

GVX: The GNSS Vector Exchange File Format and its Application in OPUS-Projects

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Key words: GNSS/GPS; Real-time kinematic; RTK; GVX; standard file formats; XML

SUMMARY

The Receiver Independent Exchange (RINEX) format was originally developed 30 years ago, and it has become an industry standard for exchanging raw Global Navigation Satellite System (GNSS) data. However, RINEX does not support post-processed data, such as GNSS vectors. A GNSS vector is derived during baseline processing, where common satellite observables collected simultaneously by receivers at each end of a baseline are differenced, resulting in Earth-Centered, Earth-Fixed differential components and their variances and covariances. GNSS vectors mathematically represent the measurement of a baseline, and they can be computed by post-processing or in real-time using real-time kinematic (RTK) techniques. RTK-derived vectors are often uploaded in software for evaluation, quality assessment, and least squares adjustment. However, this proves burdensome because vendors typically output GNSS vector data in their own proprietary, closed-source data formats. To this end, the National Geodetic Survey (NGS) proposes a standard, open-source GNSS vector exchange file format known as GVX. GVX aims to enable the sharing of all types of GNSS vectors, whether derived from an RTK survey or from post-processing. GVX is written in extensible markup language (XML), because XML is designed to store and carry data in plain text format that can be read by both machines and humans, and it is easy to expand or upgrade later. GVX consists of several elements, including but not limited to, metadata on the source of the vectors, project settings, geodetic coordinate reference system, information on the GNSS equipment utilized, estimated coordinates of the vector endpoints, differential vector components, error estimates, start and stop times of each observation, and additional vector metadata for quality control purposes. NGS is also developing its web-based and freely-available software, OPUS-Projects, so that users can upload GVX files into a survey network project. OPUS-Projects will display the uploaded GNSS vectors both on a map and in tabular form, and it will flag vectors that do not meet user-specified quality thresholds. Moreover, OPUS-Projects will provide tools for adjusting the uploaded GNSS vectors along with any other baselines

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post-processed within the software in order to estimate geodetic coordinates at control points or bench marks. Users could then submit the resulting survey network adjustments to NGS for publication in the national database. GVX and OPUS-Projects will provide an efficient means for smart surveyors to analyze, adjust, and publish RTK-vector data collected on geodetic control.

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