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Systematic Bias Elimination by Co-locations as well as by Intra- and Inter- Technique Closure Measurements

The demands for the accuracy of the GGOS measurements are a high and the system for the distribution of time and frequency on a geodetic fundamental station is in a central position. Variable delays within the main techniques of space geodesy, namely SLR, VLBI, GNSS and DORIS are limiting the stability of the measurements. This leads to the rather paradox situation, that each technique has to adjust the clock offsets independently. Although all main measurements systems on an observatory are usually based on the same clock, each technique provides different offsets. This reflects the fact that the 'clock adjustments' are highly contaminated with (variable) system specific delays, which usually have independent causes. None of these delays are stable over time. Closure measurements with an all optical time and frequency system based on the 'Einstein Synchronization Procedure' for example allow to reference all measurements to the same time scale at every measurement system and more importantly to control the system delays to a high level of accuracy within each measurement technique and from one technique to the next (e.g. from SLR to VLBI).