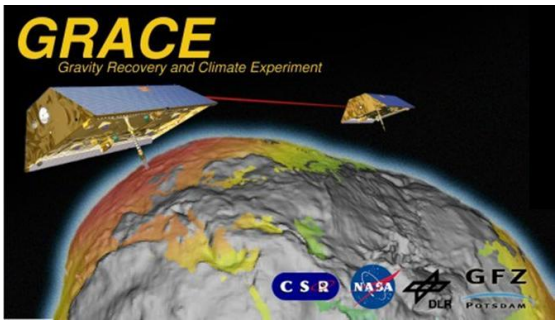
GRACE Science Data System Monthly Report December 2009



Prepared by:
Frank Flechtner GFZ flechtne@gfz-potsdam.de

Contributions by:
Srinivas Bettadpur UTCSR srinivas@csr.utexas.edu
Mike Watkins JPL michael.m.watkins@jpl.nasa.gov
Gerhard Kruizinga JPL gerhard.kruizinga@jpl.nasa.gov

Approved by:
Byron Tapley UTCSR tapley@csr.utexas.edu

Highlights:

- CSR and GFZ have generated and delivered RL04 Level-2 products for November 2009, JPL for October and November 2009. For GFZ products see comment below and in the GFZ Release Notes for GRACE L2 Products.
- The proceedings of the GRACE Science Team Meeting held in Austin on November 2/3 2009 have been made available at http://www.csr.utexas.edu/grace/GSTM/2009/

Satellite Science Relevant Events:

- Operations in Science Mode throughout the month except for the periods highlighted in the L1B Data Processing section below.
- The GRACE-1 Brouwer mean orbital elements on January 1, 2010 00:00:00 are as follows:

  A [m] = 6837655.476
  E [-] = 0.001816
  I [º] = 89.016385
- The satellites separation was 249 km on January 1, 2010 with a rate of 0.00 km/d. Orbit maintenance maneuver won't be needed for some months.

Level-0 raw data dump reception statistics at DLR ground stations Weilheim and Neustrelitz:

GRACE-A Housekeeping:	99.9 %	GRACE-B Housekeeping:	100.0 %
GRACE-A Science:	100.0 %	GRACE-B Science:	100.0 %

Level-1 Data Processing:

- Level-1B Release 01 instrument data have been processed at JPL and archived at GRACE-ISDC and JPL PO.DAAC. Please refer to the statistics below.
- **Notes:**
    - Starting on 2009-12-01 the parameterization of the Precision Orbit Determination (POD) has been changed. These changes result in a factor 2 reduction of the KBR-GPS range residuals. The new average KBR-GPS range residuals are expected to be about 0.3 cm.
    - On 2009-12-08 GRACE-A (16:01:14 to 16:01:55) and GRACE-B (16:01:14 to 16:02:25) executed a center of mass trim. For these intervals the ACC data has been removed for the ACC1B product as the ACC data is corrupted due to vibrations associated with the movement of the trim masses.
    - On 2009-12-09 GRACE A&B performed Center of Mass calibration maneuvers. Both spacecraft were in non-science mode from 05:35 to 16:22. Data in this interval may be degraded and caution should be used when using this data in the gravity field determination process.
    - On 2009-12-10 09:32:47 an ACC bias jump occurred on GRACE-B in the Science Reference Frame linear Y-axis and in the angular Z-axis. The ACC1B data was corrected by adding a bias of $-3.93683258027982e^{-9}$ m/sec^2 prior to 09:32:47. The angular Z-axis was not corrected. The linear ACC1B data are considered nominal and should be used in the level-2 gravity field determination processing
    - On 2009-12-23 09:06:15 an ACC bias jump occurred on GRACE-B in the Science Reference Frame linear Y-axis and in the angular Z-axis. The ACC1B data was corrected by adding a bias of $7.570537253267656e^{-9}$ m/sec^2 prior to 09:06:15. The angular Z-axis was not corrected. The linear ACC1B data are considered nominal and should be used in the level-2 gravity field determination processing
- **KBR statistics:**

