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Modeling GPS rapid static positional accuracies for monitoring natural hazards: Application to Koyulhisar landslide, Turkey

K. Hastaoglu (1) and D. U. Sanli (2)

(1) Faculty of Civil Engineering, Department of Geodesy and Photogrammetry Engineering, Yildiz Technical University, Istanbul, Turkey, (kemalh@yildiz.edu.tr / Phone: +90 212 259 7070), (2) Kandilli Observatory and Earthquake Research Institute, Geodesy Department, Bogazici University, Istanbul, Turkey, (ugur.sanli@boun.edu.tr / Phone: +90 216 516 3364)

Various GPS surveying methods are used in natural hazard monitoring. Rapid Static GPS is one of them. Rapid Static GPS ensures denser spatial coverage since it is based on site occupations of 1-5 min. However, positioning accuracies from Rapid Static GPS is poorer than that of the Static GPS. Since Rapid Static GPS finds applications recently especially in the area of landslide and volcano monitoring, it is useful to model these accuracies. It is useful for both survey-planning prior to field works and GPS network adjustments. In GPS literature, GPS accuracies have been modeled and accuracy prediction formulas developed for Static GPS. However, this has not been done yet for Rapid Static GPS. Therefore, in this study, we evaluate and model GPS Rapid Static positioning accuracies. We use BERNESE 5.0 and SOPAC continuous GPS data for the evaluations. We constructed a sample from the 3-day continuous GPS data, i.e. subdividing the data 5-30 min data spans, to work out the positioning accuracies. The data were processed using BERNESE Rapid Static processing strategies. Then we created a least squares (LS) functional model considering the mathematical behavior of the solution RMS values and augmenting the LS functional model developed for static GPS positioning before. It appears that the accuracy of Rapid Static Positioning depends on observing session duration, inter-station distance, and inter-station height difference. Although the effect of large inter-station height difference dates back to late 1980s, it has not been considered in GPS positioning accuracy mod-

eling yet. Here we also discuss our motivation in including the height constraint into accuracy studies. In addition, we test our prediction formulas with Rapid Static GPS solutions obtained from Koyulhisar landslide in central Turkey. The results show that predicted accuracies agree with the solution RMS errors within 5 mm. In addition, we provide recommendations for future studies to improve GPS Rapid Static baseline repeatabilities.