)
#935	2014/4/28 18:13	Return to phase code(#1)
#964	2014/4/30 15:50	GPM Delta-V Maneuver
#994	2014/5/2 13:20	Upload new test phase code of KuPR (#4)
	2014/5/2 13:21	Ku/Ka RX ATT change 9dB to 6dB
#996	2014/5/2 16:36	Upload new test phase code of KuPR(#5)

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Orbit No.	UTC	DPR Event
#998	2014/5/2 19:44	Ku/Ka RX ATT change 6dB to 9dB
	2014/5/2 19:45	Return to phase code (#1)
#1059	2014/5/6 17:35	GPS both A and B ON
#1103	2014/5/14 13:44	
#1073	2014/5/7 15:57	GPM Delta-V Maneuver
#1088	2014/5/8 14:15	Ku SSPA analysis mode (5min)
	2014/5/8 15:08	Ka SSPA analysis mode (5min)
#1089	2014/5/8 15:48	Ku LNA analysis mode (5min)
	2014/5/8 16:44	Ka LNA analysis mode (5min)
#1090	2014/5/8 17:23	Upload new test phase code of KuPR (#6)
#1092	2014/5/8 20:21	Ka SSPA analysis mode (5min)
	2014/5/8 21:12	Upload new test phase code of KuPR (#7)
#1094	2014/5/9 0:16	Return to phase code(#1)
#1150	2014/5/12 14:58	Ku/Ka RX ATT change 9dB to 12dB
#1182	2014/5/14 16:07	GPM Delta-V Maneuver
#1274	2014/5/20 13:30	GMI Deep Space Calibration
#1277	2014/5/20 18:44	
#1288	2014/5/21 11:30	Upload new test phase code of KuPR (#8)
#1290	2014/5/21 14:43	Upload new test phase code of KuPR (#9)
#1292	2014/5/21 17:59	Upload new test phase code of KuPR (#10)
#1294	2014/5/21 21:07	Upload new test phase code of KuPR (#11)
#1296	2014/5/22 0:16	Return to phase code(#1)
#1319	2014/5/23 11:38	Upload new test phase code of KuPR (#12)
#1322	2014/5/23 15:03	Upload new test phase code of KuPR (#13)
#1324	2014/5/23 15:03	Upload new test phase code of KuPR (#14)
#1326	2014/5/23 21:37	Upload new test phase code of KuPR (#15)
#1328	2014/5/24 0:57	Return to phase code(#1)
#1351	2014/5/25 11:44	Change DPR FCIF-B to A (For External Cal.)
		Ku/Ka RX ATT change 12dB to 6dB
#1354	2014/5/25 17:18	DPR External calibration (Yaw + pitch)
#1355	2014/5/25 17:54	Change DPR FCIF-A to B
		Ku/Ka RX ATT change 6dB to 12dB
#1414	2014/5/29 13:59	GPM Delta-V Maneuver
#1430	2014/5/30 13:50	Upload new test phase code of KuPR (#16)

