Bruce Gordon Bills

Planetary Science Section
Jet Propulsion Laboratory
Pasadena, CA 91109

Education

Ph.D. (1978) California Institute of Technology
Planetary Science / Geophysics

B.S. (1973) Brigham Young University
Mathematics / Physics

Appointments

Jet Propulsion Laboratory, Pasadena, California
2008-present

Scripps Institution of Oceanography, La Jolla, California
1998-present Visiting Research Geophysicist

Goddard Space Flight Center, Greenbelt, Maryland
1990-2008 Geophysicist
Geodynamics Branch

Johns Hopkins University, Baltimore, Maryland
1991-1998 Adjunct Professor
Department of Earth and Planetary Sciences

Lunar and Planetary Institute, Houston, Texas
1984-1990 Staff Scientist

Jet Propulsion Laboratory, Pasadena, California
1983-1984 Senior Scientist
Planetary Radar Group
Earth and Space Sciences Division
1979-1983 Senior Scientist
Planetary Dynamics and Geophysics Group
Earth and Space Sciences Division
1977-1979 Senior Engineer
Tracking and Orbit Determination Group
Systems Division

Professional Society Memberships

American Geophysical Union (since 1973)
Geological Society of America (since 1987)
American Quaternary Association (since 1988)

Service activities

DPM (discipline program manager) for several solar system research programs
(MDAP, LDAP, RDAP, PDART, EW, SSW) (2009 to present)

Europa mission SDT (science definition team), geophysics lead (2006-2015)

Associate editor
JGR solid Earth (1996-2000)
JGR planets (1996-2000)

AGU Whitten medal committee member (2001-2006)

Leadership roles

NASA GSFC geodynamics branch head (1990-1992
JPL group supervisor, 3224 (asteroids, comets, and satellites) 2011-2012

Teaching

Johns Hopkins University, Earth and planetary sciences, adjunct professor (1991-1998)
UCLA, Earth and Space Science, Reagents' professor, (2010)
Caltech, Geological and Planetary Science, solar system dynamics (2010)

Mission roles

GEOID mission proposal, gravity gradiometer, GSFC (1995-1997)
science lead

Psyche mission
concept originator
Co-investigator

publications

1. McNamara, D.H., and **B.G. Bills** (1973),|
   Photometric and spectrographic observations of HR6684,
   Pub. Astron. Soc. Pac., 85, 632-636. *research article*

2. **Bills, B.G**., and A.J. Ferrari (1977),
   A harmonic analysis of lunar topography,
   Icarus, 31, 244-259. *research article*

3. **Bills, B.G**., and A.J. Ferrari (1977),
   A lunar density model consistent with topographic,
   gravitational, librational and seismic data,
   J. Geophys. Res., 82, 1306-1314. *research article*

4. **Bills, B.G.,** and A.J. Ferrari (1978),
   Mars topography harmonics and geophysical implications,
   J. Geophys. Res., 83, 3497-3508. *research article*

5. Ferrari, A.J., and **B.G. Bills** (1979),
   Planetary geodesy,
   Rev. Geophys. Space Phys., 17, 1663-1677. *research article*

6. **Bills, B.G**., and A.J. Ferrari (1980),
   A harmonic analysis of lunar gravity,
   J. Geophys. Res., 85, 1013-1025. *research article*

7. Ananda, M.P., W.L. Sjogren, R.J. Phillips, and **B.G. Bills** (1980),
   A low-order global gravity field of Venus and
   dynamical implications,
   J. Geophys. Res., 85, 8303-8318. *research article*

8. Esposito, P.B., W.L. Sjogren, N.A. Mottinger, **B.G. Bills**, and E. Abbott (1982),
   Venus gravity: Analysis of Beta Regio,
   Icarus, 51, 448-459. *research article*

9. **Bills, B.G.** (1983),
   Thermoelastic bending of the lithosphere,
   Geophys. J. Roy. Astr. Soc., 75, 169-200. *research article*

10. Sjogren, W.L., **B.G. Bills**, P.W. Birkeland, P.W. Esposito,
    A.R. Konopliv, N.A. Mottinger, S.J. Ritke, and R.J. Phillips (1983),
    Venus gravity anomalies and their correlation with topography,
    J. Geophys. Res., 88, 1119-1128. *research article*

