


[Home](#) > [Journal](#) > [Earth & Environmental Sciences](#) > [IJG](#)
[Indexing](#) | [View Papers](#) | [Aims & Scope](#) | [Editorial Board](#) | [Guideline](#) | [Article Processing Charges](#)
[IJG](#) > Vol.3 No.2, May 2012



Is Isostatic Rebound in Slow Spreading Gakkel Ridge of Arctic Region Due to the Climate Change? A Case Study

PDF (Size: 3838KB) PP. 339-348 DOI: 10.4236/ijg.2012.32037

Author(s)

Arun Kumar, L. Sunil Singh

ABSTRACT

Ny-Alesund, Swalbard region which is located in the mid-ocean ridge of the Arctic Ocean, and named Gakkel ridge, is the slowest spreading ridge of the global system. In the present study an attempt has been made to associate isostatic rebound using GPS campaign data collected at Ny-Alesund area. The Arctic Region Campaign GPS network was established in 2009. The network consists of three campaign mode station. The distance between GPS point is about ~30 km. The preliminary results of our investigation appear broadly consistent with the recent tectonic activity in western Swalbard. The resultant velocity vector is $14.84 \text{ mm} \cdot \text{yr}^{-1}$ with an azimuth of 27.67° N and a vertical displacement of $7.62 \pm 3.0 \text{ mm} \cdot \text{yr}^{-1}$ is estimated in Swalbard, in which we presume Glacial Isostatic Rebound ($5.1 \text{ mm} \cdot \text{yr}^{-1}$) and post glacial geological process (Present Day Ice Melting, erosion, and shore line deposits) of 2.52 mm per year in the study area.

KEYWORDS

Isostatic Rebound; Arctic Region; GPS Processing; Crustal Deformation

Cite this paper

A. Kumar and L. Sunil Singh, "Is Isostatic Rebound in Slow Spreading Gakkel Ridge of Arctic Region Due to the Climate Change? A Case Study," *International Journal of Geosciences*, Vol. 3 No. 2, 2012, pp. 339-348. doi: 10.4236/ijg.2012.32037.

References

- [1] D. L. Anderson and R. O'Connell, "Viscosity of the Earth," *Geophysical Journal. Royal Astronomical Society*, Vol. 14, No. 1-4, 1967, pp. 287-295. doi:10.1111/j.1365-246X.1967.tb06245.x
- [2] J. M. Johansson, J. L. Davis, H.-G. Scherneck, G. A. Milne, M. Vermeer, J. X. Mitrovica, R. A. Bennett, B. Jonsson, G. Elgered, P. Elósegui, H. Koivula, M. Poutanen, B. O. Ronnang and I. I. Shapiro, "Continuous GPS Measurements of Postglacial Adjustment in Fennoscandia. 1. Geodetic Results," *Journal of Geophysical Research*, Vol. 107, 2002, pp. 2157-2184.
- [3] G. F. Sella, S. Stein, T. H. Dixon, M. Craymer, T. S. James, S. Mazzotti and R. K. Dokka, "Observation of GLACIAL ISOSTATIC ADJUSTMENT in 'STABLE' North America with GPS," *Geophysical Research Letters*, Vol. 34, No. 2, 2007, Article ID: L02306. doi:10.1029/2006GL027081
- [4] W. R. Peltier, "Postglacial Variations in the Level of the Sea: Implications for Climate Dynamics and Solid-Earth Geophysics," *Reviews of Geophysics*, Vol. 36, No. 4, 1998, pp. 603-689. doi:10.1029/98RG02638
- [5] J. X. Mitrovica and W. R. Peltier, "Present-Day Secular Variations in Zonal Harmonics of the Earth's Geopotential," *Journal of Geophysical Research*, Vol. 98, 1993, pp. 4509-4526
- [6] P. Wu and P. Johnston, "Can Deglaciation Trigger Earthquakes in N. America?" *Geophysical Research Letters*, Vol. 27, No. 9, 2000, pp. 1323-1326.
- [7] P. Wu and W. R. Peltier, "Pleistocene Deglaciation and the Earth's Rotation: A New Analysis," *Geophysical Journal of the Royal Astronomical Society*, Vol. 76, No. 3, 1984, pp. 753-792.

[• Open Special Issues](#)
[• Published Special Issues](#)
[• Special Issues Guideline](#)
[IJG Subscription](#)
[Most popular papers in IJG](#)
[About IJG News](#)
[Frequently Asked Questions](#)
[Recommend to Peers](#)
[Recommend to Library](#)
[Contact Us](#)

Downloads:	158,497
Visits:	377,469

[Sponsors, Associates, and Links >>](#)

