



Product Bulletin

GEOSPATIAL
9 JANUARY 2018

PUBLIC

TRIMBLE BUSINESS CENTER (TBC) v4.00 NEW STATIC GNSS BASELINE PROCESSING ENGINE

Introduction

After more than three years in development, TBC v4.00 introduces a new static GNSS Baseline Processing engine that improves accuracy and results in more fixed solutions for all baseline lengths. The new engine also supports three frequency post-processing, mixed-signal post-processing, and all IGS precise product corrections needed for ITRF support. This bulletin further explains the changes and improvements in the new engine.

What's New?

With the same user interface throughout the static GNSS baseline processing workflow, the improved and modernized engine might not be readily apparent in TBC v4.00, so look for the following enhancements and additions:

- *Support for Differential Code Biases (DCB) for satellites via the Internet Downloads command*

The DCBs are the biases between two code observations at the same or different frequencies, for example L2C and L2P, from the satellite signal. They are used for code-based positioning and ionospheric Total Electron Content (TEC) extraction, among other computations. Accounting for DCBs when processing static GNSS baselines in TBC supplements receivers that may or may not track all signals and modulation types from a certain frequency. With the DCBs, more signals can be used for processing and differences addressed which results in a solution with more satellites.

- *Support for Earth Orientation/Rotation Parameter (EOP) models via the Internet Downloads command*

The EOP models are International Earth Rotation and Reference Systems Service (IERS) parameters that describe the irregularities of the earth's rotation. These parameters provide information to the GNSS processing engines about the rotation of the International Terrestrial Reference System (ITRS) relative to the International Celestial Reference System (ICRS) as a function of time. Using EOP models in the baseline processing reduces horizontal and vertical errors on long baseline lengths.

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- *Automatic dynamic parameters that adjust depending on the baseline length*
The new engine handles baseline lengths in three classes, short (0 – 20 km), medium (20 – 200 km), and long (200+ km). For each of these classes, processing parameters and settings are automatically adjusted to improve the processing result.
- *Support for the Galileo E5A, E5B, and E5AltBOC signals*
More high-quality Galileo satellite signals improves the accuracy and reliability of the processed baseline solution.
- *More fixed solutions for all baseline lengths, especially long baselines - those greater than 200km.*
The new engine has refined processing algorithms and uses a number of different techniques to achieve more fixed solutions for long baselines such as automatic selection of the optimal linear combination for a given baseline length and use of a refined error-modelling algorithm. Originally developed to provide reliable solutions for baselines over 200km, the engine can provide reliable solutions for baselines up to 6000km.
- *Comparable and consistent RMS error values between short and medium length baselines.*
See the following section on development testing results for short and medium baseline lengths.

Processed Baseline Result Comparison between TBC v3.90 and TBC v4.00

Baselines included in these results are from various GNSS receivers and field conditions from in-field static sessions, Trimble VRS reference stations, and RTX network data.

Short Baselines - Broadcast Orbit, 0 - 20 km, 300 - 1800 second observations

	Total B/L Processed	Total Fixed B/L	% Fixed	Northing RMS (m)	Easting RMS (m)	El RMS (m)
TBC v4.00	7122	7122	100%	0.010	0.008	0.031
TBC v3.90	7122	7120	99.97%	0.008	0.008	0.032

Medium Baselines - Precise Orbit, 20 - 60 km, 600 and 1200 second observations

	Observation time (s)	Total B/L Processed	Total Fixed B/L	% Fixed	Northing RMS (m)	Easting RMS (m)	El RMS (m)
TBC v4.00	600	1934	1934	100%	0.011	0.009	0.033
TBC v3.90	600	1910	1774	92.88%	0.011	0.009	0.037

TBC v4.00	1200	966	963	99.69%	0.009	0.008	0.032
TBC v3.90	1200	950	888	93.47%	0.008	0.008	0.036

Medium Baselines - Precise Orbit, 80 - 120 km, 1800 and 3600 second observations

	Observation time (s)	Total B/L Processed	Total Fixed B/L	% Fixed	Northing RMS (m)	Easting RMS (m)	El RMS (m)
TBC v4.00	1800	470	456	97.02%	0.009	0.007	0.046
TBC v3.90	1800	470	466	99.15%	0.009	0.007	0.048
TBC v4.00	3600	230	230	100%	0.005	0.006	0.021
TBC v3.90	3600	230	230	100%	0.005	0.006	0.021

Medium Baselines - Precise Orbit, 60 - 200 km, 1800 and 3600 second observations

	Observation time (s)	Total B/L Processed	Total Fixed B/L	% Fixed	Northing RMS (m)	Easting RMS (m)	El RMS (m)
TBC v4.00	1800	1422	1354	95.22%	0.009	0.007	0.046
TBC v3.90	1800	1422	1347	94.73%	0.009	0.007	0.048
TBC v4.00	3600	696	685	98.42%	0.005	0.006	0.021
TBC v3.90	3600	696	683	98.13%	0.005	0.006	0.021

Implementation

The new GNSS static engine uses more rigorous analysis and computation methods compared to previous engines. Trimble has tested the new engine with over one-hundred thousand unique static sessions and the results consistently showed more fixed solutions and equivalent-to-improved precision and RMS values compared to previous TBC static baseline engines.

The new GNSS static processing engine assures that TBC offers the best GNSS baseline processing solution. The new engine is available in the Intermediate and Advanced edition of TBC v4.00, which requires a software warranty date of September 1, 2017 or later to license.

External References

- For a technical review of the new engine and comparison with Bernese GNSS software, please reference Andreas Schutz's Master's Thesis, [Comparing analysis of processing- and error models used in the Trimble Baseline Processor and the Bernese GNSS software](#).
- Differential Code Bias (DCB) definition from [Navipedia](#).
- Earth Orientation/Rotation Parameters (EOP) definition from the [International Earth Rotation and Reference Systems Service](#) (IERS).

For more information

Update to TBC v4.00 and process some baseline data with the new static GNSS baseline processor engine for yourself! Then for baseline processing or TBC-specific questions, contact your local Trimble Distribution Partner.