Low-Cost GNSS Solution to Densify the National Terrestrial Reference Frame Stations

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Key words: Deformation measurement; GNSS/GPS; Land management; Positioning; Keyword 1; Keyword 2; Keyword 3

SUMMARY

The Continuously Operating Reference Station (CORS) plays a pivotal role in establishing and maintaining a National Terrestrial Reference Frame (NTRF) for geodetic, geodynamic, and geospatial purposes. CORS stations are typically equipped with high-precision Global Navigation Satellite System (GNSS) receivers to deliver accurate positioning data. However, in developing countries, the deployment of CORS stations faces challenges due to the complexity and cost of GNSS instrumentation and operation. This limited deployment can potentially impact the quality and stability of the NTRF. On a positive note, extensive research has shown that low-cost GNSS receivers, under suitable observation conditions and with appropriate processing methods, can yield precise and reliable positioning results. One such solution is Australian-made Kurloo Technology, a unique self-powering GNSS device offering Internet-of-Things (IoT) sensing capability to support precise GNSS positioning and cloud-based analytics. In this paper, we introduce an innovative method that leverages Kurloo's multi-frequency GNSS product and Geoscience Australia's software, GiNAN, to generate global absolute coordinates with daily solutions. We present a case study focusing on almost three years of Kurloo reference station data in the Gold Coast, Queensland. The long-term daily solutions closely align with the Australian Plate Motion Model. Furthermore, the Kurloo data has been submitted to the reliable and free online GNSS service AUSPOS, also provided by Geoscience Australia. Comparison results demonstrate that Kurloo's daily Precise Point Positioning (PPP) solution achieves accuracy within the range of 1 to 2 centimeters horizontally and 2 to 4 centimeters vertically. The availability of more affordable CORS stations has the potential to benefit the socio-economic and scientific research endeavors in developing countries.
