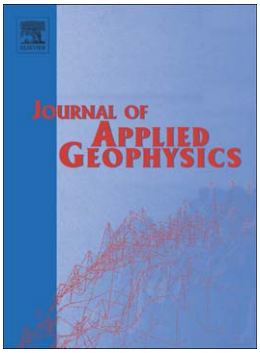

Changes in gravitational parameters inferred from time variable GRACE data—A case study for October 2005 Kashmir earthquake

Matloob Hussain, Mehdi Eshagh, Zulfiqar Ahmad, M. Sadiq, Farzam Fatolazadeh

PII: S0926-9851(16)30193-8
DOI: doi: 10.1016/j.jappgeo.2016.07.008
Reference: APPGEO 3026

To appear in: *Journal of Applied Geophysics*

Received date: 11 April 2016
Revised date: 23 June 2016
Accepted date: 12 July 2016

Please cite this article as: Hussain, Matloob, Eshagh, Mehdi, Ahmad, Zulfiqar, Sadiq, M., Fatolazadeh, Farzam, Changes in gravitational parameters inferred from time variable GRACE data—A case study for October 2005 Kashmir earthquake, *Journal of Applied Geophysics* (2016), doi: 10.1016/j.jappgeo.2016.07.008

Changes in gravitational parameters inferred from Time variable GRACE data-A case study for October, 2005 Kashmir earthquake

Matloob Hussain[a,b*], Mehdi Eshagh[a], Zulfiqar Ahmad[b], M. Sadiq[b], Farzam Fatolazadeh[c]

[a]Department of Engineering Science, University West 46186, Trollhäton, Sweden

[b]Department of Earth Sciences, Quaid-i-Azam University 45320, Islamabad, Pakistan

[c]Department of Geodesy, K. N. Toosi University of Technology, Iran

Emails: [a*]mutloob.hussain@hv.se, [b]matloobh@qau.edu.pk, [a]mehdi.eshagh@hv.se, [b]fz97@hotmail.com,[b]sdq_geo@yahoo.com, [c]ffatollahzadeh@mail.kntu.ac.ir.

Abstract

The earth's gravity changes are attributed to the redistribution of masses within and/or on the surface of the earth, which are due to the frictional sliding, tensile cracking and/or cataclastic flow of rocks along the faults and detectable by earthquake events. Inversely, the gravity changes are useful to describe the earthquake seismicity over the active orogenic belts. The time variable gravimetric data are hardly available to the public domain. However, Gravity Recovery and Climatic Experiment (GRACE) is the only satellite mission dedicated to model the variation of the gravity field and an available source to the science community. Here, we have tried to envisage gravity changes in terms of gravity anomaly (Δg), geoid (N) and the gravity gradients over the Indo-Pak plate with emphasis upon Kashmir earthquake of October 2005. For this purpose, we engaged the spherical harmonic coefficients of monthly gravity solutions from the GRACE satellite mission, which have good coverage over the entire globe with unprecedented accuracy. We have analysed numerically the solutions after removing the hydrological signals, during August to November 2005, in terms of corresponding monthly differentials of gravity anomaly, geoid and the gradients. The regional structures like Main Mantle Thurst (MMT), Main Karakoram Thrust (MKT), Hirat and Chaman faults are in closed association with topography and with gravity parameters from the GRACE gravimetry and EGM2008 model. The monthly differentials of these quantities indicate the stress accumulation in the northeast direction in the study area. Our numerical results show that the horizontal gravity gradients seems to be in good agreement with tectonic boundaries and differentials of the gravitational elements are subtle to the redistribution of rock masses and topography caused by 2005 Kashmir earthquake. Moreover, the gradients are rather more helpful for extracting the coseismic gravity signatures caused by seismicity over the area. Higher positive values of gravity components having higher terrain elevations are more vulnerable to the seismicity and lower risk of diastrophism otherwise.

Keywords: GRACE, Gravity anomaly, Geoid, Gravity gradient, Seismicity, Tectonic