11. Reasenberg, R.D., and **B.G. Bills** (1983),
    Critique of "Elastic thickness of the Venus lithosphere
    estimated from topography and gravity",
    Geophys. Res. Lett., 10, 93-96. research article

12. Sjogren, W.L., **B.G. Bills**, and N.A. Mottinger (1984),
    Venus: Ishtar gravity anomaly,
    Geophys. Res. Lett., 11, 489-491. research article

13. **Bills, B.G**., and M. Kobrick (1985),
    Venus topography: A harmonic analysis,
    J. Geophys. Res., 90, 827-836. research article

14. Mottinger, N.A., W.L. Sjogren, and **B.G. Bills** (1985),
Venus gravity: A harmonic analysis and
geophysical implications,
J. Geophys. Res., 90, C739-C756. research article

15. Kiefer, W.S., M.A. Richards, B.H. Hager, and **B.G. Bills** (1986),
A dynamic model of Venus's gravity field,
Geophys. Res. Lett., 13, 14-17. research article

16. Nakamura, Y., J. Oberst, S.M. Clifford, and **B.G. Bills** (1986),
Comments on the letter "On the influx of small comets
into the Earth's upper atmosphere",
Geophys. Res. Lett., 13, 1184-1185. research article

17. **Bills, B.G**., and S.P. Synnott (1987),
Planetary geodesy,
Rev. Geophys., 25, 833-839. research article

18. **Bills, B.G.,** W.S. Kiefer, and R.L. Jones (1987),
Venus gravity: A harmonic analysis,
J. Geophys. Res., 92, 10,335-10,351. research article

19. **Bills, B.G.,** and G.M. May (1987),
Lake Bonneville: Constraints on lithospheric thickness and
upper mantle viscosity from isostatic warping of shorelines,
J. Geophys. Res., 92, 11,493-11,508. research article

20. Herrick, R.R., **B.G. Bills**, and S.A. Hall (1989),
Variations in effective compensation depth across
Aphrodite Terra, Venus,
Geophys. Res. Lett., 16, 543-546. research article

21. **Bills, B.G.** (1989),
The moments of inertia of Mars,
Geophys. Res. Lett., 16, 385-388. research article

22. **Bills, B.G.** (1989),
Planetary geodesy,
in *The Encyclopedia of Solid Earth Geophysics*,
edited by D.E. James,
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23. **Bills, B.G.** (1989),
Comment on "More about the moment of inertia of Mars",
Geophys. Res. Lett., 11, 1337-1338. research article

24. **Bills, B.G.** (1990),
Geodetic constraints on the composition of Mars,
J. Geophys. Res., 95, 14,131-14,136. research article

25. **Bills, B.G.** (1990),
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J. Geophys. Res., 95, 14,137-14,153. research article

26. May, G.M., **B.G. Bills**, and D.S. Hodge (1991),
Far-field flexural response of Lake Bonneville from
paleopluvial lake elevations,
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27. **Bills, B.G.** (1992),
Venus: Satellite orbital decay, ephemeral ring formation,
and subsequent crater production,
Geophys. Res. Lett., 19, 1025-1028. research article

28. Esposito, P.B., W.B. Banerdt, G.F. Lindal, W.L. Sjogren, M.A. Slade,
B.G. Bills, D.E. Smith, and G. Balmino,
Gravity and topography,
in *Mars*, edited by H.H. Kiefer, B.M. Jakosky,
C.W. Snyder and M.S. Mathews,
University of Arizona Press, pp. 209-248. book chapter

29. **Bills, B.G**., and M.A. Fischer (1992),
A spatial domain Stokes flow model for the gravity and
topography of the middle latitudes of Venus,
J. Geophys. Res., 97, 18,285-18,294. research article

30. **Bills, B.G.** (1993),
Geodynamic contributions to global climatic change,
in *Orbital, Rotational and Climatic Interactions*,
NASA Conf. Publ. 3815, pp. 1-33. *conference proceeding*

