



DETERMINATION OF LOCAL GEOID WITH GPS IN TRABZON/TURKEY

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Geoid has a closed shape that coincides with the sea level which is free of tides, currents, and similar physical forces. Modeling the geoid is realized using the geoidal undulation. The distance that lies through the ellipsoidal normal between the geoidal surface and ellipsoidal surface is called as geoidal undulation. In a network established to determine local geoid, orthometric heights are given to the points by leveling. While determining the orthometric heights, making gravimetric reductions is an important factor to find the desired geoidal undulations. The ellipsoidal height, which is necessary for finding geoidal undulation, is derived by GPS. This method called as GPS/Leveling and it is one of the most popular methods used in local geoid determination. The aim of this study is to determine the local geoid of Trabzon. A network with 39 points has been established in this region that covers an area of 30 km². The orthometric heights have been given to the points by leveling. Total length of the leveling routes is approximately 108 km. The gravimetric reductions have been applied to the leveling measurements and the orthometric heights with taking two points as references in Trabzon harbor. The positions and ellipsoidal heights of the points have been derived by GPS measurements. The observations have been realized by static GPS technique using dual frequency receivers and every station has been occupied at least 45 minutes. After processing the GPS observations, the precision of the position has been obtained at the level of ± 5.8 mm horizontally, and ± 7.5 mm vertically. The precision of the orthometric heights has been determined at the level of ± 5.03 mm. As shown from these results, the geoidal undulations have been determined at sub-centimeter level. As a consequence, determination of the orthometric heights of the points at sub-cm level without leveling has been tried to achieve using only GPS observations with this study.

CONCLUSIONS

In this work, the precision of the ellipsoidal heights has been obtained at ± 7.5 mm from GPS network adjustment and the precision of orthometric heights has been obtained at ± 5.03 mm from leveling adjustment. Using obtained values above, the geoidal undulations N_i have been calculated between -10.355 m and -9.681 m with precision of ± 9.03 mm. Consequently, it is seen that the orthometric height of any point in the working area can be determined with a precision of centimeter or sub-centimeter level using only GPS measurements and the determined geoid model. Since there is no need to make leveling measurements to determine the orthometric heights, many savings will be got in time, effort, and cost point of view. Additionally, the other earth sciences such as geology and geophysics may also use the determined geoid in their studies.