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Reliability of GPS Rapid Static Positioning Solutions

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Rapid static GPS is used in practical surveying applications and in monitoring of various natural hazards such as land slides. The technique emerged as a surveying tool that provides cm positioning in which the ambiguity resolution is obtained in minutes taking the advantage of various statistics and using special algorithms. It is still tempting to use rapid static GPS today since it does not require station occupations lasting long hours as in static positioning or it does not require radio links as real time kinematic (RTK) GPS does. For instance, online rapid static positioning services have only recently come up for the use of geodetic/surveying community. Currently researchers are interested in studying the software specific accuracy of GPS rapid static positioning. The accuracy of the technique depends on various parameters specific to GPS software used such as baseline distances or inter-station height differences. Today research results agree on the amount that minimum observing session duration needs to be 15 min for rapid static surveying applications although examples are usually available between 1 to 30 min range. In this study, we revisited this issue and studied the length of rapid static observations for reliable positioning solutions. A large sample of rapid static positioning solutions produced from certain observation durations reveals that 15-30 % of the solutions might be rejected as outliers, and hence are not reliable. The results from the previous studies were usually based on restricted data samples therefore in this study we first took into account this limitation and carried our experiments over larger samples. In addition, the source of outliers in the solutions, the methodology for outlier removal using both conventional outlier tests and robust statistics, the probability distribution of the solutions and other related statistics to be used were investigated. As a consequence, it has been found that although 15 min observation length seems to be the optimum range for obtaining precision estimates, it is still possible to increase the reliability of the solutions, i.e. decreasing the number of outliers in the solution sets, by using longer station occupations. Examples will be given using the data of Scripps Orbit and Permanent Array Center (SOPAC) archives and BERNESE 5.0 software.