A Complete Processing Methodology for 3D Monitoring using GNSS Receivers

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SUMMARY
The GNSS measurements are widely used for the monitoring of several structures' deformations such as dams, bridges, high buildings as well as landslides and earth crustal movements. In most cases the use of GNSS receivers is more convenient as ensure incessant measurements and provide no manned observations, long or short baselines measurement without visibility between the points. Moreover the accuracy of relative positioning reaches the level of some mm. According to the usual procedure both horizontal and the vertical vectors of the position change for each monitoring network's point are calculated in order to prove whether they could be considered as displacements or they are within the noise of the measurements. As the most GNSS adjustment softwares don' t provide the full variance – covariance matrix as output, there is a perplexity in the calculation of the right absolute and relative error ellipses or ellipsoids for any confidence level. This work presents an alternative, more reliable processing procedure for the GNSS measurements in the 3d monitoring. This processing procedure allows the use of the original baselines' measurements and leads to analytical results according to the low of the least squares' propagation errors. The network adjustment is carried out in the geocentric reference system, the full variance – covariance matrix of the network is provided, the appropriate full rotation matrices are used in order to transform the displacement vectors as well as the variances and co variances in a local oriented plane projection in order to be more perceptible and useful. A special technique is used for a correct weights definition in order to be used in an unequal weight adjustment. The change vector of every point's position is calculated and whether this change represents a real displacement or it is within the noise of the measurements is determined. The displacements' check could be done in one, two or three dimensions by creating vectors, ellipses or ellipsoids.