On the weighted constraint design of DGPS reference stations for hydrography and navigation applications

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An optimum method for the design of reference DGPS stations is devised and used for the establishment of a national DGPS network along the southern coast of Iran. The designed DGPS network satisfies both hydrography (charting) and navigation applications and is obtained via an optimum process which algorithmically can be explained as follows: (1) Various method for computation and dissemination of DGPS corrections are considered and among them, after performing field tests, "temporal correction of pseudo ranges" is found to be the most suitable one for the aforementioned applications. (2) International Hydrography Organization (IHO) standards for navigation and hydrographic (charting) applications are considered and the distance of 110km is found as the maximum range between two adjacent reference DGPS stations, provided that the major harbors be considered, as the places where a DGPS reference station must be erected. (3) To avoid excessive installation of DGPS stations the distance of 80km is selected according to error propagation criterions as the minimum distance between two successive DGPS stations. (4) Issues like access to roads, closeness to ports, closeness to more populated cities, closeness to navigating rivers and channels, etc. are given weight according to their importance. (5) The first DGPS station is selected at the Rajai harbor, which is the biggest southern harbor of Iran. (6) The position of the next DGPS reference station is found as the position of a pixel on the digitized 1:100,000 scale map of the coast, which has the maximum weight according to weighting scheme of item (4) and is within the range of 80km to 110km around the first DGPS station. (7) step (6) is repeated until the whole coast line is covered. Application of the this procedure for the southern coast of Iran along the Persian Gulf and Oman Sea with approximate length of 2000km resulted in 8 reference DGPS stations. The details of the optimization concept and the obtained experiments during the design of the national coastal DGPS network of Iran are given in the paper.