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Orbit No.	UTC	DPR Event
#1431	2014/5/30 15:26	Upload new test phase code of KuPR (#17)
#1432	2014/5/30 17:01	Upload new test phase code of KuPR (#18)
#1433	2014/5/30 18:34	Upload new test phase code of KuPR (#19)
#1434	2014/5/30 20:07	Return to phase code(#1)
#1447	2014/5/31 16:06	Upload new test phase code of KuPR (#20)
#1448	2014/5/31 17:53	Upload new test phase code of KuPR (#21)
#1449	2014/5/31 19:59	Return to phase code(#1)
#1477	2014/6/2 15:06	DPR External calibration
#1502	2014/6/4 5:15	DPR External calibration
#1508	2014/6/4 14:13	Upload new test phase code of KuPR (#22)
#1508	2014/6/4 14:56	Upload new test phase code of KuPR (#23)
#1509	2014/6/4 16:39	Upload new test phase code of KuPR (#22)
#1511	2014/6/4 18:59	Return to phase code(#1)
#1539	2014/6/6 14:09	Upload new test phase code of KuPR (#22)
#1541	2014/6/6 17:26	Return to phase code(#1)
#1600	2014/6/4 5:15	DPR External calibration
#1603	2014/6/10 17:38	GPM 180deg Yaw Maneuver (+X to -X)
#1625	2014/6/12 2:58	DPR External calibration
#1646	2014/6/13 11:46	DPR External calibration
#1648	2014/6/13 14:08	Upload new test phase code of KuPR (#24)
#1649	2014/6/13 15:45	Upload new test phase code of KuPR (#25)
#1650	2014/6/13 17:36	Upload new test phase code of KuPR (#26)
#1651	2014/6/13 19:12	Upload new test phase code of KuPR (#27)
#1652	2014/6/13 20:54	Upload new test phase code of KuPR (#28)
#1653	2014/6/13 22:33	Upload new test phase code of KuPR (#29)
#1654	2014/6/14 0:21	Upload new test phase code of KuPR (#30)
#1655	2014/6/14 1:39	Return to phase code(#1)
#1726	2014/6/18 15:17	GPM Delta-V Maneuver
#1769	2014/6/21 9:33	DPR External calibration
#1794	2014/6/22 23:42	DPR External calibration (Yaw + pitch)
#1892	2014/6/29 7:18	DPR External calibration
#1917	2014/6/30 21:27	DPR External calibration
#1942	2014/7/2 12:42	Upload new test phase code of KuPR (#31)
#1944	2014/7/2 14:38	Upload new test phase code of KuPR (#32)

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Orbit No.	UTC	DPR Event
#1945	2014/7/2 16:30	Return to phase code(#1)
#1975	2014/7/4 15:07	Upload new test phase code of KuPR (#33)
#1976	2014/7/4 16:44	Upload new test phase code of KuPR (#34)
#1977	2014/7/4 18:24	Return to phase code(#1)
#2015	2014/7/7 5:01	DPR External calibration
#2040	2014/7/8 19:08	DPR External calibration (Yaw + pitch)
#2053	2014/7/9 16:17	GPM Delta-V Maneuver
#2163	2014/7/16 16:32	GPM 180deg Yaw Maneuver (-X to +X)
#2176	2014/7/17 13:22	Upload new test phase code of KuPR (#35)
#2177	2014/7/17 15:03	Upload new test phase code of KuPR (#36)
#2178	2014/7/17 16:37	Upload new test phase code of KuPR (#37)
#2180	2014/7/17 18:47	Return to phase code(#1)
#2184	2014/7/18 1:42	DPR External calibration
#2209	2014/7/19 15:51	DPR External calibration
#2286	2014/7/24 14:54	Change Ku timing delay
#2289	2014/7/24 19:11	Upload new test phase code of KuPR (#38)
#2290	2014/7/24 20:49	Return to phase code(#1)
#2304	2014/7/25 18:07	Upload new test phase code of KuPR (#39)
#2307	2014/7/25 23:26	DPR External calibration
#2332	2014/7/27 13:34	DPR External calibration
#2380	2014/7/30 16:04	GPM Delta-V Maneuver
#2430	2014/8/2 21:12	DPR External calibration (Yaw + pitch)
#2455	2014/8/4 11:21	DPR External calibration
#2455	2014/8/6 20:48	Upload new phase code of KaPR
#2599	2014/8/13 17:55	DPR External calibration
#2624	2014/8/15 8:03	DPR External calibration
#2706	2014/8/20 15:09	GPM Delta-V Maneuver
#2722	2014/8/21 15:40	DPR External calibration
#2747	2014/8/23 5:48	DPR External calibration
#2782	2014/8/25 12:15	Change DPR FCIF-B to A
#2782	2014/8/25 12:30	Upload new test phase code of KuPR (FCIF-A#1)
#2784	2014/8/25 14:34	Upload new test phase code of KuPR (FCIF-A#2)



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Orbit No.	UTC	DPR Event
#2785	2014/8/25 16:13	Upload new test phase code of KuPR (FCIF-A#3)
#2786	2014/8/25 17:51	Upload new test phase code of KuPR (FCIF-A#4)
#2787	2014/8/25 19:22	Change DPR FCIF-A to B
#2787	2014/8/25 19:24	Return to phase code(#39)