

GRACE Follow-On

Science Data System Newsletter

Report: July 2019 (No. 5)

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GRACE Follow-On Science Data System: News & Highlights

- The first **GRACE-FO Level-3** monthly data products have been released at JPL's Physical Oceanography Distributed Data Archive Center on 15 August. (https://podaac.jpl.nasa.gov/highlights/GRACE-FO_Level-3_RL06_Dataset). All level-3 products include the period from June 2018 through June 2019 (updated monthly with new months), and are generated using consistent post-processing as the GRACE Level-3 data grids, ensuring compatibility with them. Alternative Level-3 grids (GFZ only) are also available from GFZ's Gravis portal (<https://gravis.gfz-potsdam.de/home>).
- **Level-2** SDS data products for **June-2019** are now available at NASA's Physical Oceanography Distributed Active Archive Center (PO.DAAC) and GFZ's Information System and Data Center (ISDC).
- **Level-1 Laser Ranging Interferometer** data products have been released and are available at [PO.DAAC](#) and [ISDC](#).
- **News releases**
 - "GRACE-FO Shows the Weight of Midwestern Floods " (NASA/JPL) highlights mass changes after the wettest 12 months ever recorded in the East/Mid US through the 2018/2019 winter and extension of the Greenland mass change record into early 2019:
 - <https://www.jpl.nasa.gov/news/news.php?feature=7481>
 - "Unique data series will be continued" (GFZ) details mass changes through the extended European drought in mid-2018, as well as updates to ocean mass changes into early 2019:
 - <https://www.gfz-potsdam.de/en/media-and-communication/news/details/article/unique-data-series-will-be-continued/>
- The **GRACE/GRACE Follow-On Science Team Meeting** will be held in Pasadena this fall (Oct 8-10, 2019) and will focus on presentations and discussions of data quality, findings and analyses. Invitations to attend the Science Team Meeting and registration information will be sent out separately. **Save the dates!**



Calendar & Upcoming Events:

- GRACE / GRACE-FO Science Team Meeting (Oct 8-10, 2019, Pasadena, CA, U.S.A.)
- AGU Fall Meeting 2019 (session 'Continuous Measurements of Earth System Mass Change: GRACE, GRACE-FO and Beyond', 'GRACE-FO Town Hall', others)

GRACE Follow-On: Mission Status

GRACE Follow-On: Orbit

The GRACE Follow-On orbital parameters on 2019-08-23 (day 235) were as follows:

Sun Beta (deg)	26
Absolute Distance (km)	179.7
Drift (km/d)	0.04
Mean Altitude (>6378.1 km)	490.9
Decay Rate (GF1/GF2) (7d mean, m/d)	1.4 / 1.4

Science-relevant Mission Events & Plans:

- The mission is operating in science ranging mode and collecting nominal K/Ka-band ranging observations.
- Laser Ranging is enabled and collecting nominal ranging observations.
- Both accelerometers (ACCs) are operating and collecting observations. The GF1 ACC is operating in its nominal mode, Normal Range Mode (NRM) and the GF2 ACC is in Large-Range-Mode (LRM). GF1 ACC data are used to generate an ACC transplant data product which is provided as the ACT1B product and should be used to substitute the GF2 ACC measurements (please check the ACT-Readme for details at PO.DAAC).
- Center-of-Mass offset determinations are performed approx. monthly.
- Additional calibration periods, spacecraft activities and events are highlighted in the Level-1 v04 notes and event log below.

Level-1, Level-2, Level-3 Data Products and Processing

Level-1 Data Processing & Delivery

- Level-1 data products (current version: v04), which are available at NASA's Physical Oceanography Distributed Active Archive Center ([PO.DAAC](#)) and GFZ's Information System and Data Center ([ISDC](#)), have been continuously expanded approximately every 7 days since the first data release on May-24, 2019. The Level-1 data includes all fields required for the generation of Level-2 gravity field products. Please refer to Level-1 release notes, documentation, as well as to the Sequence-of-Events (SOE) logfile for



important updates, comments and detailed description of the data, file formats, updates, and conventions ([PO.DAAC](#) / [ISDC](#)).

KBR Performance Statistics

- [see Appendix 1A (p. 5)]

Level-1 Data Product Availability

- [see Appendix 1B (p. 6) for GRACE-FO Level-1 data]
- [see Appendix 1C (p. 6) for de-aliasing AOD1B model data]

Level-1 Release Notes & Sequence of Events

- [see Appendix 1D (p. 6)]

Level-2 Data Processing & Delivery

Level-2 Data availability

- Level-2 Release 06 data have been processed at JPL, GFZ and CSR and are archived at JPL [PO.DAAC](#) and GFZ [ISDC](#). The Level-2 products include the monthly gravity fields from the three mission Science Data System centers (JPL, GFZ, CSR), as well as the corresponding atmosphere and ocean dealiasing (AOD) background model data.
- Please refer to the Level-2 Release Notes and documentation description of the data for file formats, updates, conventions, as well as important processing recommendations ([PO.DAAC](#) / [ISDC](#)).
- [see Appendix 2A (p. 7) for overview tables on data availability].