- [8] V. Schlindwein, C. C. Muller and W. Jokat, " Microseismicity of the Ultraslow-Spreading Gakkel Ridge, Arctic Ocean: A Pilot Study," *Geophysical Journal International*, Vol. 169, 2007, pp. 100-112. doi:10.1111/j.1365-246X.2006.03308.x
- [9] D. Worsley, " Evolution of an Arctic archipelago," *The Geological History of Svalbard*, Statoil, 1986, p. 121.
- [10] S. Elvevold, " Geology of Svalbard," *Norwegian Polar Institute*, Tromso, 2007, p. 35.
- [11] A. Hjelle, " The Geology of Svalbard," *Norsk Polarinstitutt*, Oslo, 1993, p. 163.
- [12] Blythe and Kleinspehn, " Tectonically versus Climatically Driven Cenozoic Exhumation of the Eurasian Plate Margin, Svalbard: Fission Track Analyses," *Tectonics*, Vol. 17, No. 4, 1998, pp. 621-639.
- [13] H. P. Plag, " Measurement of Vertical Crustal Motion in Europe by VLBI," *Station Report for Ny-Alesund*, Norwegian Mapping Authority.
- [14] P. Tomasai and M. Rioja, " South-western Europe Movement with VLBI," In H.-P. Plag, Ed., *Book of Extended Abstracts for the 9th General Assembly of Working Group of European Geoscientists for the Establishment of Networks for Earth Science Research*, 1998, pp. 64-65.
- [15] B. J. Mitchell, H. Bungum, W. W. Chan and P. B. Mitchell, " Seismicity and Present Day Tectonics of the Svalbard Region," *Geophysical Journal International*, Vol. 102, No. 1, 1990, pp. 139-149.
- [16] L. Bockmann, L. Grimstveit, B. G. Harsson, H. P. Kierulf, O. Kristiansen and H. P. Plag, " Site Surveys at the Fundamental Geodetic Station in Ny-Alesund," *Norwegian Mapping Authority*, Svalbard, 2007.
- [17] O. Salvigsen, " Radiocarbon Dating and the Extension of the Weichselian Ice-Sheet in Svalbard," *Norsk Polarinst. ?rbok*, 1976, pp. 209-224
- [18] O. Salvigsen, A. Elgersma and J. Y. Landvik, " Radiocarbon Dated Raised Beaches in Northwestern Wedel Jarlsberg Land, Spitsbergen, Svalbard," *Wyprawy Geograficzne na Spitsbergen*, UMCS, Lublin, 1991, pp. 9-16.
- [19] Hooke and Elverhoi, " Sediment Flux from a Fjord during Glacial Periods, Isfjorden, Spitsbergen," *Global and Planetary Change*, Vol. 12, 1996, pp. 237-249. doi:10.1016/0921-8181(95)00022-4
- [20] Fiedler and Faleide, " Cenozoic Sedimentation along the Southwestern Barents Sea Margin in Relation to Uplift and Erosion of the Shelf," *Global and Planetary Change*, Vol. 12, 1996, pp. 75-93. doi:10.1016/0921-8181(95)00013-5
- [21] W. K. Dallmann, Ed., " Lithostratigraphic Lexicon of Svalbard. Upper Palaeozoic to Quaternary Bedrock," *Review and Recommendations for Nomenclature Use*, Committee on the Stratigraphy of Svalbard/Norsk Polarinstitutt, 1999, p. 320.
- [22] R. W. King and Y. Bock, " Documentation for GAMIT Analysis Software Release 10.4," *Massachusetts Institute of Technology*, Cambridge, 2010.
- [23] T. A. Herring, " GLOBK: Global Kalman Filter VLBI and GPS Analysis Program," *Department of Earth, Atmospheric and Planetary Sciences Massachusetts Institute of Technology, and Scripps Institution of Oceanography, University of California*, San Diego, 2003.
- [24] Z. Altamimi, X. Collilieux, J. Legrand, B. Garayt and C. Boucher, " ITRF2005: A New Release of the International Terrestrial Reference Frame Based on Time Series of Station Positions and Earth Orientation Parameters," *Journal of Geophysical Research*, Vol. 112, 2007, Article ID: B09401. doi:10.1029/2007JB004949
- [25] T. Okuno, J. Hinderer, J. Daniel, S. M. Plag, H. P. Francis, O. Falk and R. Fukuda, " A Geophysical Interpretation of the Secular Displacement and Gravity Rates Observed at Ny-Alesund, Svalbard in the Arctic—Effects of PostGlacial Rebound and Present-Day Ice Melting," *Geophysical Journal International*, Vol. 165, No. 11, 2006, pp. 729-743.
- [26] A. Hjelle, " Geology of Svalbard," *Polar Handbook*, No. 7, Norwegian Polar Institute, 1993, p. 162.
- [27] O. Salvigen, A. Elgersma and J. Y. Landvik, " Radiocarbon Dating Raised Beach in Northwestern Wedel Jarlsberg Land, Spitsbergen Svalbard," *Wypr. Geogr. Na Spitsbergen*, UMCS, Lubin, 1991, pp. 9-16.
- [28] R. L. Hooke and A. Lverhoi, " Sediment Flux from a Fjord during Glacial Period, Isfjorden, Spitsbergen," *Global and Planetary Change*, Vol. 12, 1996, pp. 237-240. doi:10.1016/0921-8181

- [29] A. Fiedler and J. L. Faleeide, " Cenozoic Sedimentation along the Southwestern Barent Sea Margin in Relation to Uplift and Erosion to the Shelf," *Global and Planetary Change*, Vol. 12, No. 1-4, 1996, pp. 75-93.
- [30] R. Dietrich, A. Rulke and M. Scheinert, " Present Day Vertical Crustal Deformation in West Greenland from Repeated GPS Observation," *Geophysical Journal International*, Vol. 163, No. 3, 2005, pp. 865-874.
- [31] E. Gueguen, P. Tomasi, H.-G. Scherneck, R. Haas and J. Campbell, " Recent Crustal Movements: Geological Meaning of European Geodetic VLBNetwork Observations," *Proceedings of 15th Working Meeting on European VLBI for Geodesy and Astrometry*, Barcelona, 7-8 September 2002.