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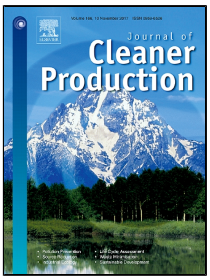

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Gabriel Weiss, Karol Bartoš, Slavomír Labant, Juraj Gašinec, Erik Weiss, Ladislav Mixtaj, Roland Weiss, Jozef Zuzik

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The identification of incorrectly determined new points in established 2D Local Geodetic Network during deformation monitoring for environmental protection

Gabriel Weiss[1], Karol Bartoš[1*], Slavomír Labant[1], Juraj Gašinec[1], Erik Weiss[2], Ladislav Mixtaj[2], Roland Weiss[2], Jozef Zuzik[2]

Abstract

Deformation analyzes are important for long-term monitoring of areas, where, in the first place, it is necessary to take into account human safety and environmental protection for the purpose of sustainable development of human society. The quality of the results of deformation analysis will also be affected by the quality of establishment of the geodetic network. When a new Local Geodetic Network (LGN) is established, for example, during deformation monitoring (landslides, open-pit mining, excavations, etc.) for the purpose of environmental protection, its determination can be influenced by some mistakes: a) geometric quantities measured can be contaminated by blunders, b) compatibilities of some "old" points in the area of LGN can be incorrect, c) appropriate coordinates of some new points may be defective. The case c), using two methods - Least Squares (LSM) unconstrained adjustment; - iteratively reweighted LSM of Robust Estimation, is analyzed in the paper. The main objective of this paper is to compare the adjustment of the geodetic network by the Gauss-Markov model based on GMM with full rank and robust LSM adjustment. The main adjustment steps with important numerical results are presented for both methods. The method how to detect the presence of the used wrong approximate coordinates of new network points is addressed, and the detection approaches are given for both adjustment procedures. The results of both adjustment procedures summarized in the Discussion indicate that the combination of these procedures is the most suitable way of detecting errors in a geodetic network.

Key words: establishment of 2D networks, identification of defective network points, human safety, environmental protection, deformation monitoring

Introduction

Nowadays, surveying provides a wide range of options for dealing with issues of deformation phenomena for the needs of environmental protection and sustainable development, ranging from conventional terrestrial measurements, GNSS technology, digital photogrammetry, laser scanning, to interferometric synthetic aperture radar (InSAR). Although the methods of determination of new, respectively incorrectly determined, survey control points in 2D LGN specified in this work are relatively well known in surveying practice and their mathematical apparatus is long-established, their use for monitoring deformation phenomena has indisputable advantages compared to other methods in their economic and time availability, quickness, and accuracy of results.

Determination of deformation vectors (and thus possible deformations, or displacements) is important in a wide variety of human activities and natural phenomena. Whereby, they may have a negative impact on them whether in the form of socio-economic impact on society or in the form of a negative effect on the environment (Danisch et al., 2008). The monitoring of changes in the spatial position of points on the earth surface, or on objects situated on the surface, is important for the needs of environmental protection whether in the assessment of the

[1] *Gabriel Weiss, Karol Bartoš, Slavomír Labant, Juraj Gašinec,* Institute of Geodesy, Cartography and GIS, BERG Faculty, Technical University of Košice, Letná 9, 042 00 Košice, Slovak Republic, gabriel.weiss@tuke.sk, karol.bartos@tuke.sk, slavomir.labant@tuke.sk, juraj.gasinec@tuke.sk,

[2] *Erik Weiss, Ladislav Mixtaj, Roland Weiss, Jozef Zuzik* Institute of Earth Resources, BERG Faculty, Technical University of Košice, Letná 9, 042 00 Košice, Slovak Republic, erik.weiss@tuke.sk, ladislav.mixtaj@tuke.sk, roland.weiss@tuke.sk, jozef.zuzik@tuke.sk

* corresponding author