31. Nerem, R.S., **B.G. Bills**, and J.B. McNamee (1993),
A high resolution gravity model for Venus: GVM-1,
Geophys. Res. Lett., 20, 599-602. research article

32. **Bills, B.G.** (1994)
Obliquity-oblateness feedback: Are climatically sensitive values of
obliquity dynamically unstable?
Geophys. Res. Lett., 21, 177-180. research article

33. **Bills, B.G.,** S.L. de Silva, D.R. Currey, R.S. Emenger, K. Lillquist,
A. Donnellan, and B. Worden (1994),
Hydro-isostatic deflection and tectonic tilting in the Central Andes:
Initial results of a GPS survey of Lake Minchin shorelines,
Geophys. Res. Lett., 21, 293-296. research article

34. **Bills, B.G.,** D.R. Currey, and G.A. Marshall (1994),
Viscosity estimates for the crust and upper mantle from patterns
of lacustrine shoreline deformation in the eastern Great Basin,
J. Geophys. Res., 99, 22,059-22,086. research article

35. **Bills, B.G.,** and R.R. Nerem (1995),
A harmonic analysis of Martian topography,
J. Geophys. Res. 100, 26,317-26,326. research article

36. **Bills, B.G.,** and D.P. Rubincam (1995),
Constraints on density models from radial moments:
Application to the Earth, Moon and Mars,
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37. **Bills, B.G.** (1995)
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of inertia of the Moon
J. Geophys. Res. 100, 26,297-26,303. research article

38. **Bills, B.G.,** and F.G. Lemoine (1995),
Gravitational and topographic isotropy of
the Earth, Moon, Mars and Venus,
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39. Kiefer, W.S., **B.G. Bills**, and R.S. Nerem (1996),
An inversion of gravity and topography for mantle and
crustal structure on Mars,
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40. Frey, H.V., **B.G. Bills**, R.S. Nerem, and J.H. Roark (1996),
The isostatic state of Martian topography revisited,
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41. **Bills, B.G.**, and T.S. James (1996),
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due to glacial cycle polar wander,
Geophys. Res. Lett. 23, 3023-3026. research article

42. Shirron, P.J, M.J DiPirro, S.H. Castles, **B.G. Bills**, H.J Paik,
E.R. Canavan and M.V. Moody (1996),
Mission concepts for the Superconducting Gravity Gradiometer,
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43. Folkner, W.M., R.D. Kahn, R.A. Preston, C.F. Yoder, C.D. Edwards,
R. Hellings, E. M. Standish, M. Eubanks, and **B.G. Bills** (1997),
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the Mars Pathfinder Lander,
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44. **Bills, B.G.,** and T.S. James (1997),
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45. Tackman, G.E., D.R. Currey, **B.G. Bills**, and T.S. James (1998),
Paleoshoreline evidence for postglacial tilting in Southern Manitoba,
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46. **Bills, B.G.,** and T.S. James (1999),
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J. Geophys. Res. 104, 9081-9096. research article

47. **Bills, B.G.** (1999),
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and outer core effective viscosity
J. Geophys. Res. 104, 2653-2666. *research article*

48. **Bills, B.G.,** J.G. Mengel, and T.S. James (1999),
Climatic impact of glacial cycle polar motion:
Coupled oscillations of ice sheet mass and rotation pole position,
J. Geophys. Res., 104, 1059-1075. *research article*

49. Tackman, G.E., **B.G. Bills**, T.S. James, and D.R. Currey (1999),
Lake gauge evidence for regional postglacial tilting in Southern Manitoba
Geol. Soc. Amer. Bull., 111, 1684-1699. *research article*

50. Adams, K.D., S.G. Wesnousky, and **B.G. Bills** (1999),
Isostatic rebound, active faulting, and potential geomorphic effects
in the Lake Lahontan Basin, Nevada and California
Geol. Soc. Amer. Bull., 111, 1739-1756. *research article*

51. Ray, R.D., **B.G. Bills**, and B.F. Chao (1999),
Lunar and solar torques on the oceanic tides,
J. Geophys. Res. 104, 17,653-17,659. *research article*