Level-2 Ancillary Products and Comments

- TN-11 containing C20 estimates derived from SLR and using Level-2 RL06 standards (Cheng and Ries, 2013) is updated in synch with Level-2 monthly releases. It is recommended to replace the native GRACE-FO C20 coefficient with this product.
- TN-13[a,b,c] containing geocenter estimates using the methods of Swenson et al. (2010) and Sun et al. (2016) is updated in synch with Level-2 monthly releases. It is recommended to augment the GRACE / GRACE-FO geocenter with this product.
 - NOTE: A previous version from 04/2019 had an inconsistent epoch removed - please update all TN-13 data with the most recent version; this affected all monthly data points only by a constant offset value.
- TN-14 containing C30 estimates derived from SLR and using Level-2 RL06 standards (Loomis et al., 2019) is updated in synch with Level-2 monthly releases. SDS recommends to replace the native GRACE-FO C30 coefficient with this product.

Level-3 Data Processing & Delivery

- SDS Level-3 monthly global grids of mass changes are generated by JPL and available at [PO.DAAC](#).



Resources and Links:

Data Archives (Level 1-3):

- NASA PO.DAAC (<http://podaac.jpl.nasa.gov>)
- GFZ ISDC (<https://isdc.gfz-potsdam.de/grace-fo-isdc>)

Miscellaneous Links:

- For GRACE Follow-On mission updates and news, please visit <https://gracefo.jpl.nasa.gov> and <http://gfz-potsdam.de/en/grace-fo>.
- The proceedings of previous GRACE / GRACE-FO Science Team Meetings are available at <https://www.gfz-potsdam.de/en/grace/>.
- Searchable databases of **GRACE and GRACE-FO related publications** are available at
 - http://www-app2.gfz-potsdam.de/pb1/op/grace/references/sort_date.html
 - <https://grace.jpl.nasa.gov/publications/>
 - If you are missing a publication please send an e-mail to Frank Flechtner (flechtne@gfz-potsdam.de) and contact the JPL team via <https://grace.jpl.nasa.gov/about/feedback/>.



Appendix

1.A - KBR Performance Statistics

KBR QUALITY ASSESSMENT

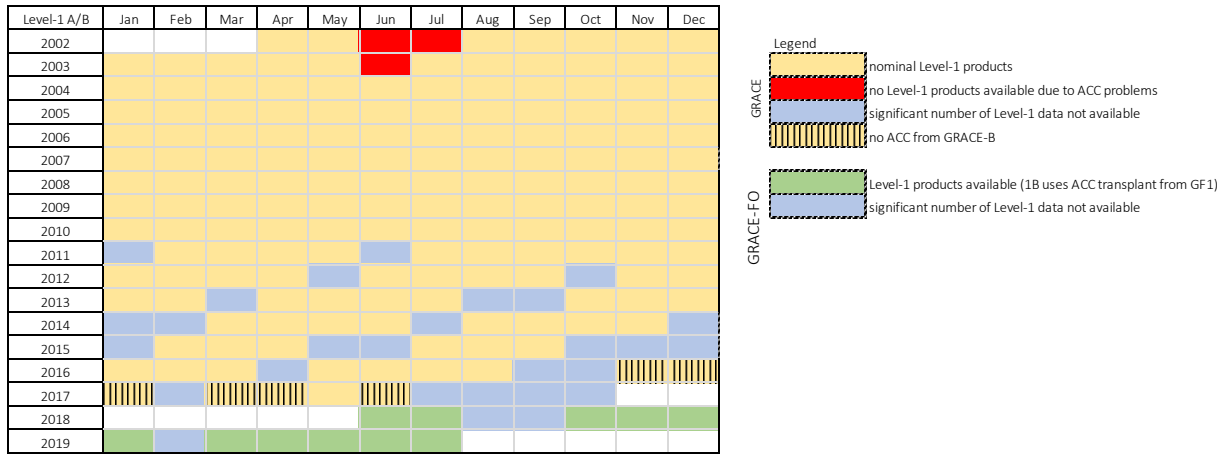
Key to columns in the table below

- 1) KBR1B product name
- 2) Total arc length with data (hours)
- 3) Number of observations used in KBR-GPS range residual calculation
- 4) KBR-GPS range residual RMS (mm)
- 5) Minimum KBR-GPS range residual (mm)
- 6) Maximum KBR-GPS range residual (mm)
- 7) Number of continuous segments in the KBR product