    A) KBR1B product name

    B) Total arc length with data (hours)

    C) Number of observations used in residual calculation

    D) KBR-GPS range residual RMS (cm)

    E) minimum KBR-GPS range residual (cm)

    F) maximum KBR-GPS range residual (cm)

    G) number of continuous segments in the KBR product

A	B	C	D	E	F	G
KBR1B_2009-12-01_X_01.dat	24.0	17280	0.33	-1.0	1.2	1
KBR1B_2009-12-02_X_01.dat	24.0	17280	0.30	-1.0	1.0	1
KBR1B_2009-12-03_X_01.dat	24.0	17280	0.27	-1.1	0.9	1
KBR1B_2009-12-04_X_01.dat	23.8	17141	0.43	-1.2	2.4	2
KBR1B_2009-12-05_X_01.dat	24.0	17259	0.30	-1.1	1.0	2
KBR1B_2009-12-06_X_01.dat	24.0	17280	0.29	-1.4	1.1	1
KBR1B_2009-12-07_X_01.dat	24.0	17280	0.44	-1.1	2.4	1
KBR1B_2009-12-08_X_01.dat	24.0	17258	0.37	-0.9	1.9	2
KBR1B_2009-12-09_X_01.dat	24.0	17280	0.31	-1.1	0.8	1
KBR1B_2009-12-10_X_01.dat	24.0	17256	0.28	-0.7	1.0	2
KBR1B_2009-12-11_X_01.dat	24.0	17252	0.36	-0.9	1.3	2
KBR1B_2009-12-12_X_01.dat	24.0	17280	0.32	-1.0	1.4	1
KBR1B_2009-12-13_X_01.dat	24.0	17280	0.32	-1.4	1.5	1
KBR1B_2009-12-14_X_01.dat	24.0	17280	0.42	-1.6	1.4	1
KBR1B_2009-12-15_X_01.dat	24.0	17253	0.47	-0.8	3.0	2
KBR1B_2009-12-16_X_01.dat	24.0	17251	0.31	-1.0	1.2	2
KBR1B_2009-12-17_X_01.dat	24.0	17280	0.29	-1.1	1.3	1
KBR1B_2009-12-18_X_01.dat	24.0	17280	0.30	-0.9	1.1	1
KBR1B_2009-12-19_X_01.dat	24.0	17280	0.26	-0.8	0.9	1
KBR1B_2009-12-20_X_01.dat	24.0	17280	0.35	-1.1	1.5	1
KBR1B_2009-12-21_X_01.dat	23.9	17203	0.32	-1.0	1.3	2
KBR1B_2009-12-22_X_01.dat	24.0	17257	0.27	-0.8	0.8	2
KBR1B_2009-12-23_X_01.dat	24.0	17280	0.25	-0.9	0.7	1
KBR1B_2009-12-24_X_01.dat	24.0	17280	0.30	-1.3	0.8	1
KBR1B_2009-12-25_X_01.dat	23.9	17205	0.37	-0.9	1.7	2
KBR1B_2009-12-26_X_01.dat	24.0	17280	0.29	-0.9	1.3	1
KBR1B_2009-12-27_X_01.dat	24.0	17280	0.27	-1.0	1.3	1
KBR1B_2009-12-28_X_01.dat	24.0	17280	0.29	-0.8	0.9	1
KBR1B_2009-12-29_X_01.dat	23.9	17183	0.38	-1.7	1.7	2
KBR1B_2009-12-30_X_01.dat	24.0	17260	0.30	-1.1	1.0	1
KBR1B_2009-12-31_X_01.dat	24.0	17260	0.25	-1.1	0.8	1

- Following JPL RL00 (yellow) and RL01 (green) L1B products are publicly available. June and July 2002 (red) are not provided due to accelerometer problems.