52. **Bills, B.G. (**1999),
Obliquity-oblateness feedback on Mars,
J. Geophys. Res. 104, 30,773-30,798. *research article*

53. **Bills, B.G.,** and R.D. Ray (1999),
Lunar orbital evolution: Synthesis of recent results,
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54. Clifford, S.M., **B.G. Bills** et al. (2000),
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Icarus, 144, 210-242. *research article*

55. **Bills**, **B.G.,** and R.D. Ray (2000),
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J. Geophys. Res., 105, 29.277-29,282. *research article*

56. **Bills**, **B.G.,** and R.S. Nerem (2001),
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domain comparisons of Mars Orbiter Laser Altimeter and
U.S. Geological Survey data,
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57. **Bills**, **B.G.**, T.J. Wambeam, and D.R. Currey (2002),
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in *Great Salt Lake: An overview of change*,,
ed. J. Wallace Gwynn, Utah Geol. Survey, pp. 7-32. *book chapter*

58. Comstock, R.L., and **B.G. Bills** (2003),
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59. Egbert, G.D., R.D. Ray, and **B.G. Bills** (2004),
Numerical modeling of the global semidiurnal tide in
the present day and in the last glacial maximum,
J. Geophys. Res. Oceans, 109, C03003. *research article*

60. **B.G. Bills** (2005),
Free and forced obliquities of the Galilean satellites of Jupiter,
Icarus, 175, 233-247. *research article*

61. **B.G. Bills,** and R.L. Comstock (2005),
Spatial and temporal patterns of solar eclipses by Phobos on Mars,
J. Geophys. Res. Planets, 110, E04004. *research article*

62. **B.G. Bills,** and R.L. Comstock (2005),
Forced obliquity variations of Mercury,
J. Geophys. Res. Planets, 110, E04006. *research article*

63. **Bills, B.G.,** G.A. Neumann, D.E. Smith, and M.T. Zuber (2005),
Improved estimate of tidal dissipation within Mars from
MOLA observations of the shadow of Phobos,
J. Geophys. Res. Planets, 110, E07004. *research article*

64. Munk, W.H., and **B.G. Bills** (2007),
Tides and the climate: some speculations,
J. Phys. Ocean. 37, 135-147. *research article*

65. Fricker, H.A., A.A. Borsa, J.B. Minster, C. Carabajal, K. Quinn, and **B.G. Bills** (2005),
Assessment of ICESat performance at the salar de Uyuni, Bolivia
Geophys. Res. Lett. 32, L21S06. *research article*

66. **Bills, B.G.**, (2005),
Variations in the rotation rate of Venus due to orbital
eccentricity modulation of solar tidal torques,
J. Geophys. Res. Planets, 110, E11007. *research article*

67. **Bills, B.G.,** K.D. Adams, and S.G. Wesnousky (2007),
Viscosity structure of the crust and upper mantle in western
Nevada from isostatic rebound patterns of Lake Lahontan shorelines,
J.*Geophys. Res.*, 112, B06405.. *research article*

68. **Bills, B.G**., A.A. Borsa, and R.L. Comstock (2007),
MISR-based passive optical bathymetry from orbit with cm-level
accuracy on the salar de Uyuni, Bolivia
Remote. Sens. Environ., 107, 240-255. *research article*

69. Borsa, A.A., J-B Minster, **B.G. Bills**, and H A. Fricker (2007),
Modeling long-period noise in kinematic GPS applications,
J. Geodesy, 81, 157-170. *research article*

70. Borsa, A., H.A. Fricker, **B.G. Bills**, J-B, Minster, C. Carabajol, and K. Quinn (2008),
Topography of the salar de Uyuni, Bolivia from kinematic GPS,
Geophys. J. Int.., 172, 31-40. *research article*

71. Luttrell, K., D Sandwell, B. Smith-Konter, **B.G. Bills**, and Y. Bock (2007),
Modulation of the earthquake cycle at the southern San Andreas fault by lake loading
J. Geophys. Res., 112, B08411. *research article*

72. Bulow, R.C., C.L. Johnson, **B.G. Bills**, and P.M. Shearer (2007),
Temporal and spatial properties of some deep Moonquake clusters,
J. Geophys. Res., 112, E09003. *research article*