KBR1B_2019-07-01_Y_04.dat	24.0	17280	1.37	-4.0	5.5	1
KBR1B_2019-07-02_Y_04.dat	24.0	17280	1.45	-5.8	6.1	1
KBR1B_2019-07-03_Y_04.dat	24.0	17280	1.48	-6.9	3.5	1
KBR1B_2019-07-04_Y_04.dat	24.0	17280	1.61	-5.4	4.3	1
KBR1B_2019-07-05_Y_04.dat	24.0	17280	1.98	-6.4	7.4	1
KBR1B_2019-07-06_Y_00.dat	24.0	17280	2.32	-8.5	7.4	1
KBR1B_2019-07-07_Y_00.dat	24.0	17280	2.25	-7.4	5.7	1
KBR1B_2019-07-08_Y_00.dat	24.0	17199	1.81	-5.9	5.4	2
KBR1B_2019-07-09_Y_00.dat	24.0	17280	1.60	-6.4	6.0	1
KBR1B_2019-07-10_Y_00.dat	24.0	17280	1.52	-4.8	5.1	1
KBR1B_2019-07-11_Y_00.dat	24.0	17189	1.79	-10.1	4.8	2
KBR1B_2019-07-12_Y_00.dat	24.0	17280	1.64	-5.4	4.4	1
KBR1B_2019-07-13_Y_00.dat	24.0	17280	1.77	-6.7	7.0	1
KBR1B_2019-07-14_Y_00.dat	24.0	17280	1.59	-6.4	6.0	1
KBR1B_2019-07-15_Y_00.dat	24.0	17280	2.34	-19.1	6.5	1
KBR1B_2019-07-16_Y_00.dat	24.0	17280	1.60	-4.8	4.9	1
KBR1B_2019-07-17_Y_00.dat	24.0	17280	1.59	-6.1	4.9	1
KBR1B_2019-07-18_Y_00.dat	24.0	17153	1.44	-4.3	5.0	2
KBR1B_2019-07-19_Y_00.dat	24.0	17280	1.25	-4.5	4.5	1
KBR1B_2019-07-20_Y_04.dat	24.0	17152	1.52	-4.6	5.1	2
KBR1B_2019-07-21_Y_04.dat	24.0	17280	1.21	-3.8	3.5	1
KBR1B_2019-07-22_Y_04.dat	24.0	17280	1.52	-6.1	4.6	1
KBR1B_2019-07-23_Y_04.dat	24.0	17280	1.38	-4.8	3.6	1
KBR1B_2019-07-24_Y_04.dat	24.0	17280	1.66	-6.4	4.5	1
KBR1B_2019-07-25_Y_04.dat	24.0	17280	1.41	-3.9	4.5	1
KBR1B_2019-07-26_Y_04.dat	24.0	17208	1.74	-5.1	9.2	2
KBR1B_2019-07-27_Y_04.dat	24.0	17280	1.29	-3.9	3.7	1
KBR1B_2019-07-28_Y_04.dat	24.0	17280	2.05	-5.6	5.7	1
KBR1B_2019-07-29_Y_04.dat	24.0	17280	2.49	-9.5	6.2	1
KBR1B_2019-07-30_Y_04.dat	24.0	17154	1.53	-3.7	6.4	2
KBR1B_2019-07-31_Y_04.dat	24.0	17280	1.44	-6.6	4.3	1

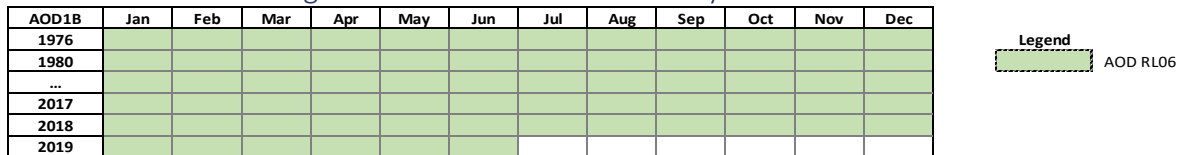


1.B – Level-1 GRACE-FO Data Availability



Current version: Level-1 v04

1.C – Level-1 De-aliasing Model AOD1B Data Availability



- For more information on the AOD de-aliasing AOD1B model please visit <https://www.gfz-potsdam.de/en/aod1b/>.