L1B data	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2002												
2003												
2004												
2005												
2006												
2007												
2008												
2009												

- The software to convert from GRACE GPS1x format to Rinex format has been updated to handle the presence of data from PRN32 since Feb. 26, 2008. Users should download and re-install the entire Level-1 Read software suite (RELEASE_2008-03-20) from the GRACE archives. This software is backwards compatible and can process all mission data.
- L1B De-aliasing Products Status (for details see AOD1B Product Description Document):
    - Release 01: Generation has been stopped June 30, 2007.
    - Release 03: Generation has been stopped January 31, 2007.
    - Release 04: Generated until January 4, 2010 and extended to 1976-2000 (see newsletter for December 2008).
    - Quality statistics for Release 04 products are online available at http://www.gfz-potsdam.de/pb1/op/grace/results (follow link “GRACE Atmosphere and Ocean De-aliasing Statistics).
    - Following AOD1B products are publicly available (yellow: RL01, RL03 and RL04; green: RL01 and RL04, blue: RL04 only):

AOD1B	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976												
…												
1999												
2000												
2001												
2002												
2003												
2004												
2005												
2006												
2007												
2008												
2009												

Level-2 Product Generation and Distribution:

- Besides historical CSR RL01, GFZ RL03 and JPL RL02 time-series (see below) and more experimental releases which are only available to the GRACE Science Team the following RL04 L2 products are presently available to the public (green: available, yellow: in preparation; red: missing due to accelerometer data problems):

  - **GFZ:** GSM solutions for August 2002 until November 2009. July 2004 until October 2004 and December 2006 are also available as constrained solutions (*GK2-*, reason is GRACE 4d repeat orbit). GSM coefficients of November 2009 products recommended to be used only up to degree and order 90 (reason is GRACE 7d repeat orbit). Corresponding background GAA, GAB, GAC and GAD products and calibrated errors (GSM*.txt) have been provided too. Details are listed in the GFZ L2 Release Notes.

GFZ RL04	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2002												
2003												
2004							**GK2**	**GK2**	**GK2**	**GK2**		
2005												
2006												**GK2**
2007												
2008												
2009												

  - **CSR:** GSM solutions along with the GAC and GAD background model files and calibrated errors (GSM*.txt) are available for the period April 2002 until November 2009. Details are listed in the CSR L2 Release Notes.

CSR RL04	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2002												
2003												
2004												
2005												
2006												
2007												
2008												
2009												

  - **JPL:** GSM version 4.1 labeled "*JPLEM_0001_0004" along with the GAA, GAB, GAC and GAD background model files and calibrated errors (GSM*.txt) are available for the period April 2002 until November 2009. Details are listed in the JPL L2 Release Notes.

JPL RL04	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2002												
2003												
2004												
2005												
2006												
2007												
2008												
2009												

- GFZ has stopped RL03 processing (Feb 2003 until Jan 2007 available at the archives. For further details refer to the GFZ RL03 release notes for Level-2 products).
- CSR has stopped RL01 processing. (Apr. 2002 until Dec 2006 available at the archives. For further details refer to the CSR RL01 release notes for Level-2 products).
- JPL has stopped RL02 processing (January 2003 until November 2005 available at the archives. For further details refer to the JPL RL02 release notes for Level-2 products).
- TN05 containing C20 estimates derived from SLR and using GRACE RL04 standards is periodically updated.

Miscellaneous:

- Next GRACE Science Team Meeting will take place at GFZ in Potsdam on 11/12 November 2010!
- The following acknowledgement shall be added to any new GRACE related publication (paper, poster etc.): *Acknowledgement: We would like to thank the German Space Operations Center (GSOC) of the German Aerospace Center (DLR) for providing continuously and nearly 100% of the raw telemetry data of the twin GRACE satellites.*
- A list of GRACE related publications which can be sorted by author or date is available at http://www.gfz-potsdam.de/pb1/op/grace/index_GRACE.html under item "Publications" (current status: 452 papers). This list is regularly updated and maybe incomplete. If you are missing a publication please send an e-mail to Frank Flechtner (flechtne@gfz-potsdam.de).
- Science data users are encouraged to submit citations of their own and other works related with GRACE to the bibliography web page implemented at PO.DAAC: http://podaac.jpl.nasa.gov/grace/bibliography.html.