73. Hurford, TA., P. Helfenstein, G.V. Hoppa, R. Greenberg, and, **B.G. Bills** (2007),
Eruptions arising from tidally controlled periodic openings of rifts on Enceladus,
Nature, 447, 292-294. *research article*

74. **B.G. Bills**, and F. Nimmo (2008),
Forced obliquity and moments of inertia of Titan,
Icarus, 196, 293-297. *research article*

75. Borsa, A.A., **B.G. Bills**, and J.B. Minster (2008)
Modeling the topography of the salar de Uyuni, Bolivia, as an
equipotential surface of Earth's gravity field,
J. Geophys. Res., B10408. *research article*

76. **B.G. Bills** (2009),
Tidal flows in satellite oceans,
Nature Geoscience, 2, 13-14 *research article*

77. Hurford, T.A., A.R. Sarid, R. Greenberg, and **B.G. Bills** (2009)
The influence of obliquity on Europan cycloid formation,
Icarus, 202, 197-215. *research article*

78. Hurford, T.A., **B.G. Bills**, P. Helfenstein, R. Greenberg, G.V. Hoppa,
and D.P. Hamilton (2009),
Geological implications of a physical libration on Enceladus,
Icarus, 203, 541-552 *research article*

79. Weber, R.C., **B.G. Bills**, and C.L. Johnson, (2009),
Constraints on deep moonquake focal mechanisms through analysis of tidal stress,
J. Geophys. Res., 114, E05001 *research article*

80. **Bills, B.G**., F. Nimmo, O. Karatekin, T. Van Hoolst, N. Rambaux, B. Levrard, and J. Laskar (2010),
Rotational dynamics of Europa,
in Europa, eds. R. Pappalardo, W. McKinnon, and K. Khurana, Univ. Arizona Press. *book chapter*

81. Nimmo, F**.** and **B.G. Bills** (2010),
Shell thickness variations and the long-wavelength topography of Titan,
Icarus, 208, 896-904. *research article*

82. Matsuyama, I., and **B.G. Bills (**2010),
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Application to Mercury and Iapetus,
Icarus, 29, 271-279. *research article*

83. Weber, R.C., **B.G. Bills**, and C.L. Johnson (2010),
A simple physical model for deep moonquake occurrence times,
Phys. Earth Plan. Inter., 182, 152-160. *research article*

84. Nimmo, F., **B.G. Bills**, P.C. Thomas, and S.W. Asmar (2010),
Geophysical implications of the long-wavelength topography of Rhea,
J. Geophys. Res., 115, E10008. *research article*

85. D.A. Paige, **B.G. Bills**, and 23 others (2010),
Diviner lunar radiometer observations of cold traps in the Moon's south polar region,
Science, 330, 479-482. *research article*

86. Siegler, M.A., **B.G. Bills**, and D.A. Paige (2011),
Effects of orbital evolution on lunar ice stability,
J. Geophys. Res., 116, E03010. *research article*

87. **Bills, B.G**., and F. Nimmo (2011),
Forced obliquities and moments of inertia of Ceres and Vesta,
Icarus, 213, 496-509. *research article*

88. **Bills, B.G**., and F. Nimmo (2011),
Rotational dynamics and internal structure of Titan,
Icarus, 214, 351-355. *research article*

89. Park, R.S., S.W. Asmar, B. Buffington, **B.G. Bills**, S. Campagnola, P. W. Chodas, W. M. Folkner, A.S. Konopliv, and A.E. Petropoulos (2011),
Detecting tides and gravity at Europa from multiple close flybys,
Geophys. Res. Lett., (nov 2011) *research article*

90. F. Nimmo, **B.G. Bills**, P.C. Thomas (2011),
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91. Konopliv, A.S., S.W. Asmar, **B.G. Bills**, N. Mastrodemos, R.S. Park, C.A. Raymond, D.E. Smith, M.T. Zuber (2011),
The DAWN gravity investigation at Vesta and Ceres,
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92. Pappalardo, R.T., **B.G. Bills**, et al. (2013),
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93. Siegler, M.A., **B.G. Bills**, D.A. Paige (2013),
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94. **Bills, B.G**., S.W. Asmar, A.S. Konopliv et al. (2014),
Harmonic and statistical analyses of the gravity and topography of Vesta,
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95. Konopliv, A.S. **B.G. Bills**, et al. (2014),
The Vesta gravity field, spin pole and rotation period,
Icarus, 240, 103-117. *research article*

