CURRENT ISSUES IN GEODETIC TIME/FREQUENCY TRANSFER

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Utilizing primarily the carrier phase measurements from modern space navigation systems such as GPS, the International GNSS Service (IGS) now routinely generates products for high-accuracy users. These consist of satellite ephemerides (post-processed and predicted), satellite and receiver clock estimates, and terrestrial reference frame coordinates and velocities. The post-processed orbits and clocks allow users to autonomously point position with centimeter-level accuracy anywhere globally. In the past several years, utilizing the code measurements as well as carrier, the IGS has produced an improved set of timing products, which offer the potential for ultra-stable timescale dissemination and access to Coordinated Universal Time (UTC) in particular. Because the GPS code data are largely unnecessary for geodetic positioning but are required for geodetic timing (owing to the unknown carrier phase ambiguities), geodetic timing requires some special considerations. For example, receiver temperature, code (as well as phase) multipath sources, receive system delays, and inter-modulation biases (in the satellite transmitters and the receivers) must all be properly controlled or calibrated. Also, with the addition of Galileo satellites and modernized GPS signals, users will see many new navigation signals in coming years. Differential code biases at the multi-nanosecond level between and within the different GNSS systems greatly complicate data analyses but must be well compensated for accurate timing applications. As manufacturers are now designing and implementing receivers capable of simultaneously tracking all GNSS systems, conventions and methods for handling these biases are particularly relevant now. We discuss the advances over the last few years of geodetic timing, its limitations, and some of the issues relevant for multi-GNSS geodetic timing.