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The Importance of Coherent Time for a Fundamental Station

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The demands of GGOS are a high for a modern system for the distribution of time and frequency on a geodetic fundamental station. 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 also contaminated with (variable) system specific delays.

We have designed and built such a coherent time and frequency distribution system for the Geodetic Observatory Wettzell. It is based on a mode-locked fs- pulse laser, fed into a network of actively delay controlled two-way optical pulse transmission links. This utilizes the ultra low noise properties of optical frequency combs, both in the optical and electronic regime. Currently the system is capable of maintaining a phase coherence of $\Delta\tau \approx 1$ ps for the electronic representation of the two-way optically distributed time in the long-term over several hundred meters of distance. Due to the exact agreement of the distributed clock pips this time and frequency distribution system can be used to identify and remove systematic measurement errors in an onsite process. Together with a common central inter- and intra- technique target time can provide consistency for the complex instrumentation of SLR and VLBI systems in situ, which was not possible before. This talk outlines the concept and discusses the obtained results.