

The Durante2020 Gravity Field Model

Based on PJ-01, PJ-03, PJ-06, PJ-08, PJ-10, PJ-11, PJ-13, PJ-14, PJ-15, and PJ-17.

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This file contains coefficients and related data for the DURANTE2020 (shorthand: DUR2020) spherical harmonic gravity field of Jupiter published on 03 FEB 2020.

DURANTE2020 is a model of Jupiter's gravity field obtained from radiometric tracking (X-band and Ka-band Doppler data) of the Juno spacecraft in orbit around Jupiter. The gravity model includes data from PJ-01, PJ-03, PJ-06, PJ-08, PJ-10, PJ-11, PJ-13, PJ-14, PJ-15, and PJ-17.

The reference for this gravity field is:

Durante, D., et al. Jupiter's gravity field halfway through the Juno primary mission. Geophysical Research Letters 47.4 (2020): e2019GL086572. doi.org/10.1029/2019GL086572 [DURANTE2020].

Some details describing this model are:

The spherical harmonic coefficients are UNNORMALIZED.

The associated GM value is = $126686534.1 \pm 8.4 \text{ km}^3/\text{s}^2$ (3x formal, jointly estimated with the gravity field)

The reference radius is = 71492 km

The value for J2 includes a permanent tidal contribution effect estimated to be 6.72×10^{-8} from interior model prediction.

This gravity field estimates a set of gravitational Tidal love numbers and uses a set of fixed ones.

The k22, k32, k33, k42, and k44 Love numbers are estimated to be (uncertainties 3x formal):

$$k_{22} = 0.565 \pm 0.018 (0.074^*)$$

$$k_{31} = 0.248 \pm 0.046 (0.171^*)$$

$$k_{33} = 0.340 \pm 0.116 (0.181^*)$$

$$k_{42} = 1.289 \pm 0.189 (1.059^*)$$

$$k_{44} = 0.546 \pm 0.406 (0.493^*)$$

* uncertainties given within the parentheses assume a satellite-dependent tidal model and are for the lo contribution in the satellite-dependent tidal model

The k20 and k40 Love numbers are fixed, based on internal models, to be:

k20 = 0.4699
k40 = 1.8231

The pole location is estimated jointly with the gravity field. The pole right ascension and declination in inertial EME2000 coordinates at each perijove epoch are:

PJ	Epoch (UTC)	RA (deg)	Dec (deg)
01	27-AUG-2016 12:50:44	268.057034555	64.497180857
03	11-DEC-2016 17:03:41	268.057089217	64.497179339
06	19-MAY-2017 06:00:43	268.057170837	64.497177073
08	01-SEP-2017 21:48:50	268.057225233	64.497175562
10	16-DEC-2017 17:57:38	268.057279722	64.497174049
11	07-FEB-2018 13:51:49	268.057306919	64.497173293
13	24-MAY-2018 05:39:50	268.057361315	64.497171783
14	16-JUL-2018 05:17:22	268.057388593	64.497171025
15	07-SEP-2018 01:11:40	268.057415791	64.497170270
17	21-DEC-2018 16:59:48	268.057470186	64.497168759

Between each perijove, the motion of the pole is assumed linear. The uncertainties in right ascension and declination of the pole are (3x formal), along with the correlation coefficient:

PJ	RA (deg)	Dec (deg)	Correlation Coeff.
01	4.4e-05	4.8e-05	-0.851479
03	3.8e-05	4.2e-05	-0.893336
06	3.2e-05	3.2e-05	-0.913300
08	3.3e-05	2.6e-05	-0.882449
10	3.7e-05	2.1e-05	-0.860732
11	4.0e-05	1.7e-05	-0.867578
13	4.7e-05	1.6e-05	-0.896929
14	5.1e-05	1.6e-05	-0.895178
15	5.5e-05	1.7e-05	-0.873202
17	6.4e-05	2.0e-05	-0.795860

Observations for the gravity field consist of Doppler and range measurements from Deep Space Network (DSN) tracking.

This product is a set of two ASCII tables: a header table and a coefficients table. Definitions of the tables follow. The uncertainties are given as statistical 3-sigma. Any

parameters in the spherical harmonic coefficients not given in the table are assumed zero.

The DURANTE2020 gravity model is delivered as a Spherical Harmonics Gravity ASCII Data Record (SHADR). The gravity field was produced by Daniele Durante et al at Sapienza University of Rome. The archival data product was produced by the Jet Propulsion Laboratory Planetary Radar and Radio Sciences Group."