Relations of UTC and TAI with GPS time, GLONASS time, UTC(USNO)_GPS and UTC(SU)_GLONASS

(File available at ftp://ftp2.bipm.org/pub/tai/other-products/utcgnss/utc-gnss)

[TAI - GPS time] and [UTC - GPS time]

The GPS satellites disseminate a common time scale designated ‘GPS time’. The relation between GPS time and TAI is:

\[ [\text{TAI - GPS time}] = 19 \text{s} + C_0, \]

where the time difference of 19 seconds is kept constant and \( C_0 \) is a quantity of the order of tens of nanoseconds, varying with time.

The relation between GPS time and UTC involves a variable number of seconds as a consequence of the leap seconds of the UTC system and is as follows:

From 1 January 2017, 0 h UTC, until further notice, \([\text{UTC - GPS time}] = -18 \text{s} + C_0, \]

Here \( C_0 \) is given at 0 h UTC every day.

\( C_0 \) is computed as follows. The GPS data recorded at the Paris Observatory for highest-elevation satellites are first corrected for precise satellite ephemerides and for ionospheric delays derived from IGS maps, and then smoothed to obtain daily values of \([\text{UTC(OP) - GPS time}] \) at 0 h UTC. Daily values of \( C_0 \) are then derived by linear interpolation of \([\text{UTC - UTC(OP)}]. \)

The standard deviation \( \sigma_0 \) characterizes the dispersion of individual measurements for a month. The actual uncertainty of user’s access to GPS time may differ from these values. \( N_0 \) is the number of measurements.

[TAI – UTC(USNO)_GPS] and [UTC – UTC(USNO)_GPS]

The GPS satellites broadcast a prediction of UTC(USNO) calculated at the USNO, indicated by UTC(USNO)_GPS. The relation between UTC(USNO)_GPS and TAI involves a variable number of seconds as a consequence of the leap seconds of the UTC system, and is as follows:

From 1 January 2017, 0 h UTC, until further notice, \([\text{TAI – UTC(USNO)_GPS}] = 37 \text{s} + C_0' \]

Here \( C_0' \) is given at 0 h UTC every day.

\( C_0' \) is computed using the values of \([\text{UTC - UTC(OP)}] \) similarly than the computation of \( C_0 \).

The relation between UTC(USNO)_GPS and UTC is \([\text{UTC – UTC(USNO)_GPS}] = 0 \text{s} + C_0' \]

The standard deviation \( \sigma_0' \) characterizes the dispersion of individual measurements for a month. The actual uncertainty of user’s access to UTC(USNO)_GPS may differ from these values. \( N_0' \) is the number of measurements.
Relations of UTC and TAI with GPS time, GLONASS time, UTC(USNO)_GPS and UTC(SU)_GLONASS (Cont.)

(File available at ftp://ftp2.bipm.org/pub/tai/other-products/utcgnss/utc-gnss)

[UTC - GLONASS time] and [TAI - GLONASS time]

The GLONASS satellites disseminate a common time scale designated ‘GLONASS time’. The relationship between GLONASS time and UTC is

\[ [\text{UTC - GLONASS time}] = 0 \text{ s} + C_1, \]

where the time difference 0 s is kept constant by the application of leap seconds so that GLONASS time follows the UTC system, and \( C_1 \) is a quantity of the order of tens of nanoseconds (tens of microseconds until 1 July 1997), which varies with time.

The relation between GLONASS time and TAI involves a variable number of seconds and is as follows:

From 1 January 2017, 0 h UTC, until further notice, \([\text{TAI - GLONASS time}] = 37 \text{ s} + C_1'\).

Here \( C_1' \) is given at 0 h UTC every day.

\( C_1' \) is computed as follows. The GLONASS data recorded at the Astrogeodynamical Observatory, Borowiec, Poland for the highest-elevation satellites are smoothed to obtain daily values of \([\text{UTC(AOS) - GLONASS time}]\) at 0 h UTC. Daily values of \( C_1' \) are then derived by linear interpolation of \([\text{UTC - UTC(AOS)}]\).

To ensure the continuity of \( C_1' \) estimates, the following corrections are applied:

\[
+1285 \text{ ns} \text{ from 1 January 1997 (MJD 50449) to 22 March 1999 (MJD 51259)}
\]
\[
+107 \text{ ns} \text{ for 23 March 1999 and 24 March (MJD 51260 and MJD 51261)}
\]
\[
0 \text{ ns since 25 March 1999, (MJD 51262)}.\]

The standard deviation \( \sigma_{1'} \) characterizes the dispersion of individual measurements for a month. The actual uncertainty of user’s access to GLONASS time may differ from these values. \( N_{1'} \) is the number of measurements.

[TAI – UTC(SU)_GLONASS] and [UTC – UTC(SU)_GLONASS]

The satellites broadcast a prediction of UTC(SU) calculated at the SU, indicated by UTC(SU)_GLONASS.

The relation between UTC(SU)_GLONASS and TAI involves a variable number of seconds as a consequence of the leap seconds of the UTC system, and is as follows:

From 1 January 2017, 0 h UTC, until further notice, \([\text{TAI – UTC(SU)_GLONASS}] = 37 \text{ s} + C_1'\).

Here \( C_1' \) is given at 0 h UTC every day.

\( C_1' \) is computed using the values of \([\text{UTC - UTC(AOS)}]\) similarly than the computation of \( C_1 \).

The relation between UTC(SU)_GLONASS and UTC is \([\text{UTC – UTC(SU)_GLONASS}] = 0 \text{ s} + C_1'\).

The standard deviation \( \sigma_{1'} \) characterizes the dispersion of individual measurements for a month. The actual uncertainty of user’s access to UTC(SU)_GPS may differ from these values. \( N_{1'} \) is the number of measurements.