96. Park, R.S., **B.G. Bills**, et al. (2014),
Gravity field expansion in ellipsoidal harmonics applied to Vesta,
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97. Oviatt, C.G., **B.G. Bills**, et al. (2014),
Interpretation of evidence for large Pleistocene paleolakes in the Bonneville basin,
Paleogeo. Paleoclim. Paleoeco., 401, 173-176 *research article*

98. Hurford, T.A., **B.G. Bills**, et al. (2014)
Tidal disruption of Phobos as the cause of surface fractures,
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99. Romero-Wolf, A., **B.G. Bills**, et al. (2016),
Prospects of passive radio detection of a subsurface ocean on Europa
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100. Park, R.S., **B.G. Bills**, et al. (2016),
A partially differentiated interior for (1) Ceres deduced from its
gravity field and shape,
Nature, 537, 515-517. *research article*

101. **Bills, B.G**., B.R. Scott (2017),
Secular obliquity variations of Ceres and Pallas,
Icarus, 284, 59-69. *research article*

102. Konopliv, A.S., **B.G. Bills** et al. (2017),
The Ceres gravity field, spin pole, rotation period and orbit
Icarus, 299, 411-429. *research article*

103. Vance, S.D., **B.G. Bills** et al. (2018),
Geophysical investigations of habitability in ice-covered ocean worlds,
J. Geophys. Res., 123, 180-205. *research article*

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Vital signs: Seismology of icy ocean worlds,
Astrobiology, 18, 37-53. *research article*

105. Ermakov, A.I., R.S. Park, **B.G. Bills** (2018),
Power laws of topography and gravity spectra of solar system bodies,
J. Geophys. Res., 123, 238-2064. *research article*

106. Gorski, K.M., **B.G. Bills**, A.S. Konopliv (2018),
A high resolution Mars surface gravity grid,
Plan. Space Sci., 160, 84-106. *research article*

107. Henriquet, M., J.P. Avouac, **B.G. Bills** (2019),
Crustal rheology of southern Tibet constrained from
lake-induced viscoelastic deformation,
Earth Plan. Sci. Lett., 506, 308-322. *research article*

108. **Bills, B.G.** and A.I. Ermakov (2019),
Simple models of error spectra for planetary gravitational potentials as obtained from a variety of measurement configurations,
Plan. Space Sci., 179, 104744. *research article*

109. **Bills, B.G**. et al. (2020),
Gravitational signatures of atmospheric thermal tides on Venus,
Icarus, 340, 113568. *research article*

110. Elkins-Tanton, L.T., **B.G. Bills**, et al. (2020),
Observations, meteorites, and models: A preflight assessment of the composition and formation of (16) Psyche,
J. Geophys. Res., 125, e2019JE006296. *research article*

111. Vance, S.D., **B.G. Bills**, et al. (2021),
Magnetic induction responses of Jupiter's ocean Moons,
J. Geophys. Res., 126, JE006418 *research article*

112. Jaumann, R., **B.G. Bills**, et al. (2022),
The Psyche topography and geomorphology investigation,
Space Sci. Rev., 218, 7. *research article*

113. Elkins-Tanton, L.T., **B.G. Bills**, et al. (2022),
Distinguishing the origin of asteroid (16) Psyche,
Space Sci. Rev., 218, 17. *research article*

114. **Bills, B.G**. and A.J. Brown (2022),
Influence of energy dissipation on spin pole precession trajectories,
Plan. Sci. J. 3: 18. *research article*

115. **Bills, B.G**. and D.R. Skillman (2022),
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Plan. Space Sci., 214, 105415. *research article*

116. **Bills, B.G**. and K.M. Gorski (2022),
Sensitivity and antenna pattern for an interplanetary laser trilateration network,
Plan. Space Sci., 215, 105423. *research article*