1.D - Level-1 Release Notes & Sequence of Events

Date	Events
2019-07-08	GRACE-C IPU S/W restart at 15:34:10 in order to reset an inactive DSP channel
2019-07-11	GRACE-C IPU S/W restart at 16:06:00 in order to reset a hanging DSP channel
2019-07-18	GRACE-C IPU reboot (commanded) at 04:11:40
2019-07-18	GRACE-D IPU reboot (commanded) at 04:11:40
2019-07-20	GRACE-C IPU S/W restart was commanded at 03:00
2019-07-20	GRACE-D IPU S/W restart was commanded at 03:00
2019-07-23	GRACE-C: 05:29:30 to 2019-07-26 04:11:26 GRACE-C GPS hardware channel 17 put out bad data. IPU soft reset on 2019-07-26 at 04:11:26 fixed this problem. Channel 17 data have been deleted except for GPS1A.
2019-07-24	GRACE-C: CMcal started on 2019-07-24 at 06:20 and ended at 16:35
2019-07-24	GRACE-D: CMcal start on 2019-07-24 at 17:00 and ended on 2019-07-25 at 01:53
2019-07-26	GRACE-C IPU S/W restart was commanded at 04:11
2019-07-26	GRACE-D IPU S/W restart was commanded at 04:11
2019-07-30	GRACE-C: IPU reboot (commanded) at 04:40:40
2019-07-30	GRACE-D: IPU reboot (commanded) at 04:41:10



2.A – Level-2 Product and Data Availability

JPL, GFZ & CSR

- Current Level-2 version: RL06
- All centers provide GSM solutions
 - Please check the Level-2 Release Notes for further details
- JPL and GFZ provide corresponding monthly de-aliasing models [GAA, GAB, GAC, GAD]; CSR provides [GAC, GAD].

Level-2 (JPL)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2002				1	2			3	4	5	6	7
2003	8	9	10	11	12		13	14	15	16	17	18
2004	19	20	21	22	23	24	25	26	27	28	29	30
2005	31	32	33	34	35	36	37	38	39	40	41	42
2006	43	44	45	46	47	48	49	50	51	52	53	54
2007	55	56	57	58	59	60	61	62	63	64	65	66
2008	67	68	69	70	71	72	73	74	75	76	77	78
2009	79	80	81	82	83	84	85	86	87	88	89	90
2010	91	92	93	94	95	96	97	98	99	100	101	102
2011		103	104	105	106		107	108	109	110	111	112
2012	113	114	115	116		117	118	119	120		121	122
2013	123	124		125	126	127	128			129	130	131
2014	132		133	134	135	136		137	138	139	140	
2015	141	142	143	144	145		146	147	148			149
2016	150	151	152		153	154	155	156			157*+	158*+
2017	159*+		160*+	161*+	162*	163*+						
2018						1*+	2*+			3*+	4+	5+
2019	6+	7*+	8+	9+	10+	11+						

GRACE
 Level-2 products
 no Level-2 products available

GRACE-FO
 Level-2 products available

Current Level-2 Release: RL06

- + Level-2 products (with ACC transplant)
- * partial / overlapping cal-months

Tab: GRACE and GRACE-FO Level-2 product availability.

2.A – Level-3 Product and Data Availability

JPL, GFZ & CSR

- Based on current Level-2 version (RL06)
- JPL provides Land (LND) and Ocean (OCN) global data grids for all three SDS centers (JPL, GFZ, CSR) via PO.DAAC:
 - <https://tinyurl.com/tellus-level3-grids>

Level-2 (JPL)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2002				1	2			3	4	5	6	7
2003	8	9	10	11	12		13	14	15	16	17	18
2004	19	20	21	22	23	24	25	26	27	28	29	30
2005	31	32	33	34	35	36	37	38	39	40	41	42
2006	43	44	45	46	47	48	49	50	51	52	53	54
2007	55	56	57	58	59	60	61	62	63	64	65	66
2008	67	68	69	70	71	72	73	74	75	76	77	78
2009	79	80	81	82	83	84	85	86	87	88	89	90
2010	91	92	93	94	95	96	97	98	99	100	101	102
2011		103	104	105	106		107	108	109	110	111	112
2012	113	114	115	116		117	118	119	120		121	122
2013	123	124		125	126	127	128			129	130	131
2014	132		133	134	135	136		137	138	139	140	
2015	141	142	143	144	145		146	147	148			149
2016	150	151	152		153	154	155	156			157*+	158*+
2017	159*+		160*+	161*+	162*	163*+						
2018						1*+	2*+			3*+	4+	5+
2019	6+	7*+	8+	9+	10+	11+						

GRACE
 Level-3 products
 no Level-3 products available

GRACE-FO
 Level-3 products available

Current Level-2 Release: RL06

- + Level-3 products (with ACC transplant)
- * partial / overlapping cal-months